Chapter 6
HYDRAULIC SYSTEM

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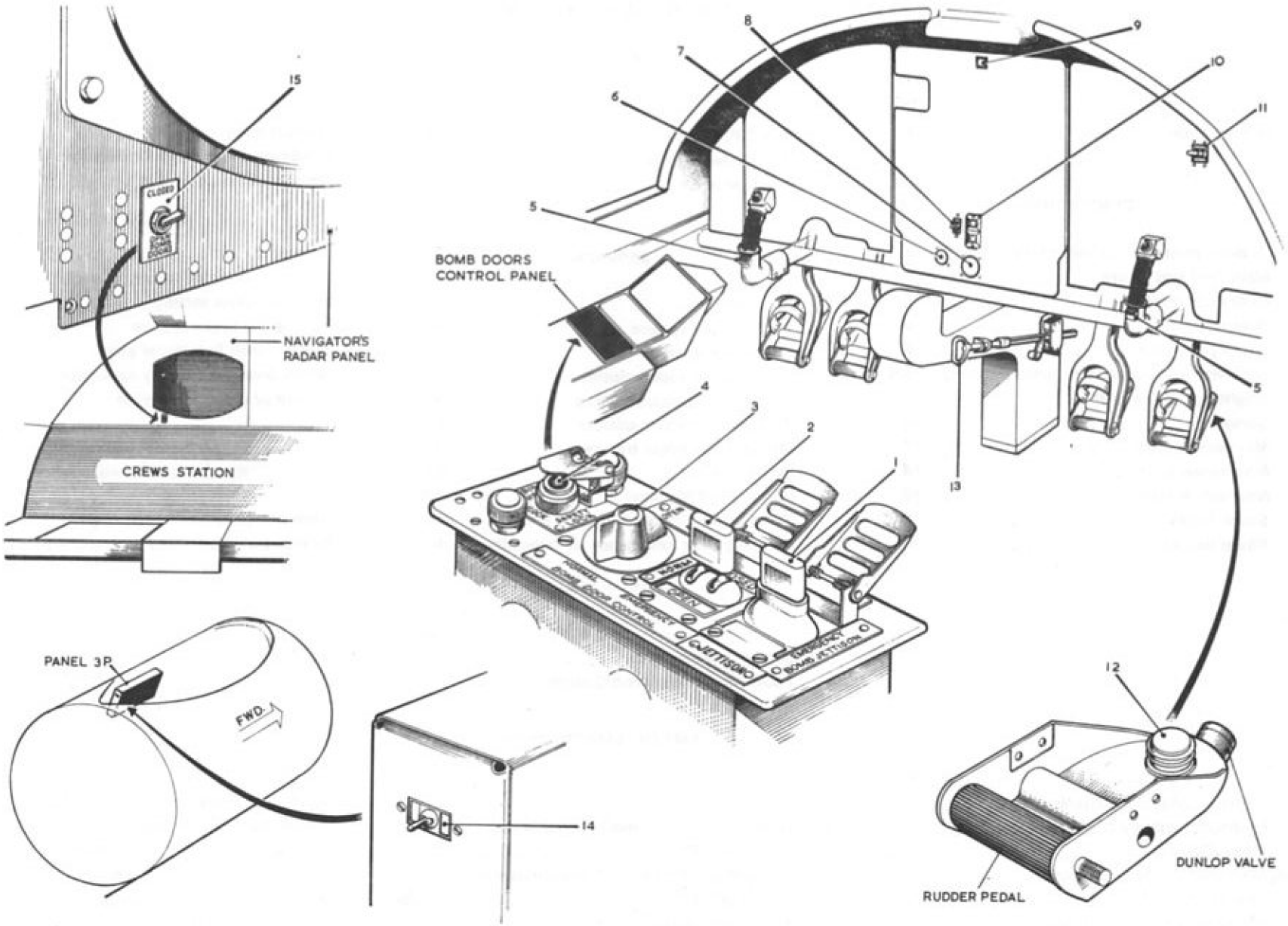

Fig. 1. Cockpit controls and indicators

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KEY TO FIG.1

Cockpit controls and indicators

1. EMERGENCY BOMB JETTISON SWITCH
   Aft – JETTISON, forward-OVERRIDE
   Spring-loaded to central OFF position

2. BOMB DOOR EMERGENCY SWITCH
   Aft – OPEN, centre – NORMAL, forward – CLOSED

3. BOMB DOOR SELECTOR SWITCH (NORMAL)
   Outboard – OPEN, centre – AUTO, inboard – CLOSE

4. BOMB RELEASE SAFETY LOCK SWITCH

5. NOSE-WHEEL STEERING ENGAGE SWITCH
   Guarded push-switch

6. HYDRAULIC PRESSURE GAUGE
   Calibrated 0 to 6 000 lb/in^2

7. ALIGHTING GEAR POSITION INDICATOR
   UNLOCKED – LOCKED DOWN

8. HYDRAULIC POWER PACK MOTOR SWITCH
   Spring-loaded to central OFF position

9. BOMB DOOR INDICATOR
   Magnetic indicator
   Energised when bomb doors are closed

10. ALIGHTING GEAR SELECTOR SWITCH
    Two buttons – u/c UP – u/c DOWN

11. WINDSCREEN WIPERS
    Two switches – 1st., 2nd. Up – OFF, centre – FAST, down – SLOW

12. BRAKES FOOT CONTROL
    For full descriptive use refer to A.P.1803S, Vol.1

13. EMERGENCY AIR CONTROL HANDLE
    Pulled to operate
    After being used, can only be reset when aircraft is on the ground

14. NOSE-WHEEL STEERING EMERGENCY OVERRIDE
    Inboard – NORMAL, outboard – EMERGENCY

15. BOMB DOOR SELECTOR SWITCH
    Up – CLOSED, down – OPEN

DESCRIPTION

Introduction

1. A high-pressure hydraulic system is installed to operate the following:-

   (1) Alighting gear and associated doors

   (2) Bomb doors

   (3) Nose-wheel steering

   (4) Wheel brakes

   (5) A.A.P.P. scoop

Separate self-contained systems are used for operation of the windscreen wipers, these being described in para.24 and 25.

2. The various hydraulic circuits are separately controlled by electrically-operated selector valves with the exception of the nose-wheel centring jack, which is connected directly to the main supply line.

3. The emergency air supplies are coupled to the alighting gear and associated door circuits for lowering them in the event of hydraulic failure.

4. Subsequent paragraphs describe the complete system and give details of servicing operations, but reference must be made to the appropriate Air Publications for detailed information on the various hydraulic and wheel brake components. A list of the main components comprising the system, together with their A.P. references and their location in the aircraft is given in Table 1.

COCKPIT CONTROLS AND INDICATORS

5. These are located at the pilots' and crew stations and with the exception of the brakes

and the emergency air controls are electrical in operation. Fig.1 illustrates the controls and indicates their position and the Key to Fig.1 gives a brief description of them. Reference must be made to Sect.6 of this Publication for details of the electrical functions of these controls.

6. The alighting gear selector switch embodies a safety device to prevent selection of retraction when the weight of the aircraft is on the wheels, as described in Sect.1, Chap.3 which also describes the use of the emergency air control.

MAIN FEED AND RETURN

Hydraulic reservoir

7. This unit consists of a spherical fabricated body, mounted in the bomb compartment roof immediately aft of the bomb arch station 123. Mounted in the base of the reservoir are return, suction and power pack connections, the return connection incorporating a non-return valve assembly. The unit is piped to the power pack to suit the filling arrangements, combined filling of the reservoir and pack being achieved from the reservoir charging valve through a filter. An assembly at the top of the unit embodies separate pressurisation and vent connections, the latter incorporating a vent valve set to blow-off at 22-27 lb/in^2 and to re-seat at a minimum of 16 lb/in^2. Pressurisation of the reservoir, pre Mod.2321, is by air from the engines (para.9A and 9B) or, post Mod.2321, by nitrogen tapped from the A.R.I.5874 and 18076 pressurisation system in the rear fuselage (para.9A and 9C) each system being fed through pressure-reducing valves. A sight glass window is fitted for the purpose of checking the fluid level in the reservoir.

Power circuit

8. Fluid is drawn from the reservoir, through separate filters, by the three engine-driven pumps. Each pump delivers fluid to a common feed pipeline via an hydraulic accumulator, a 5 micron filter and a non-return valve. The common feed pipe is connected to the various selectors which are also connected to the common return pipeline to the reservoir. The pumps are of the two stage type, i.e., a low pressure gear pump feeding a high pressure radial piston pump, capable of delivering fluid on demand at a working pressure of 3 600 to 4 000 lb/in^2. Each pump incorporates an automatic cut-out device, and when idling between operational demands, circulates fluid to the reservoir through the main return line. The hydraulic accumulators in each pump delivery line are removed when Mod.2278 is embodied. The 5 micron filters introduced by Mod.2261 located in their respective engine bays are provided to prevent debris fouling the hydraulic system in the event of an engine driven pump failure.

8A. The filter introduced by Mod.2261 (fig.1A) incorporates a pressure differential 'clogging' indicator assembly mounted at the top of the filter casing. With the pressure difference between the filter inlet and outlet ports normal, the indicator pin is flush with the top surface of the indicator cap nut. When the pressure difference exceeds 70 ± 10 lb/in^2 the red coloured indicator pin will protrude ¼ in above the cap nut. Following rectification the indicator is reset by pushing the indicator pin until it is flush with the top surface of the cap nut.

Power pack unit

9. A power pack unit is installed for ground and emergency operation of the bomb door circuit and for operation of the wheel brakes during towing operations. The unit comprises a high-pressure radial pump embodied in a cylindrical casing, to which an electric motor and a canister containing a filter assembly are mounted. The cylinder is filled with fluid which is drawn through the filter and a suction pipe by the pump. The operating pressure of 3 700 ± 185 lb/in^2 is governed by a switch incorporated in the electrical circuit to the motor. To prevent the power pack motor from becoming overloaded on initial starting, a by-pass valve is incorporated in the circuit to direct fluid to the pack return line until the motor is capable of accepting full load, the by-pass valve is closed by a time-delay unit two seconds after the pack is started. The fluid cylinder is pressurised, pre Mod.2321, by engine air (para.9A and 9B) or, post Mod.2321, by nitrogen tapped from the A.R.I.5874 and 18076 pressurisation system in the rear fuselage (para.9A and 9C) each system being fed through pressure-reducing valve. A sight glass window is fitted for the purpose of checking the fluid level in the cylinder.

Reservoir and power pack pressurisation

9A. The reservoir and power pack fluid cylinder are pressurised, pre Mod.2321 with engine air and post Mod.2321 with nitrogen, to ensure a positive head of pressure is maintained on their outlet connections to prevent cavitation.

9B. On aircraft pre Mod.2321:-
Air from the engines passes through a 200-15 lb/in^2 pressure-reducing valve Part No. A.C.M.27450 and a non-return valve to a four-way connector before branching to the hydraulic reservoir and emergency power pack. One branch is vented from atmosphere through a non-return valve, the second passes to the

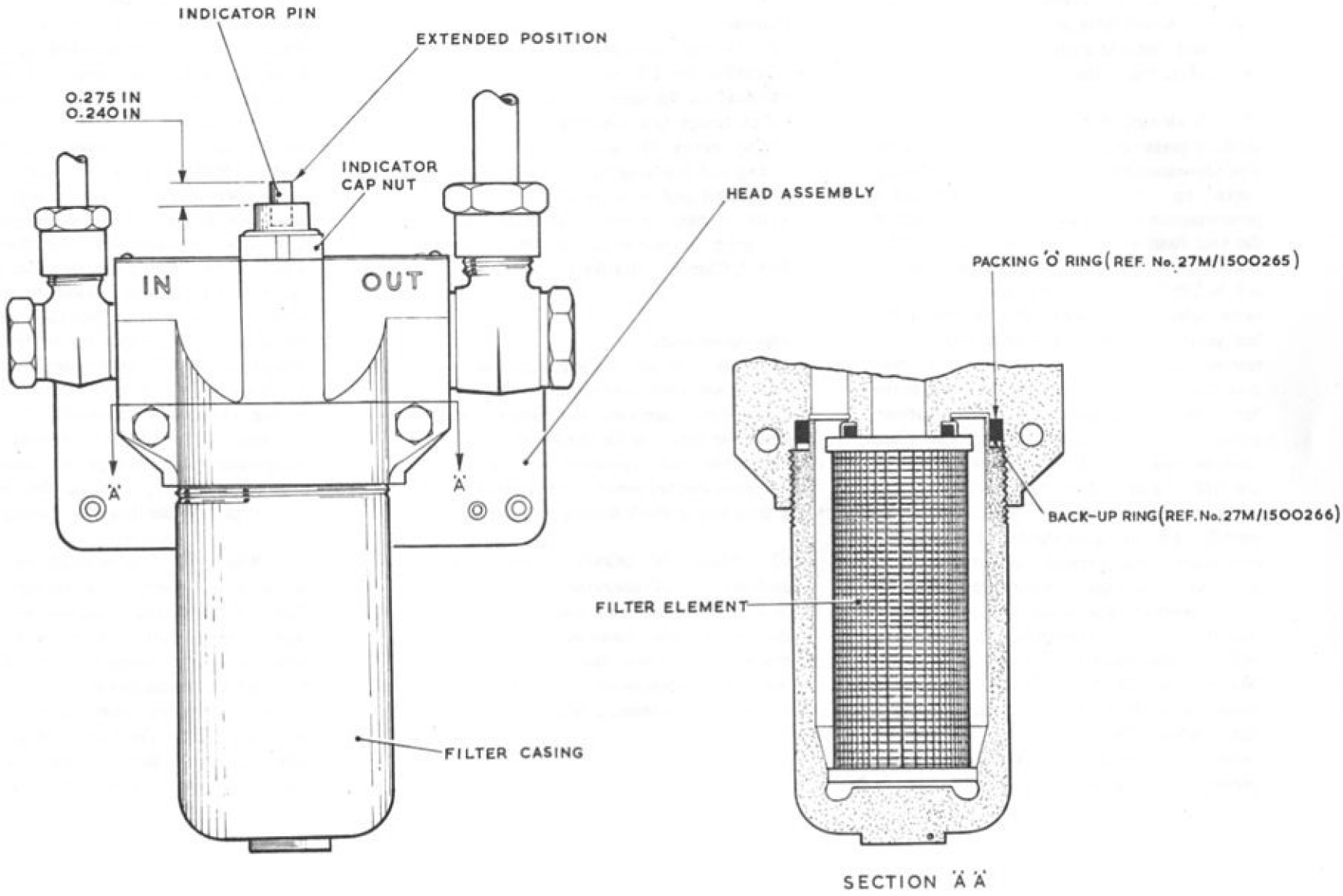

Fig. 1A Hydraulic delivery line 5 micron filter (Mod. 2261)

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power pack and the third branch passes via a restrictor and a non-return valve to the reservoir. A vent valve, set to blow-off at 22-27 lb/in^2 and reseat at a minimum of 16 lb/in^2, is mounted on top of the reservoir.

9C. On aircraft post Mod.2321:-
Medium pressure nitrogen is tapped from the pipe downstream of the pressure-maintaining valve on the rear warning installation pressurisation panel located on the port side of the rear fuselage (Sect.3, Chap.16), through a 200-15 lb/in^2 pressure-reducing valve Part No. A.C.M.27518 and via a test point to an on/off valve. Selection of the on/off valve lever to the 'on' position ensures a flow of nitrogen to the reservoir and power pack. A guard is fitted over the valve lever to maintain the valve in the 'on' position. Before servicing the reservoir, power pack or hydraulic system the guard must be removed and the valve lever moved to the 'off' position, thus closing off the supply of pressurised nitrogen. Downstream of the on/off valve the pipe divides at a four-way connector, one branch is vented from atmosphere through a non-return valve, the second passes to the power pack and the third branch passes via a restrictor and a non-return valve to the reservoir. A vent valve set to blow-off at 22-27 lb/in^2 and reseat at a minimum of 16 lb/in^2 is mounted on top of the reservoir. The test point in the circuit is used to check the output of the pressure-reducing valve.

