Section 4

ROUTINE SERVICING
(Completely Revised)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. This chapter describes the method of carrying out those servicing operations listed in the servicing schedule. The instructions detail the extent of dismantling necessary to carry out routine examination and include acceptance standards for worn or damaged components where applicable. The rectification or replacement of units found necessary as a result of routine servicing is given in Sect.5.

2. The main servicing points covered by this chapter are shown in fig.1, 2 and 3. Some servicing operations, however, require the a.a.p.p. to be mounted in the ground running stand, and tested, for full details of this procedure, refer to Sect.6.

General

3. Before undertaking any servicing operation ensure that the live cartridges have been removed from the cartridge breeches and replaced with clean empty cases complete with sealing O-rings.

4. Never use mutton cloth, cotton waste or any other type of fluffy rag for cleaning purposes as these materials tend to leave a hair or fluff deposit. Ensure that all tools and rags are removed from within the nacelle after servicing.

PIPES, ELECTRICAL HARNESS AND CLIPS

Removing and refitting flexible pipes

5. At the intervals laid down in the servicing schedule, the flexible pipes both inside and outside the nacelle must be carefully examined visually to ensure that none of the following defects is present.

(1) Signs of distortion, especially for signs of the flexible pipe being pulled sharply away from the coupling.

(2) Abrasion between the pipe and adjacent members.

(3) Corrosion on the coupling components.

(4) Visible cracks or other unusual conditions pertaining to the end-couplings.

(5) Insecurity of end-couplings and condition of wire locking.

6. When fitting pipes, loosely couple each end of the assembly, check the pipe run, then tighten gradually to avoid applying tension to the pipe and to maintain the assembly in a free and unstressed condition.

7. Care should be excercised in the tightening of swivel nuts and banjo bolts to avoid distortion of nipples, banjo faces and threads. Except where spanners of special design are called for, standard spanners of the correct length must be used.

