

Chapter 4

MISCELLANEOUS
(Completely Revised)

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1. This chapter gives a description, with servicing notes, of those installations which are not covered in earlier Chapters of this Section; electrical, instrument and radio installations are covered in Sect.4 and 5. Where necessary, references are made to associated Air Publications.

BRAKE SYSTEM (fig.1, 2 and 3)

Description

2. A broken view of the undercarriage wheel and brake units is given on fig.3 and, as far as the wheels are concerned, it is self explanatory. The wheels are

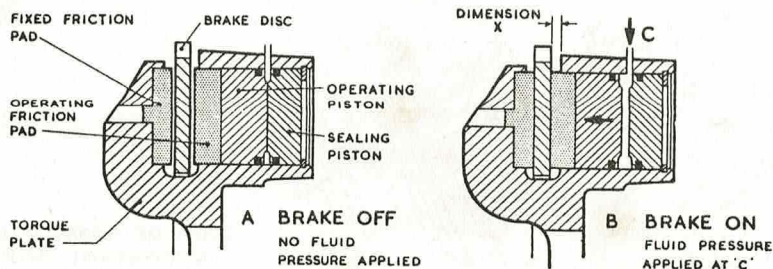
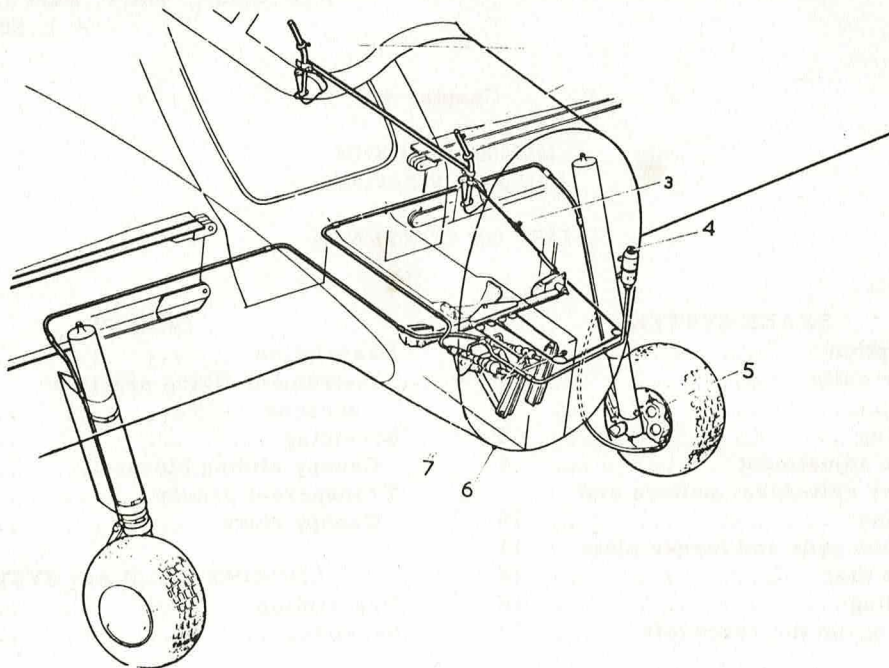