ALIGHTING GEAR CIRCUITS

General

10. Normal operation of the alighting gear is controlled by UP and DOWN push-buttons, mounted on the valve instrument panel, use of which brings into operation the appropriate selector valves. The sequence of operations for raising and lowering the main-wheel units and nose-wheel unit is controlled electrically by a series of microswitches, particulars of which are given in Sect.6 of this Publication and Sect.3, Chap.5 of this Book.

Main-wheel units

11. The port and starboard main-wheel unit circuits are each controlled by three selector valves, one operates the doors, one the retracting jack and the third one, fitted to the main-wheel unit, operates the down-lock. The full operating sequence of one main-wheel unit is described in the following paragraphs.

12. When U/C DOWN is selected in the cockpit, the U/C door-operating selector valve only is energised and high-pressure fluid is directed to the door-operating jacks which extend and open the door. A one-way restrictor incorporated in the system return line governs the speed at which the door opens, by impeding the flow of fluid forced out of the jack. As the door reaches the fully open position, a microswitch is tripped causing the selectors serving the main-unit jack and the down-lock jack to be energised. High-pressure fluid from the main feed line is passed to the main-unit jack which retracts to lower the undercarriage. Fluid, reduced in pressure to 1 500 ± 150 lb/in^2 by a pressure-reducing valve in the selector feed line, is also supplied to the down lock jack which extends and prepares the down-lock for engagement when the main unit is fully down. Fluid from the upper portion of the bogie trim jack is allowed to pass to the return line through the open main selector and the jack extends, under the influence of the compressed air in its lower portion, positioning the bogie wheels in the correct attitude for landing. On aircraft with Mod.1280 embodied, the hydraulic pressure is relieved from the recuperator valve, through the main-unit jack selector to return, allowing the recuperator valve to close under its spring loading.

13. When U/C UP is selected, the down-lock and main unit selectors are energised, directing fluid to the down-lock jack, main-unit jack, the bogie trim jack and on aircraft with Mod.1280 embodied the recuperator valve. The down-lock jack is retracted to unlock the main-unit, which is retracted when the main-unit jack extends. Pressure fluid directed to the bogie jack causes it to shorten against its change of compressed air, raising the sliding tube

in the main fitting and turning the bogie about the shock-absorber lower attachment to position it for stowage in the wheel bay. When the sliding tube reaches the end of its travel, it operates a microswitch which, together with a microswitch operated by a cam on the main unit pivot shaft, energises the door jack selector valve. The electrical circuit is so arranged that the door jack selector valve is only energised when both microswitches are operated and the main unit fully retracted. During retraction, progressive action of a cam-operated restrictor valve slows the retraction speed of the main unit as it enters the wheel bay. On aircraft with Mod.1280 embodied, a branch line, taken from the supply line to the bogie trimmer jack, supplies pressure to hold the recuperator valve open against its spring loading. The open recuperator valve ensures that correct pressure is maintained in the shock-absorber by action of the hydraulic pressure acting on the separator floating piston. It also ensures that over-recuperation of the shock-absorber is prevented when the shock-absorber is subjected to extreme cold at high altitude. Final movement of the compartment door, to the fully closed position, operates a microswitch to give visual indication in the cockpit that the undercarriage is stowed.

Nose-wheel unit

14. A circuit similar to that for the main-wheel units, controlled by two selectors, is installed for the nose-wheel unit and doors. When U/C DOWN is selected, the door selector valve is energised concurrently with those for the main-wheel units, and fluid is directed to the 'down' ends of the door jacks. When the doors are open, a microswitch energises the nose-wheel unit selector valve to direct fluid to the 'down' end of the nose-wheel jack. The unit is then lowered and the retracting strut straightened and locked automatically.

15. When U/C UP is selected, fluid is directed by the nose-wheel selector valve to the 'up' end of the nose-wheel jack to effect retraction. As retraction is completed, a microswitch is operated to energise the doors selector valve and fluid is directed to the 'up' ends of the door jacks to close them.

Nose-wheel steering

16. The operation of this circuit is governed by a steering stop valve, a control valve, and the position of the rudder pedals. The stop valve, which is supplied from the main feed line through a pressure-reducing valve, functions as a selector valve and directs or isolates the pressure line to the steering control valve. Selection of the control valve is governed by a drum switch attached to a bracket which permits both the switch body and spindle to be rotated, the body is connected to the rudder push-pull rods and the spindle to a follow-up rod connected to the nose-wheel. The remaining units in the steering circuit are a two-way pressure - relief valve, a by-pass valve and a steering jack which are mounted on the nose-wheel unit together with a centring jack. The centring jack is fed directly from the main supply line through a pressure - regulating valve which maintains an essential minimum pressure to the jack should the supply to the steering jack fail. When the steering switch, on either pilot's control handle, is engaged, the steering stop valve is energised and fluid is fed to the steering control valve. Movement of the rudder pedals, move the drum switch body out of alignment with the spindle which energises the appropriate steering control valve solenoid to direct fluid to the steering jack. As the nose wheels turn, the follow-up rod will rotate the drum switch spindle to align the spindle with the drum to de-energise the steering control and hold the nose-wheels in the selected position. Further movement is prevented until further movement is applied to the rudder pedals. When the stop valve is open, the by-pass valve is closed, any overload imposed while taxying is relieved by the two-way relief valve. When the weight of the aircraft is off the wheels and the shock-absorber fully extended, a microswitch is operated to cut the electrical supply to the steering stop valve rendering the steering system inoperative. At the same time the by-pass valve opens permitting a flow from one side of the steering jack to the other. The centring jack is then the only unit exerting force on the wheels which are therefore automatically centred. In the event of failure of the microswitch supplying power to the stop valve, when the weight of the aircraft is on the wheels, power is supplied to the stop valve by selecting EMERGENCY on the NOSEWHEEL STEERING EMERGENCY OVERRIDE switch located on the main fuse and T.B. panel 3P.

BOMB DOORS

17. This circuit is supplied through three selectors for operation of the bomb door jacks. For normal operation two selectors are used which govern supply from the engine driven pumps. For ground use and for emergency operation in flight the third selector, fed from the power pack, is used. The pilot's controls for this circuit are located on the port console (fig.1). A selector switch labelled BOMB DOORS, OPEN, CLOSED, located on the navigator/air bomber's panel gives control for normal operation.

18. When normal control is used, fluid is directed from the main supply through the selector valves on the port side of the bomb bay. When emergency control is used, fluid is supplied from the electro-hydraulic power pack via a five micron filter and its associated selector valve on the starboard side of the bomb bay. The filter is introduced by Mod.2261 to prevent contamination of the system in the event of a failure of the pump in the power pack. The normal and emergency supply lines are connected from their associated selector valves to the door jacks via a common shuttle valve. The shuttle valve, introduced by Mod.2318, is mounted on the port side of the bomb bay adjacent to the normal selectors. The shuttle moves

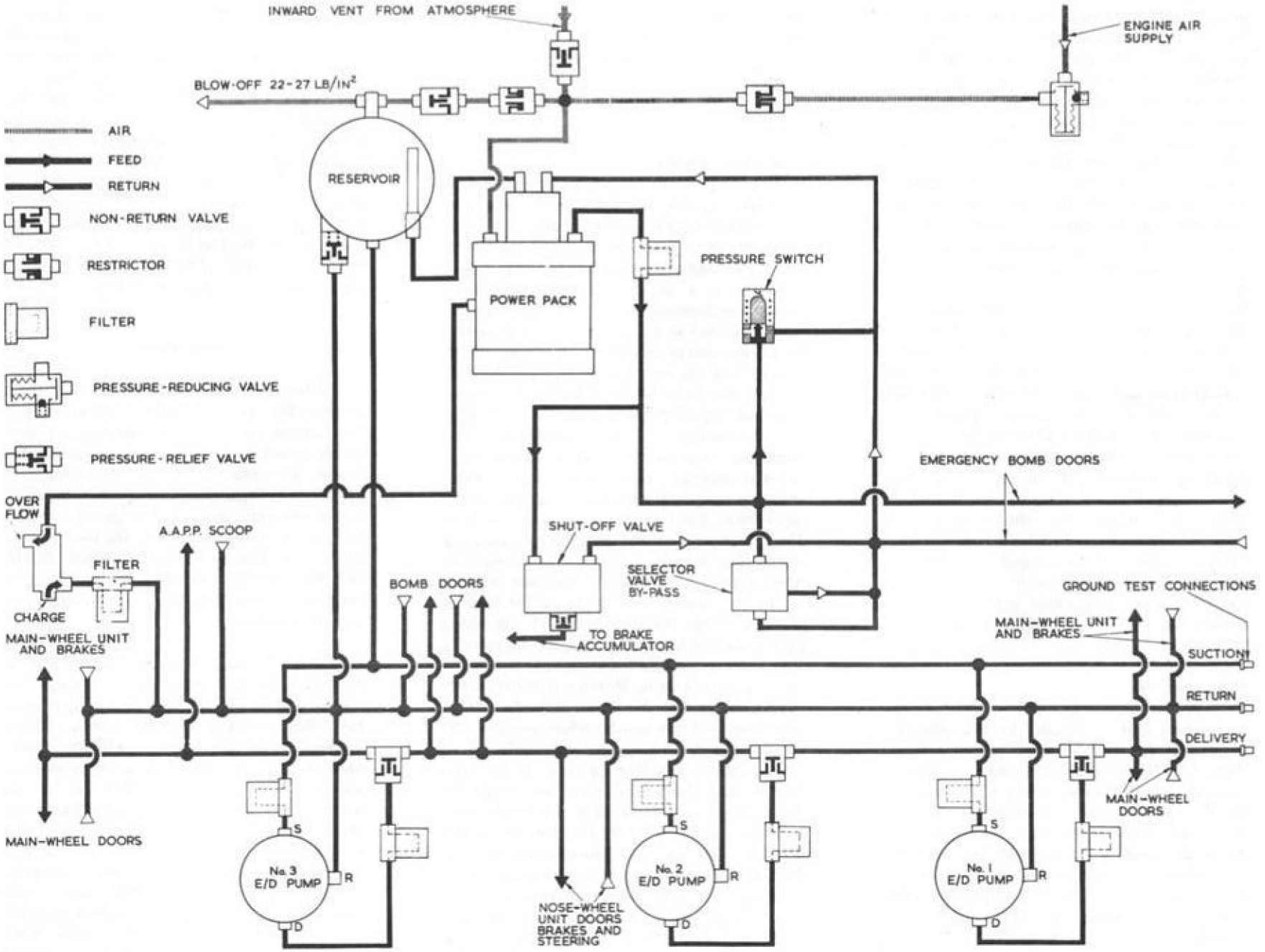

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Fig. 2 Main feed and return diagram (pre Mod. 2321)

◄ *New Illustration* ►

FS/3A

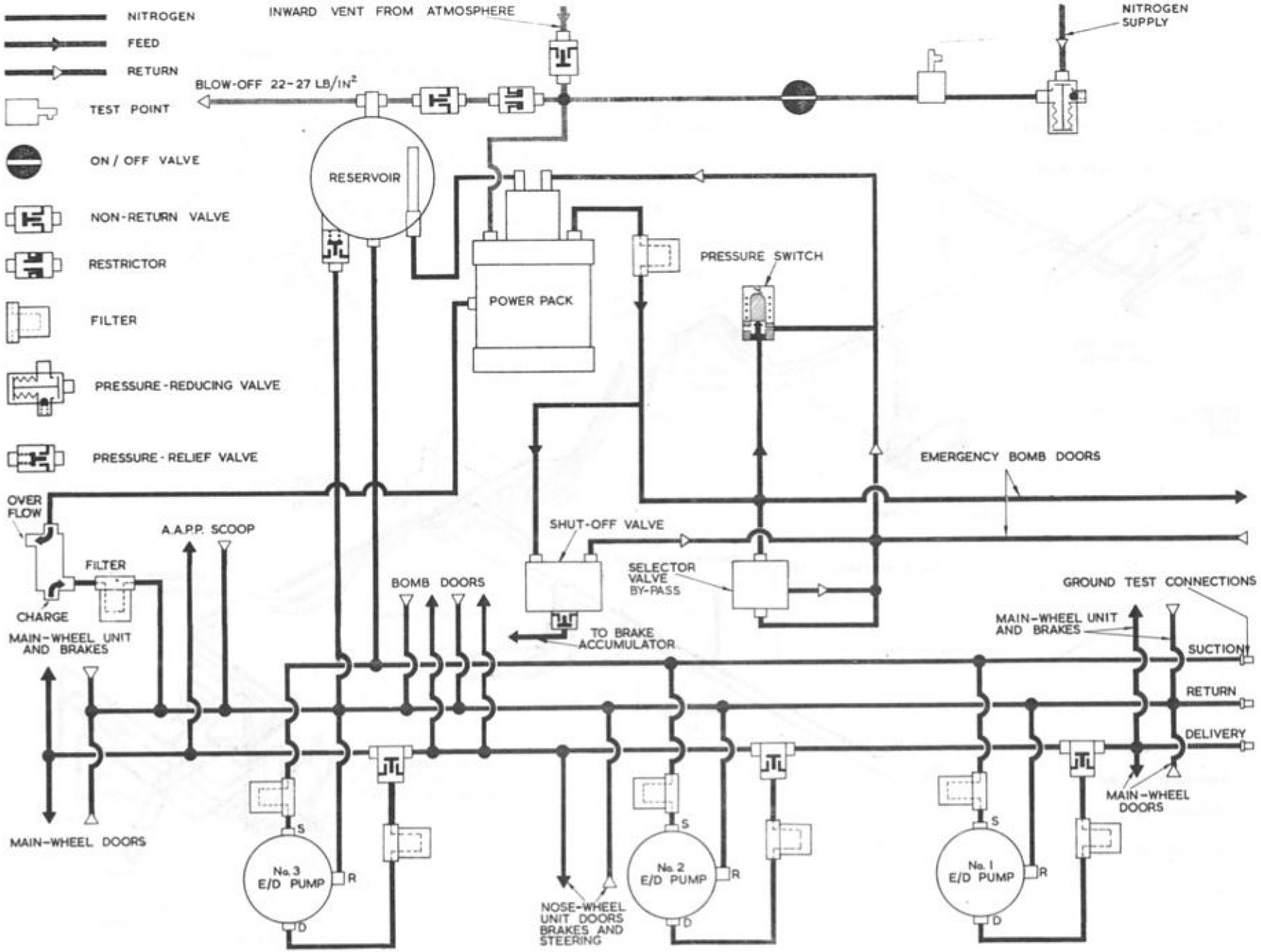

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Fig. 2A Main feed and return diagram (post Mod. 2321)

