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HYDRAULIC SYSTEM

Reference:- AP 4505B, Vol 1 (Gen and Tech Info).
AP 1803 series (Dowty Hydraulic Equipment).
AP 2337A (A/c Brakes, Wheels and Tyres).

1. Introduction

A high-pressure hydraulic system using OIL OM-15 (34B/9100572) is installed to operate the following:-

a. Alighting gear and associated doors. No

b. Bomb doors.

c. Nose wheel steering. No

d. Wheel brakes.

e. AAPP scoop.

f. Blue Steel fin gap doors. No

The various hydraulic circuits are controlled by electrically operated selector valves, with the exception of the nose wheel unit centring jack, which is connected to the main hydraulic supply line, and the wheel brake circuit.

Also installed is an electrically driven hydraulic power-pack unit for operation on the ground of the bomb doors (or fin gap doors), wheel brakes and Blue Steel hoist jack, and for in-flight emergency operation of the bomb doors (or fin gap doors) and wheel brakes.

Emergency high pressure stored air supplies are coupled to the alighting gear and associated door circuits for lowering them in event of hydraulic or u/c jacks selectors circuit failure.

2. Main Feed and Return System

The main feed and return circuit consists of a spherical reservoir mounted in the bomb bay roof, port side, and containing 2¼ gallons of fluid. Mounted in the base of the reservoir are connections for suction, return (incorporating a non-return valve) and a power pack connection for filling arrangements. The combined filling of the reservoir and power pack being achieved from a charging point situated on the inboard wall of the starboard undercarriage bay.

An assembly at the top of the reservoir embodies separate pressurisation and vent valve connections. The vent valve is set to relieve at 22 - 27 lbs. pressure per square inch, and resets at 16 lbs. pressure per square inch. The pressurisation of the reservoir is by air from the engines co-axial compressors which is reduced to a working pressure of 15 to 18 lbs. per square inch. The pressure air is also fed to the power pack via the connection from the reservoir.

A sight glass in the reservoir and power pack is provided for the purpose of checking the level of fluid in each.

/3.

3. Pump Circuit

Fluid is drawn from the reservoir, through three separate filters, by three Dowty Super Vardel engine driven pumps, driven from Nos. 1, 2 and 3 engines. Each pump delivers fluid to the common feed line via separate hydraulic accumulators (Mod. 1281 and 1282) and non-return valves are capable of delivering fluid on demand at a working pressure of 3,600 - 4,000 psi.

The common feed pipe is connected to the various selectors, which are in turn also connected to the common return pipe to the reservoir.

The pumps are of the two-stage type ie. a low pressure spur-gear pump feeding a high pressure radial piston pump.

Each pump incorporates an automatic unloading device which circulates fluid back to the reservoir through the common return line to allow the pumps to idle between operation periods.

4. Ground Test Connections

Ground test connections are fitted in the suction, return and delivery lines to allow the coupling of an external pump rig to the circuit, so that power tests may be carried out without running the aircraft engines.

5. The Hydraulic Power Pack Circuit

The unit comprises a high pressure radial piston pump to which an electric motor and a canister containing a filter element are mounted.

Fluid is drawn by the pump from the fluid contained within the power pack via the filter, to the pressure outlet connection on the top of the unit and thence to the bomb door emergency selector and the wheel brake circuit shut off cock; the selector and cock in turn are connected to the return line of the power pack unit.

A tapping is taken from the pressure feed line to a pressure switch, which is incorporated in the electrical circuit to the power pack motor, and cuts the motor supply as soon as a fluid pressure of 4,000 lbs. pressure per square inch is obtained.

The Hydraulic Power Pack on the Vulcan Mk.2 aircraft is powered by an AC electrical motor. In order to satisfy the requirements for this type of motor a solenoid operated by-pass valve is connected into the power pack circuit in such a manner that the motor, when switched on, will run up to speed in a no load condition until the correct motor speed is reached. When this occurs, the by-pass valve will be automatically closed to put the motor on load, after a period of 2 seconds.

The by-pass valve is basically a single solenoid type selector valve, the pressure inlet of which connects with the pack feed, whilst the return and service unions connect with the pack return. The valve solenoid when energised, connects the pack feed and return pipelines via the service connection, thus providing an idling circuit for the pump. When the valve solenoid is de-energised, the connection between the valve inlet and service unions is blanked and the pump now becomes effective.

/The operating

The operating solenoid is electrically connected to a Transistorised Time Delay Unit. When either Emergency Bomb Doors or Brake Accumulator Recharge is selected, the valve is energised to by-pass "Open" thus permitting the motor to run up to speed with the pump idling. A restrictor in the service connection on the valve body, prevents overspeeding of the motor and pump when the by-pass valve opens, partially restricting the idling flow to maintain a certain low loading on the motor. After two seconds the time delay operates to de-energise the valve to by-pass "Close" when the motor will be loaded as the pump is connected to the circuit selected.

6. Alighting Gear Circuit - General

Normal operation of the alighting gear is controlled by UP and DOWN push buttons mounted on the pilots centre instrument panel, use of which brings into operation the appropriate selector valves.

The sequence of operations for raising and lowering the main and nose wheel units is controlled electrically by a series of micro-switches. A safety device is incorporated which prevents the UP button being depressed when the weight of the aircraft is on the ground, and can be over-ridden by rotating the UP button through 60° before pressing.

7. Main Wheel Units

The port and starboard main-wheel unit circuits are each controlled by three selector valves; one operates the main retraction jack and bogie trim jack, one the down lock jack, and the third one operates the door. The full operating sequence of one main-wheel unit is described in the following paragraphs.

8. 'UP' Selection

As the aircraft becomes airborne, movement of the bogie frame to its trailed position, on both undercarriages, operates micro-switches, which in series, completes the circuit of the push button selector, and the UP button can now be pressed. The down lock and retraction jack selectors are now energised, directing fluid to the down lock jack, retraction jack, and the bogie trim jack.

The down lock jack retracts, and the lock strut is freed and the retraction jack then extends to retract the unit about the main pivot. On unlocking of the unit, a micro switch on the down lock assembly puts the green light to red on the pilots undercarriage indicator on the centre instrument panel. During extension of the retraction jack, the body end of the jack imparts a turning moment to the 'drag link' and the bracing tubes, to move the upper universal joint towards the main fitting and push the down lock strut through the down lock assembly.

Simultaneously pressure is admitted to the bogie trim jack, via the special relief valve, by way of a branch pipe from the line to the retraction jack, and the bogie trim jack shortens against its compressed air charge, drawing the sliding tube up inside the main fitting turning the bogie frame about the shock absorber attachment to position it for stowage whilst the unit is retracting.

/On completion

On completion of the travel of the sliding tube a micro-switch is made which is in series with a second micro switch above the main fitting. The second switch is made as soon as retraction is completed the electrics being so arranged that the door cannot close until both switches are made.

During the last third of retraction, a cam operated snubber valve slows up the final stage of the retraction jack extension, restricting retraction to a suitable entry speed. The shock absorber remains fully extended, correct pressure being maintained by the separator unit.

On complete retraction of the unit, and trimming of the bogie frame, the door selector is energised to close the door, and on closing, the door hooks automatically engage with their respective latches. When the door is closed and the hooks are engaged, the hooks operate micro-switches which extinguish the red light on the pilots undercarriage indicator to a NO LIGHT condition.

No UP locks are incorporated and the undercarriage is therefore held by a permanent UP selection of the alighting gear circuit from the main feed system.

9. 'DOWN' Selection

On a 'DOWN' selection, the door selector only is energised, and fluid is delivered to the door jacks to extend them. Initial movement of the door jack ram ends in their respective attachment bracket slots, pull the door hooks away from the latches. This movement operates the latch micro-switches to illuminate the red light on the pilots undercarriage indicator. Further extension of the door jacks fully opens the door. A restrictor is placed in the line to prevent excess door opening speed.

On complete opening of the door, a micro-switch operated by the forward hinge is operated to select undercarriage 'DOWN' to the retraction jack and down lock jack selectors. The down lock jack is extended and the lock is ready to engage when the undercarriage unit reaches the fully down position. The retraction jack shortens to lower the unit and simultaneously the fluid from the bogie trim jack is expelled to return, via the retraction jack selector, by the compressed air charge in its lower part, extending the sliding tube and setting the wheel bogie frame to the correct landing attitude.

Further movement of the retraction jack completely lowers the undercarriage unit and the turning moment of the jack body imparted to the drag link and bracing tubes draws the upper universal joint away from the main fitting, which pulls the down lock strut back through the down lock assembly enabling the down lock toggle mechanism to lock home behind the lock strut. The micro-switch on the down lock assembly is made to extinguish the red light and illuminate green on the undercarriage indicator to indicate that the undercarriage is locked down.

During lowering of the undercarriage, a one way restrictor in the retraction jack circuit imposes a constant restriction to limit the lowering speed.

The required pressure in the shock absorber for landing loads is maintained by the separator unit.

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10. Nose Wheel Unit - General

The nose wheel unit is controlled by two selector valves; one operates the retraction jack and one the nose wheel doors.

11. 'UP' Selection

As the nose wheels leave the ground, a micro-switch on the pivot bracket is operated to de-energise the stop valve in the steering circuit which allows the by-pass valve to open, permitting flow from one side of the steering jack to the other. The centring jack is now the only unit exerting any force on the pivot bracket, which is therefore automatically centred.

On an 'UP' selection the retraction jack selector is energised to admit fluid to the jack to shorten it.

As the down lock latch is still engaged the main fitting is unable to retract therefore the retraction jack body moves down its stationary ram. This movement imparts a turning moment to the torque lever shaft, which, in rotating, pulls the latch tube which in turn pulls the latch away from the latch pin, a micro-switch on the latch putting green to red on the undercarriage indicator. On the instant that the latch is fully off, the jack lever kidney slot engages with the lever pin of the cross-shaft.

Further movement of the jack body will impart a turning moment to the torque shaft and cross shaft which will break the geometric lock formed by the upper and lower retraction struts, to effect the retraction of the main fitting.

On complete retraction the doors selector is energised by a micro-switch, which is operated when the nose unit is fully stowed, to close the doors, and on closing, the door hooks automatically engage with their respective latches. When the doors are fully closed and the latches engaged, the hooks operate the micro-switch which extinguishes the red light on the pilots undercarriage indicator.

A restrictor is placed in the line to prevent excess door closing speeds.

Like the main undercarriage, no 'UP' locks are incorporated and the undercarriage is therefore held by a permanent 'UP' selection of the alighting gear circuit from the main feed system.

12. 'DOWN' Selection

On a 'DOWN' selection the doors selector only is energised and fluid is delivered to the jacks to extend them. Initial movement of the jack ram ends in their respective attachment and bracket slots pulls the door hooks away from the latches, this movement operates the latch micro-switches to illuminate the red light on the pilots undercarriage indicator. The doors then open unrestricted and on complete opening of BOTH doors, a micro-switch on each door hinge line is energised in series with each other to energise the undercarriage down selector. Fluid is then directed to the retraction jack which extends to lower the main fitting and move the retraction struts, to reform the geometric lock and the mechanical latch.

/The final

The final movement of retraction is effected by the latch pin striking the latch taper face to move it against the latch tube spring. As the latch pin enters the latch recess, the latch snaps home under the influence of the latch tube spring to securely lock the upper and lower retraction struts.

The latch micro-switch then puts the red light to green on the pilots undercarriage indicator.

13. Nose Wheel Steering - General

The nose wheel steering is controlled by one single solenoid selector, which functions as a steering/stop valve, and one twin solenoid whose function is to direct fluid to one side of the steering motor or the other as selected by the pilots control.

14. Steering Selection

a. With the nose wheel on the ground, and the pivot bracket micro-switch released and energised, and the steering button on either pilots flying control grip depressed, the steering stop valve is energised to admit fluid via the pressure reducing valve to the steering selector, and the by-pass valve, which closes to isolate the by-pass of fluid from one side of the steering motor piston to the other.

b. The steering selector is controlled by the drum switch, which is in turn controlled by the pilots rudder control system.

With paragraph a. conditions satisfied and, a deflection of the rudder controls in any one direction, the drum switch contacts are made to energise one of the steering selector's solenoids. Fluid is then admitted to the appropriate side of the steering motor jack to deflect the nose wheels in the direction required.

The follow-up mechanism which is effected by the nose wheel deflection, cancels out the drum switch signal to the steering selector, and the selector is de-energised to a hydraulic lock condition, thereby holding the nose wheel deflection in proportion to the pilots control input, until a further pilots input is made to the drum switch.

Any overloading of the steering circuit during taxying is relieved by a two-way relief valve.

15. Nose Wheel Centring

Automatic centring of the nose wheel unit is effected by a jack which is fed directly from the main supply line through a pressure regulating valve, which maintains an essential minimum pressure to the jack, should the main system fail, of 1,500 psi.