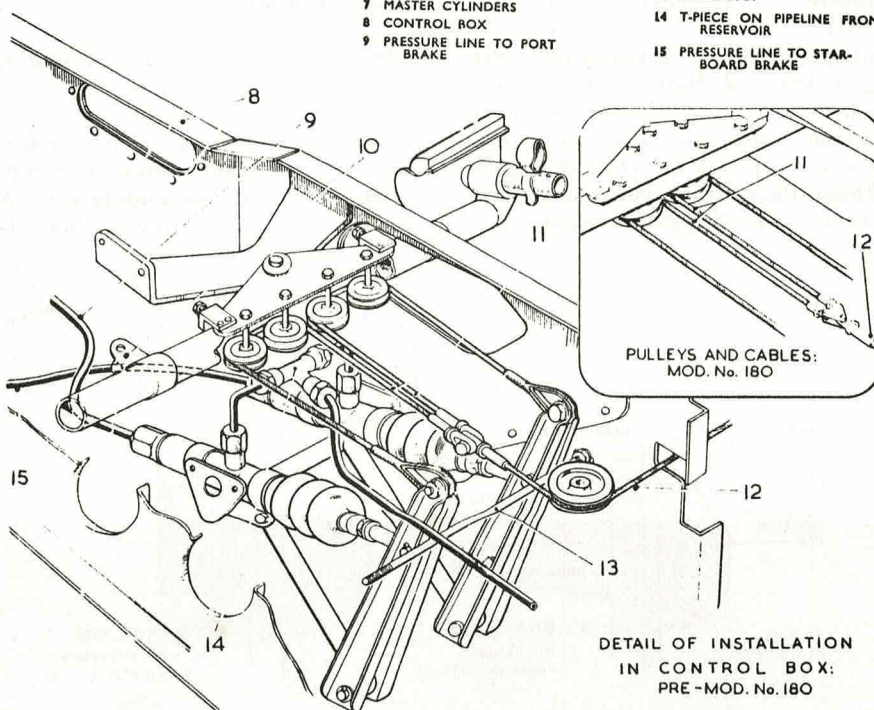
Fig.1. Brake friction pads

RESTRICTED



- 1 REAR BRAKE LEVER
- 2 FRONT BRAKE LEVER
- 3 TURNBUCKLE ADJUSTER
- 4 FLUID RESERVOIR
- 5 BRAKE UNITS (fig. 2)
- 6 FIREWALL
- 7 MASTER CYLINDERS
- 8 CONTROL BOX
- 9 PRESSURE LINE TO PORT BRAKE

- 10 RUDDER PEDALS CONNECTION
- 11 CABLES TO MASTER CYLINDER LEVERS
- 12 CABLE FROM COCKPIT LEVERS
- 13 LEVER STOP
- 14 T-PIECE ON PIPELINE FROM RESERVOIR
- 15 PRESSURE LINE TO STARBOARD BRAKE



PULLEYS AND CABLES:
MOD. No. 180

DETAIL OF INSTALLATION
IN CONTROL BOX:
PRE-MOD. No. 180

Fig.2. Brake system

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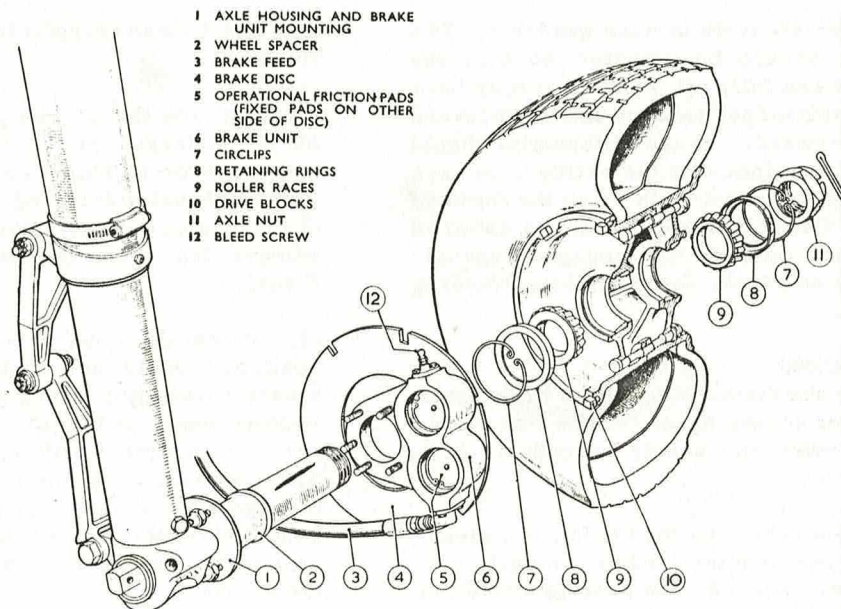


Fig.3. Wheel and brake units

fitted with Dunlop hydraulic brake units which are operated, for straight braking, by the levers on the port side of the cockpits, or differentially, when the levers are partially ON, by the rudder pedals. The system incorporates a master cylinder (fig.2, item 7), for each wheel, supplied with fluid from a reservoir (4) mounted on the front face of the firewall (6). A single supply line couples the reservoir to a T-piece (14), located below the front rudder bar, which is connected by short pipes to the master cylinders.