◄ *Illustration re-titled* ►

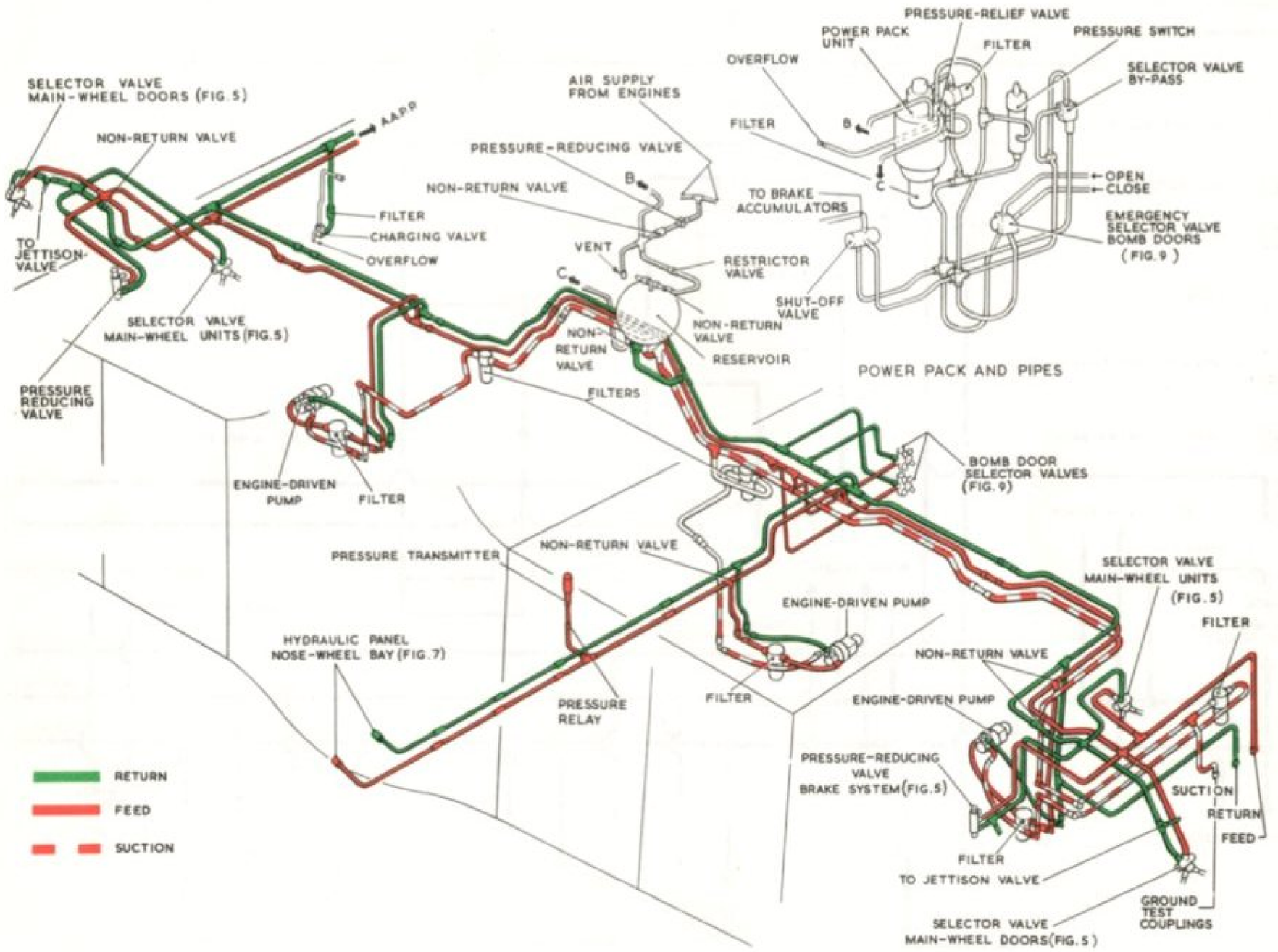

Fig. 3 Hydraulic system – main feed and return (pre Mod. 2321)

◄ New illustration ►

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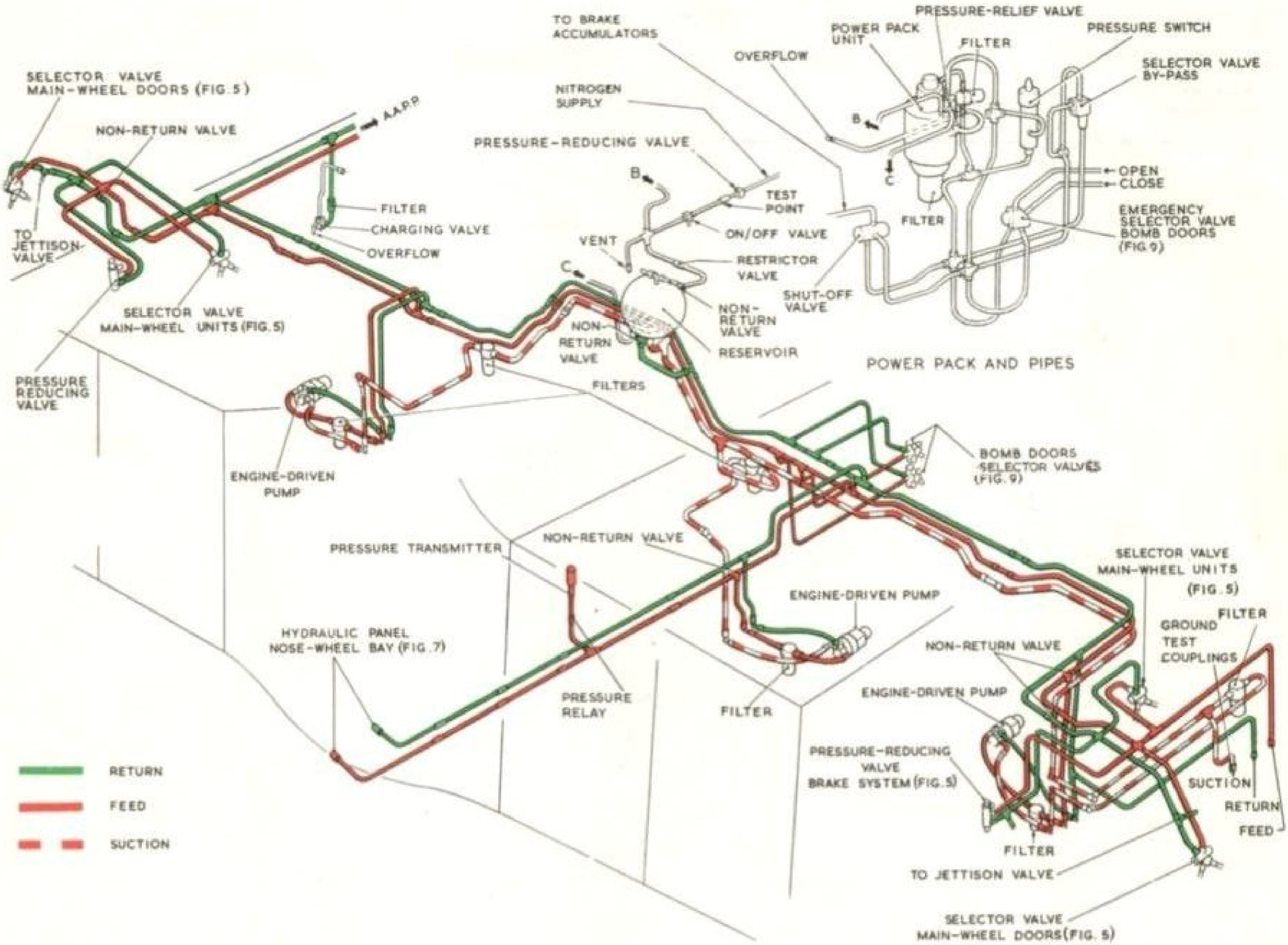

Fig. 3 A Hydraulic system–main feed and return (post Mod. 2321)

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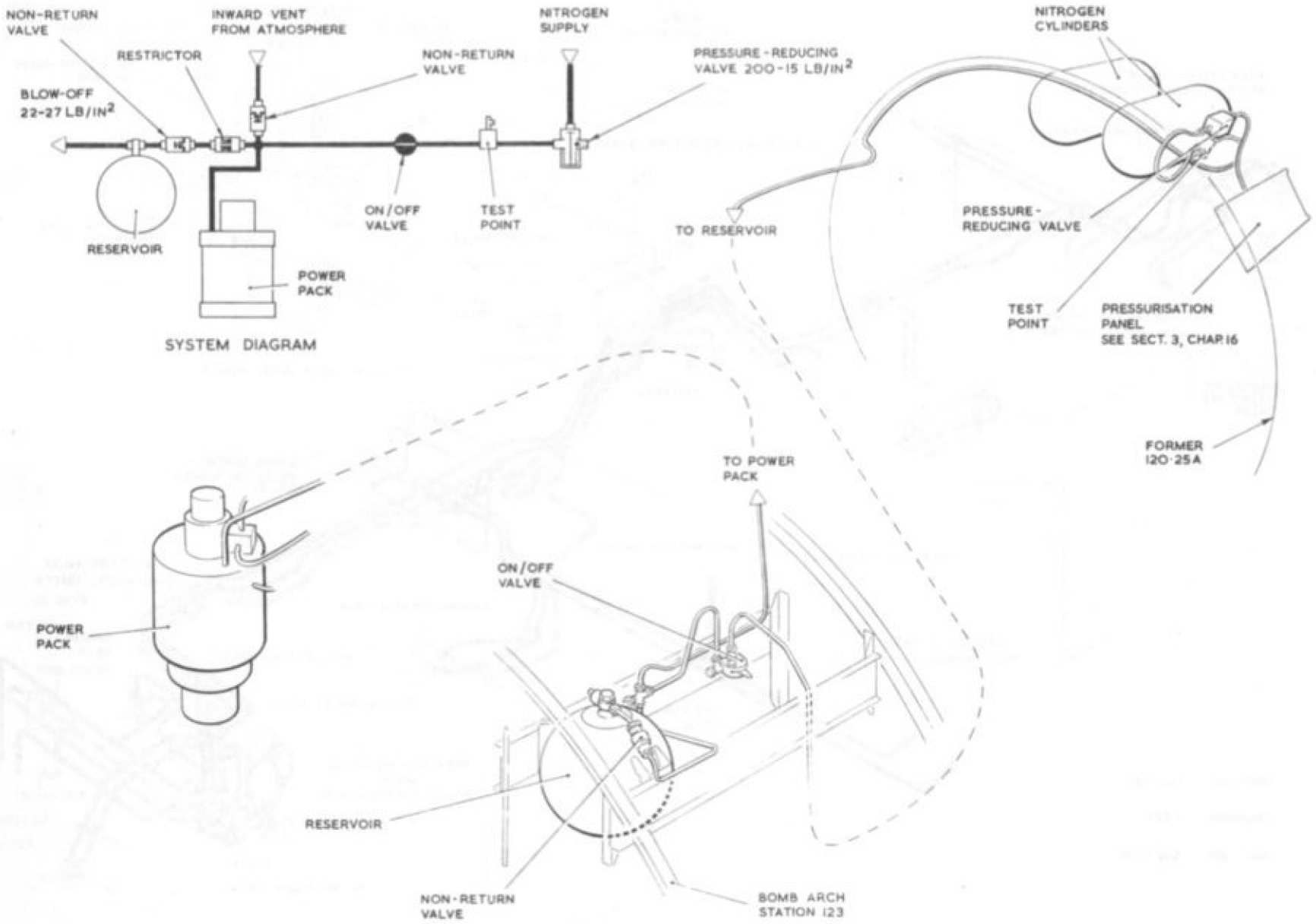

Fig. 3B Reservoir and power pack pressurisation (post Mod. 2321)

◄ *Illustration re-titled* ►

accordingly to the source of supply selected directing fluid simultaneously to the four jacks and closing the feed and return lines of the supply not being used.

19. The filter introduced by Mod.2261 (fig.1A) incorporates a pressure differential clogging indicator which is described in para.8A.

WHEEL BRAKES

20. There are two feed lines to the brake control valve, each passing through a non-return valve and a pressure-reducing valve which reduces the operating pressure for the brakes to 2 500 lb/in^2. Between the non-return valve and the pressure-reducing valve the lines are branched to accumulators, which meet the immediate requirements of the system and provide an emergency fluid supply. To facilitate depressurising the accumulators, the feed lines to them are branched to manually-operated release valves. Two dual pressure gauges, which record the brake line pressures, are mounted on the panel in the nose-wheel bay, together with two accumulator air pressure gauges and two air charging points. Interposed in each line to the dual pressure gauges is a pressure relay valve, which prevents loss of fluid from the main system should a failure occur between the valve and the gauge.

21. Operation of the master cylinders, which are mounted one on each rudder pedal, provide the pressure necessary to operate the brake control valve, allowing pressure fluid from the hydraulic system to pass to the brake units selected. Pressure delivered to the brakes is proportional to the pressure applied to the master cylinder. Fluid passes from the control valve to the brakes through shuttle valves which ensure, should the supply in one line fail, that the brakes receive pressure from the remaining line. When pressure is removed from the foot motor, the exhaust valve in the brake control valve opens, and pressure fluid from the brake unit is returned to the reservoir. The Maxaret units fitted to the brake units permit maximum braking pressure to be applied without fear of locking the wheels. Should a wheel tend to lock, the associated unit momentarily connects the pressure line to the return, and re-applies the brake pressure when the locking tendency ceases.

22. The accumulators may be recharged, when necessary, by the use of the bomb-door system electro-hydraulic power pack. This can be started up without bomb door selection by operating one of two switches, one at the rear of the nose-wheel bay on the starboard side, the other on the port console in the cockpit. This operation automatically opens the shut-off valve and pressure fluid is admitted from the power pack via the valve direct to the brakes accumulators. Thus in the event of a hydraulic failure in the main system, the accumulators can be charged through this line from the power pack.

NOTE . . .
It is important that the accumulators are correctly charged with air before introducing hydraulic fluid under pressure, para.35 refers.

A.A.P.P. SCOOP

23. The A.A.P.P. scoop selector valve is supplied from the main feed line through a 4 000 - 1 800 lb/in^2 reducing valve. The selector valve is normally energised and directs fluid at reduced pressure to keep the spring-loaded jack in the extended position, this holds the scoop closed. When either the A.A.P.P. is started or the R.A.T. toggle is pulled, the selector valve is de-energised and this releases pressure from the jack allowing the jack ram to retract under the action of the spring, which opens the scoop.

WINDSCREEN WIPERS

24. Three hydraulically-operated windscreen wipers are provided, one for each windscreen. They are not connected to the main hydraulic system but are powered by two Maxivue pump units mounted on the pilots' floor, one below each console. Pressure and return lines connect the pump units to the wiper heads at the base of each windscreen, the centre and port heads being served by the port pump. For details of operation refer to fig.12.

25. Operation of the wipers is controlled by a three-position switch located on the second pilot's instrument panel and labelled OFF-FAST-SLOW; for electrical details refer to Sect.6. No parking control is provided, the wipers being held against stops by air pressure during flight.

EMERGENCY AIR SYSTEM

26. Two separate air supplies, contained in air cylinders mounted in the nose-wheel bay, are provided for emergency lowering of the alighting gear, one for the main-wheel units and one for the nose-wheel unit. Each cylinder is charged through an A58 charging valve, overcharging being prevented by relief valves set to blow off at 3 300 lb/in^2. Cylinder pressures are registered on gauges calibrated 0-4 000 lb/in^2.