With the nose wheel off the ground and the pivot bracket micro-switch de-energised or, no selection on the pilots steering button, then the steering stop valve is de-energised to the 'OFF' condition and no fluid passes through to the steering circuit. The loss of pressure in the system allows the by-pass valve to open, and the centring jack to align the wheels to a fore and aft condition.

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16. Bomb Door Circuit - General

The bomb door circuit is controlled by three twin solenoid selectors, two supplying fluid to the door jacks for normal opening and closing of doors and one incorporating a permanent bleed to return, for emergency opening and closing of the doors.

17. Normal Bomb Door Opening

On an open selection, fluid is fed, by the two normal selectors from the main feed line, to the door jacks. The door jacks extend to rotate their respective bell cranks and open the doors, the tension struts being shortened by the action of the opening doors.

18. Normal bomb door closing

On a close selection fluid is fed to the main door jacks, which in shortening, close the doors. The action of the doors mechanically extending the tension struts.

19. Emergency bomb door opening

On an open selection, fluid is fed to the main jacks via the emergency selector, from the power pack system. Shuttle valves attached to all the jacks moveclosing the main feed and return lines and allowing power pack pressure fluid to enter the jacks.

The return fluid from the main jacks passes back through the emergency selector to the power pack via the shuttle valves.

The tension struts are shortened by the action of the doors as they open.

20. Emergency bomb door closing.

On a closed selection fluid from the power pack is fed to the main jacks which shorten to close the doors, the action of which mechanically extends the tension struts to the tension condition.

On completion of doors open or doors closed the power pack motor is switched off by a pressure switch when power pack system pressure is 4,000 . . psi.

The permanent bleed to return in the emergency selector is to allow for a displacement of oil by the main bomb door jack shuttle valves. This allows the shuttle valves to neutralise and reconnects the door jacks to the normal bomb door system selector lines.

NOTE: Flexible pipes and additional four way unions included in the bomb bay main and emergency systems feed and return lines, when MOD 748 is embodied, facilitate conversion of the existing systems to the Blue Steel role.

21. Bomb Door Controls

The bomb door control switches are located on a panel situated on the port console.

Three types of switches are fitted and operate in the following manner:-

a. Normal Selector Switch

The switch is three position rotary type marked, OPEN CLOSED and AUTO. The open and closed positions are for normal selection, whilst the auto position ensures the auto matic opening of the doors as part of the bombing operation. After bombing is completed the doors are closed using the normal selector.

b. Emergency Jettison Switch

This switch is a double pole type marked JETTISON and OVERRIDE, and when operated to the jettison position causes the bomb doors to open, cutting off the supply to the bomb fusing units and, in conjunction with the 'doors open' micro switches causes the bomb to drop,and in conjunction with a time delay unit closes the bomb doors.

The override position cancels the jettison circuit supply should the pilot have a change of mind on the jettison of the bomb.

c. Emergency Selection Switch.

This switch is a double pole type marked OPEN, CLOSED and NORMAL, and is used in the event of failure of the normal system.

The open and closed positions start the power pack motor, energise the emergency selector, and the by-pass valve to the 2 second by pass condition, and cut off the electric supply to the normal selectors.The normal position completes the circuitof the normal system and cuts off the emergency opening and closing electric supply.

d. Navigators Bomb Door Selector

Mod No Vulcan 1970 introduces a switch at the navigators station. This switch is single pole type, Marked CLOSED and OPEN and operates the bomb doors through the medium of the normal Hydraulic system.

22. Bomb Door Indicator

A three position magnetic indicator is located on the pilots centre instrument panel, shows black when the doors are closed, black and white candy stripe when doors are between open and close position, and white when the doors are fully open.

23. Blue Steel Conversion

At conversion to Blue Steel role, one of the normal bomb door system selectors is used to operate the fin gap doors,(the other selector being blanked off).

The power pack and its twin solenoid selector are also used to open and close the fin gap doors in event of failure of the normal system. A shuttle valve inter-connecting both systems, moves according to the source of supply, closing the feed and return lines of the supply not being used.

The power pack is also used (in conjunction with a separate twin solenoid selector) to provide a store hoisting and lowering system within the aircraft and is controlled from a portable ground test and control panel, which, when not in use is stowed in the bomb bay.

24. Fin Gap Doors Control and Indicator

This is now done by two switches operated by the AEO at the crew's station. One switch operating the normal system selector, and the other (covered by a spring load yellow and black striped gate) operating the doors through the power pack system.

The original bomb door position indicator is now utilised as the Fin position indicator using a similar sequence.

25. Wheel Brakes Circuit - General

The brake circuit is controlled by a brake control valve which permits fluid from the main feed and return system, at a reduced pressure, to pass to the brake units at variable pressure proportional to the pilot's foot motor pressure .

Two accumulators are installed in the system to meet the immediate requirements of braking during normal operation and, to provide an emergency fluid supply in event of main system failure, and for brake applications during towing operations.

All brakes can be applied evenly by means of a parking brake located on the port side of the throttle box.

26. Brake Application

Operation of the brake foot motors, which are mounted one on each rudder pedal, provides the pressure necessary to operate the brake control valve, which allows fluid pressure from the hydraulic system to pass to the brake units selected via the maxaret units. Pressure delivered to the brakes is proportional to the pressure applied to the foot motors due to the fluid back pressure, combined with spring pressure, in the control valve, transmitting this back pressure through the control valve beam lever mechanism, to the foot motor system.

27. Brake Release

Release of the brake foot motors, closes the brake control valve main system to reduced pressure, and the pressure fluid in the brakes is exhausted to main return via the control valve exhaust connection.

28. Shuttle Valves

These are installed between the brake control valve and brake units, (one valve for port brakes and one for starboard brakes), which ensures that should the supply in one line to either the Port or Starboard braking system fail, the brakes receive pressure from the remaining line.

29. Charging the Brake Accumulators

The accumulators can be recharged without the engines running, or by the hydraulic system pressurised by the ground servicing trolley, by use of the power pack.

This operation can be carried out by one of two switches. One switch is located in the nose wheel bay, rear starboard side, and the other is located on the pilots centre instrument panel on left of u/c selector buttons.

/When one

When one of these switches is selected to 'Start', the shut-off and by-pass valves are opened and the power pack is started. After the two second delay the by-pass valve is switched off and full power pack pressure is then available to pressurise the wheel brake circuit accumulators.

If the power pack switch is not operated to 'Stop', the pressure switch will operate at 4,000 lbs. per square inch to cut off the electrical supply to the power pack. The shut-off valve is also de-energised to the closed position.

30. Maxaret Units

These units, fitted to all the brake units, permit the pilot to apply maximum braking effort to the wheels without the fear of locking the wheels.

The unit consists primarily of a valve arrangement, regulated by a fly wheel housed in a rubber tyred shell. The tyre is driven by direct contact with a special track on the aircraft landing wheel. The valve arrangement is connected in the line to the brake units, and is sensitive, via the fly wheel, to angular deceleration consistent with an approaching locking of the wheel.

When this condition occurs, the associated unit valve mechanism momentarily connects the pressure line to return, thereby reducing the pressure existing in the brake unit, and re-applies the brake pressure when the locking tendency ceases.

With this unit the a/c must not be landed with the brakes 'ON' as the unit does not function until the wheel rotates.

31. Brake Units

Reference: AP 4505B, AP 2337, Volume 1, Book 2.

Introduction

This hydraulically operated plate brake utilises inorganic brake pads and segmented plates. It embodies an automatic device which maintains a set working clearance as the brake pads wear, thereby ensuring a constant operating fluid displacement. Fluid under pressure causes pistons to impart a clamping force between the brake pads which are stationary, and the segmented plates which are rotated by the landing wheel.

32. Description

The torque plate has a central axle aperture and is secured to the sliding tube assembly. The outer face carries the fluid supply connection and a mounting bracket for the Maxaret unit.

The ends of the pistons face up to a pressure plate through which the combined thrust is applied to the brake components. Bolted to the inner face of the torque plate is a Torque Tube which has, around its periphery, a series of integral keys. These keys engage slots in the stator assemblies which carry the brake pads and permit their axial movement without rotation. A fouling piece rivetted to the torque tube ensures that the stator plates are always fitted correctly. A pressure plate is mounted on the inner end of the torque tube and is in direct contact with the piston assemblies, whilst a thrust plate is secured to the outer end by a ring nut, locked by a locking plate.

Mounted around the torque tube and located between the pressure plate and thrust plate are two single and three double stator assemblies and four segmented rotor assemblies.

33. Stator Assembly

Each single stator assembly consists of a circular metal plate, to one side of which, a set of circular inorganic pads is secured by rivets. The pads are integral with their casings, a small projection on the back of each engages with a hole in the stator plate to prevent rotation. There is a total of 96 pads on the brake assembly.

34. Rotor Assembly

Rotor assemblies take the place of brake plates. Each assembly is made up of eight steel segments, jointed together by links and pins halfway along their radius. Their outer edges at the joints are shaped to form the tenons which mate with the aircraft landing wheel.

35. Automatic Adjusters

Each automatic adjuster assembly is held in the torque plate by a circlip and consists of an abutment sleeve, a cover, a helical spring, a retraction pin and a friction bush. The friction bush is pressed into the bore of the abutment sleeve which is retained in the adjuster housing by the coil spring under load. One end of the retraction pin is fastened to the pressure plate and its shank passes through the friction bush. Spring travel is limited by the location of the abutment sleeve flange, against the cover when the brake is OFF, and against the internal flanges of the housing when the brake is applied. This movement represents the total working clearance when the brake is 'OFF'.

Operation

When the brake is applied, fluid under pressure passes through the conduits in the torque plate to each of the five cylinders. Subsequent extension of the pistons move the pressure plate towards the thrust plate and so imparts a clamping force on the rotor and stator plates. The braking force is thus provided by the rotation of the rotor plates, and therefore the aircraft wheel.

As the pressure plate moves, the springs in the brake adjusters are compressed by the retraction pins and abutment sleeves to the limit of their travel. Any further movement necessary to apply the brake results in the retractor pins being withdrawn through the friction bushes. As the pads wear so this withdrawal increases, so that when hydraulic pressure is released, the return springs withdraw the pressure plate and pistons, only the amount allowed by spring travel. After each brake application Where wear takes place, the retraction pin protrudes a little further and the working clearance remains the same. The fluid displacement thus remains constant throughout the life of the brake unit.

36. Friction Pad Wear

Friction pad wear may be gauged by checking the movement of the piston with the brakes pressurised. The measurement is taken

/from the

from the outer face of the torque plate to the outer face of the pressure plate with Pad wear gauge Part No. AO 103401. When the mark on the rod coincides with 'F.W.' on the scale, the limit has been reached.

37. Wear between tenons of the Stator Plate

The width of the gap between tenons must not exceed 0.427 ins. This limit is reached when gauge No. AO 102435 enters the gap.

38. AAPP Scoop

The AAPP Scoop selector valve is supplied by fluid from the main feed line through a 4,000 to 1,800 lbs, pressure per square inch reducing valve. The selector is normally energised and directs fluid at this reduced pressure to keep the spring loaded jack in the extended position. This holds the scoop closed.

When either the AAPP is started, ~~or the RAT toggle is pulled,~~ the selector valve is de-energised and this releases the pressure from the jack allowing the jack ram to extend under the action of the spring which opens the scoop.

39. Emergency Air System

Two separate air supplies contained in air cylinders mounted in the nosewheel bay, rear starboard side, are provided for emergency lowering of the undercarriage units, one for the main wheel units and one for the nose wheel unit. Each cylinder is charges to 3,000 lbs. per square inch, each associated charging point being adjacent to the cylinders.

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 pilots throttle pedestal.

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 these valves so that return fluid expelled from the actuating jacks is able to pass to atmosphere.

The spigoted end of the valve piston protrudes at one end, to provide a means of manually resetting the piston after emergency air operation.

From the jettison valves the air then passes to the shuttle valves, integral with the main and door jacks of each wheel unit, and the main wheel down lock jacks, 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 selectors in the undercarriage circuit except, the nose wheel steering control valve which can still be operated in the normal manner, and of course, the u/c indicator lights system.

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40. Windscreen Wipers

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 against each cockpit wall, forward of the rudder pedals.

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 motor.

Operation of the wipers is controlled by two 3 position switches labelled OFF/FAST/SLOW. The switches are located on the 2nd pilots starboard instrument panel.

No parking control is provided, the wipers being held against stops by slipstream pressure during flight.

All information on the windscreen wiper blade settings is contained in the AP 4505B, Vol 1, Sect 3, Chap 6, Para 49.

41. Cockpit controls and indicators

These are all located at the pilots station, and with the exception of the brakes and emergency air control, are electrical in operation.

A triple pressure gauge is fitted on the pilots centre instrument panel which indicates main system pressure and brake accumulator pressure.

An undercarriage indicator on the pilots centre instrument panel shows green lights for undercarriage locked down, red lights for undercarriage unlocked and no lights for undercarriage fully up.

