Chapter 12 MISCELLANEOUS

(Revised)

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LIST OF ILLUSTRATIONS

Introduction

1. This chapter contains a description, including the method of operation, of the selection and indication circuits of the general services hydraulic supply controls, canopy and windscreen wiper systems. Detailed information on the associated components employed is contained in the Air Publications referred to in Chap. 1 of this Section; the same chapter also illustrates the location and means of access to the components.

Modification standard

2. This chapter includes Mod 16, 103, 184, 340 and 881.

GENERAL SERVICES HYDRAULIC SUPPLY CONTROL

General

3. Control of the general services hydraulic system is effected by hydraulic selector valves operated by an electrical control circuit which also incorporates a three-position indicator to show the state of the system at all times. A device to prevent the normal selection of any of the general services, or the emergency selection of the bomb door, during ground servicing is also embodied. Detailed information regarding the general services hydraulic system and its components is contained in Book 1, Cover 2, Sect. 3, Chap. 6 of this publication.

Description

Control selector valves

4. Hydraulic pressure from the main supply is directed into either the normal or emergency supply lines by two electro-hydraulic selector valves; each valve has a normal solenoid and an emergency solenoid. Normally the normal solenoid of each valve is energized to allow the fluid to pass into the normal supply line. In the event of the hydraulic system being automatically changed to emergency, by the two main reservoir microswitches (*para* 6) or a failure of the normal electrical supply, the normal solenoid of each valve is de-energized to neutralize the valve and isolate the fluid supply from all the general services except the fuel proportioner motors. With the system in this condition, a selection of the standby control for any service causes the emergency solenoid of each valve to be energized, thus allowing fluid to pass into the emergency supply line. The valves are located in the accessories bay on the forward face of bulkhead 244.

Emergency vent valve

5. A solenoid-operated valve is incorporated in the general services hydraulic system to prevent a pressure build up in the emergency supply line due to fluid seepage past shuttle valves during normal operation of the system. The solenoid is normally energized to hold the valve in the open position. In the event of the system being changed to emergency operation, by either automatic or manual selection, the solenoid is de-energized and the valve closes, thus retaining the hydraulic fluid in the emergency supply line. The valve is mounted on the air brakes mounting.

Reservoir switches

6. Should the loss of hydraulic fluid from anywhere in the general services hydraulic system be sufficient to drain the main fluid reservoir, the contacts of two series-connected microswitches, located at the base of the reservoir, are opened by the action of a piston within the reservoir. Actuation of these switches open circuits the normal d.c. supply to the control circuit thereby affecting the system as follows:-

(1) The normal solenoids of the control valves are de-energized. to prevent fluid passing into either the normal or emergency supply lines, except the supplies to the fuel proportioner motors, which are taken off before the control valves.

(2) The solenoid of the emergency vent valve is de-energized to blank off the emergency supply line from the return line, thus preventing fluid escaping from the emergency line until it has passed through an emergency selector valve.

(3) The three-position indicator is de-energized to show black and white diagonal stripes (*para.* 7).

Magnetic indicator

7. The state of the general services hydraulic system is shown by a three-position magnetic indicator located on the pilot's starboard console panel C-F/1. The three indications shown by the indicator are: NORM in white letters on a black background, EMGY in black letters on a white background, and black and white diagonal stripes. A NORM indication is shown when the normal electrical supply is available, the main hydraulic reservoir microswitches have not been actuated (*para.* 6) and no manual standby selection is effective. The striped indication is shown when a loss of hydraulic fluid from the main reservoir causes the contacts of the two microswitches to be actuated (*para.* 6) or when the normal electrical system fails. If the air brakes, bomb door, or, on pre-Mod 881 aircraft, flight refuelling probe are selected by their standby controls, EMGY is shown until the bomb door reaches either its locked open or closed position, the air brakes reach the fully in position, or the flight refuelling probe door is closed. The indicator then