27. Air is released to the circuits by the operation of two air release valves mechanically linked together. Control of these valves is by a single control handle located on the starboard side of the pilot's engine console. When emergency air is used, the supply first passes to the jettison valves, two in the main-wheel circuit and one in the nose-wheel circuit, and the pressure moves the internal pistons of the valves so that the fluid expelled from the actuating jacks is able to pass to atmosphere. The spigoted end of the valve piston pro-

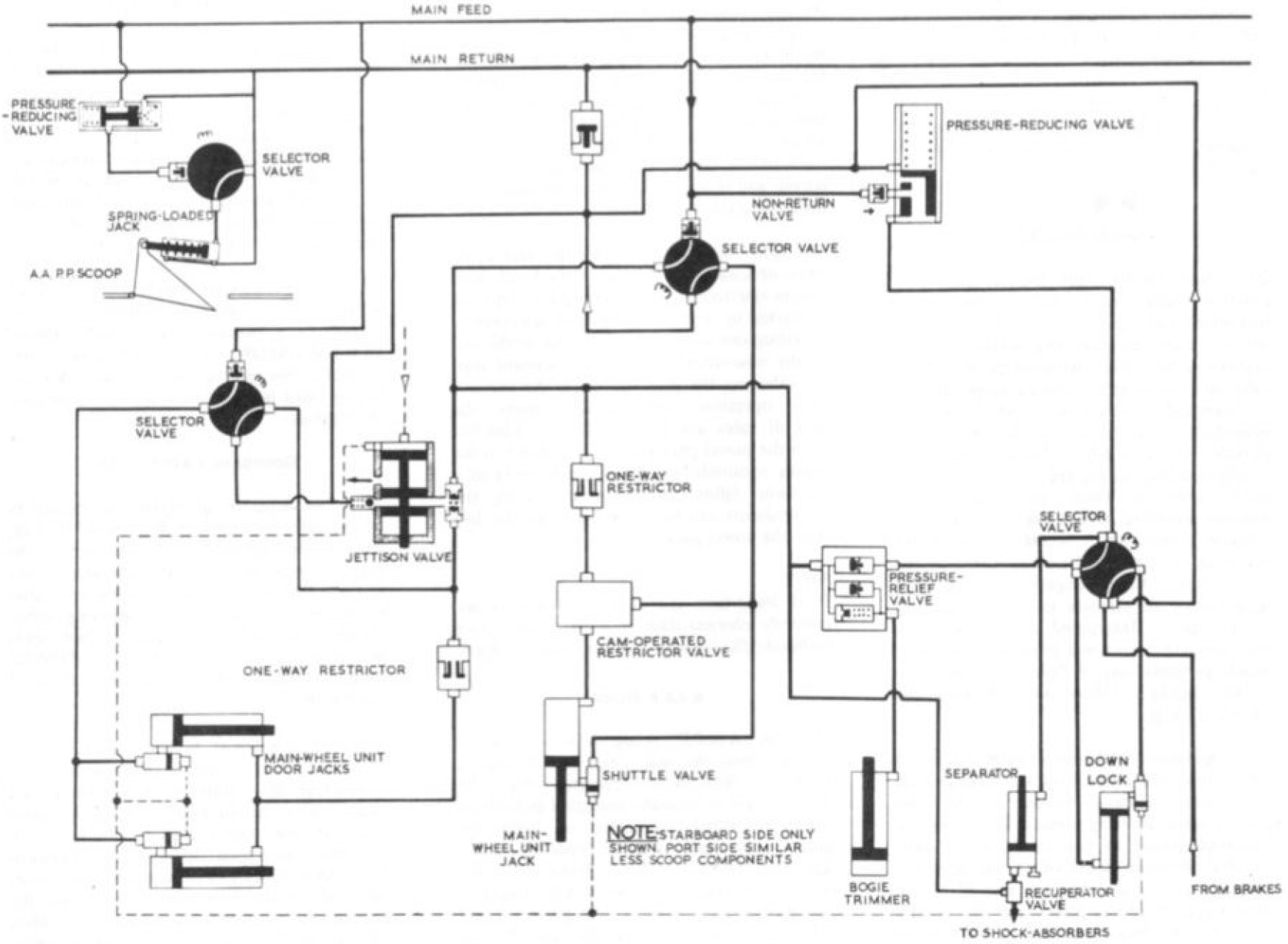

Fig. 4 Main-wheel circuit diagram

◄ Down lock emergency air supply connected ►

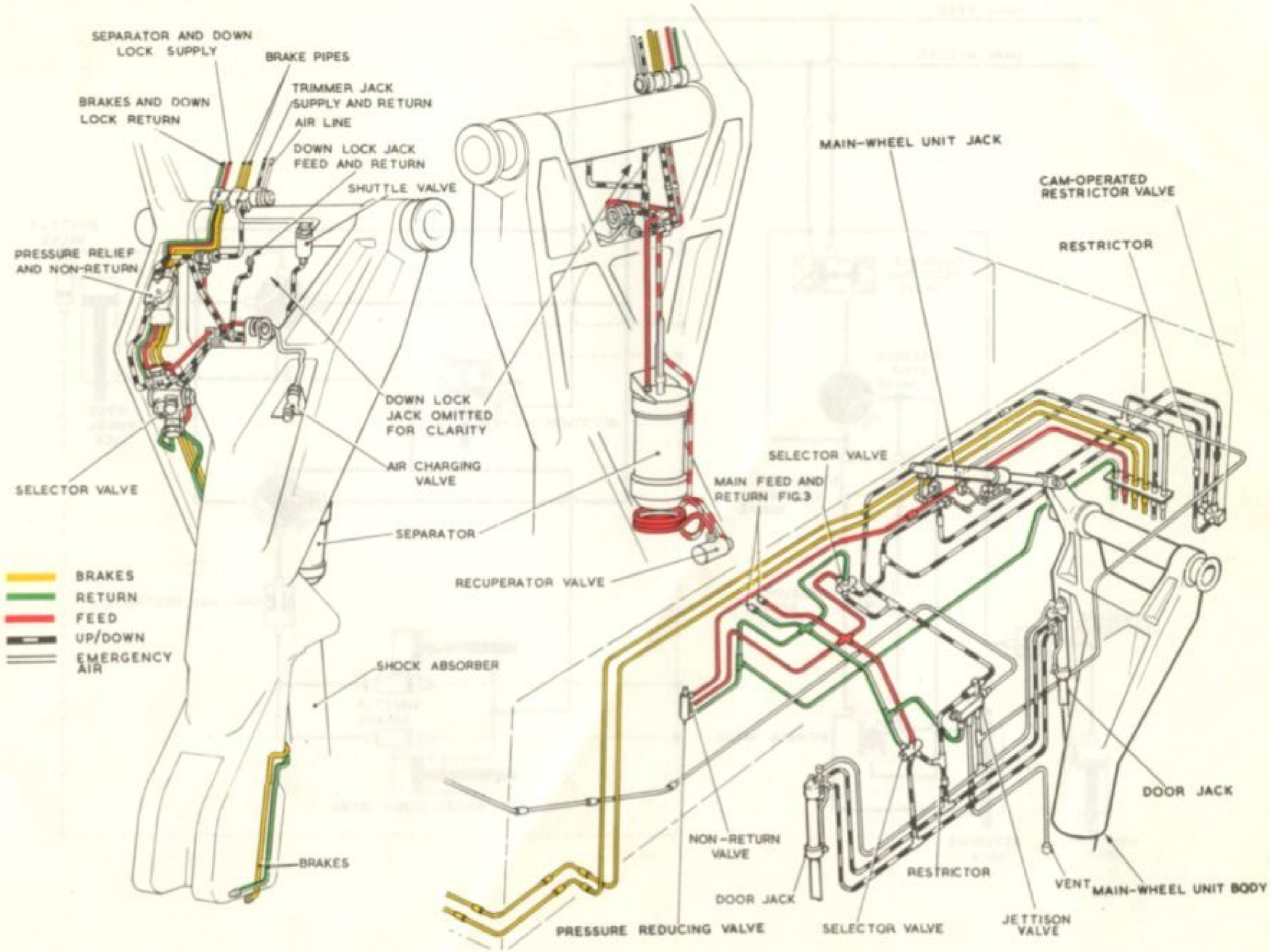

Fig.5. Hydraulic system main wheel unit and doors.

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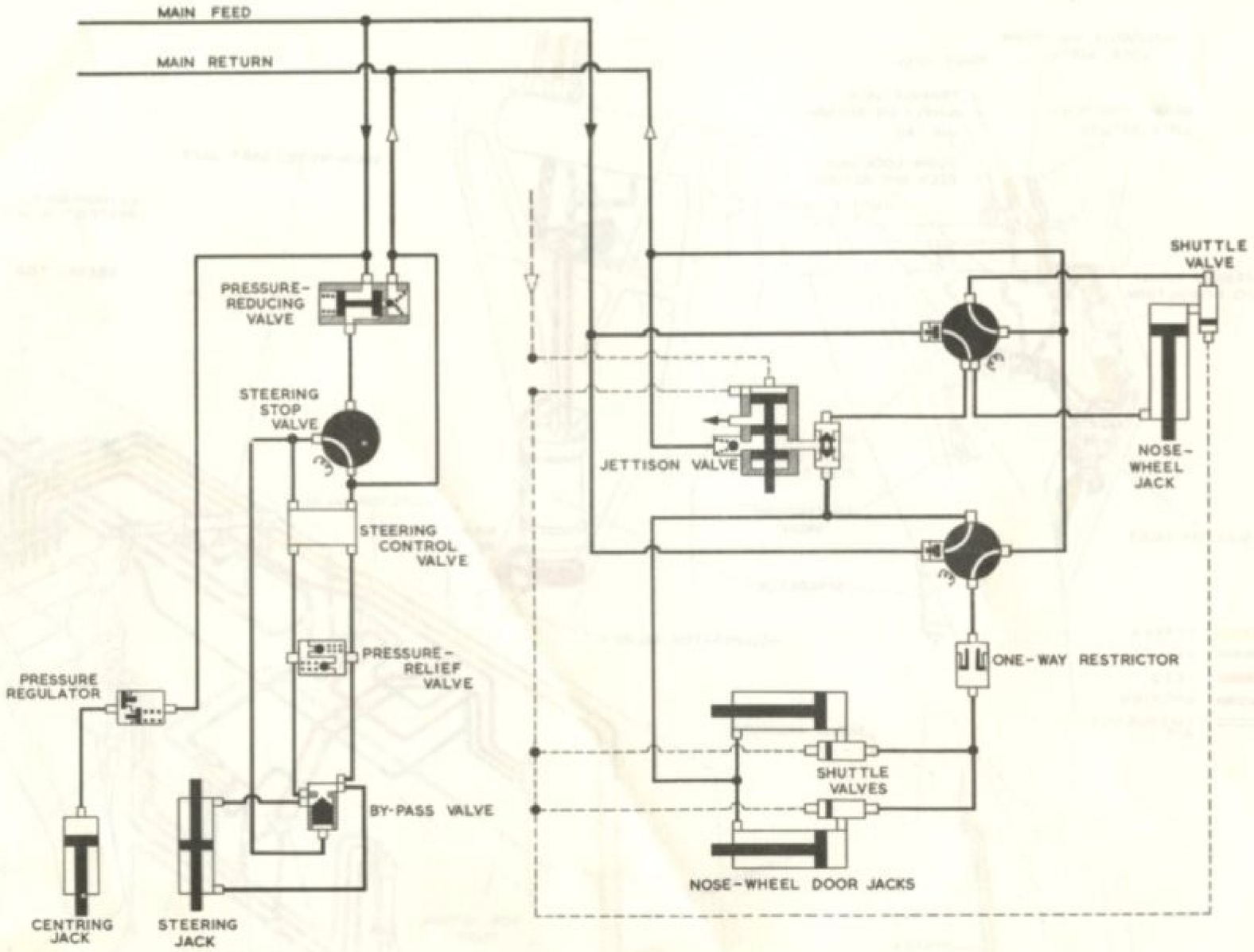

Fig. 6. Nose-wheel circuit diagram

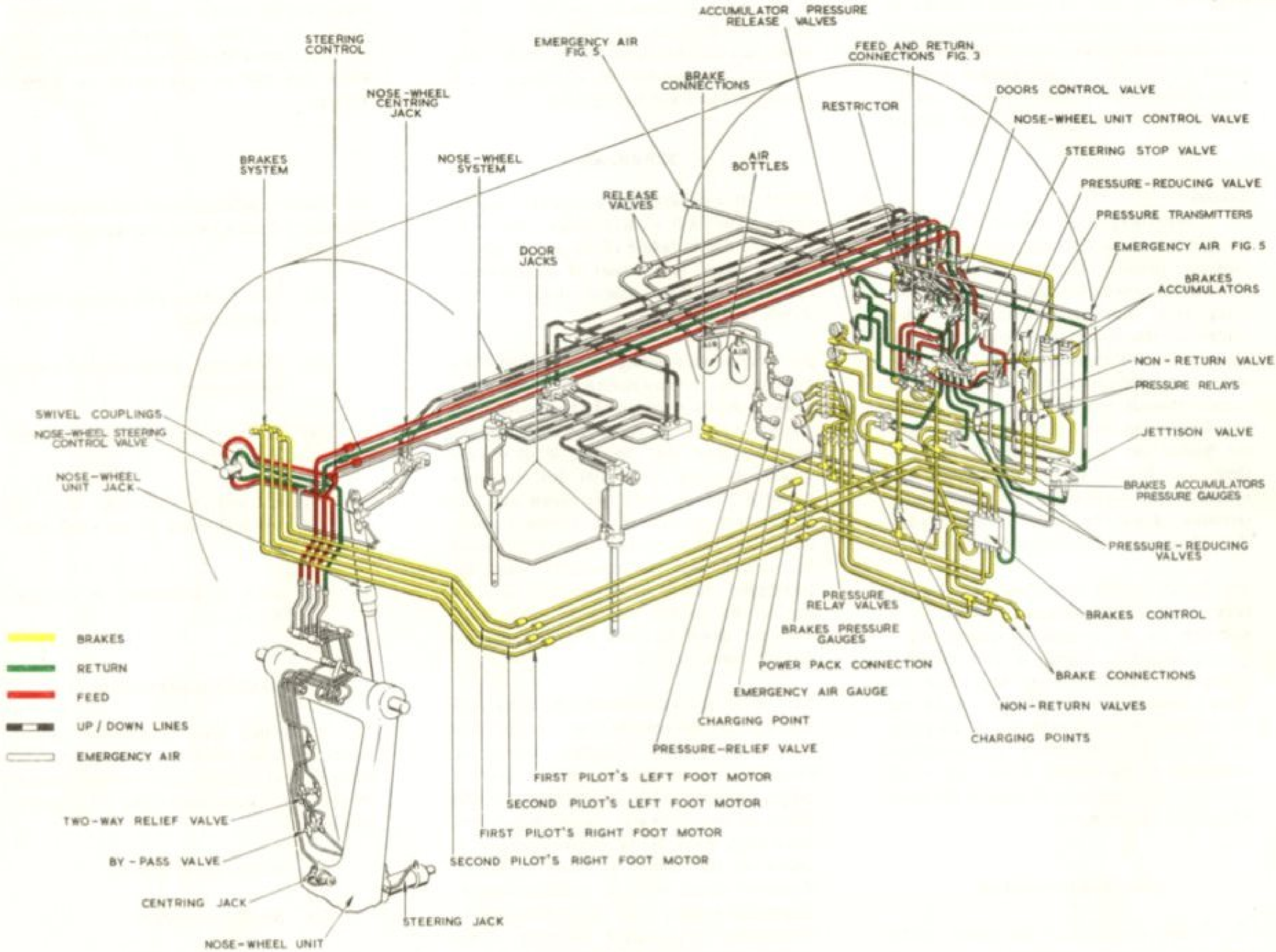

Fig.7 Hydraulic system in nose-wheel bay

trudes at one end to provide a means of manually resetting the piston after emergency air operation. From the jettison valves, air then passes to the shuttle valves integral with the main and door jacks of each wheel unit and the main-wheel unit downlock, forcing the shuttles in the valves to move to shut off the fluid supply to the jacks. Air then passes to the down side of the jacks, the pressure being sufficient to ensure that the alighting gear will be fully lowered and locked down. Use of the emergency air control cuts off the electrical supply to all the electro-hydraulic valve solenoids except the nose-wheel steering valve, which can still be operated in the normal manner.