An additional flag type indicator is fitted in the second pilot's airspeed indicator, and is operated through the medium of the down lock micro-switches. The flag appears and serves as a warning when the locks are broken, and the airspeed is around 150 knots or less.

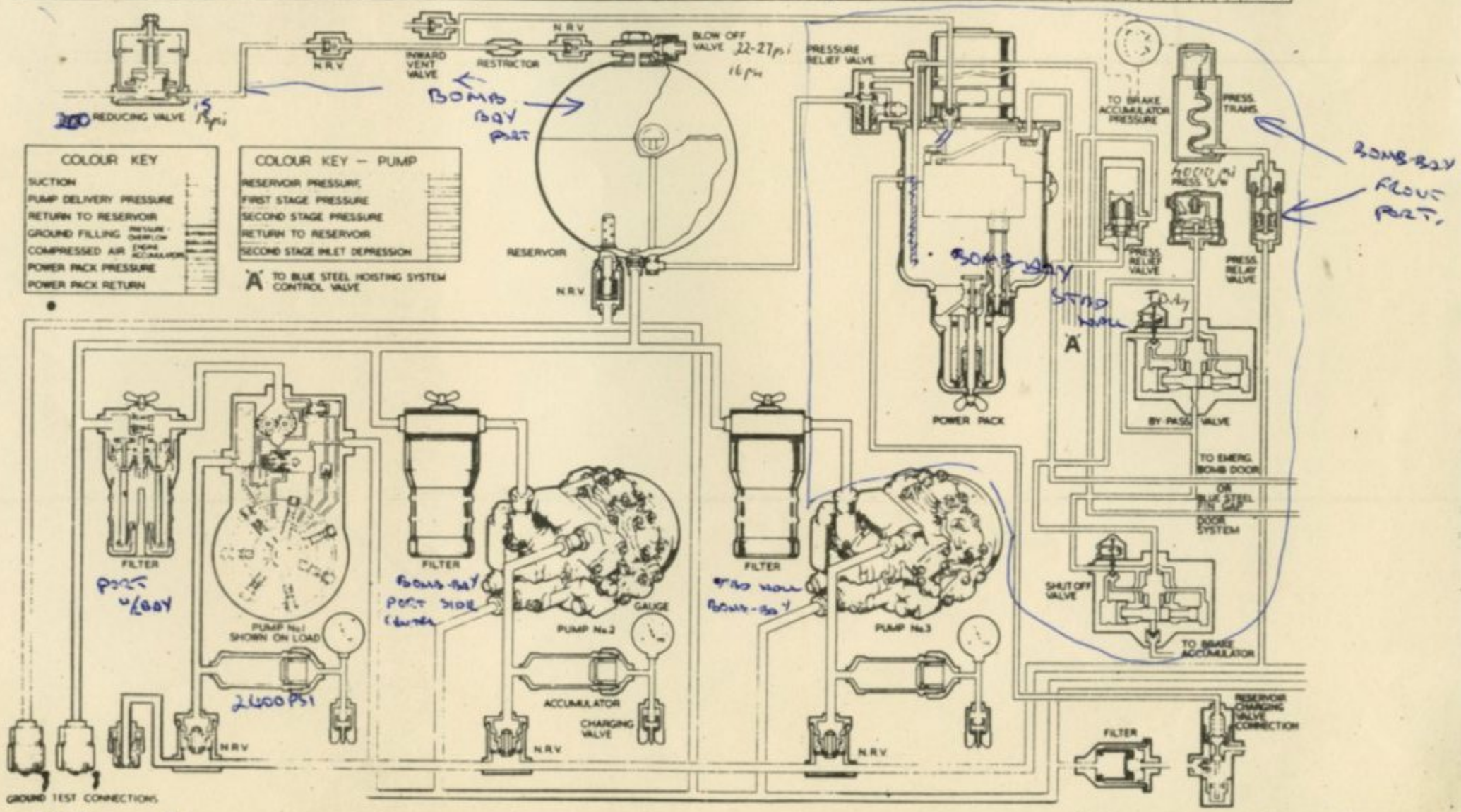
VULCAN B.MK. 2

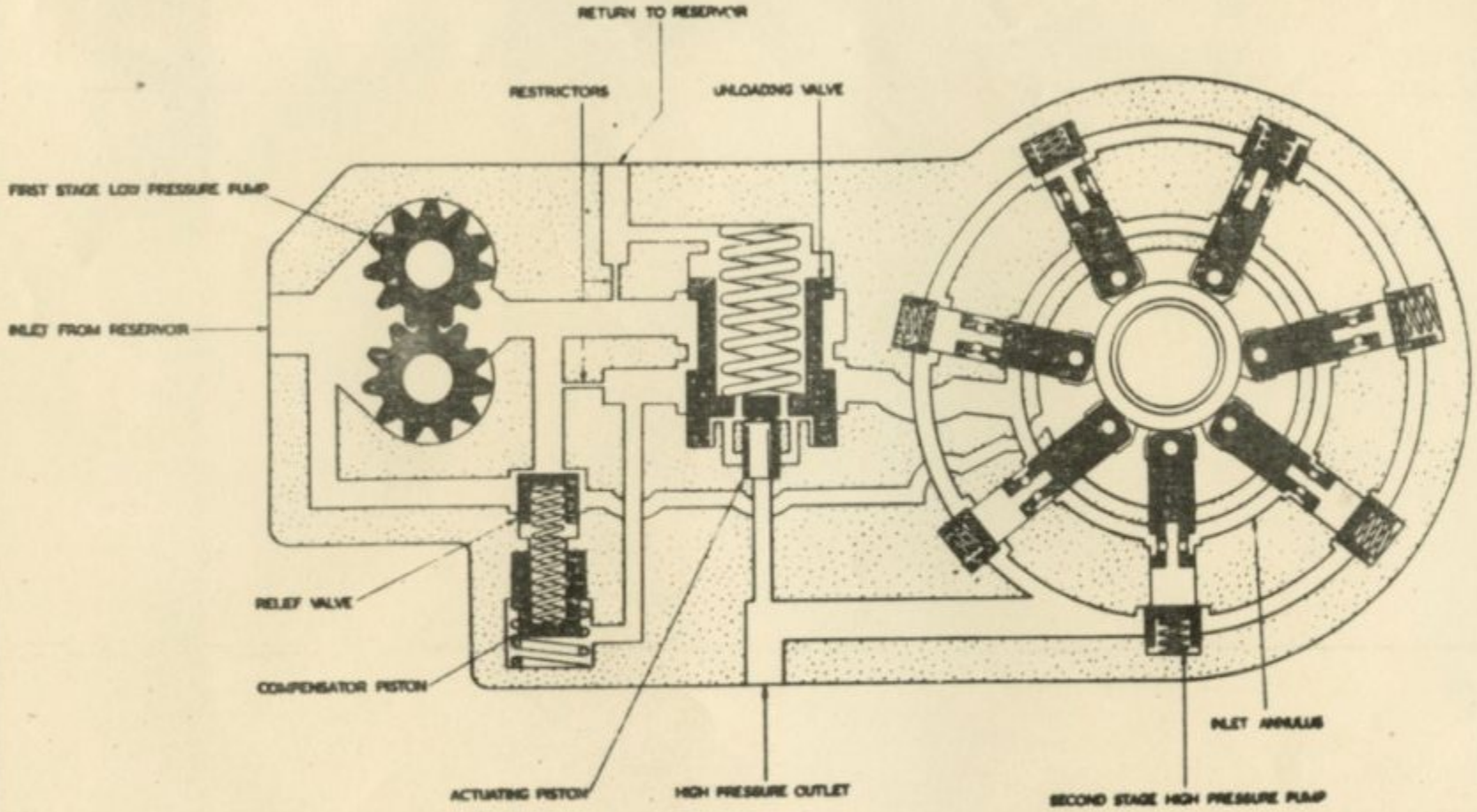
A·V·ROE & Cº LIMITED
MANCHESTER

HYDRAULIC SYSTEM

FEED CIRCUIT

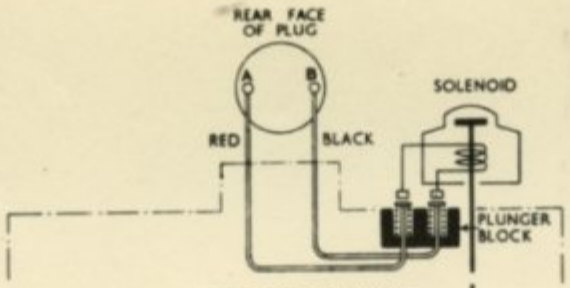
MOD NO
ISSUE NO





DOWTY VARDEL HYDRAULIC PUMP TYPE 5050Y

TP.3072



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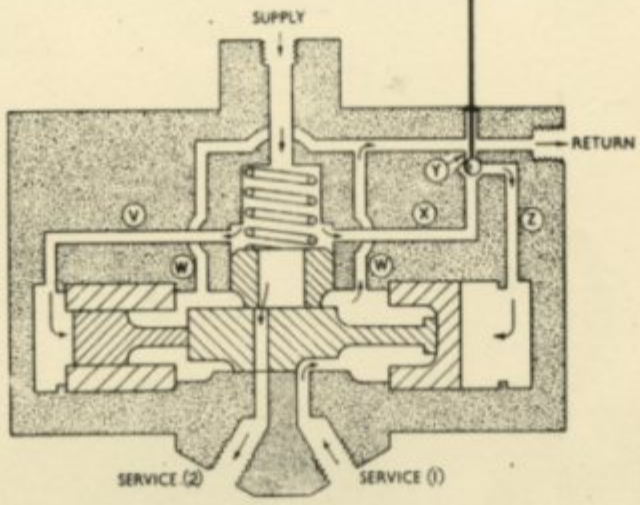
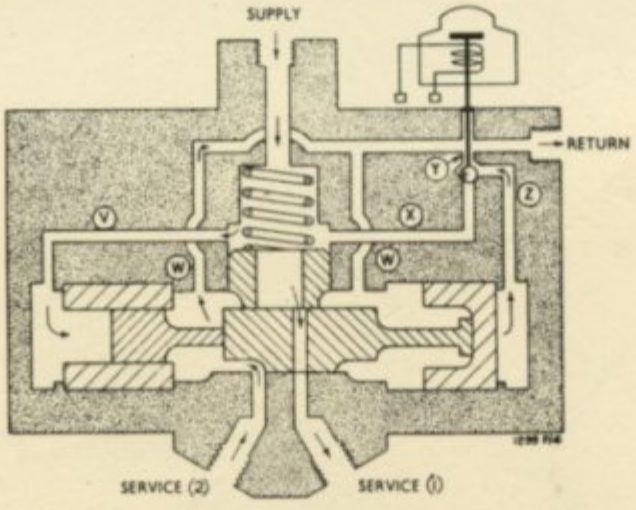
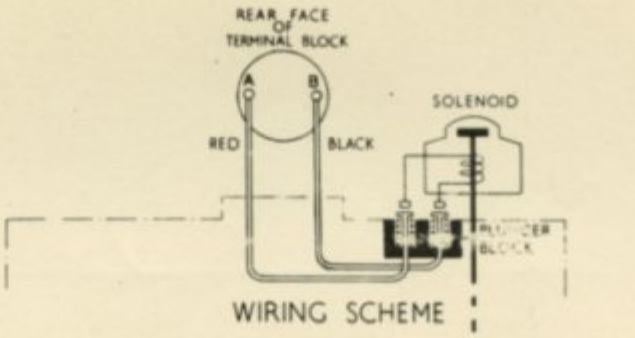


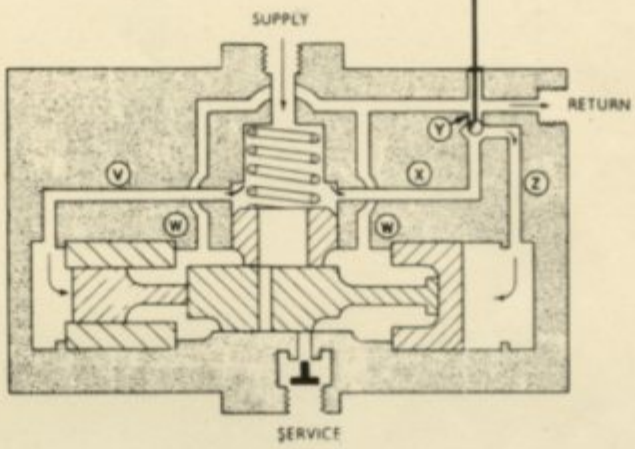
(a) SOLENOID DE-ENERGISED



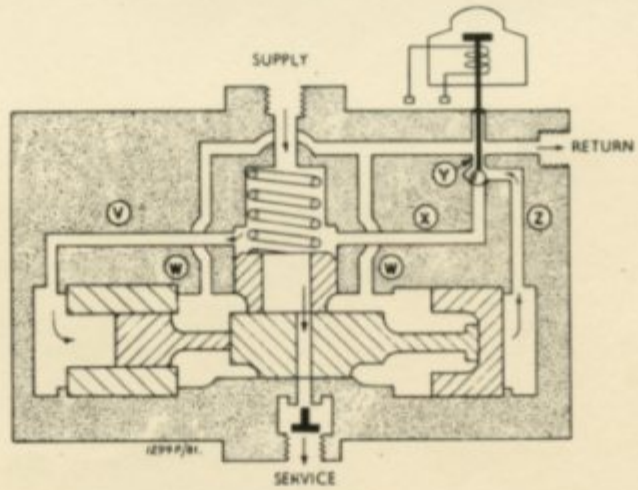
(b) SOLENOID ENERGISED

FIG 3. PRINCIPLE OF OPERATION.