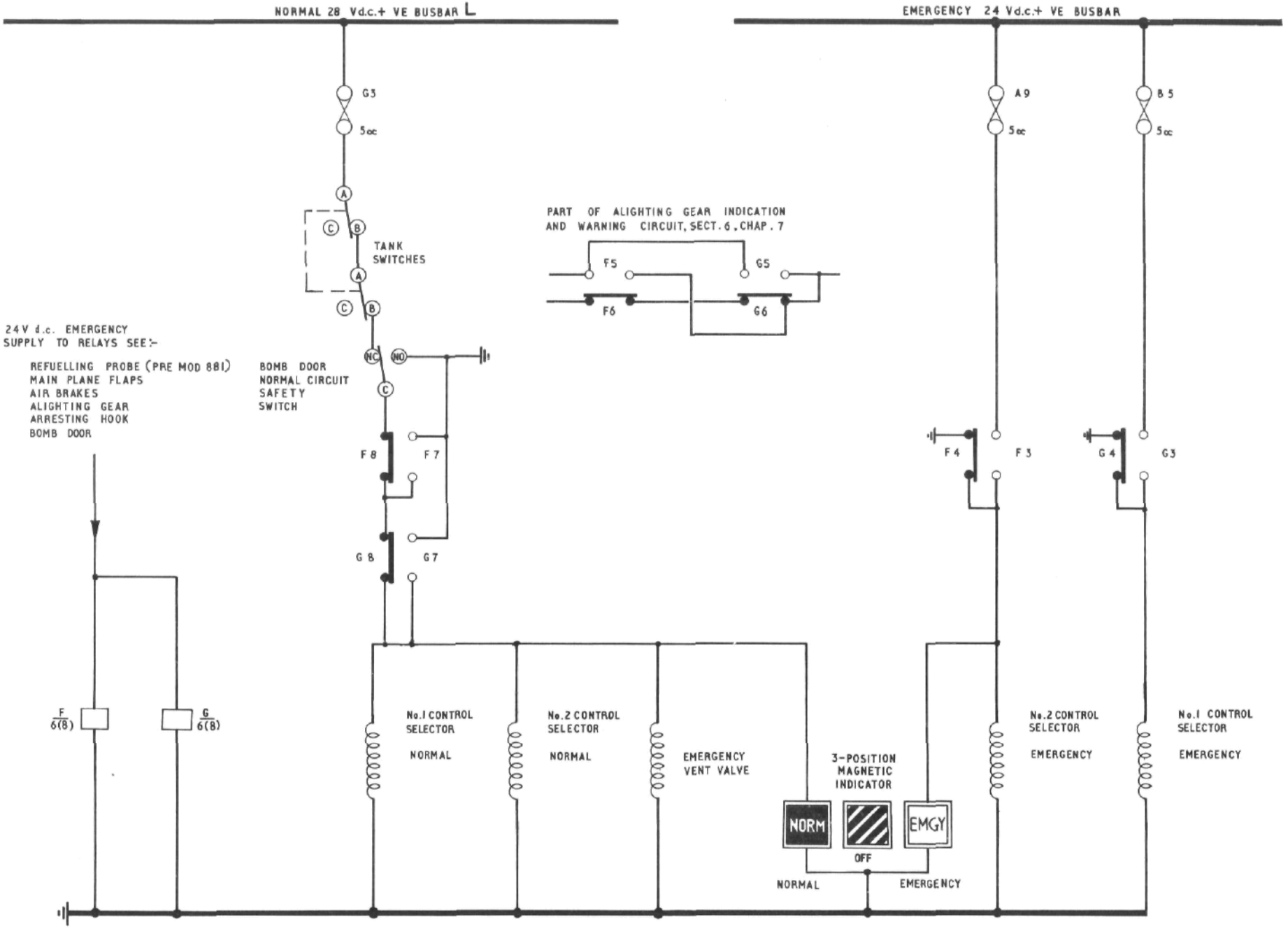

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Fig. 1. General services hydraulic supply control – theoretical

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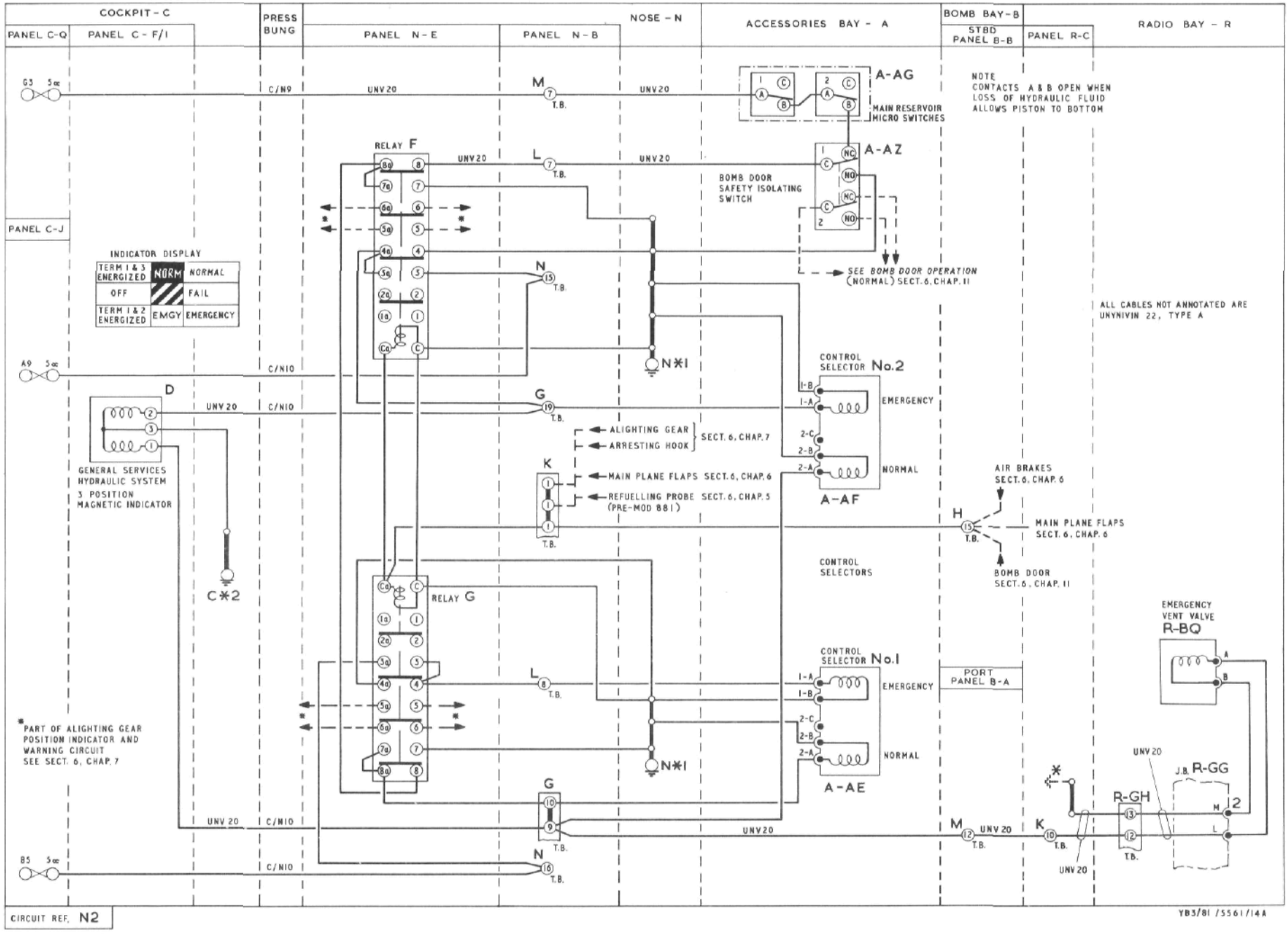