SERVICING

General

28. Cleanliness is essential in the maintenance of the hydraulic system. All fluid containers, funnels, etc., should be thoroughly cleaned and rinsed with hydraulic fluid before being used. Only clean fluid from sealed containers should be used when filling or topping-up. Disconnected pipes should be sealed to prevent the entry of dirt. It should be ensured that all components are clean before installation, and that new pipes and couplings are flushed out with hydraulic fluid before they are fitted. For specifications and reference numbers of fluids used in the system, reference should be made to the Leading Particulars at the beginning of the publication.

29. In all ground operations involving the functioning of the hydraulic system, it is necessary to use a servicing trolley, and a ground electrical supply is also required. Satisfactory operations may be carried out using a hydraulic servicing trolley Mk.3A and the operating times given in para.52 are based on its use. It is emphasised that scrupulous cleanliness of the trolley is essential at all times, and end caps must be kept on the hoses when these are not in use.

FAULTS IN THE SYSTEM

30. Faulty operation of the system can be caused by hydraulic, electrical or mechanical defects. It is unlikely that a complete stoppage of the system will occur, but should this occur it will be due to failure of the pumps and the control valves. In all cases of unsatisfactory operation, the fluid contents of the reservoir should be checked.

31. Before dismantling any components for examination, the functioning of the system as a whole should be observed; by adopting this procedure faults can usually be traced and the cause localised. For example, if all services operate sluggishly it suggests that the power circuit is at fault, and if one circuit only fails to function satisfactorily it implies a power leakage in that particular circuit. Tests should be carried out in accordance with the paragraphs dealing with testing and for instructions on the testing of components, reference should be made to the appropriate A.P.1803 series, Vol.1.

32. A list of common hydraulic faults, each with its cause and remedy, is provided in Table 2. As the various hydraulic circuits are controlled by electrically-operated selector valves, complete failure of the system, or the failure of any particular circuit, may be the result of a break in the electrical circuit or failure at the source of electrical supply. Reference should be made to the appropriate chapter in Section 6 of this publication for information on electrical operation of the system and rectification of electrical faults.

33. Faulty operations may also be caused by mechanical defects, which may be summarised as follows:-

(1) Side load on jack pistons due to malalignment.

(2) Mechanical interference between moving parts.

(3) Presence of obstruction between moving parts.

(4) Excessive friction due to over-tightening of the gland nuts, etc.

(5) Lack of lubrication at bearings, hinges, etc.

FILLING THE RESERVOIR

34. A sighting glass is provided in the reservoir through which the fluid level may be checked. The reservoir must be filled through the reservoir charging valve under the following conditions:-

(1) Alighting gear DOWN

(2) Bomb doors OPEN

(3) Brake controls OFF

(4) Accumulators CHARGED

Before replenishing the reservoir on aircraft post Mod.2321, first remove the cover from the nitrogen on/off valve, located adjacent to the reservoir, and move the valve lever to the 'off' position.

To replenish the reservoir, remove the blanking cap from the charging valve inlet connection, located on the port side of the starboard main-wheel bay, connect the charging line end fitting and pump in fluid. An escape of fluid from the charging valve overflow indicates that the reservoir is full.

NOTE . . .
The fluid overflow should be allowed to cease before the charging line is removed.

Remove the charging line and fit the blanking cap. Finally check the fluid level through the reservoir sight glass window, and on aircraft post Mod.2321 move the on/off valve lever to the 'on' position and fit the valve cover.

CHARGING THE ACCUMULATORS

35. There are five accumulators in the system, three in the power circuit and two in the brake circuit. (On aircraft with Mod.2278 embodied, the three accumulators in the power circuit have been removed). These accumulators are charged with both air and hydraulic fluid by the following procedure:-

Power circuit accumulators

36.

(1) Discharge all fluid from the accumulators by depressing the push-buttons of the manually-operated release valves on the hydraulic panel in the nose-wheel bay.

(2) Lower the No.1 engine front access door and locate the charging valve. The accumulator, charging valve and air pressure gauge are mounted in a compact group on the lower portion of the engine front bulkhead, adjacent to the hydraulic pump. Connect an air supply to the charge valve and apply air at low pressure to position the accumulator piston at the far end of its stroke. This position will be indicated by a steady reading on the gauge. The manually-operated release valves should be kept open during this operation.

(3) Continue applying air to charge the accumulator to a pressure of 2 400 lb/in^2.

(4) When the engine is run the accumulator will be charged with fluid automatically from the engine driven pump.

(5) Repeat items (1), (2) and (3) on No.2 and 3 engines.

Brake circuit accumulators

37.. The accumulators, mounted on the panel on the nose-wheel bay, are charged with both air and hydraulic fluid, the procedure being as follows:-

(1) Set aircraft brakes to OFF.

(2) Discharge all fluid from the accumulators by depressing the push-buttons of the manually-operated release valves on the hydraulic panel in the nose-wheel bay.

(3) Connect an air supply in turn to each of the air charging valves adjacent to the air pressure gauges, and apply air at low pressure to position the accumulator piston at the far end of its stroke. This position will be indicated by a steady reading on the gauge. The manually-operated release valves should be kept open during this operation.

(4) Continue applying air to charge the accumulator to a pressure of 2 550 lb/in^2.

(5) Using a hydraulic servicing trolley (para.29) charge the accumulators with hydraulic fluid to the main system working pressure of 4 000 lb/in^2 or alternatively, using the emergency electro-hydraulic power pack (para.22) with an external 200 volt, 3 phase, 400 cycles supply charge the accumulators to 3 700 ± 185 lb/in^2 (power pack pressure switch setting). The pressure will be registered on the air pressure gauges as entry of the fluid into the accumulators moves their pistons further to compress the air.

(6) Check hydraulic pressure in No. 1 and 2 brake accumulators after 2½ hours, comparing readings of nose wheel bay gauges with readings of triple indicator in the cockpit.

WARNING . . .
It is important that the accumulators are correctly charged with air before introducing fluid under pressure. Hydraulic fluid at working pressure with no air in the opposite end of the accumulator will cause unbalanced pressure on the piston with possible damage to the sealing rings.

CHARGING THE BOGIE TRIMMERS

38. Each bogie trimmer jack must be charged with air through the inflation valve located on the front face of the main-wheel unit leg assembly outboard of the jury strut lugs. If the jacks are charged with the alighting gear fully extended and off the ground, the inflation pressure is 225 lb/in^2. If the charging operation is effected with the aircraft on the ground under load, reference should be made to the graph in Sect.2, Chap.2 of this Publication for the correct pressure.

PUMP FILTERS

39. The filters in the engine-driven pump suction lines must be examined and the element replaced, if necessary, at the periods stated in the Servicing Schedule. Each filter incorporates a casing which may be removed for the purpose of examining or changing the element, without loss of fluid from the system. The casing must be filled with the hydraulic fluid prior to refitting, in order to exclude air from the pipelines. Surplus fluid will pass into the system through the valves in the filter head. The reservoir level must be checked after this procedure.

39A. The filters in the engine-driven pump and electro-hydraulic power pack delivery lines are to be examined on defect or at periods specified in the Servicing Schedule and if necessary the element is to be replaced. The pressure differential 'clogging' indicator at the top of the filter casing in the emergency power pack delivery line can be viewed by shining a torch through an inspection hole drilled in the inboard mounting beam.

NOTE . . .
When it is necessary to replace a filter element Ref.No. 27M/1500264, the packing 'O' ring Ref.No. 27M/1500265 and the back-up ring Ref.No. 27M/1500266 are also to be renewed.

39B. When assembling the filter after changing the filter element, or for any other reason, torque load the casing to the head to 25-30 lb ft. Use torque wrench Part No.H5744, extension bar Part No.H4420 and torque adapter Part No.1/Z12691.

PRIMING AND BLEEDING

40. To prime and bleed the complete system proceed as follows:-

(1) Jack the aircraft clear of the ground (Sect.2, Chap.4).

(2) Ensure that the accumulators are charged with air to their correct pressures, i.e., brake accumulators -2 550 lb/in^2; power circuit accumulators -2 400 lb/in^2.

(3) Connect a ground rig pump to the ground test couplings in the port main-wheel bay.

(4) Leaving the main-wheel unit retraction jacks connected, disconnect all remaining jacks at the rod end attachment points and support these ends so that the jacks can be operated without fouling adjacent structure. Disconnect the electrical supply to all control valves.

(5) Connect the ground dispensing trolley to the reservoir charging valve. Pump in hydraulic fluid to the main and power pack reservoirs until fluid flows from the overflow of the charging connection. Wait until the flow ceases before proceeding.

(6) Start a power pump running (ground test rig) preferably at low rev/min (1 000 rev/min or less) and wait for the suction and pressure line to become primed.

(7) With the pump still running, open the bleed screw on the DOWN side of one main-wheel unit jack and depress the manually-operated solenoid on the appropriate selector valve. Bleed until all air is expelled. Close the bleed screw and release the solenoid.

(8) A similar operation should be carried out on the remaining jacks in the nose and main alighting gear circuits but it is not necessary to bleed the downlock jacks.

(9) Open the bleeder screw at the banjo fitting on both main alighting gear separators until all air is expelled. Check by reference to the level indicators on the separators that the silicones content is correct and top up as necessary.

(10) Before bleeding the UP side of the jacks, stop the power pump and

check the reservoir fluid level. If necessary, top up and then disconnect the ground dispensing trolley. As the bleeding operation continues, a constant check must be kept on the level of the fluid in the reservoir.

(11) The UP side of the jacks can be bled in a similar manner, i.e., by opening the appropriate bleed screw and depressing the corresponding manually-operated solenoid. It must be borne in mind, however, that the main-wheel unit retraction jacks are attached to the unit and are, therefore, functionally operational.

(12) Bleed the bomb bay door jacks in a similar manner to the other jacks by opening a bleed screw and depressing the appropriate solenoid. Keep a constant check on the reservoir fluid level, and remove the dispensing trolley if the jacks are to be operated.

(13) When all air has been expelled from the circuit, the jacks should be reconnected to their respective lugs. Adjust the eye ends to line up with the lugs on the main fittings in accordance with the instructions for each particular service.

(14) Re-connect the nose alighting gear jack to its attachment point. The jack should be fully pressurised in the DOWN position, and with the unit locked DOWN adjust the jack eye end to give 0.050 in – 0.060 in override; it is important that this adjustment is correctly made. Lock the eye-end and retract the jack sufficiently to allow the attachment pin to be inserted.

(15) The UP positions of both main and nose-wheel units can be adjusted by means of an external stop on the jack body. The adjustment of these jacks, and the connecting of the door jacks and locking struts should be carried out in accordance with the instructions given in Sect.3, Chap.5 of this book. Similarly the bomb bay door jacks should be adjusted in accordance with the instructions in Sect.3, Chap.1.

(16) When all jacks have been connected and adjusted correctly, the system as a whole is ready for functional testing. Before beginning the tests, the reservoir should be topped-up and the ground dispensing trolley removed. Check the settings of the Dowmic switches in the alighting gear circuits, and reconnect the electrical supply to all control valves.

Bleeding the brakes hydraulic system

41. The brake hydraulic system is bled in three stages:-

(1) Foot-operated master cylinder to the brake control valve.

(2) Brake control valve to the brake unit.

(3) Brake control valve to the dual pressure gauge.

42. Prior to commencing stage (1), ensure that the charging run Ref.No. 27KC/2979 is filled and primed with the correct fluid i.e., OM-15, and that the accumulators are fully charged. The following procedure then applies to each of the foot motors in turn:-

(1) Remove the cap from the foot motor and in its place connect the adapter Dowty Part No.1/Z9893 and 27G/2979 placing the free end in a suitable container.

(2) Connect the adapter (manufactured locally from A.G.S.1107/A) to the charging gun and, after priming, fit the gun to the relevant bleed screw on the brake control valve (fig.10).

(3) Open the bleed screw slightly and gently pump the charging gun until air-free fluid issues from the foot motor. It should be noted that excessive pressure will force the bleed pipe off the bleed screw.

(4) While air-free fluid is issuing from the foot motor, close the bleed screw.

(5) Operate the brakes to ensure that the pedal is firm and does not feel spongy and that with the foot motor piston bottomed the pressure reads 2 500 lb/in^2.

(6) If necessary, repeat operations (3), (4) and (5) until satisfactory, then remove the charging gun and adapters, refit the foot motor caps and lock with wire.