SOLENOID DE-ENERGISED



SOLENOID ENERGISED

FIG. 3 PRINCIPLE OF OPERATION.

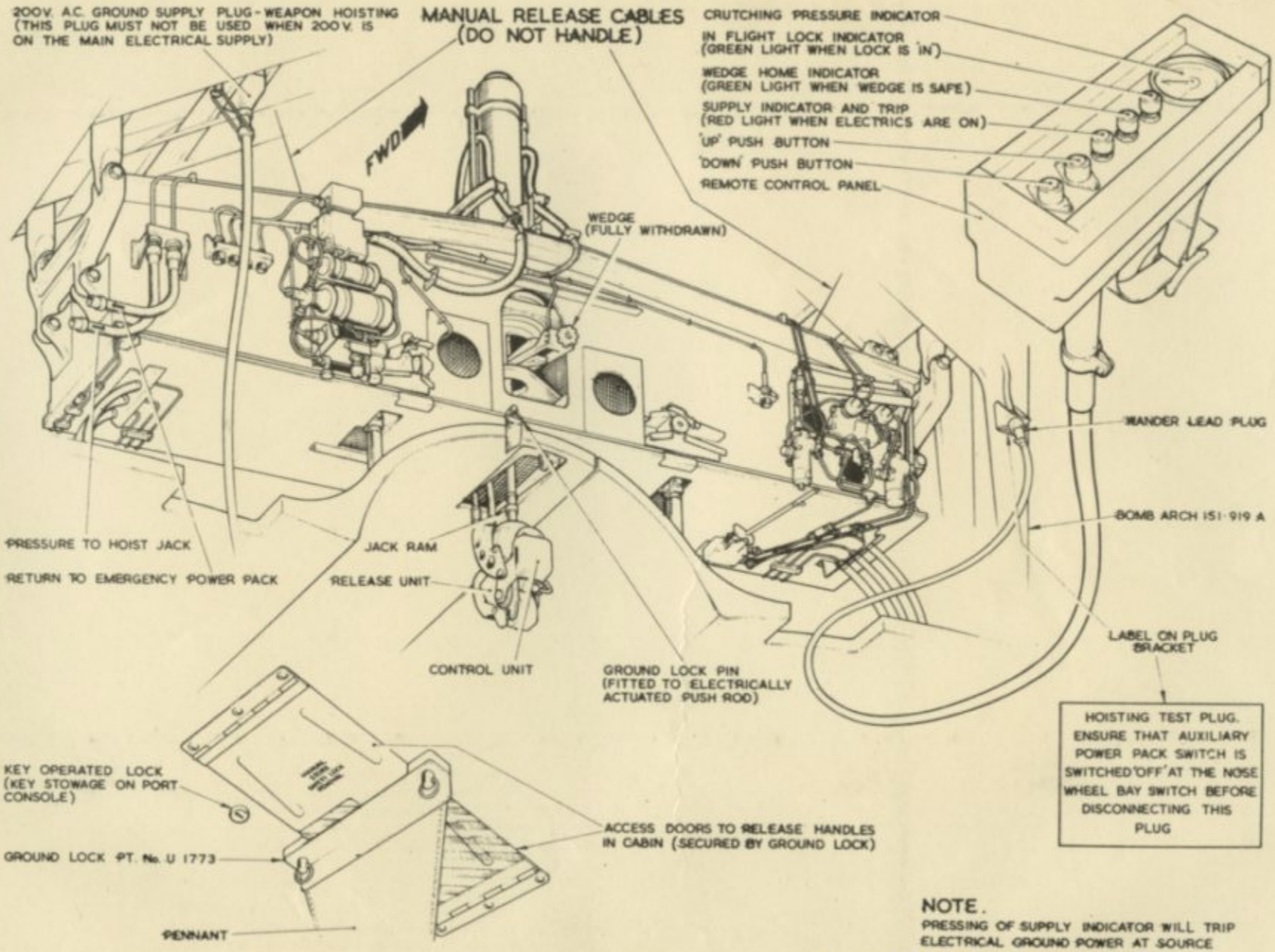


Fig. 18. Operation of hoist jack (Blue Steel a/c only)

(FROM POWER PACK) NOSE SWITCH.

5

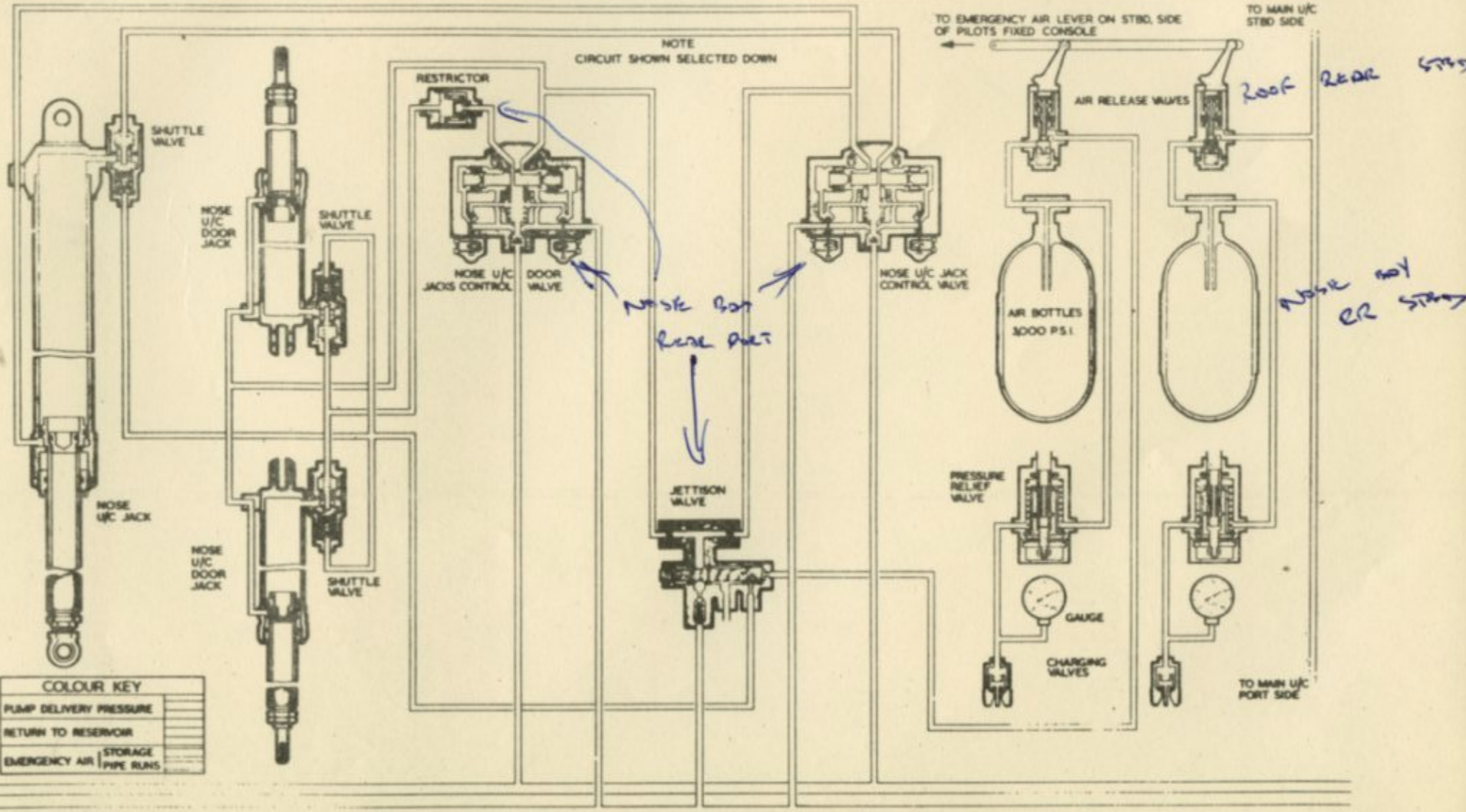
VULCAN B.MK.2

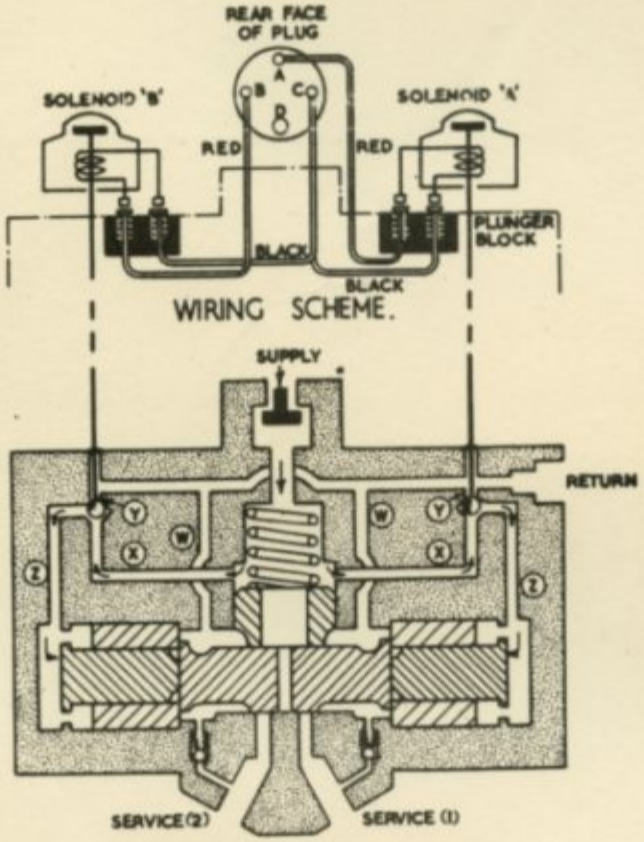
A·V·ROE & C9 LIMITED
MANCHESTER

HYDRAULIC SYSTEM

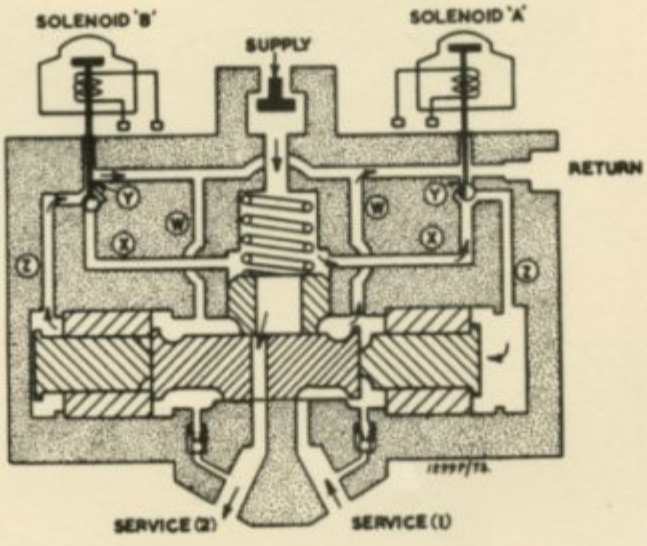
NOSE UNDERCARRIAGE

MOD NO
ISSUE NO





(a) BOTH SOLENOIDS DE-ENERGISED



(b) SOLENOID B ENERGISED. SOLENOID A DE-ENERGISED.

FIG. 3. PRINCIPLE OF OPERATION.