Fig. 2. General services hydraulic supply control

automatically reverts to NORM provided the main reservoir microswitches have not been actuated or another manual standby selection has been made in the meantime. A standby selection of the alighting gear, arresting hook, or main plane flaps causes EMGY to be shown and retained.

Bomb door safety switches

8. The bomb door external safety pin, described in Book 1, Cover 1, Sect. 2, Chap. 1 of this publication, is secured by turning it through 90 deg. This movement causes the two lobes of a cam to depress the actuators of two microswitches. The operation of one switch open-circuits the bomb door normal selection circuit, renders the normal operation of the general services hydraulic system inoperative and connects a d.c. supply to the bomb bay lamps. The operation of the other switch open-circuits the bomb door emergency selection circuit. The functions regarding the bomb bay lights and door selection are described in Chap. 9 and 11 of this Section respectively.

9. The microswitch contacts associated with the general services hydraulic controls system are connected in series with the contacts A-B of the main reservoir microswitches so that, when the safety pin is inserted and secured, the system is affected in the same manner as described in para 6.

Operation *(fig 1 and 2)*

Normal

10. During normal operations of the general services, a d.c. supply is fed from fuse G3 in the normal d.c. fuse panel C-Q, via the contacts A-B of the main reservoir microswitches A-AG, contacts NC-C of the bomb door safety switch A-AZ and contacts 8-8a of relays F and G, in panel N-E, to the normal solenoids of No. 1 and 2 control selector valves A-AE and A-AF, the solenoid of the emergency vent valve R-BQ and the solenoid connected across terminals 1 and 3 of the indicator D. When energized, the position of each control selector valve permits fluid to pass into the normal supply line, the emergency vent valve opens to prevent pressure build up in the emergency supply line and the indicator shows NORM.

Automatic emergency

11. If the normal electrical supply fails or is disconnected from the circuit by the opening of the contacts of the main reservoir microswitches or the bomb door safety switch, the normal solenoids of No. 1 and 2 control selector valves, the solenoid of the emergency vent valve and the indicator are de-energized. When de-energized, the control selector valves move to the neutral position to isolate the normal and emergency supply lines from the engine-driven pumps, the emergency vent valve closes to blank off the emergency supply line from the return line, and the indicator shows black and white diagonal stripes.

Selected emergency

12. A standby selection of any service causes an emergency d.c. supply to be fed, via terminal K1 in junction box N-B, to the solenoids of relays F and G. Contacts 8-8a of both relays disconnect the supply to the normal solenoids of the No. 1 and 2 control selector valves unless the system is already on automatic emergency. Contacts 3-3a of relay F connect a supply, fed from fuse A9 in the emergency d.c. fuse panel C-J, to the emergency solenoid of the No. 2 control selector valve and the solenoid connected across terminals 2 and 3 of the indicator. Contacts 3a-3 of the energized relay G connect a supply, fed from fuse B5 in panel C-J, to the emergency solenoid of the No. 1 control selector valve. When energized the indicator shows EMGY and the position of the valves permits fluid to pass into the emergency supply line.

Note...

Following a selection of the emergency down service to either the main plane flaps or the arresting hook, the general services hydraulic system will remain on emergency only as long as a selection is maintained. Such selections must not, therefore, be cancelled by returning the switches to OFF.

Servicing

13. It is important that no electrical servicing of any part of the system or its services is performed until the tradesman responsible for the general services hydraulic system has been informed.