3. The control cable (12) from the brake levers extends, round pulleys in the nose of the fuselage, to two cables (11), to which it is connected by a hinge pin. The cables (11) extend, round pulleys, to the port and starboard master cylinder levers to which they are coupled, one to each lever. A stop (13) is mounted forward of the master cylinder levers to prevent them falling forward and the possibility of the operating rods dropping clear of the cylinders.

Brake units (fig.3)

4. The brake unit for the wheel is of the

disc type, with the action dependent upon the hydraulic operation of the friction pads (fig.1) on the rotating surface of a vertically-mounted concentric brake disc. Two jack units, housed in integral cylinders of the torque plate, regulate the movement of the friction pads when hydraulic pressure is applied.

Operation

5. It will be seen from fig.2 that, by operation of either lever in the cockpit, a pull on the cable (12) exerts an equal pull on the master cylinder levers, thus transmitting similar hydraulic pressure to each wheel brake. Application of port or starboard rudder results in movement of starboard or port master cylinder respectively, and hydraulic pressure is transmitted through the single pipe line to the appropriate wheel brake resulting in the operation of the friction pads as shown on fig.1. To avoid the possibility of the brake levers fouling the elevator trim wheels, a blanking plate, Part No. C1 CF 1383ND is secured by two bolts and stiffnuts to the rear end of each brake lever quadrant. These plates blank off

the rear six teeth of each quadrant. The cables should be adjusted so that the brakes are fully off with the rudder bars in the neutral position and the brake levers fully forward. Brake differential should then be obtained with the ratchets on each lever in the third tooth from the forward end. Check that full braking is obtained when the ratchets are engaged approximately two teeth forward of the blanking plates.

SERVICING

6. For the dismantling of the brake units and other servicing operations not covered here, reference should be made to A.P. 2337, Vol. 1.

7. When servicing the equipment, cleanliness is essential. After the equipment has been cleaned, components should be rinsed with hydraulic fluid which should not be used again. New pipe lines and connections must be flushed out with fluid before assembly.

8. The routine servicing of the brake system consists of checks on the following :-

- (1) Brake setting (para. 9).
- (2) Components under the control box (para. 10), for general adjustment, inspection for leaks and cleanliness.
- (3) Friction pads (para. 11), for wear.
- (4) Brake disc (para. 14), and torque plate (para. 11), for damage, cracks, distortion and corrosion.
- (5) Air in the pipe lines (para. 16).
- (6) Correct topping up of fluid reservoir (para. 17).

Note...

Brake checks must not be made while the brakes are hot.

Brake adjustment

9. To adjust the brakes proceed as follows :-

- (1) Disconnect the brake pipe lines at the wheels and place the ends of the

pipes in a clean receptacle to catch the fluid.

(2) Remove the access panel located on the underside of the fuselage skin, and break the locking wire from the two $\frac{1}{4}$ in. B.S.F. bolts securing the lever end of the master cylinder operating levers; remove the bolts, (anchor nuts are fitted).

(3) Place the hand brake to the off position. Move one of the operating levers carefully forward until the push rod attached to it is clear of the master cylinder complete with rubber gaiter. This assembly can now be lowered through the access hole and checked for bent push rods. Correct or replace as necessary, re-assemble and repeat for other lever.

(4) Place the hand brake to the full on position, slacken the $\frac{1}{4}$ in. lock-nuts on the operating push rods and adjust until the piston just bottoms in the master cylinder, with rudder full over in the opposite direction to the unit being adjusted, and with rudder stops in contact at the correct rudder settings. Shorten the push rod two full turns to bring the piston off its stop then tighten the lock-nut; repeat for other unit.

(5) Place the hand brake in the off position and tension the cable, at the turnbuckle on the control cable to the front cockpit brake lever, to take up the slack.

Note...

When adjusting the turnbuckle, it is essential that the correct tools are used to prevent distortion and possible failure of the threaded portion of the eye-end.

(6) Connect the brake hoses to the wheels, fill the reservoir, and bleed each brake in turn in accordance with para. 16.

(7) Adjust the cable turnbuckle so that with the brakes full on the aircraft can

be held up to approximately 1900 to 2000 r.p.m. without chocks, and that differential braking will give easy taxiing when the hand brake is set approximately four to six notches from off position.