4

VULCAN B.MK.2

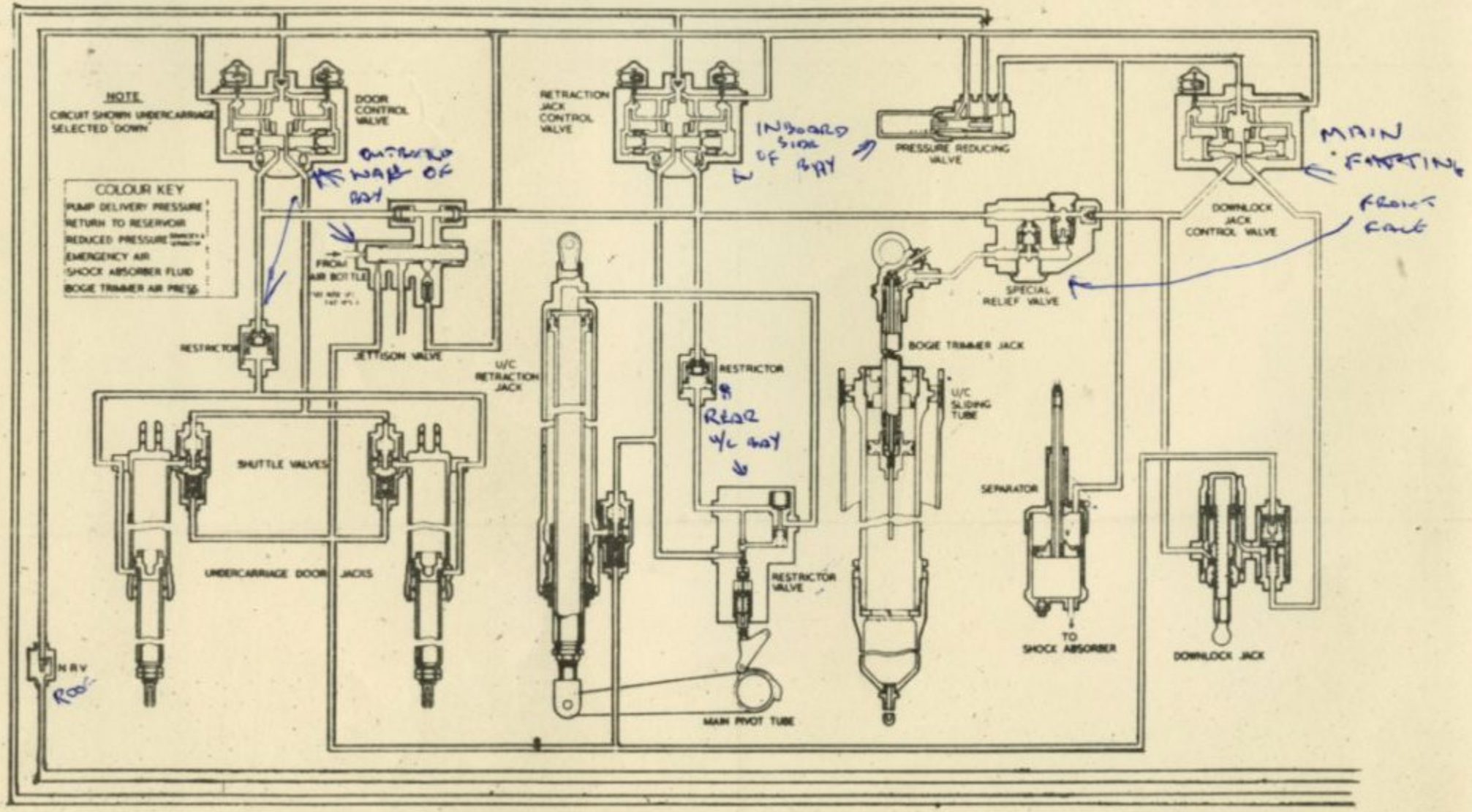
A·V·ROE & C9 LIMITED
MANCHESTER

HYDRAULIC SYSTEM

MAIN UNDERCARRIAGE

MOD. NO
ISSUE NO

4



VULCAN B:MK. 2

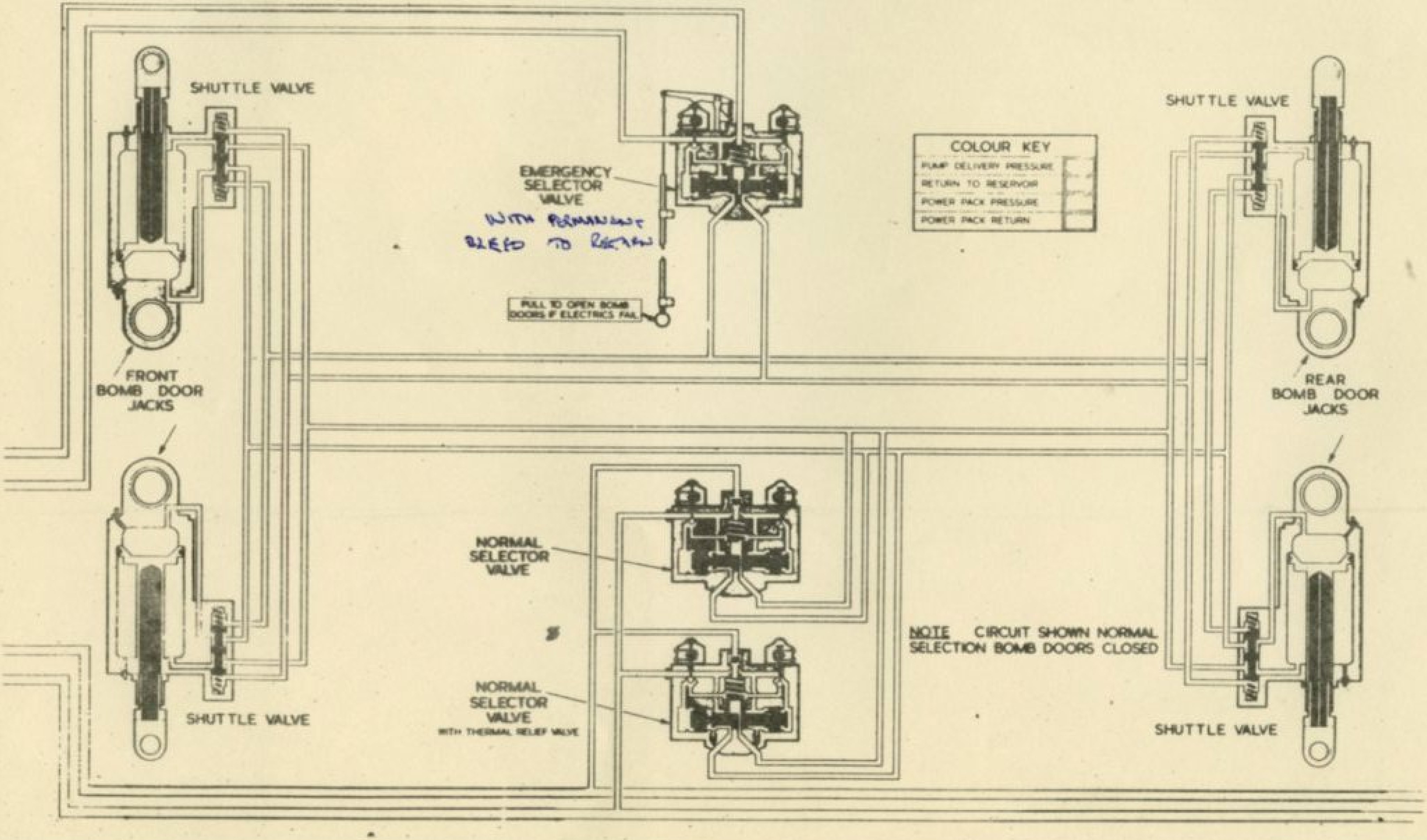
A·V·ROE & Cº LIMITED
MANCHESTER

ISSUE 2 TAO 114
1237

HYDRAULIC SYSTEM

BOMB DOORS

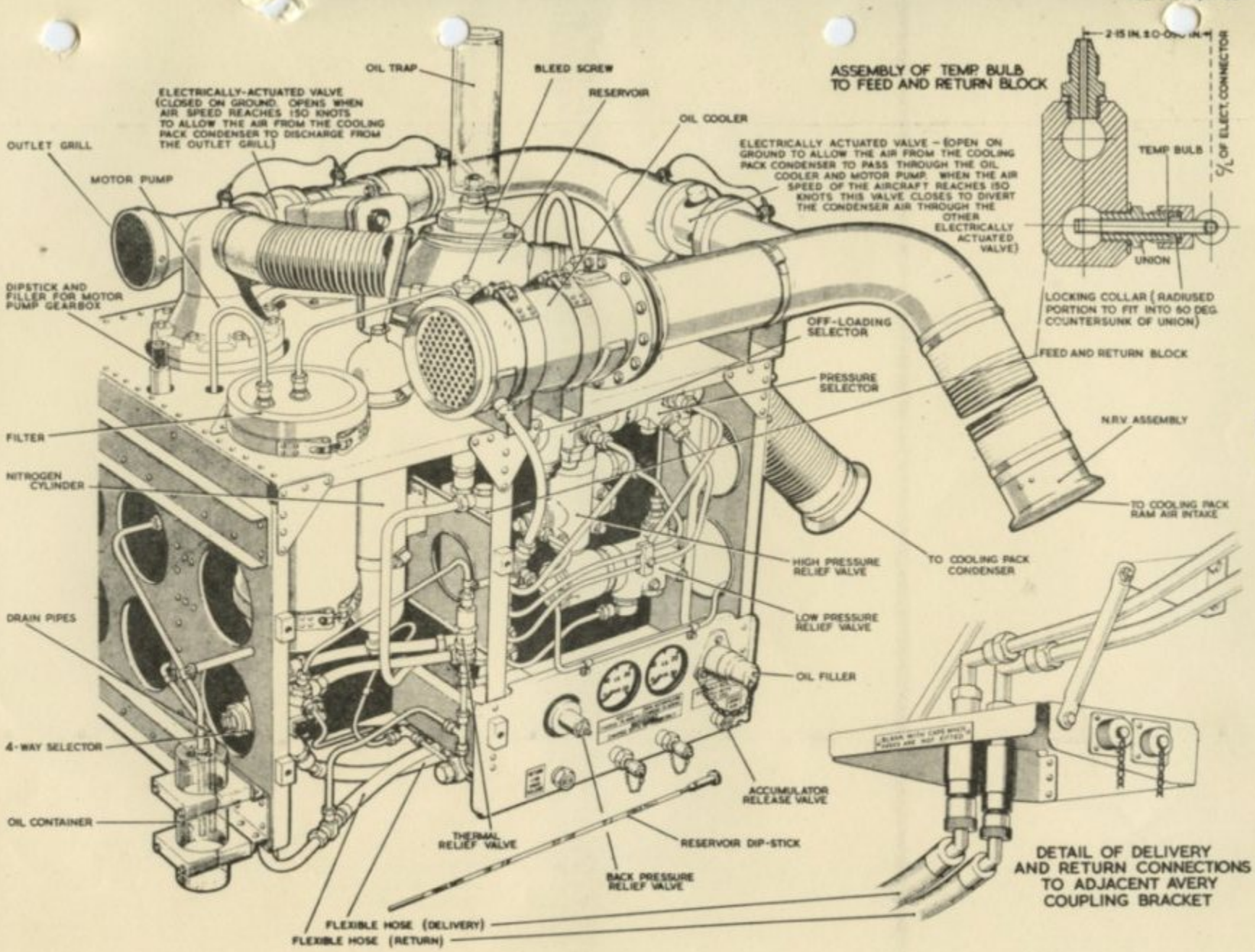
	MOD NO
2	ISSUE NO



COLOUR KEY

PUMP DELIVERY PRESSURE	
RETURN TO RESERVOIR	
POWER PACK PRESSURE	
POWER PACK RETURN	

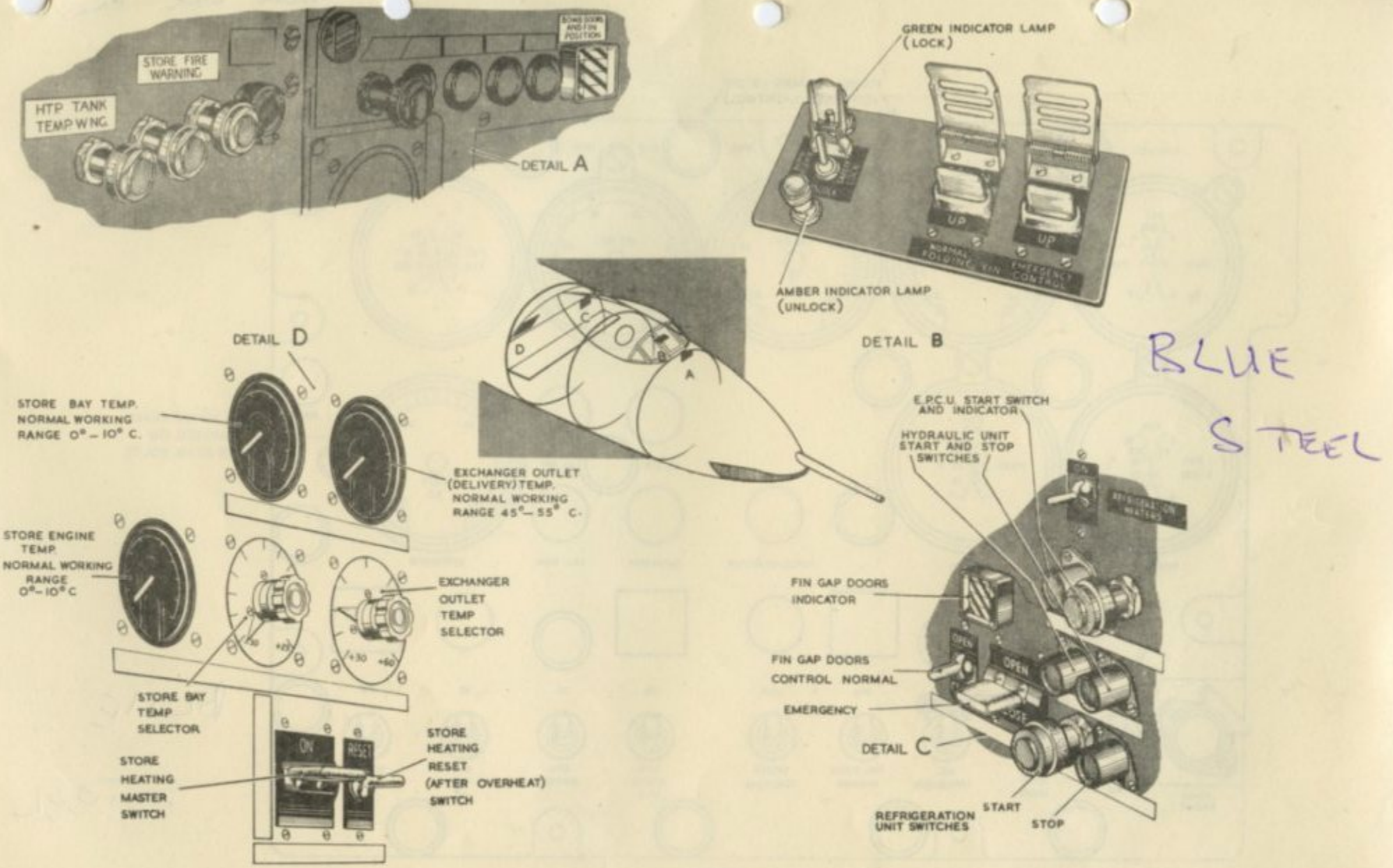
NOTE CIRCUIT SHOWN NORMAL SELECTION BOMB DOORS CLOSED



BLUE STEEL

Fig. 12. Hydraulic unit.