HYDRAULICS INTEGRATION

General

14. In the event of failure of one flying controls hydraulic system and subsequent failure of the opposite engine, or vice versa, the general services hydraulic system power supply can be connected to the serviceable flying controls system. Integration is controlled by two electrically-operated relay valves incorporated in the hydraulic system as described in Book 1, Cover 2, Sect. 3, Chap. 6, Service A. The operation of each valve is selected by a two-position switch on the standby control panel at the pilot's

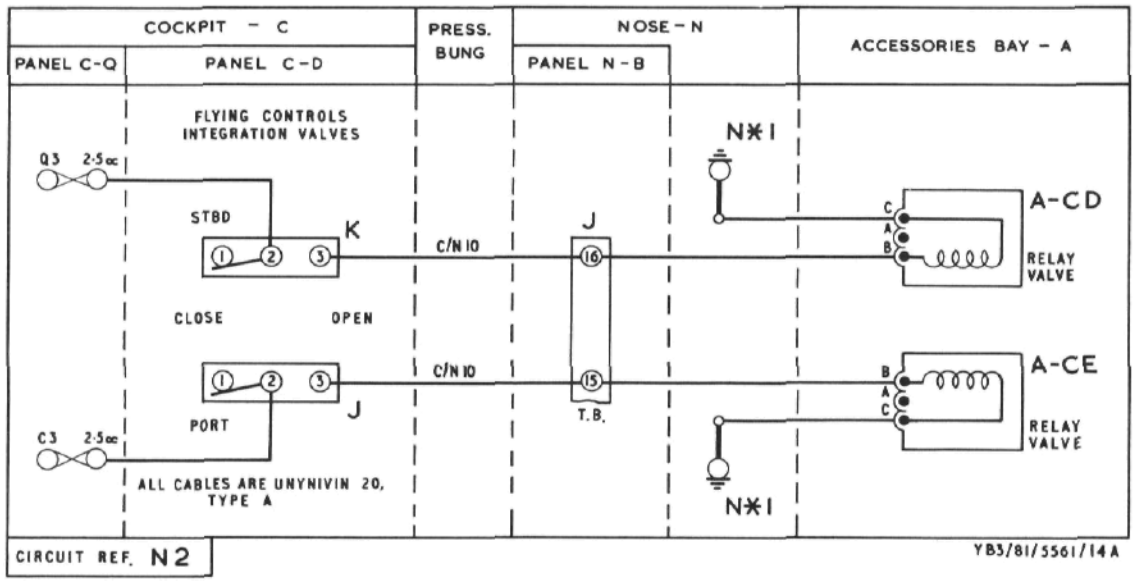

Fig. 3. Hydraulics integration

station. The two switches are mounted side by side and are marked FLYING CONTROLS INTEGRATION VALVES, PORT and STBD, OPEN – CLOSE. When integration is required the switch associated with the serviceable flying controls system should be selected to OPEN.

Function

15. If a failure of the starboard engine is concurrent with a failure of the port (No. 1) flying controls system, the selection of the starboard flying controls integration valve switch to OPEN causes the associated relay valve to be energized to the open position. This allows fluid, under pressure from the port general services engine-driven pump, to be fed to the starboard (No. 2) flying controls system. Similarly, if a failure of the port engine is concurrent with a failure of the starboard flying controls system, the selection of the port flying controls integration valve switch to OPEN causes the associated relay valve to be energized to the open position. This allows fluid under pressure from the starboard general services engine-driven pump to be fed to the port flying controls system.

Operation *(fig 3)*

Note...

As the electrical operation of both integration relay valves is similar, only the circuit for the operation of the valve which connects No. 1 flying controls system with the output of the starboard general services engine-driven pump is described. The corresponding components of the other valve operating circuit are given in brackets.

16. When the port (stbd) flying controls integration valve switch J (K) on the pilot's standby control panel C-D is selected to OPEN, a d.c. supply is fed from fuse C3 (Q3) in the normal d.c. fuse panel C-Q to the solenoid of the relay valve A-CE (A-CD).

GENERAL SERVICES HYDRAULIC PUMP FAILURE WARNING

General

17. Failure of the hydraulic pumps which pressurize the general services hydraulic system is indicated by two two-position magnetic indicators, one to each pump, on the pilot's starboard console panel C-F/1.

Function

18. A fall in the flow pressure from either of the hydraulic pumps in the general services hydraulic system causes a hydraulic flow indicator transmitter to open the contacts of a microswitch in the indicator circuit of the defective pump. The open contacts disconnect the supply to the solenoid of the respective pumps indicator causing it to be de-energized and show black and white diagonal stripes.

Operation *(fig 4)*

Note...

As both the port and starboard pump failure warning circuits are similar, the operation of the port circuit only is described. The identification letters of the corresponding components of the starboard circuit are shown in brackets.

19. The d.c. supply to the indicator is controlled by a microswitch which is actuated by a flow transmitter incorporated in the output side of the pump. The microswitch is located in the accessories bay, immediately adjacent to the transmitter, on the forward face of bulkhead 120.5. When the pump is operating satisfactorily the hydraulic pressure operates a plunger in the transmitter. The plunger depresses the microswitch A-AD (A-AJ) thereby closing contacts 6-5 which connect a supply from fuse C8 (H8), in the normal d.c. fuse

panel C-Q, to the indicator C(E). On being energized the indicator shows black.

20. A fall in pressure at the pump outlet causes the transmitter plunger to be withdrawn; this permits contacts 6-5 of the microswitch to open and disconnect the supply to the indicator. On being de-energized the indicator shows black and white diagonal stripes.