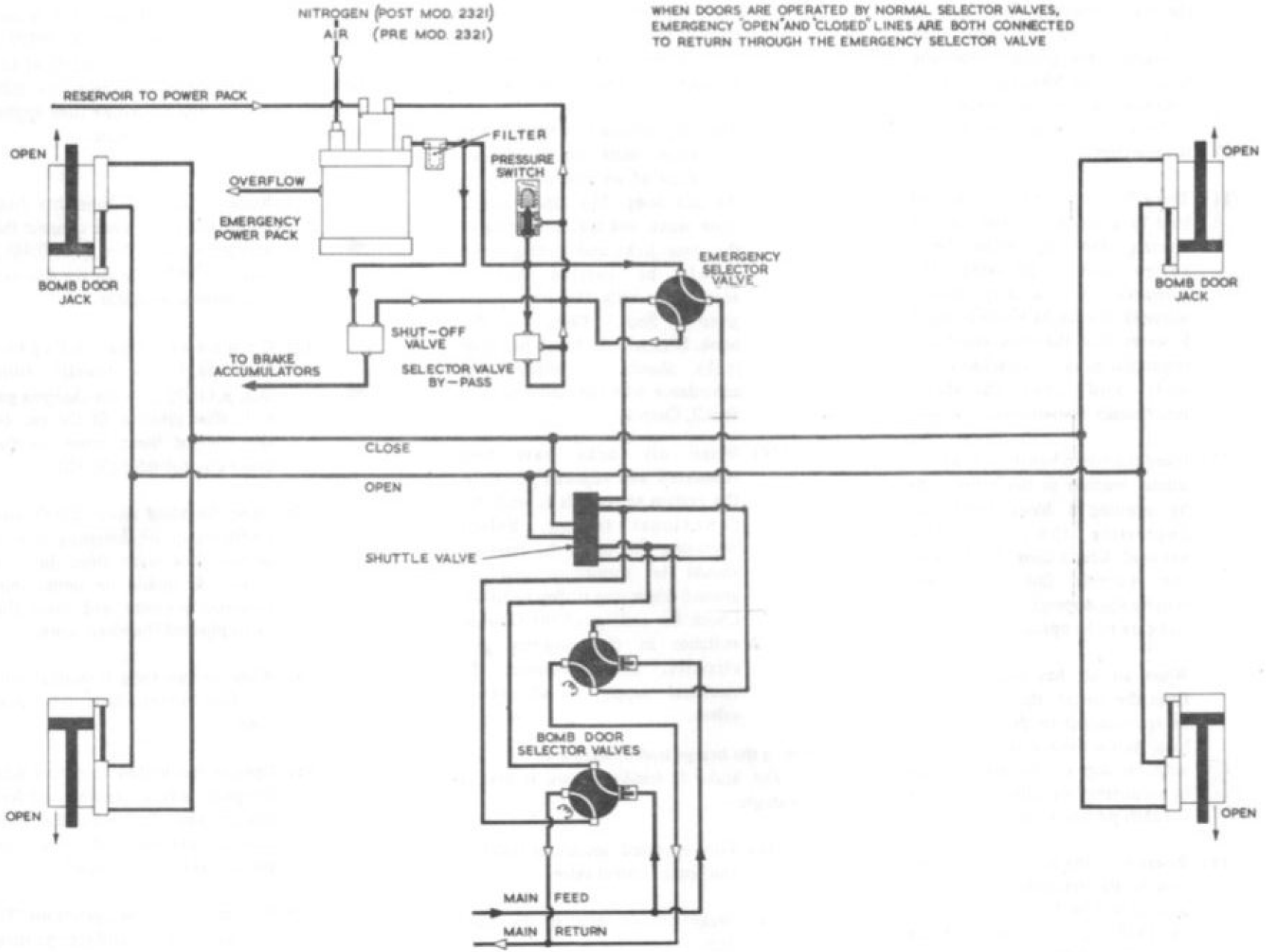

Fig. 8 Bomb door circuit diagram

◄ Mod. 2321 ►

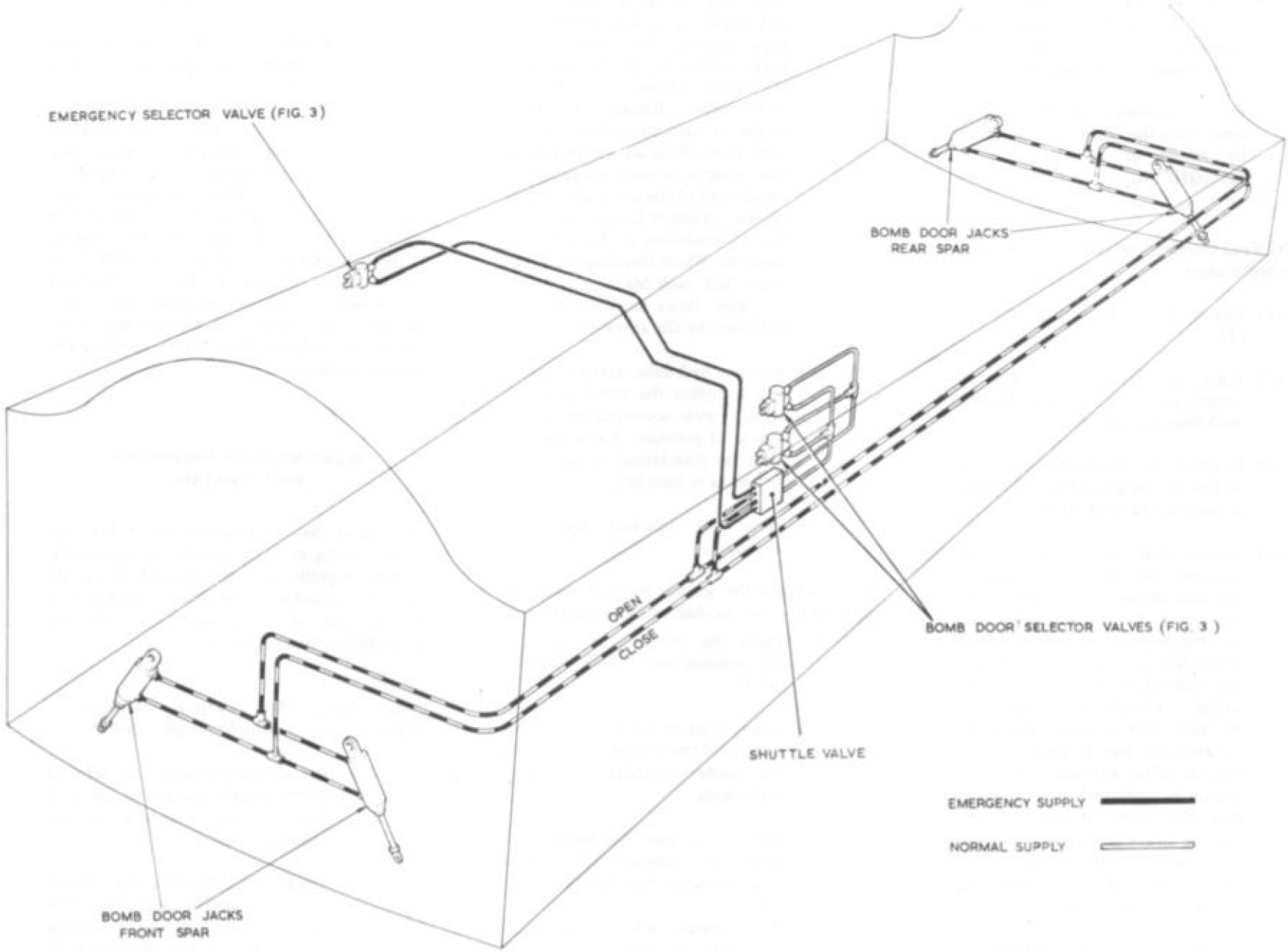

Fig. 9 Hydraulic system – bomb doors

◄ Mod 2318 ►

(7) Repeat the above procedure (1) to (6) on each of the remaining foot motors in turn until all the air has been expelled from the system.

(8) On completion of the above operations the wheel brakes are to be tested in accordance with A.P.101B-1902-5.

43. To bleed between the brake control valve and the brake units:-

(1) Ensure that the parking brake is off.

(2) Ensure that the brake accumulators are correctly charged with fluid and air.

(3) Connect a hydraulic servicing trolley to the ground test coupling in the port main-wheel bay.

(4) Ensure that the pistons of the pressure relay valves in the lines to the dual pressure gauges are at the bottom of the valve cylinders. To do this, release the pipe couplings at the top and bottom of the valve and then blow into the top of the valve. Attach a clamp Part No.ACO.5928 to each valve body between the two grooves near the bottom of the cylinder. The clamp should be tightened just enough to flex the body of the cylinder slightly and grip the piston but not enough to cause permanent distortion. Attach warning streamers to the clamps.

(5) Reconnect the pipe couplings to the top and bottom of each relay valve.

(6) Start the hydraulic servicing trolley and build up a low pressure of approximately 200 lb/in^2 in the brake system by slowly operating the master cylinder or the parking brake lever. Release the bleed screws in turn on each brake unit until most of the air is expelled. At this stage it is only necessary to bleed most of the air as this section of the system is finally bled using the accumulators as the source of pressure. When bleeding the brake units flick each Maxaret unit two or three times in the direction indicated by the arrow on the unit.

(7) Stop the hydraulic servicing trolley and complete the bleeding of the section with accumulators as the source of pressure. A low pressure must be maintained in the brake system as in item (6).

(8) Close and wire-lock the bleed screws.

44. To bleed the section between the brake control valve and the dual pressure gauges:-

(1) Leave the clamps in position on the pressure relay valves (para.43 (4)).

(2) Admit fluid at low pressure to this section of the system by operating the master cylinder or parking brake lever.

(3) Bleed fluid from the bleed block above the pressure relay valves until it emerges free from air.

(4) Partly release each coupling at the dual pressure gauge in turn and bleed fluid until all air is expelled. Tighten the couplings.

(5) Wire-lock the bleed screws.

(6) Remove the clamps and warning streamers from the pressure relay valves.

45. If necessary, the lines to the pressure transmitters for the triple pressure gauge may be bled in a manner similar to that outlined in para.42 i.e., by clamping the pressure relay valves admitting fluid to the system at low pressure and bleeding fluid from the couplings at the transmitter until all air is expelled. Note that it will be necessary to discharge fluid and air pressure from the accumulators before clamping the pistons of the pressure relay valves and recharge them before bleeding the transmitter lines.

BLEEDING AFTER EMERGENCY AIR OPERATION

46. After the emergency air circuit has been used, nothing must be touched in connection with the alighting gear circuits until the aircraft has been jacked with the wheels not less than 6½ in clear of the ground. The following procedure is then necessary:-

NOTE . . .
Ensure that a DOWN selection is made on the alighting gear normal selector press switch.

(1) Return the emergency air selector in the pilot's cockpit to the OFF position and wire-lock in the approved manner.

(2) Open all DOWN side bleed screws on the alighting gear and door circuits. The nose-wheel centring jack is not in the emergency air circuit and so is not affected.

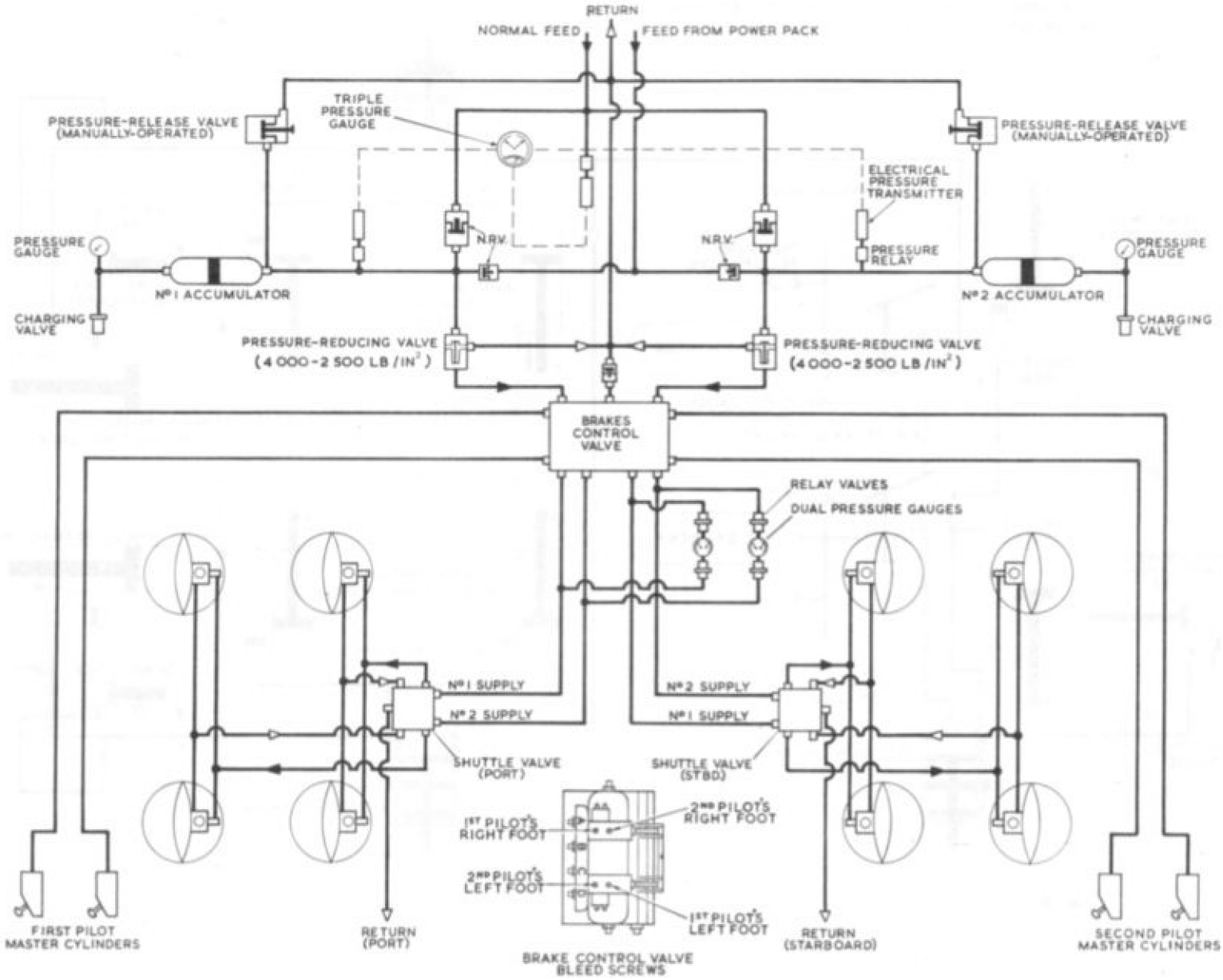

Fig. 10. Wheel brakes circuit diagram

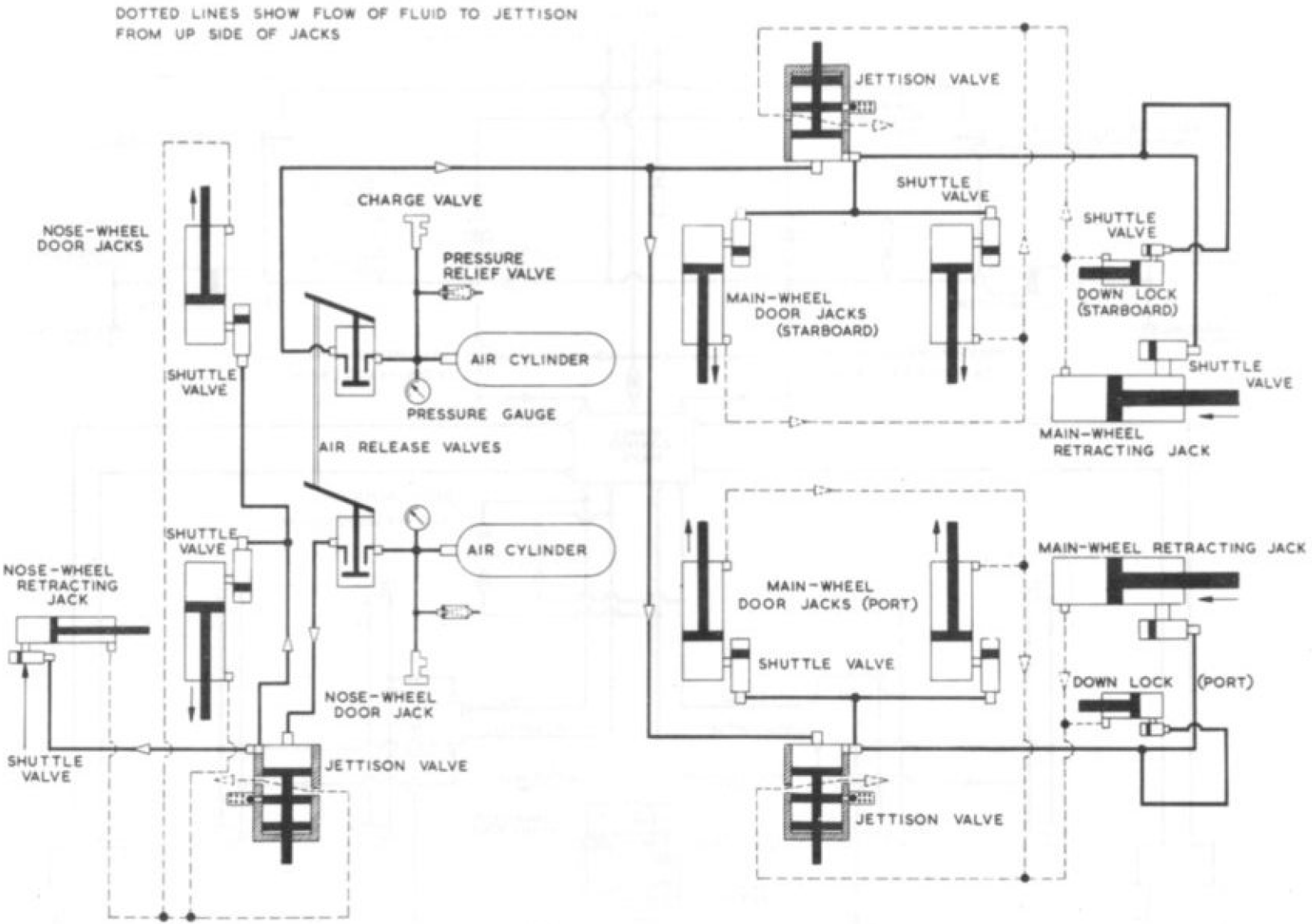

Fig. 11 Emergency air circuit diagram

◄ *Pipe runs altered* ►

(3) When all high-pressure air has been expelled, close all bleed screws. Reset the pistons on the three jettison valves, one for each main and nose alighting gear unit. To ensure that the piston has been reset correctly, lightly tap the plunger with a hide-faced hammer.

(4) Connect the ground rig pump to the ground test connections and a ground dispensing trolley to the reservoir charging valve. Top up the reservoir and start up the pump.

(5) Bleed the DOWN side of each jack individually, at the same time ensuring that the reservoir level is maintained.

NOTE . . .