(8) Where necessary, a further slight adjustment may be made to one or other of the push rods at this stage to obtain equal braking for each wheel when run up to the above r.p.m. with rudder bar neutral and hand brake full on. This adjustment should be made by shortening the push rod on the wheel that is tight and further slight tensioning of the cable turnbuckle in the cockpit. This will prevent the clearance to the piston obtained in sub-para. (4) from being altered.

Note...

Once the master cylinder push rods are correctly set they need not be altered. Any further compensation for wear to the brakes should be taken up on the turnbuckle on the control cable attached to the brake lever in the front cockpit only.

(9) With brake adjustment completely satisfactory, a check is to be made to ensure that no fouling exists between the push rod and the seeger circlip. This will be seen if the rubber gaiters are turned inside out in a forward direction, and the brakes operated while inspection with a torch and mirror is conducted. Where fouling is found, the circlip should be repositioned to gain maximum clearance over full range of movement.

(10) With completion of brake adjustment, put hand brake to full off position and check for full rudder movement of 31 deg. $\pm$ 2 deg. port and starboard. This should be obtained without cushioning of the brake system.

Note...

Failure to adjust the brakes in accordance with the above procedure may cause damage to the master cylinder push rods, the rudder bar pivot bear-

ing housing, and the master cylinders.

Master cylinders, pulleys and cables

10. Access to the master cylinders, pulleys and cable linkage is gained by removing the forward top panel of the control box, on the cockpit floor, and the foremost inspection panel (Part 2, Sect. 1, Chap.1, fig.4) on the undersurface of the fuselage. Fig.2 shows the disposition of these components. The stop (fig.2 (13)) should be adjusted in the slots so that, with an operating rod adjustment fully out, the rod should have at least 0.06 in. movement before any resistance is felt.

Friction pads and torque plate

11. The friction pads should be examined for cracks, chipping and evidence of burning, or contamination by oil or grease. If one or more of the pads is faulty for any of these reasons, the complete set of four pads must be renewed. The torque plate should also be examined for damage, cracks, distortion or corrosion and, if faulty, renewed.

12. The fixed friction pad (fig.1) should be examined for evidence of wear sufficient to cause metallic contact between the brake and torque plate. Where this is diagnosed, the pad must be renewed by drilling out the three rivets and removing the retaining plate.

13. An indication of friction pad wear, which will be representative of the wear of both pads, is given by the dimension X (fig.1), which extends from the inner face of the cylinder jaw to the rubbing face of the brake disc. The dimension is taken with the wheel removed and the brake pressurized; the warning limit, i.e. that friction pad renewal should be effected at the first opportunity, is 0.18 in.; the absolute limit is 0.22 in. when the friction pads must be renewed immediately. To allow wear to continue until the latter limit has been reached will inevitably result in damage to the brake unit.

Brake disc

14. The brake disc should be inspected, after periods of approximately twenty-five

landings, for damage, distortion, cracks and corrosion. Scoring of the friction surface may be caused by the accidental introduction of extraneous matter between the friction pads and the brake disc. Light and evenly made friction pad rubbing marks do not effect the efficiency of the brakes, but should the depth of the score exceed 0.015 in., the effected disc must be renewed. Any wear or damage resulting in extensive exposure of the steel beneath the chrome surface of the brake disc, will require disc renewal.

15. Checks should be made periodically for possible wear of the brake disc slots on the wheel drive blocks (fig.3, item 10). When the check is being made, it is essential that the drive faces of the blocks and slots are in close contact, and that the resulting clearance between the trailing faces be checked by a feeler gauge. Any clearance exceeding 0.04 in. will indicate that the brake disc should be removed and the wheel inspected for wear of the drive blocks. A direct measurement of the width of all the drive slots must not exceed 0.665 in. in each instance.

Bleeding

16. The presence of air in the pipe lines is indicated by sponginess in the control and necessitates bleeding the system. To bleed the system, top-up the reservoir (para.17) and proceed as follows :-

- (1) Tighten the bleed screw (fig.3, item 12) and push the end of a length of $\frac{1}{4}$ in. bore petrol-resistant rubber tube over the rounded head of the bleed screw.
- (2) Place the free end of the tube in container, preferably of clear glass.
- (3) Pressurize the brake unit and slacken the bleed screw.
- (4) With the end of the tube held below the level of the discharged fluid in the container, it will readily be observed when all air has been expelled.