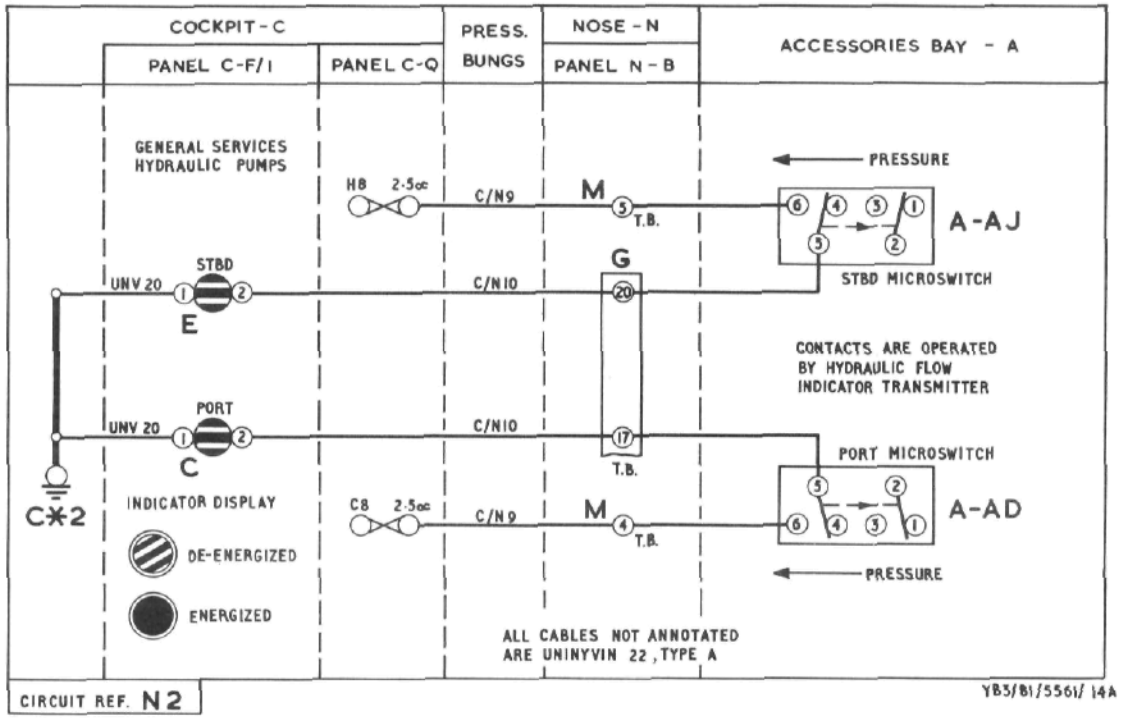

Fig. 4. General services hydraulic pump failure warning

CANOPY OPERATION

General

21. The canopy can be opened and closed both electrically and manually from inside and outside the cabin. These operations are controlled by a canopy operation control handle and a canopy motor selector, both of which are mounted on the starboard wall of the cabin. Information regarding the general assembly and manual operation of the canopy is contained in Book 1, Cover 2, Sect. 3, Chap. 1 of this publication.

Description

22. The circuit for the electrical operation of the canopy comprises a rotary actuator, a reversing relay, and microswitches employed as limit and selection switches. The d.c. supply is fed directly from the normal battery, thereby permitting electrical operation of the canopy when normal supplies are not available on the main busbar; the supply also remains intact should a crash landing occur (*Chap. 2, this Section*).

Rotary actuator

23. The canopy is opened and closed by an actuator, idented D-AC and located in the dorsal structure immediately aft of the sloping bulkhead at the rear of the cabin.

Reversing relay unit

24. The direction of rotation of the actuator is governed by a reversing relay unit, idented D-AD and located in the dorsal structure adjacent to the actuator. A delay switch, incorporated in the unit, operates when the canopy motor selector is selected to the TO OPEN position; this allows the canopy seal to deflate before the actuator is brought into operation.

Limit switches

25. When the canopy reaches the limit of maximum travel, in either direction, the d.c. supply to the actuator is disconnected by the operation of a limit switch. The closed limit switch is located below the forward end of the starboard canopy rail and is actuated by a lever mounted on the rail. The open limit switch is located in the dorsal structure at the rear of the canopy shuttle guide rails and is actuated by a buffer type stop on the shuttle.

Function

26. Selections of the canopy motor selector are only effective when the canopy operation control handle is in the UNLOCKED position. Selection of the canopy motor selector to either the TO OPEN or TO CLOSE position causes the actuator motor to rotate in such a direction as to effect the movement of the canopy in the