RESTRICTED



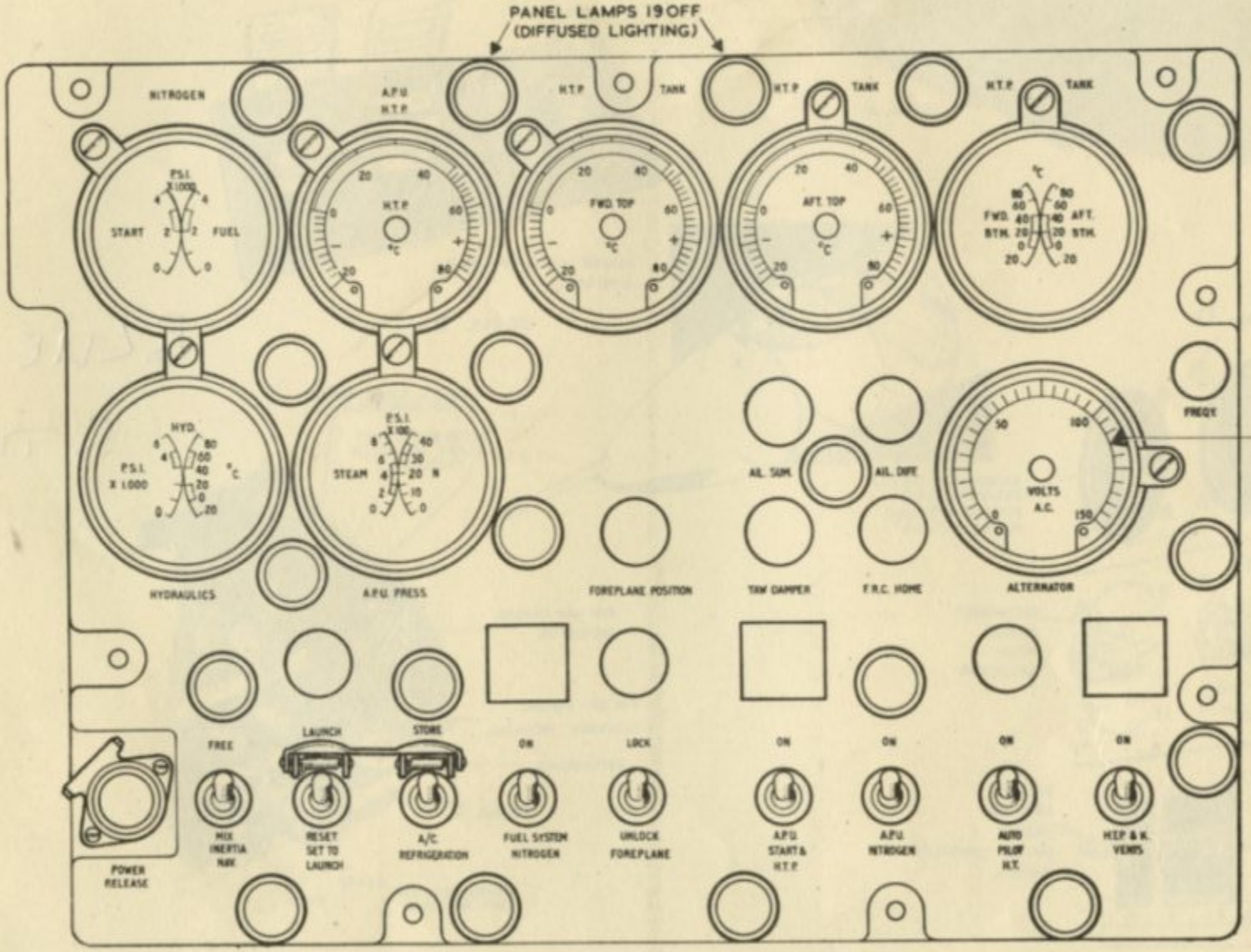
BLUE STEEL

Fig. 2. Miscellaneous controls and indicators.

(◂ Mods 1139 and 1353 ▸)

RESTRICTED

FOR THE HONK ONLY



NAV./PLOTTER'S PANEL (94P)