With the 28-volt supply ON to the alighting gear circuit, all valves are energised in the DOWN position, so that there is no need of manual operation of the solenoid buttons.

(6) It should not be necessary to bleed the UP sides of the jacks after an emergency air operation, since this would entail disconnecting the 28-volt supply and also each jack from its attachment point. It should be sufficient to operate the alighting gear a few times, topping up the reservoir after each operation, and not omitting to disconnect the ground dispensing trolley after each topping up.

PRESSURE RELAY VALVES

47. Mounted on the hydraulic panel in the lines to the dual pressure gauges are four pressure relay valves, with associated bleed points mounted in a bleed block above them. After installing or replacing a valve, or after a pipeline or component has been disconnected, the following procedure should be carried out:-

(1) Ensure that the piston of the affected valve is at the bottom of the valve cylinder.

(2) Attach a clamp (Pt.No.ACO.5926) to the valve body between the two grooves near the bottom of the cylinder. The clamp should be tightened just enough to flex the body slightly and grip the piston, but not enough to cause permanent distortion. Attach the warning streamer to the clamp.

(3) Open the appropriate bleed cock.

(4) Admit fluid at low pressure to the valve, by applying gentle and steady pressure to the associated foot motor, until fluid free from air issues from the bleed point.

(5) While fluid is still escaping, close the bleed point.

(6) Remove the clamp and warning streamerfrom the valve.

WINDSCREEN WIPER SYSTEM BLEEDING

48. The procedure for priming and bleeding the windscreen wiper system is as follows:-

(1) Remove the wiper blade and operating arm assembly.

(2) Fill the reservoir of the pump unit with oil OM-15.

(3) Operate the system at slow speed and continue filling the reservoir until the fluid level remains constant at approx. ½in. below the filler orifice. Continue operation of the system for 5 min. If difficulty is experienced in expelling air from the system it is permissible to slacken the two 1/8in. B.S.P. unions on the wiper head.

(4) Tighten the unions on the wiper head and then switch off the system; lock the unions. Top up the reservoir to the level stated in item (3) and replace the filler cap.

(5) Refit the wiper blade and operating arm assembly according to procedure detailed in para.47.

WARNING . . .
Wipers must not be operated on a dry windscreen.

WINDSCREEN WIPER SETTING

49. The procedure for setting the actuating arm and blade during assembly is as follows:-

(1) Slacken the 1/8in. B.S.P. unions on the wiper head to relieve hydraulic locking.

(2) Turn the serrated drive of the wiper head to the limit of outboard travel.

(3) Fit the arm, complete with the parallel motion assembly and wiper blade, to the serrated drive of the wiper head so that the blade is ¼in. from the edge of the window and just touching the stop.

(4) Adjust and connect the parallel motion rod to its pivot below the windscreen so that the wiper blade lies parallel to the side of the windscreen.

(5) Make any fine adjustments that are necessary by resetting the micro adjuster on the actuating arm.

(6) Adjust the spring on the actuating

arm to obtain a blade pressure on the windscreen of approx. 4lb. If blade pressure is not constant over the full range of movement it is an indication that the blade is not mounted normal to the windscreen.

(7) Function wipers and check for full and correct movement.

TESTING

General

50. When it is necessary to perform functional tests, the aircraft should be jacked as described in Sect.2, Chap.4.

Emergency air

51. At the specified periods the emergency air system should be tested, prior to performing hydraulic operation tests. The procedure is as follows:-

(1) Check that the air cylinders are correctly inflated.

(2) Place containers under the mouths of the vent pipes from the jettison valves to receive the fluid expelled from the jacks. The main and nose alighting gear must be hydraulically raised to the UP position

(3) Operate the emergency air control valves. It is not necessary to operate any of the selector valves.

(4) The alighting gear doors should open and the main and nose alighting gear should move smoothly to the DOWN position. Check that the alighting gear is locked DOWN.

(5) After emergency air operation, the complete system must be re-primed and bled before normal operation tests are performed.

Normal functional testing

52. The procedure for testing the hydraulic system is as follows. A ground electrical supply must be used, and the Mk.3 servicing trolley must be coupled to the aircraft via the ground service couplings at the port main-wheel bay.

(1) Jack the aircraft with the wheels clear of the ground (Sect.2, Chap.4).

(2) Remove the blanking caps from the half-couplings on both the aircraft and servicing trolley flexible hoses and connect the three sets of half-couplings. Incorrect attachment is avoided by the use of different sized couplings, i e., the suction line is ¾in. dia., delivery ½in. dia., and return 3/8in. dia.

(3) With the servicing trolley operating, retract and lower the alighting gear at least four times, and ensure that:-

(a) The alighting gear retracts and extends correctly.

(b) The locks engage correctly.

(c) The alighting gear doors open and close correctly.

(d) The position indicator functions in agreement with the position of the alighting gear units.

(4) With the servicing trolley operating and using the NORMAL bomb door control switch, operate the bomb doors and check for correct opening and closing. Check that the bomb door warning indicator functions correctly.

The following operating times are given for use when using the Mk.3 hydraulic servicing trolley, Ref. No.4F/3603:-

Alighting gear:-

UP 33 ± 2 sec. DOWN:- 25 ± 2 sec.

Bomb doors:-

OPEN 9 sec. ± 2 sec.
CLOSE 7 sec. ± 2 sec.

SNUBBER VALVES SETTING

53. A restrictor valve is situated in the hydraulic lines to each main-wheel unit, its function being to retard the unit during the final stages of retraction. Each valve is mechanically operated by a striker and cam on its main-wheel unit pivot shaft. On initial installation the valve should be adjusted so that with its plunger depressed to the seating position the gap between the striker adjusting screw and the valve plunger is 0.035in. to 0.04in., with the alighting gear in the down position. The seating position of the valve plunger caries on individual valves, but can be plainly felt as the plunger is depressed. A retraction test should be done to check the correct operation and timing of the restrictor valve, and final adjustment made so that the valve causes the main-wheel unit to check visibly when the rear wheel axle is just inside the retraction bay. Due to the very slow movement of the alighting gear when using the Mk.3 trolley, accurate observation of the "check point" is difficult, and a more efficient observation can be made by setting each main-wheel unit independently; this can be done by disconnecting the electrical leads to those selector valves not to be operated, a final retraction of the whole alighting gear being done to ensure that electrical connections have been correctly remade. On completion of restrictor valve adjustments, the

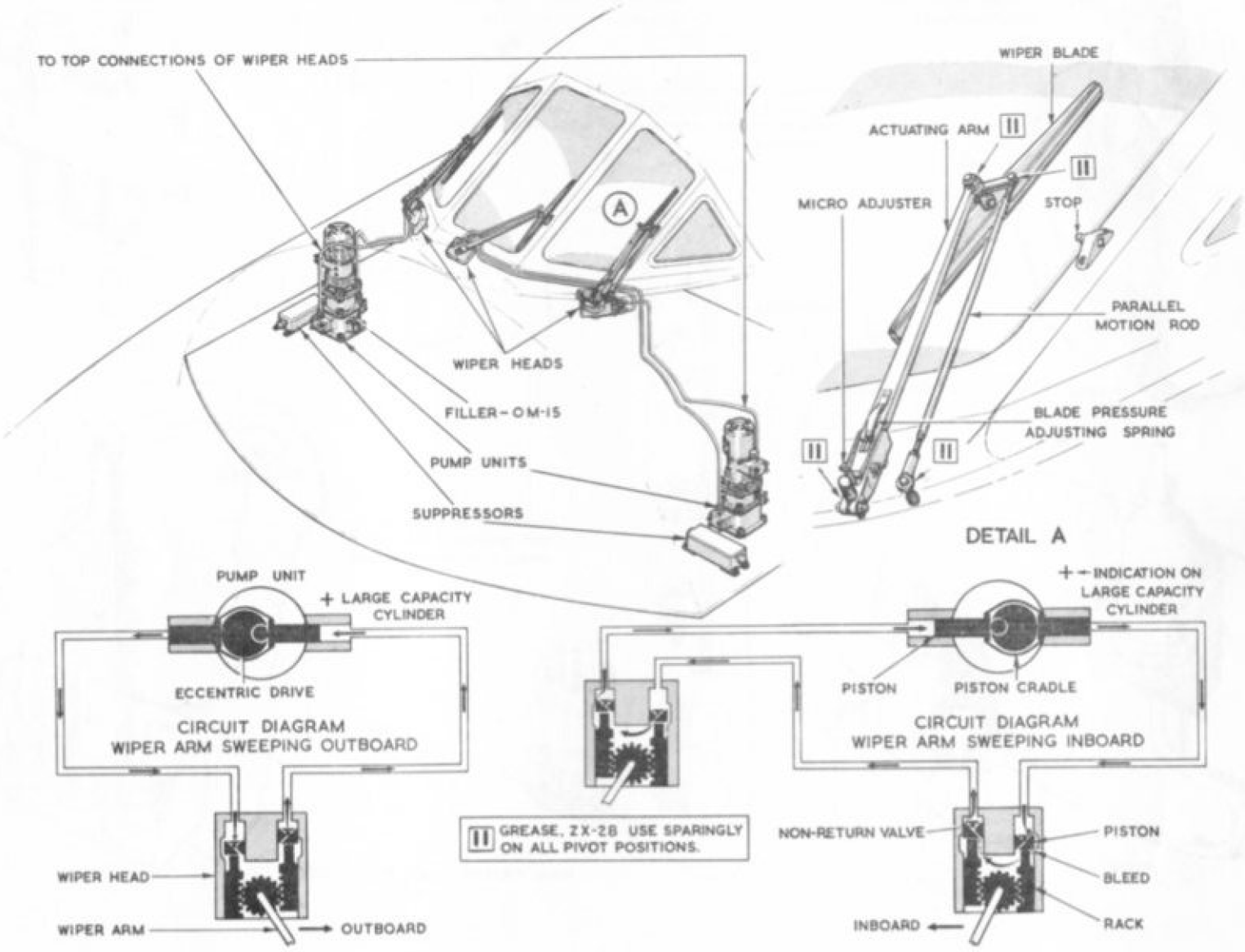

Fig. 12. Windscreen wipers.

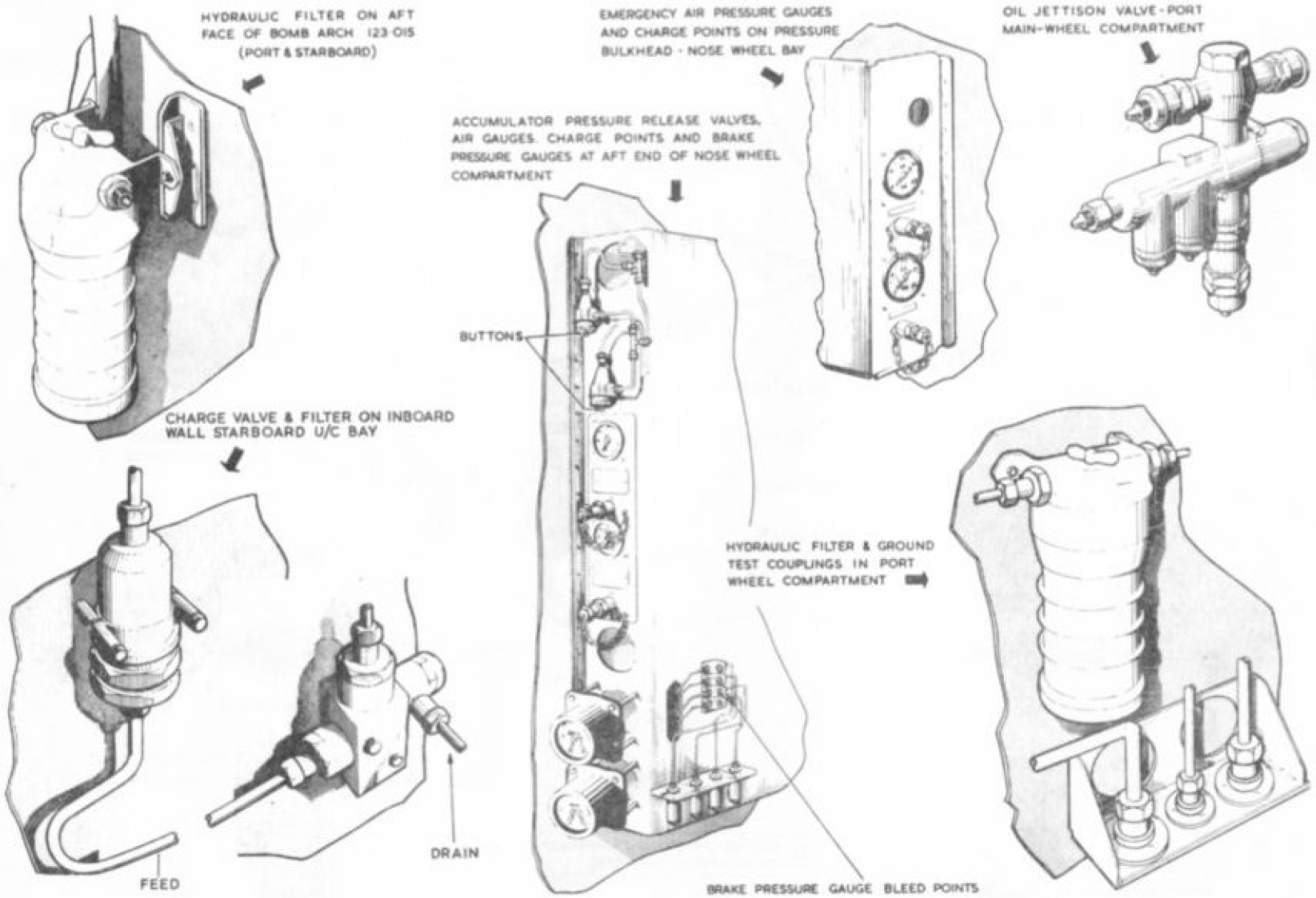

Fig.13. Hydraulic system servicing points

lock-nuts and adjusting screws must be wire-locked to resist rotation in both directions.

TESTING THE BRAKE SYSTEM

54. With the accumulators correctly charged, have each pilot's left and right foot motors operated, and note the reading shown by the dual pressure gauges on the hydraulic panel in the nose-wheel compartment. The progressive rise in pressure as each motor is depressed should be equal for all motors, and the final pressure for each should be 2 500 lb/in^2 with the motor pedal fully depressed.

MAXARET UNIT FUNCTIONAL CHECK

54A. Following fitment or disturbance of maxaret unit/s and/or associated pipelines the following check is to be carried out:-

(1) Ensure a 28V d.c. power supply is available on the aircraft.

(2) Ensure brake accumulators are correctly charged (Sect.2, Chap.2) and that during following checks hydraulic system pressure does not fall below 3 000 lb/in^2 as indicated on the triple pressure gauge on the pilots' panel. If the system pressure falls below 3 000 lb/in^2 re-charge brake accumulators following instructions in Sect.2, Chap.2.

(3) Remove stone guard from port bogie (Sect.3, Chap.5).

(4) Test each maxaret unit (4 off) on the port bogie, as follows:-

(a) Ensure arrow on maxaret unit points in direction that flywheel rotates when aircraft moves forward.

(b) Press on maxaret unit until flywheel tyre is free from aircraft wheel driving track.

(c) Depress port foot brake pedal.

(d) Spin flywheel vigorously by hand in direction indicated by arrow, arrest rotation smartly and check that brake pressure indicated on the triple pressure gauge drops momentarily and then returns to normal (2 500 lb/in^2).

(e) Repeat sub-operation (d) several times and ensure operation of maxaret is satisfactory.

(f) Release port foot brake pedal.

(g) Release maxaret unit and ensure unit takes up its correct running position. Length of contact between flywheel tyre and aircraft wheel driving track should be 0.875 to 1.125 in.

(5) Fit stone guard to port bogie.