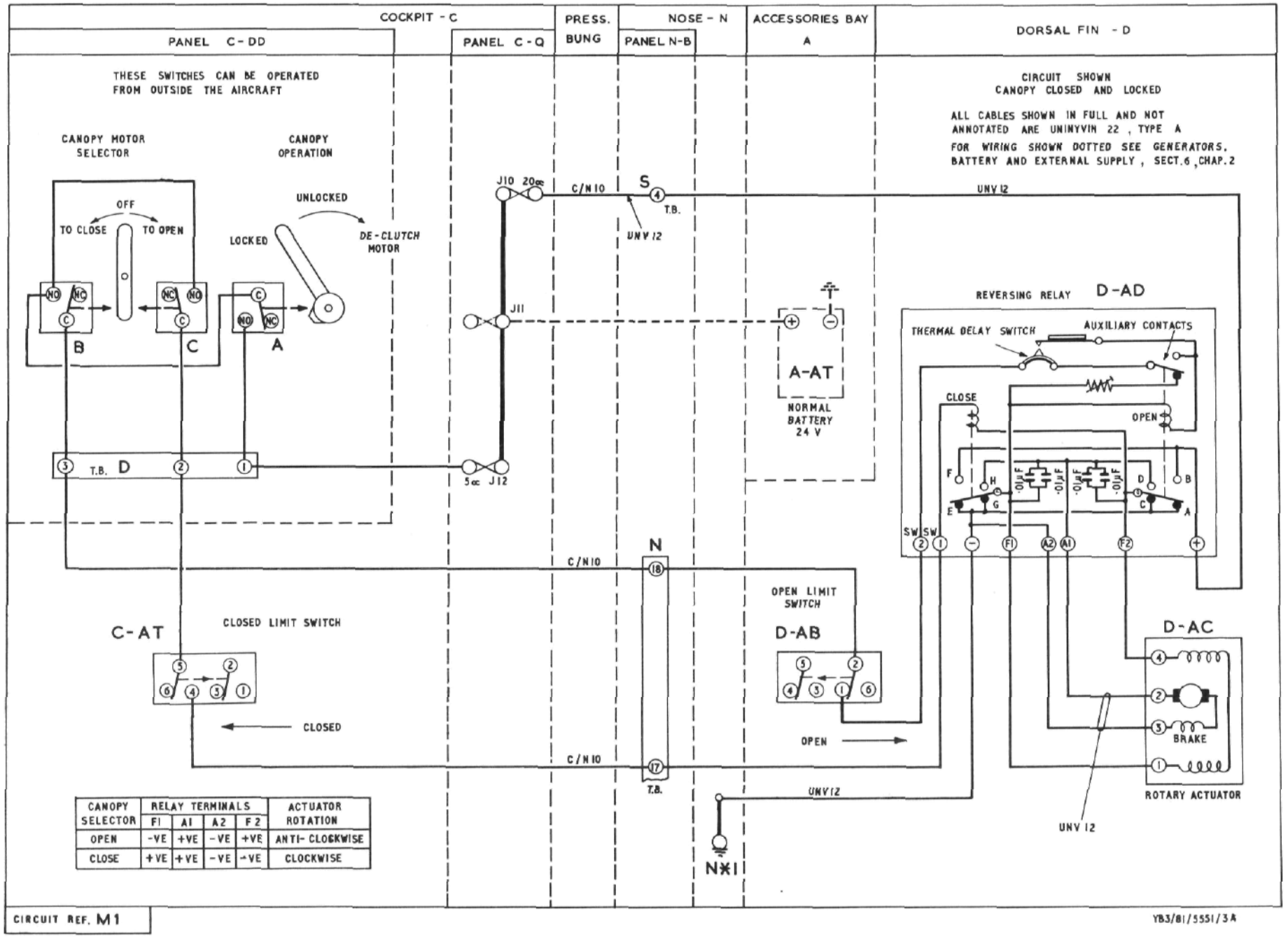

Fig. 5. Canopy operation

direction selected, until the d.c. supply to the actuator is disconnected by the operation of the appropriate limit switch or the motor selector is returned to OFF.

Operation *(fig 5)*

Open from closed

27. With the canopy closed, or in an intermediate position, and the canopy operation control handle in the UNLOCKED position, a TO OPEN selection of the canopy motor selector connects a d.c. supply from fuse J12, in the normal d.c. fuse panel C-Q, via contacts NO-C of microswitches A and B and contacts 2-1 of the 'open' limit switch D-AB, to terminal SW2 on the reversing relay unit D-AD. Current then flows through the bi-metal strip, the auxiliary contacts and the pre-set resistor, the negative being made through contacts G and E of the 'close' relay. The heat generated in the bi-metal strip due to the current flow causes the strip to deflect until, after a delay of approximately 2 to 3 sec., it closes the contacts of the thermal switch thus connecting the supply from terminal SW2 to the operating coil of the 'open' relay.

28. Energization of the 'open' relay causes the auxiliary contacts to complete a hold circuit from terminal SW2 direct to the relay operating coil and to open-circuit the pre-set resistor. At the same time the main contacts B-D of the 'open' relay complete a circuit from fuse J10, in panel C-Q, to terminals A1 and F2 of the reversing relay unit. The supply at terminal A1 is then fed to the brake release solenoid of the actuator D-AC and the supply at terminal F2 is connected to the actuator motor windings. The actuator then opens the canopy. When the canopy reaches its fully-open position, the operation of the 'open' limit switch D-AB disconnects the supply to the operating coil of the 'open' relay which, on being de-energized, opens contacts B-D thus disconnecting the supply to the brake solenoid and motor windings of the actuator. The canopy can be stopped in any intermediate position by selecting the canopy motor selector to OFF; this affects the circuit in the same manner as the action of the 'open' limit switch.

Close from open

29. With the canopy fully open, or in any intermediate position, and the canopy operation control handle in the UNLOCKED position, a TO CLOSE selection of the canopy motor selector connects a d.c. supply from fuse J12, in panel C-Q, via contacts NO-C of microswitches A and C and contacts 5-4 of the 'closed' limit switch C-AT, to terminal SW1 on the reversing relay unit D-AD and hence to the operation coil of the 'close' relay.