BLUE

STEEL

Fig. 3 Store Controls and Monitoring

BLUE HOSE ONLY

1A

VULCAN B. MK.2

A·V·ROE & Co LIMITED
MANCHESTER

NEW STORE

GENERAL ARRANGEMENT OF FIN GAP DOOR-
HOISTING & PNEUMATIC RELEASE SYSTEMS

1A

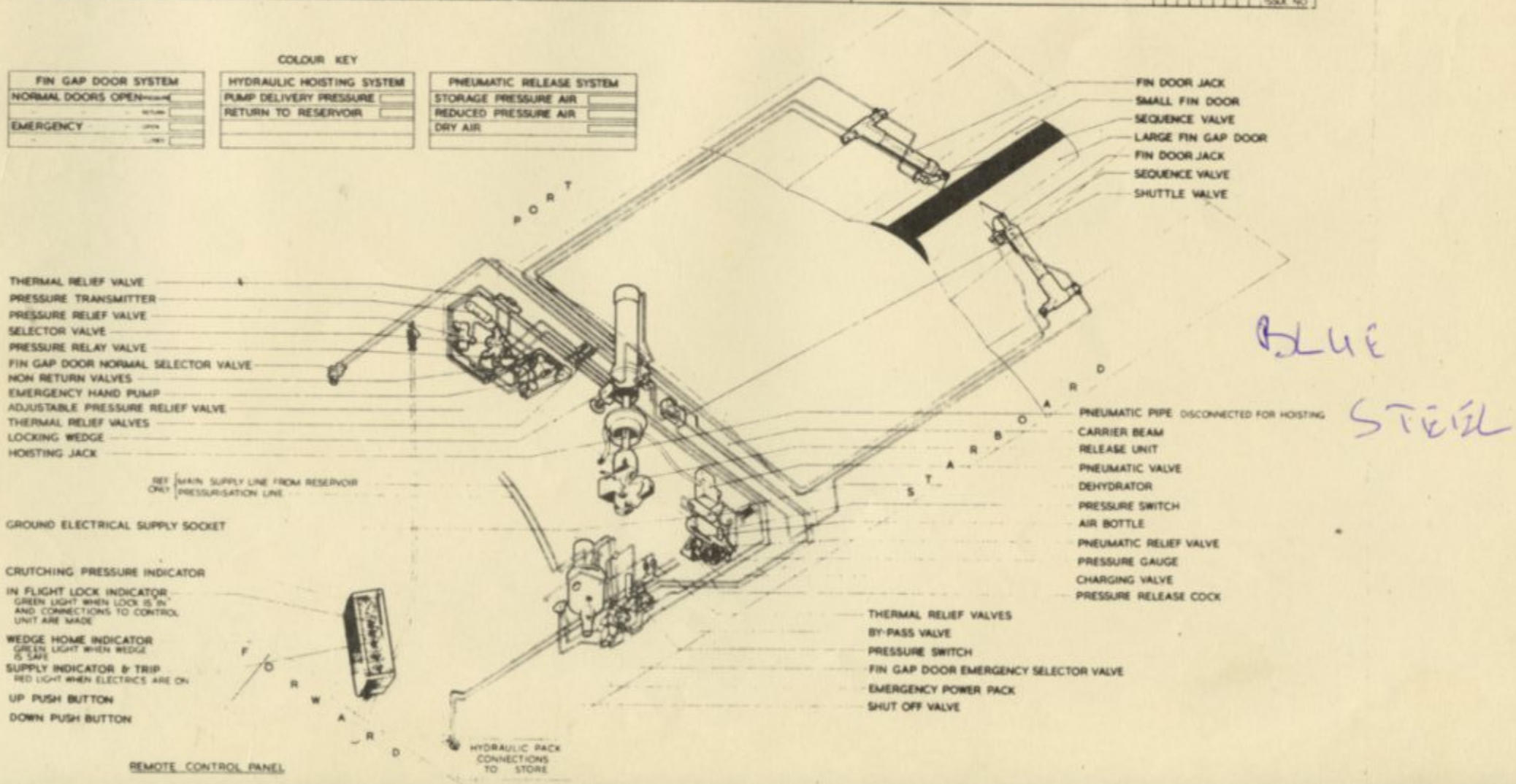
MK'S NO
SQNS NO

COLOUR KEY

FIN GAP DOOR SYSTEM	
NORMAL DOORS OPEN	
EMERGENCY	

HYDRAULIC HOISTING SYSTEM	
PUMP DELIVERY PRESSURE	
RETURN TO RESERVOIR	

PNEUMATIC RELEASE SYSTEM	
STORAGE PRESSURE AIR	
REDUCED PRESSURE AIR	
DRY AIR	



BLUE

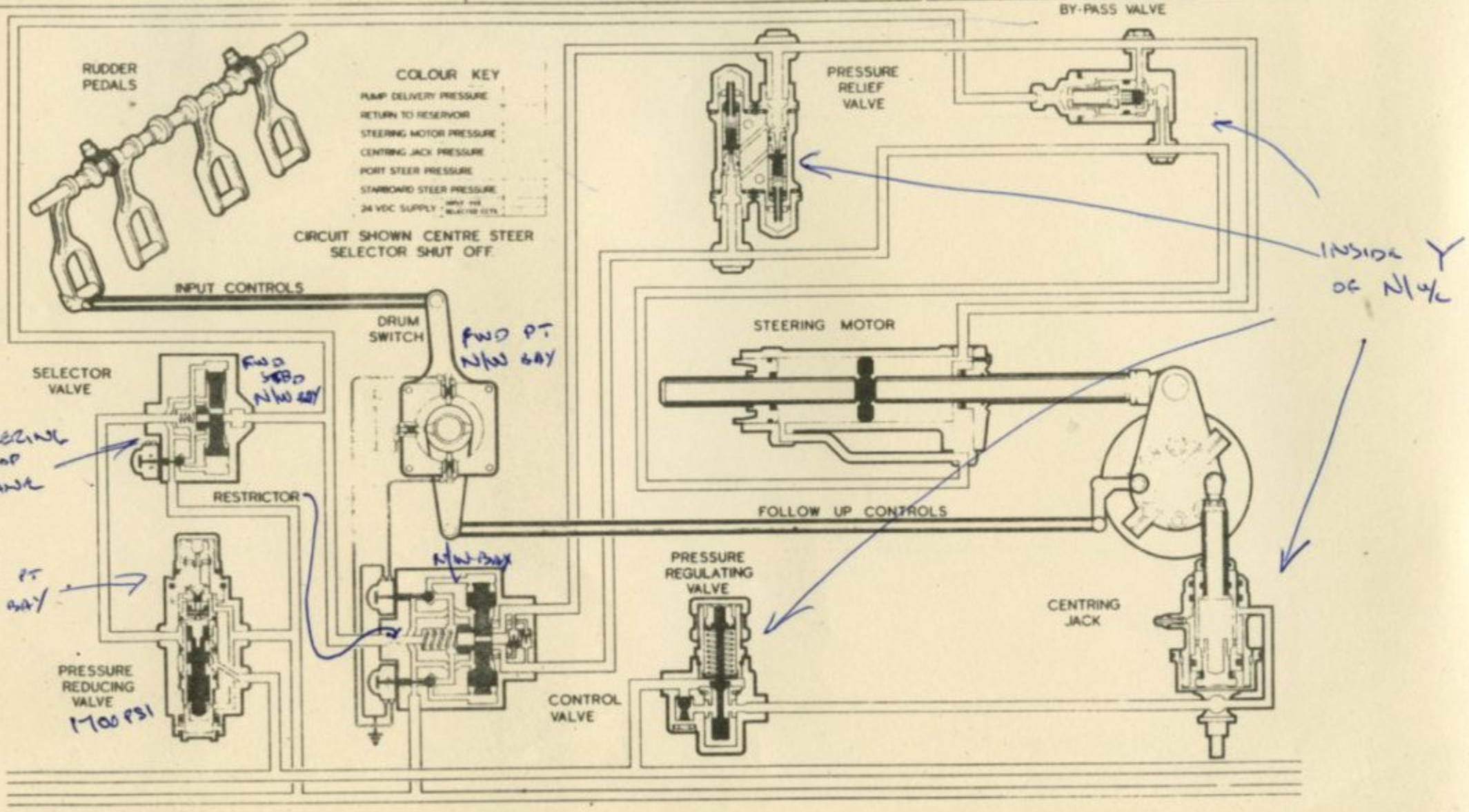
STEEL

VULCAN B.MK. 2

A·V·ROE & Co LIMITED
MANCHESTER

HYDRAULIC SYSTEM

NOSE WHEEL STEERING



NOSE WHEEL STEERING

Blue Hawk only

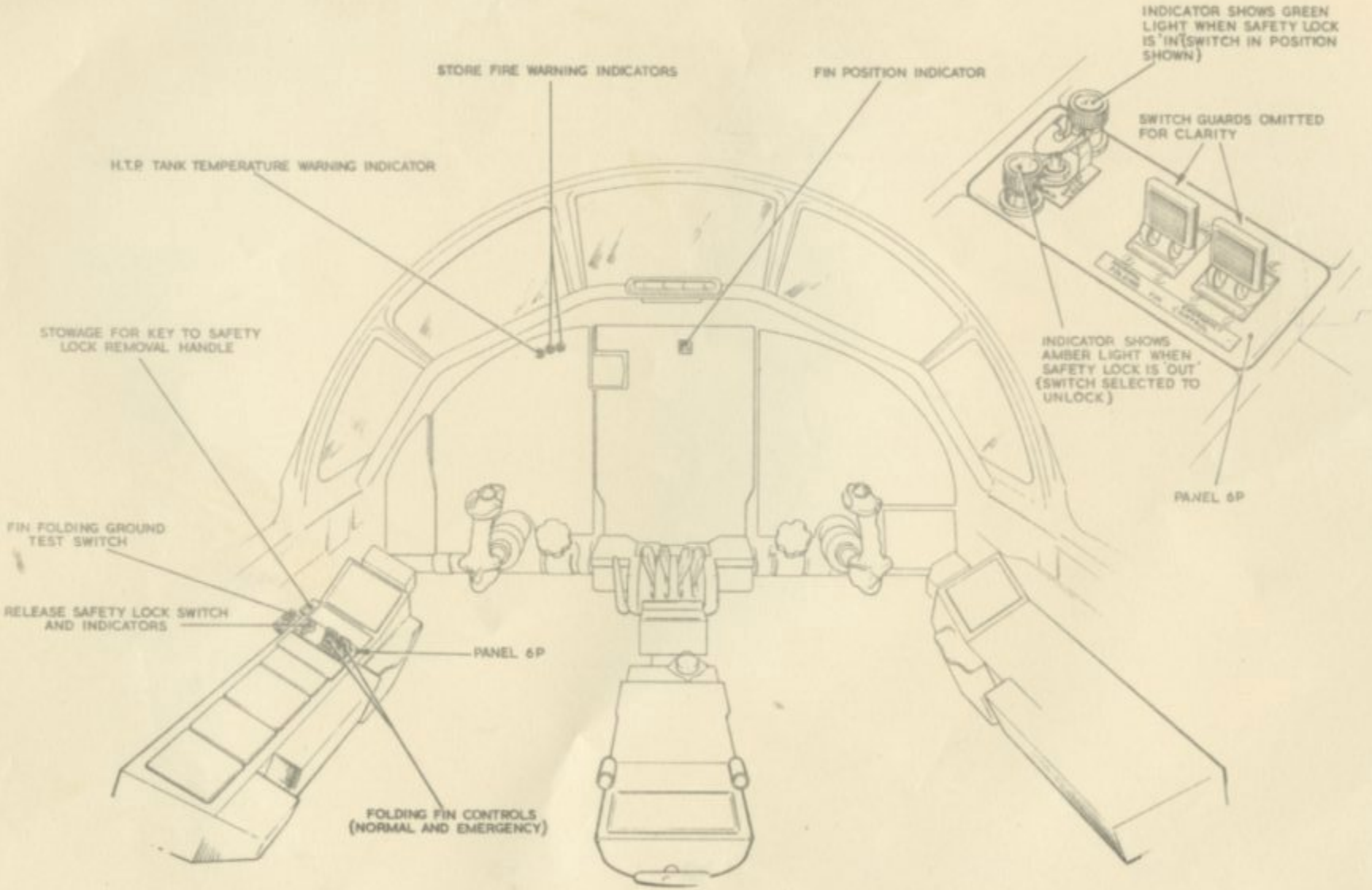
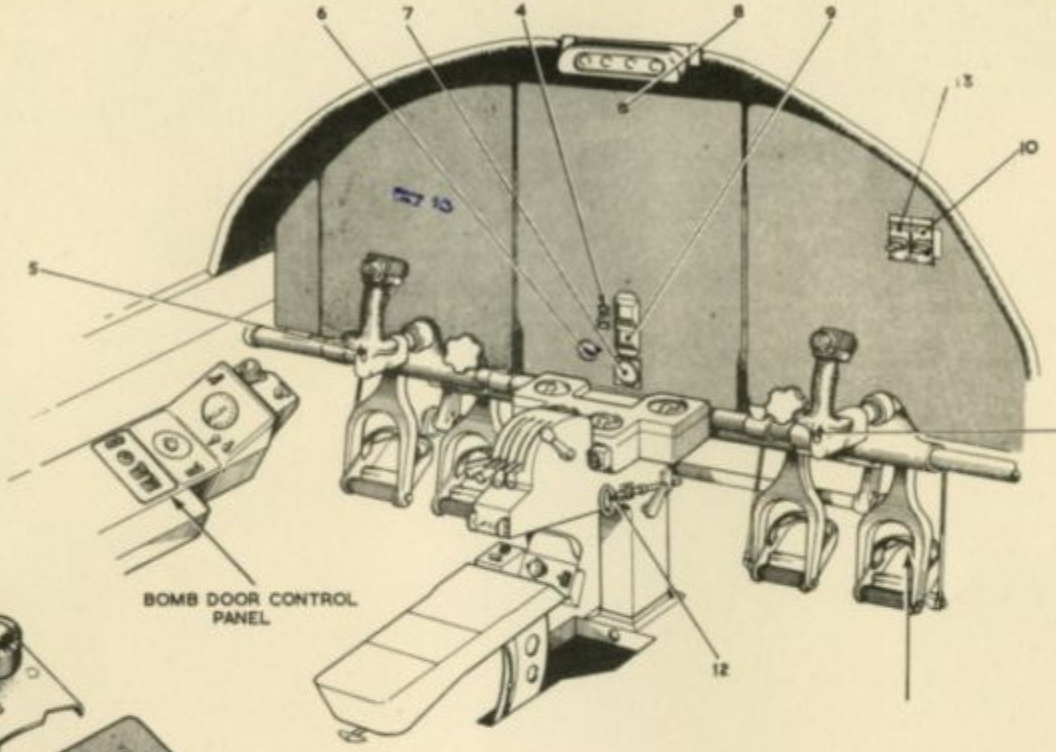


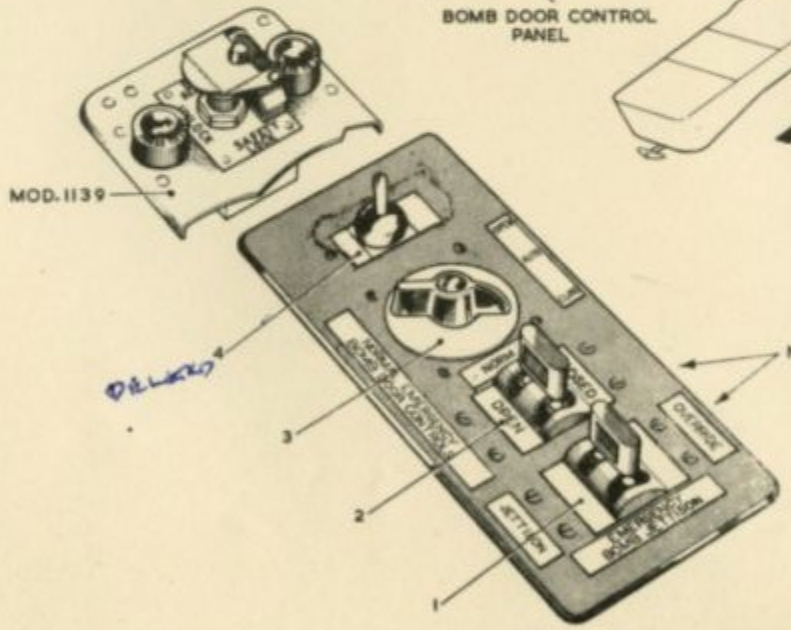
Fig. 3. Blue Steel controls and indicators at pilot's position.

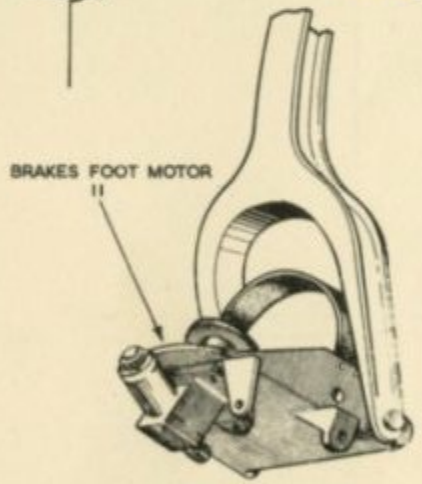
1 BOMB SETTISON SWITCH
2 BOMB DOOR EMERGENCY
3 NORMAL BOMB DOOR (DUPLICATED NAV. BOARD)
4 HYD. POWER PACK. (DUPLICATED IN NAV BOARD)
5 ~~HYD. NOSE WHEEL STEER IND~~
6 HYD PRESS GAUGE.
7 U/C INDICATION
8 BOMB DOOR INDICATOR
9 U/C SELECTOR
10 WINDSCREEN WIPER.
11 FOOT MOTOR
12 U/C EMERGENCY LOWER
13 WINDSCREEN DE-ICE.