(6) Remove stone guard from starboard bogie (Sect.3, Chap.5).

(7) Repeat operation (4) on the maxaret units (4 off) on the starboard bogie. Ensure in sub-operation (c) that the starboard foot brake pedal is depressed.

(8) Fit stone guard to starboard bogie.

BOMB DOORS EMERGENCY OPERATION

55. To check bomb doors emergency operation proceed as follows:-

NOTE . . .
Before operating the emergency switch to any position, including a selection to NORMAL, the pilot's normal selector switch should first be checked to ensure that it agrees with the position of the doors; the navigator's switch should then be checked CLOSED.

(1) Ensure that the ground electrical supply is connected to the aircraft.

(2) At the pilots' port console (panel 6P), select the EMERGENCY bomb door control switch to OPEN.

(3) Check that emergency power pack commences to operate and that the bomb doors move to the open position.

(4) When the BOMB DOOR magnetic indicator shows WHITE and the power pack has automatically shut down, immediately select the EMERGENCY bomb door control switch to the centre NORMAL position.

(5) Select the EMERGENCY bomb door control switch to CLOSED and when the BOMB DOOR magnetic indicator shows BLACK and the power pack has shut down, select the EMERGENCY bomb door control switch to the centre NORMAL position.

Failure of doors to operate

55A. Should this occur, the cause may be an incorrect sequence of switch selection. The following sequence of switching should be made and, if the system is serviceable, the doors should operate normally.

(1) Set the navigator's switch to correspond with the position of the doors.

(2) Set the pilots' normal selector switch to correspond with the position of the doors.

(3) Set the emergency selector switch to NORMAL.

(4) Set the navigator's selector switch to CLOSED, if not already in that position.

REMOVAL AND ASSEMBLY

General

56. No special instructions are considered necessary relative to the methods of removal of components from the system. Extreme care should at all times be exercised in handling, in order to avoid damage to components and pipe-lines, and where special tools are called for they must always be used. Used locking wire, tab washers and split pins removed during dismantling must be discarded. In the case of pressurised components, the pressure must be released carefully before removal operations are commenced.

57. Should the brakes accumulators or components connected directly to them require to be removed, before any disconnections are made the fluid should be discharged from the accumulator (Para.35), after which the air pressure must be discharged using an inflation adapter Ref.No.4G/4131 at the appropriate charging valve. Similarly with emergency air cylinders or gauges, before any attempt at removal, the air pressure in the cylinders must be discharged by means of the inflation adapter.

Windscreen wiper head

58. A removal sequence for the centre windscreen wiper head is given, but this may be applied, in part, to the port or starboard units as required. The work must be carried out in conjunction with an electrical tradesman as the removal of certain electrical components is involved.

(1) Ensure that all electrical supplies to or from the aircraft, are disconnected.

(2) On the outside of the aircraft, remove the windscreen wiper arm and its associated parallel motion rod, and the two nuts from the bolts which secure the wiper head to the windscreen frame.

(3) Lower the pilots' centre panel (A.P.101B-1902-1C, Sect.7, Chap.1).

(4) Remove the small access panel from the front central area of the cockpit coaming.

(5) Disengage all plug connectors from the plug panel and, after removing the four securing bolts and nuts, remove the plug panel.

(6) Remove the locking wire and disconnect the hydraulic pipe unions from the wiper head. Blank off pipe ends and unit connectors.

NOTE . . .
Adequate precautions must be taken to ensure that hydraulic fluid does not spill over adjacent components and cables.

(7) Withdraw the unit from the windscreen frame, taking care to retain packing block, seals, etc., on the front face of the unit.

NOTE . . .
When Mod.1366 is embodied, a Gaco seal is fitted on the shaft and housed in a recess in the packing block, fore-and-aft of which are fitted two neoprene/cork seals.

When a port or starboard windscreen wiper head is to be removed, obviously the first or second pilots' panel will be lowered and the plug panel need not be disturbed. Precaution, with regard to spillage, must still be exercised and care of seals (Mod.1366) must still be taken.

59. In addition to reversing the procedure given in the preceding paragraph, the following instructions are considered necessary for the installation of a windscreen wiper head.

(1) Ensure that all seals are undamaged and show no sign of deterioration.

(2) Thoroughly clean all pipe ends and unit connectors.

(3) When a new Gaco seal is to be fitted, the special tool Part No. 1Z/10582 must be used and assembly carried out in the following manner (fig.14 refers):-

(a) Place seal Part No. 28/Q2058 over the shaft and locating bolts to rest against the front face of the wiper head.

(b) Remove the internal spring from the Gaco seal Part No. M.I.S.O.6 and lightly lubricate the seal with grease XG-315.

(c) Position the seal on the special tool with its open end opposite the open end of the tool.

(d) Place the tool complete with seal, over the splined position of the shaft and slide the seal on to the waisted portion. Remove the tool and slide the seal along the shaft to the face of the neoprene/cork seal (a).

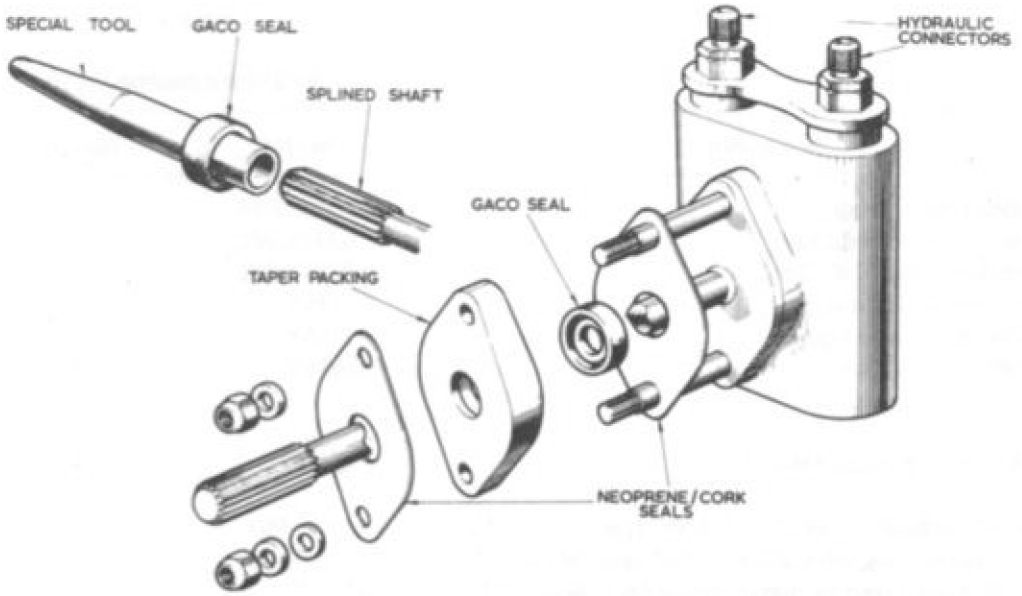

Fig.14. Arrangement of windscreen wiper head seals

(e) Replace the internal spring in the Gaco seal and pack cavity with grease XG-315.

(f) Assemble taper packing block Part No. 26/Q2058 to the wiper head so that the Gaco seal is accommodated in the recess provided.

(g) Place seal Part No. 27/Q2058 over the shaft and locating bolts to rest against the front face of the packing block.

The wiper head is now ready for assembly to the windscreen frame.

(4) When the wiper head is secure to the windscreen frame, reconnect the two hydraulic pipes and prime the system in accordance with the instructions given in para.48 of this chapter.

(5) Fit wiper arm and associated parallel motion rod. Set and adjust in accordance with information contained in para.49 of this chapter.

(6) On completion of bleeding and adjustment operations, wire-lock all pipe unions in the approved manner.

TABLE 1

SYSTEM COMPONENTS

Component	Part No.	No. off	A.P. References	Location
Engine driven pump	1.00500.044	3	1803D	On No.1, 2 and 3 engines
Reservoir (pre Mod.2326)	1.03312.001	1	1803D	Bomb bay
Reservoir (post Mod.2326)	1.03312.002	1		
Reservoir charging valve	C7335Y	1	1803D	Stbd. main-wheel bay
Filter, reservoir charging	D7515Y	1		Stbd. main-wheel bay
Filter, main suction	C5655Y	3	1803D	Port main-wheel bay (No.1 engine) Port side bomb bay (No.2 engine) Port side bomb bay (No.3 engine)
Filter, main pressure (Mod.2261)	1/Q3863	4		No.1, 2, 3, engine bays and one in bomb bay
Pressure-reducing valve 200-15 lb/in^2 (pre Mod.2321)	ACM27450	1	4303B	Bomb bay
Pressure-reducing valve 200-15 lb/in^2 (post Mod.2321)	ACM27518	1	4303B	ECM compartment
On/off valve, reservoir pressurisation (post Mod.2321)	AC1071	1	4303B	Bomb bay
Triple pressure gauge	S214/1/11	1		Instrument panel
Selector valve – main and nose-wheel doors	1.0098.2005	5	1803D	Two in each main-wheel bay and one in the nose-wheel bay
Main-wheel unit retraction jack-port	1.03024.010	1	1803D	Port main-wheel bay
Main-wheel unit retraction jack-stbd.	1.03025.010	1	1803D	Stbd. main-wheel bay
Main-wheel door jack – fwd. port	1.01297.003	1		
Main-wheel door jack – aft port	1.01298.003	1	1803D	Appropriate wheel bay
Main-wheel door jack – fwd. stbd.	1.01297.004	1		
Main-wheel door jack – aft stbd.	1.01298.004	1		
Down lock selector valve – port	1.00144.004	1	1803D	Appropriate U/C units
Down lock selector valve – stbd.	1.00144.005	1		
Main-wheel down lock jack	C8608Y Mk.A	2	1803D	One on each U/C unit
Pressure-relief and non-return valve	C5789Y Mk.C	2	1803D	One on each U/C unit
Bogie trimmer jack	2.0087.001	2	1803D	One on each U/C unit
Separator	1.01025.001	2	1803D	One on each U/C unit
Restrictor valve – main undercarriage	C6771 Mk.A	2	1803D	Main-wheel bay P and S
Pressure-reducing valve	1.02817.001 or 1.02299.003	2	1803D	One in each main-wheel bay
Jettison valve-main U/C	C6770Y Mk.A	2	1803D	One in each main-wheel bay
Selector valve nose-wheel unit	1.0012.006	1	1803D	Nose-wheel bay
Nose-wheel retraction jack	1.01299.014	1	1803D	Nose-wheel unit
Nose-wheel door jack	1.01300.003	2	1803D	Nose-wheel bay

TABLE 1 – continued

Component	Part No.	No. off	A.P. Reference	Location
Nose-wheel centring jack	11678Y01	1	1803D	Nose-wheel unit
Steering control valve	1.00112.006	1	1803D	Nose-wheel unit
Steering stop valve	1.00137.002	1	1803D	Nose-wheel unit
Pressure-reducing valve 4 000-1 800 lb/in^2	0.4719Y.B.07	1	1803D	One in the nose-wheel bay
Pressure-reducing valve 4 000-1 800 lb/in^2	C4719Y Mk.B	1	1803D	One in the A.A.P.P. compartment
Nose-wheel steering unit	A8554Y Mk.A	1	1803D	Nose-wheel unit
Jettison valve – nose U/C unit	C6770Y Mk.B	1	1803D	Nose-wheel bay
Emergency power pack (pre Mod.2320)	1.00547.001	1	1803D	Bomb bay – stbd. side
Emergency power pack (post Mod.2320)	1.00547.002			
Selector valve – bomb door emergency	07489YB03	1	1803D	Bomb bay. – stbd. side
Pressure switch	TP636	1		Bomb bay – stbd. side
Shut-off valve	1.00148.002	1	1803D	Bomb bay – stbd. side
Selector valve – power pack circuit	1.00138.003	1	1803D	Bomb bay – stbd. side
Selector valve – bomb door	1.00125.002	1	1803D	Bomb bay – port side
Selector valve – bomb door – T.R.V.	1.00112.004	1	1803D	Bomb bay – port side
Bomb door jack R.H. (Mod.2318)	1.02179.023	2	1803D	Bomb bay, stbd. fwd., port rear
Bomb door jack L.H. (Mod.2318)	1.02178.023	2	1803D	Bomb bay, port fwd., stbd. rear
Shuttle valve (Mod.2318)	1.03770.001	1		Bomb bay, port side
Brakes master cylinder	AC.13812	4	1803S	Rudder pedals
Brakes control valve	AC.14512	1	1803S	Nose-wheel bay
Brakes system accumulator	AC.14048	2	1803S	Nose-wheel bay
Pressure gauge-accumulator	Ref.No. 6A/2237916	2		Nose-wheel bay
Pressure gauge 0-3000 lb/in^2	AHO.29130	2		Nose-wheel bay
Pressure relay	ACM.18798	7	1803D	6 in nose-wheel bay – 1 in bomb bay
Pressure transmitter	S122 Form 4	3		Bomb bay
Release valves-accumulator	D4930	2	1803D	Nose-wheel bay
Brakes – pressure-reducing valve, 4 000 – 2 500 lb/in^2	AC.12220	2	1803S	Nose-wheel bay
Emergency air cylinder	Ref.No. 6D/1459M	2		Nose-wheel bay
Selector valve – A.A.P.P. scoop	1.00145.002	1	1803D	A.A.P.P. compartment
Jack – A.P.P. scoop	12114YAO1	1	1803D	A.A.P.P. compartment
Windscreen wiper – pump unit	ACM.1344	2	1803S	Pilot's floor – port and stbd.
Wiper head port	ACM.18606	1	1803S	Base of 1st pilot's windscreen
Wiper head starboard	ACM.18608	1	1803S	Base of 2nd pilot's windscreen
Wiper head centre	ACM.21120	1	1803S	Base of centre windscreen
Pressure gauge – emergency air	Ref.No. 6A/2237916	2		Nose-wheel bay

TABLE 2 - FAULT FINDING AND RECTIFICATION

Fault	Possible cause	Remedy
All services fail to operate when engine driven pumps are in action	Insufficient or no oil in the system	(a) Re-fill or top-up the reservoir (b) Check for leaks and rectify
Operation speed below normal for all services	Engine-driven pump failure	Replace defective pump with serviceable one
Operation speed below normal for a particular circuit	Air in system	Prime and bleed affected circuit
Backlash at the bomb doors and alighting gear doors	Air in system	Prime and bleed affected circuit
Doors droop or can be moved slightly by hand when control is in neutral	Leakage past glands on jack pistons	Service defective jacks according to instructions in A.P.1803D
Alighting gear does not retract fully	(a) Leakage past gland jack pistons	As above
	(b) Mechanical fault	
Excessive deflection of main-wheel unit shock-absorber	(a) Leakage past recuperator valve on shock-absorber	Change recuperator valve
	(b) Loss of fluid from shock-absorber	Top-up shock-absorber and separator with silicones mixture fluid, after checking for leaks
Excessive recoil speed of shock-absorber	(a) Broken piston ring in shock-absorber	Service affected shock absorber in accordance with instructions in A.P.1803D
	(b) Leakage past plate valve in shock-absorber due to foreign matter between plate valve and piston flange	

TABLE 2 - FAULT FINDING AND RECTIFICATION

Fault	Possible cause	Remedy
Sluggish steering or nose wheel shimmy	(a) Faulty two-way relief valve in steering circuit (b) Faulty control valve in steering circuit	Service valve in accordance with instructions in A.P.1803D
Bomb doors fail to operate	Incorrect selections	Carry out the following sequence of operations (a) Ensure rear crew selector switch corresponds to position of bomb doors (b) Ensure pilot's normal selector corresponds to position of bomb doors (c) Ensure emergency switch selected "normal" (d) Ensure rear crew selector switch selected "closed"