30. Energization of the 'close' relay closes contacts F-H, thus connecting a d.c. supply from fuse J10, in panel C-Q, to terminals A1 and F1 of the reversing relay unit. The supply at terminal A1 is fed to the brake release solenoid of the actuator D-AC and the supply at terminal F1 is connected to the actuator motor windings. The canopy can be stopped in any intermediate position by selecting the canopy motor selector to OFF; this affects the circuit in the same manner as the action of the 'closed' limit switch.

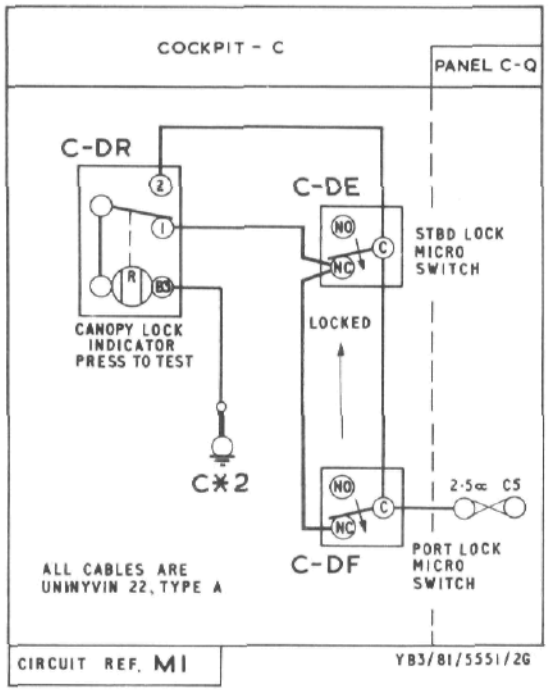

Fig. 6. Canopy locks indicator

CANOPY LOCKS INDICATOR

General

31. A red warning lamp is incorporated in the head of an indicator push-switch above the pilot's starboard console on the aft face of frame 120.5. The lamp illuminates when the canopy is unlocked and is only extinguished when both the port and starboard locks are fully home. The lamp can be tested for serviceability by depressing the push-switch. A description of the canopy lock mechanism is contained in Book 1, Cover 2, Sect. 3, Chap. 1.

Function

32. The action of the port and starboard canopy lock mechanisms, located at the rear of their respective canopy rails, actuates the contacts of an associated microswitch. The microswitches are connected in parallel and control a d.c. supply to the red lamp in the head of the indicator push-switch. The lamp illuminates until both the port and starboard locks are fully home.

Operation *(fig 6)*

33. While the canopy is unlocked the contacts of the microswitches (C-DF port and C-DE stbd.) are closed and connect a d.c. supply from fuse C5, in the normal d.c. fuse panel C-Q, to the lamp in the push-switch of the canopy lock indicator (C-DR). When both the port and starboard canopy locks are fully home the contacts of their respective microswitches open and disconnect the supply to the lamp causing it to extinguish.

34. If it is required to test the canopy lock indicator lamp, with the canopy locked, depression of the push-switch connects a supply from fuse C5 direct to the lamp.

WINDSCREEN WIPER

General

35. The windscreen wiper is operated by a self-contained hydraulic system pressurized by an electro-hydraulic pump unit. The unit comprises a hydraulic pump driven, through a reduction gearbox, by two 200V, 3-phase a.c. motors. The speed of the wiper arm is determined by the operation of one or both motors as selected by a rotary switch, located on frame 120.5 beneath the pilot's