POWER PACK SWITCH ITEM 4 MOVED TO CENTRE INSTRUMENT PANEL WHEN MOD.1139 (BOMB RELEASE SAFETY LOCK GROUP SWITCH AND TWO INDICATORS) IS EMBODIED

BOMB DOOR CONTROL PANEL





FORWARD FACE – RUDDER PEDAL

Fig. 1. Cockpit controls and indicators

RESTRICTED

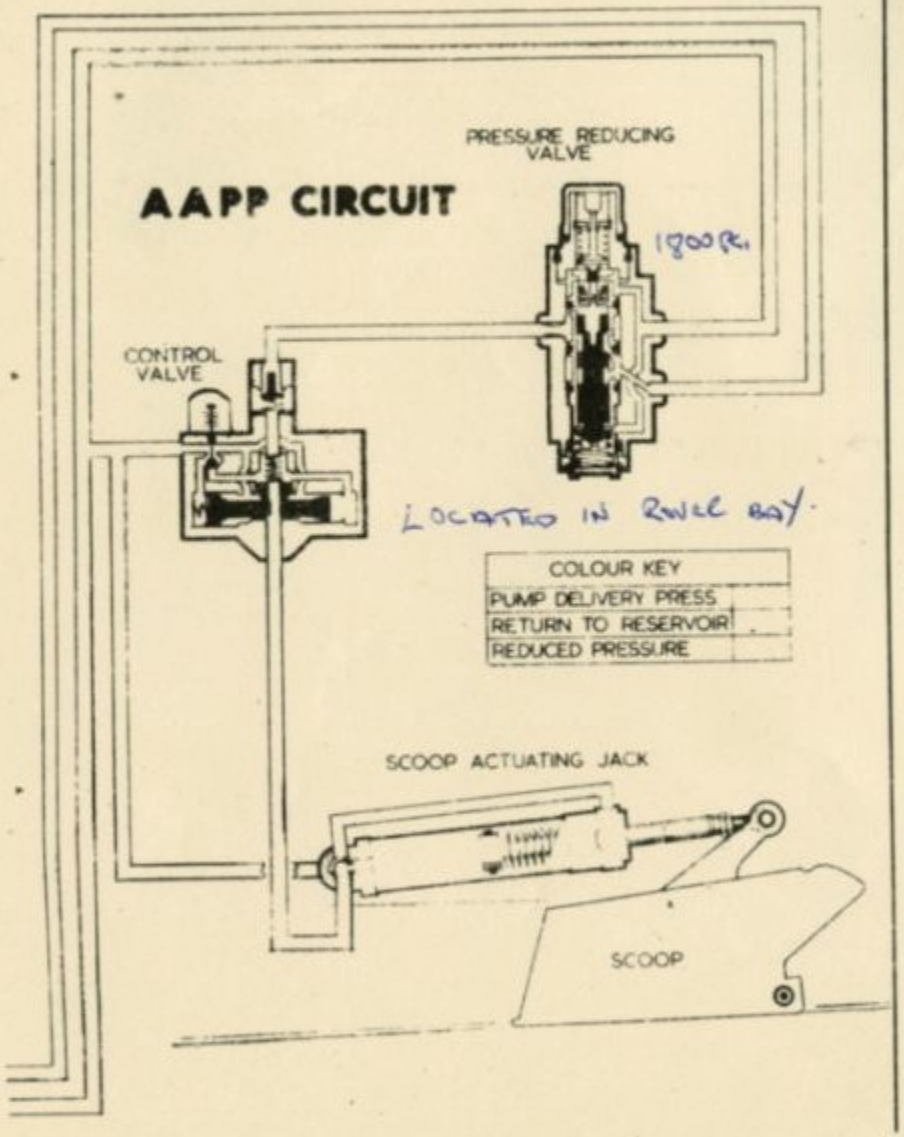
VULCAN B. MK.2

A·V·ROE & Co LIMITED
MANCHESTER

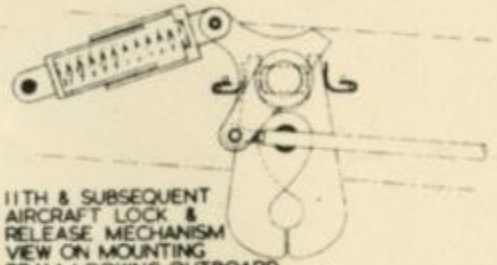
HYDRAULIC SYSTEM
AAPP AIRSCOOP & RAT RELEASE

MOD NO.
DRAW NO.

AAPP CIRCUIT

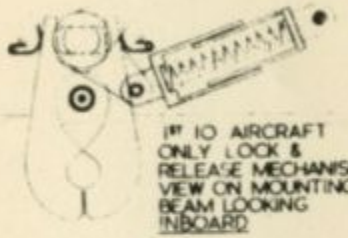


FORWARD ➡



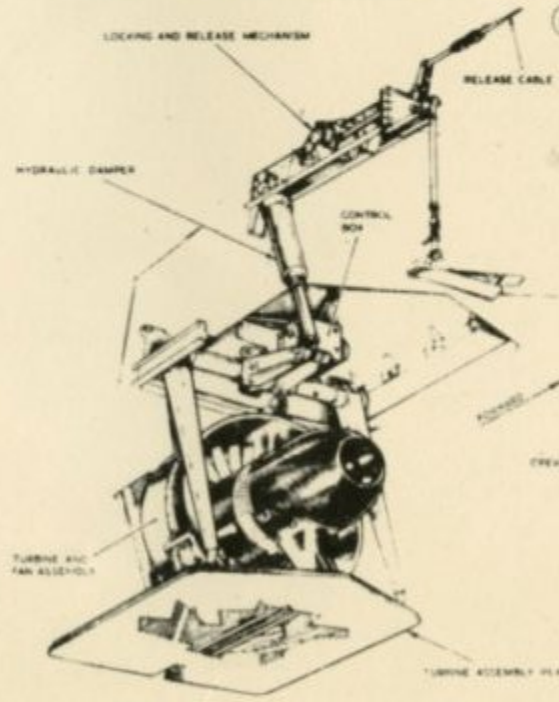
11TH & SUBSEQUENT AIRCRAFT LOCK & RELEASE MECHANISM VIEW ON MOUNTING BEAM LOOKING OUTBOARD

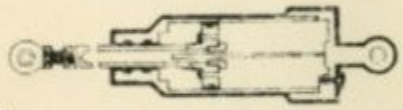
⬅ FORWARD



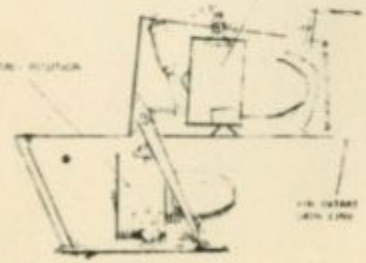
1ST 10 AIRCRAFT ONLY LOCK & RELEASE MECHANISM VIEW ON MOUNTING BEAM LOOKING INBOARD

R.A.T OPERATION





DAMPER UNIT DETAIL



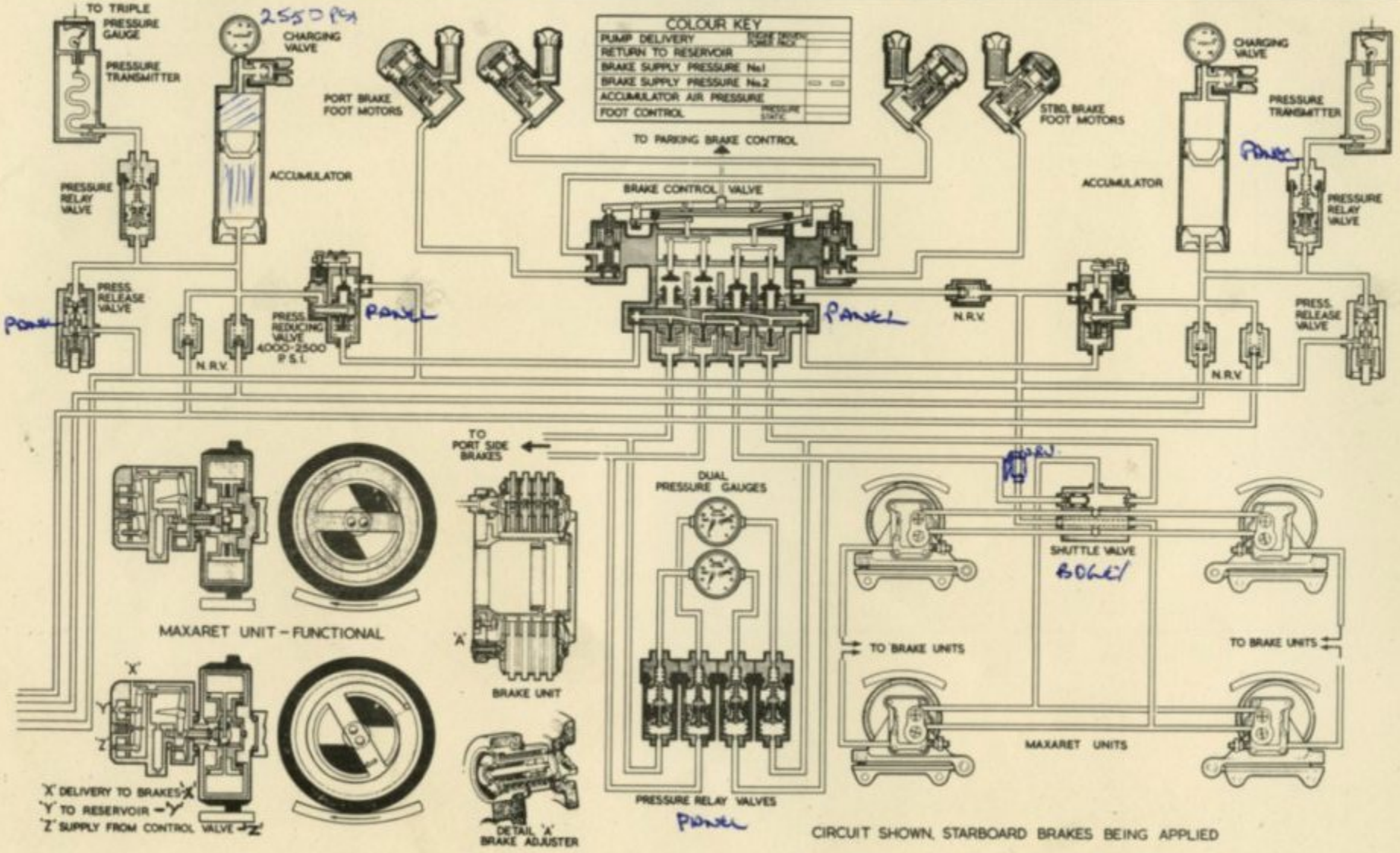
VULCAN B.MK.2

A·V·ROE & Co LIMITED
MANCHESTER

HYDRAULIC SYSTEM

BRAKES CIRCUIT

MOD NO
ISSUE NO



CIRCUIT SHOWN, STARBOARD BRAKES BEING APPLIED

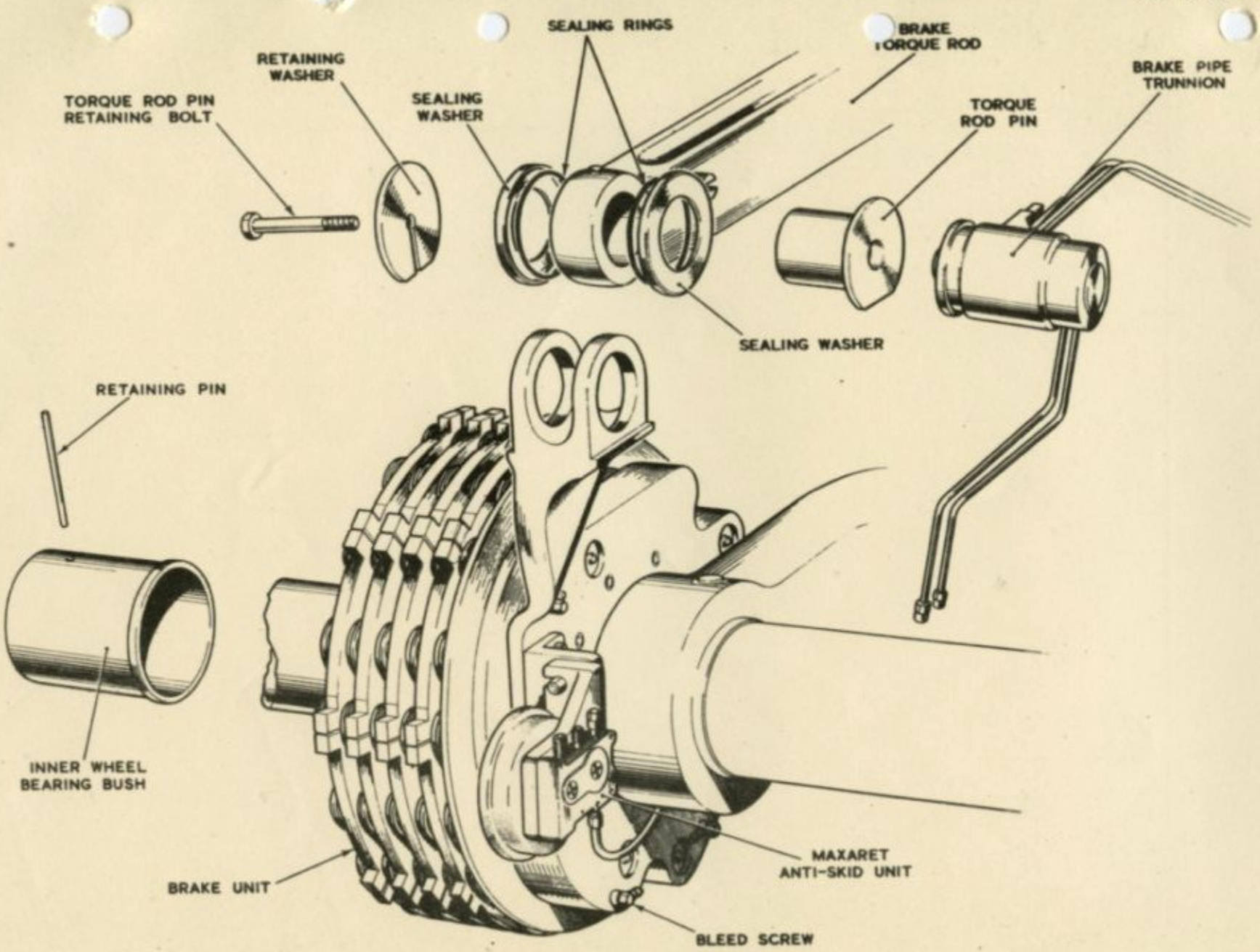


Fig.15 Removal of brake units