- (5) Whilst the brake unit is still pressurized, tighten the bleed screw.

Note...

Tightening the bleed screw under pressure eliminates the possibility of air being drawn into the system as the master cylinder recharges.

- (6) Remove the rubber tube, lock the bleed screw and top up the reservoir again.

Topping-up the reservoir

17. The reservoir, on the front face of the firewall must be kept filled with fluid OM-15 (Ref.No.34B/9100572).

CANOPY (fig.4)

Description

18. The single canopy which, when in the closed position, extends from the windscreen to a point aft of the rear cockpit, consists of steel-tube frames to which transparent panels are secured by channel sealing strips. The rear side panels are of blister form to improve rearward view.

19. The canopy is provided with three sliding blocks, two of which engage rails on port and starboard top longerons whilst the third is located in a rail built into a dorsal fin on the rear section of the fuselage structure. These square sliding blocks, which were introduced by Mod. H.173 for the front canopy and H.182 for the rear in lieu of rollers, are mounted on steel ball members which enable them to maintain alignment during movement of the canopy. A spring-loaded plunger, controlled from either cockpit by levers in the roof, engage one of four holes in the central rail enabling the canopy to be locked in one of four positions; internally fitted handholds on each side of the front frame assist the operation. The levers are directly connected to streamline external handles for outside operation.

20. The canopy is not jettisonable, but an "assister door" (fig.4) has been incorpo-

ated for a quick exit in an emergency; details of this, together with notes on the normal entry and exit, are described in Part 1, Sect.1.

Instrument-flying practice screens

21. Provision is made for the fitting of instrument-flying practice screens (amber) inside the front cockpit windscreen and canopy. General descriptive and assembly details of the installation are given in Part 2, Sect.1, Chap.3.

SERVICING

22. To facilitate servicing, the canopy can be removed by detaching the fibre blocks which are provided at the aft end of the side rails to limit rearward movement. The removal operations are given in Part 2, Sect.2, Chap.1.

Canopy sliding blocks

23. Periodically, the three canopy sliding blocks should be lubricated with grease, low temperature, XG-275 (Ref.No.34B/9100512).

Transparent panels

24. It is essential that the transparent panels, both of the windscreen and canopy, are kept clean and polished. Since acetone, benzine, carbon tetrachloride and lacquer thinners, and certain window-cleaning sprays and solutions which contain these solvents, will seriously damage the surface, they must not be used. It is important that reference be made to A.P.2656A, Vol.1, Sect.13, for detailed information on the care and servicing of transparent panels.

Canopy skirt

25. When the canopy is in the closed position, there must be a minimum clearance of 0.15 in. between the rear skirt and the fuselage. The skirt can be cut, if necessary, to obtain this clearance.

COCKPIT COLD AIR SYSTEM

Description

26. Cooling air for the cockpits is obtained via a duct having a controllable inlet shutter immediately forward of the windscreen, in line with the starboard side of the instrument panel. The air vent control knob is shown in Part 1, Sect.1, fig.2. When the duct shutter is open, air passes into the front cockpit through a hole in the top skin forward of the instrument panel; a drain tube connects the aft end of the duct to an adjacent outlet on the starboard side of the fuselage.

27. Pivoting about two side bearings, the shutter has a curved lever which projects down through the duct and is coupled to a control rod from the cockpit. The control rod, supported by two brackets, embodies an adjuster near its forward end and passes through rubber grommets, one in the aft support bracket and one in the instrument panel. A felt strip secured by Bostik, is fitted around the shutter lever slot in the duct and the shutter itself bears on a rubber seal when closed.

Servicing

28. It is important that the shutter should have an effective seal when closed. Before adjusting the control rod, a general check should be made to ensure that the rubber grommets and felt strips are in serviceable condition and, if necessary, the shutter hinges should be lubricated. Control rod adjustment may then be made so that, when the shutter is open, the front face of the operating knob aligns with the rear face of the instrument panel and there is a slight clearance between the shutter hinge arms and the aft edge of the air inlet aperture. When closed, the shutter should bear evenly on all parts of the seal. Finally, ensure that all lock-nuts on the control rod are tight, and that the duct drain tube is unobstructed and undamaged.



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