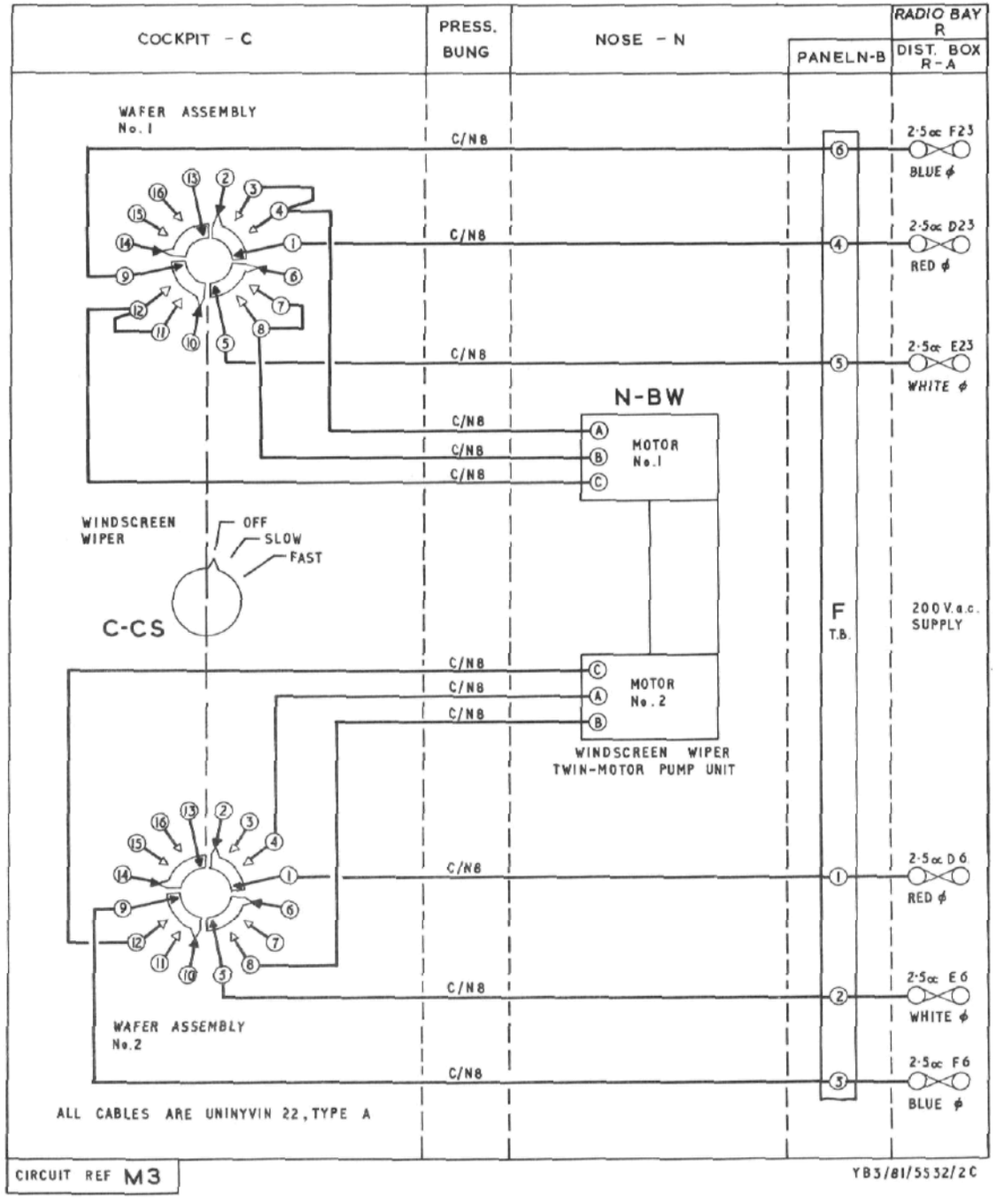

Fig. 7. Windscreen wiper

standby control panel and marked WINDSCREEN WIPER, OFF – SLOW – FAST. To provide for the operation of the wiper arm in the event of a failure of the normal a.c. supplies, the normal supply to one of the motors is fed from fuses which, in the event of a failure, are supplied by the standby a.c. system; this enables the wiper arm to operate at its slow speed only, irrespective of the speed selected. Information regarding the hydraulic components of the system is contained in Book 1, Cover 2, Sect. 3, Chap. 6 of this publication.

Operation *(fig 7)*

Normal

36. When the rotary switch C-CS is selected to SLOW, a 3-phase a.c. supply is fed from fuses D23, E23 and F23 in the a.c. distribution panel R-A, via the rotary switch, to the No. 1 motor of the pump unit N-BW which provides the fluid pulses necessary to drive the wiper arm at approximately 100 cycles/min. Selection of the rotary switch to FAST maintains the supply to the No. 1 motor while connecting a further 3-phase a.c. supply from fuses D6, E6, and F6, also in panel R-A, to the No. 2 motor; the resultant increase in fluid pulses increases the speed of the wiper arm to approximately 200 cycles/min. If the rotary switch is selected to OFF with the wiper arm at an intermediate position, the arm will travel to the parked position, on the starboard side of the windscreen, under the influence of the airflow over the windscreen.

Emergency

37. In the event of a failure of the normal a.c. supplies a standby a.c. supply is automatically connected to fuses D23, E23 and F23 in distribution box R-A. In this condition a selection of the rotary switch C-CS to either SLOW or FAST causes a supply to be fed to the No. 1 motor of the electro-hydraulic pump unit thereby operating the wiper arm at 100 cycles/min. In the event of an electrical failure occurring during normal operation of the wiper, the system will automatically change to emergency operation.

LIST OF APPENDIXES

Appendix 1 GENERAL SERVICES HYDRAULIC SUPPLY CONTROL (Mod 340)

1. On aircraft with Mod 340 incorporated a terminal block and junction box are fitted in lieu of the plug and socket connectors R-GH and R-GG. As shown in fig 1 the modified circuit incorporates minor routeing changes and the letters R-GH and R-GG are retained as the identification letters of the terminal block and junction box, respectively.

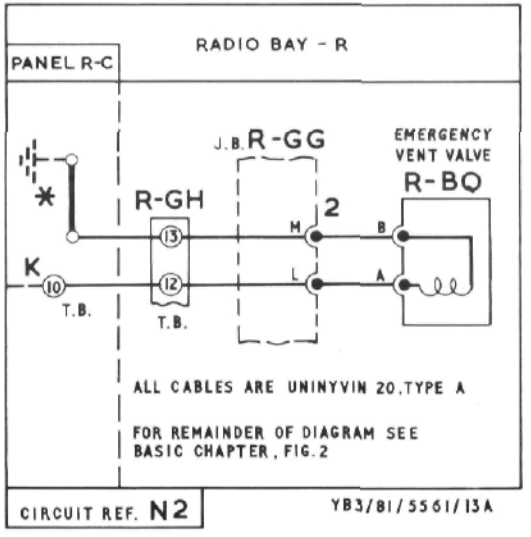

Fig. 1. General services hydraulic supply control