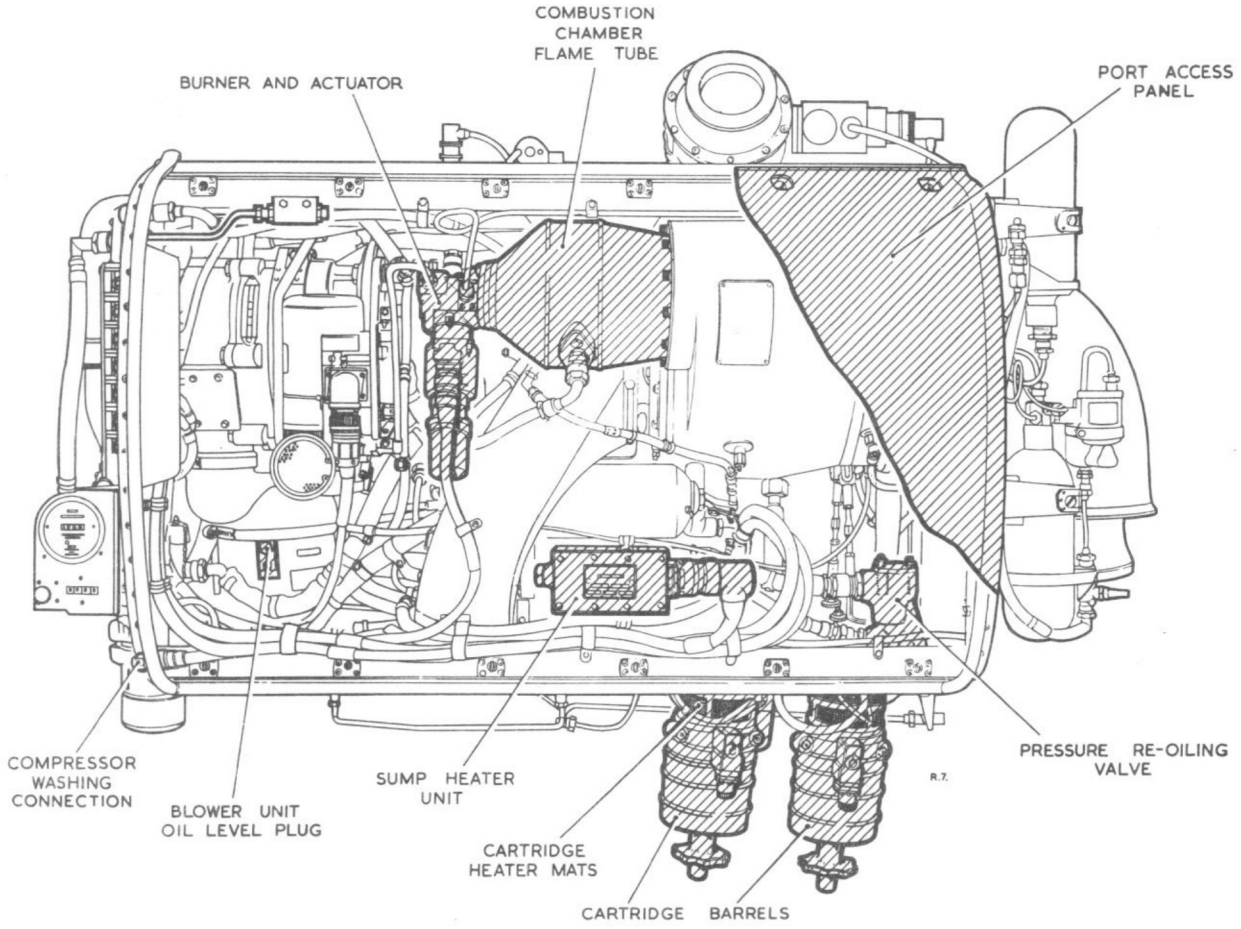

Fig.1 Routine servicing points (sheet 1)

Electrical harness

8. A general examination should be made of all harness runs for security, 'kinking' and signs of chafing, and to ensure that the protective lacquer is intact. Cables showing scratched or peeling lacquer must be re-treated.

9. The cables should also be examined to ensure that they have not been shortened during any previous repair and to make quite certain that the identification labels have not been damaged or removed.

Pipe and harness clips

10. All pipes and harness clips should be examined for security and distortion. Particular attention should be paid to the rubber sheathing; clips showing torn or cracked sheathing should be renewed.

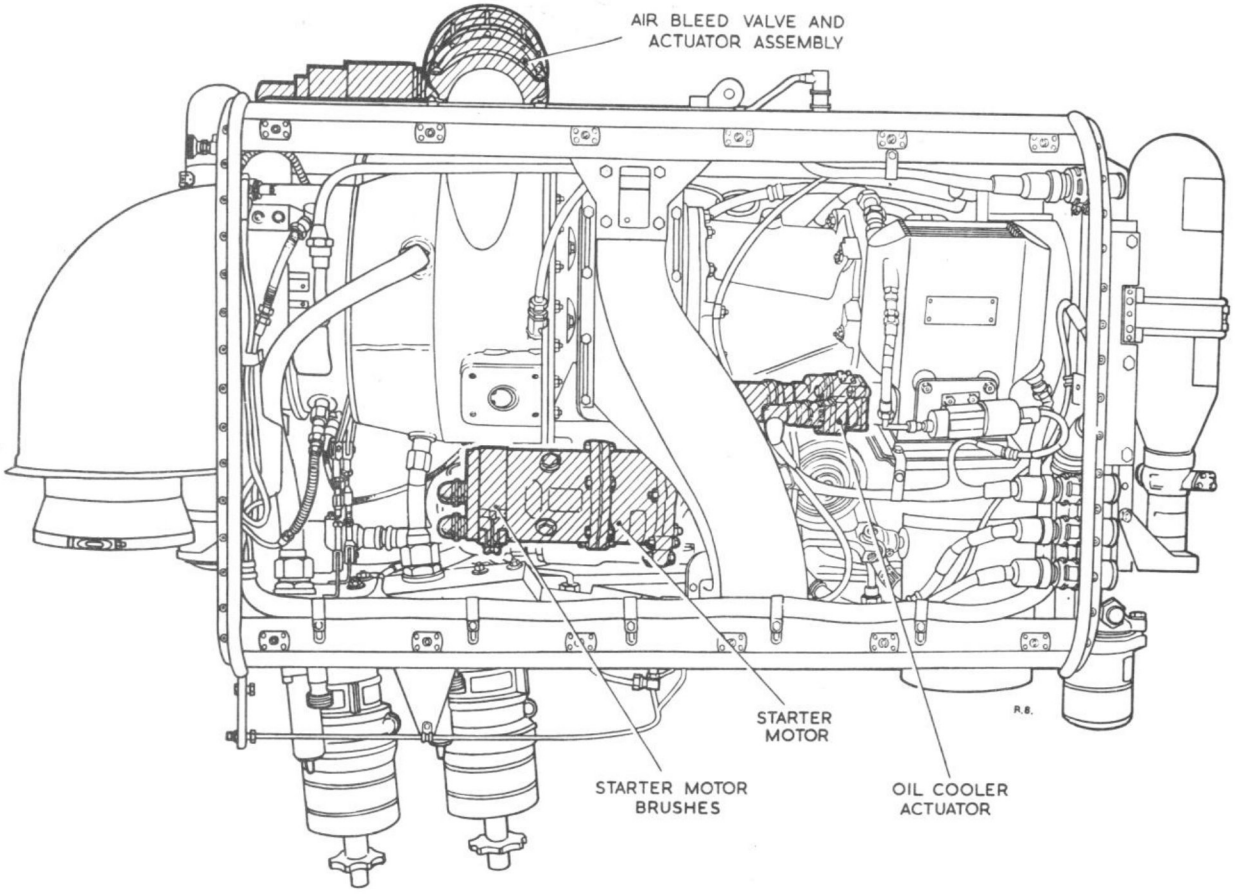

Fig. 2. Routine servicing points (sheet 2)

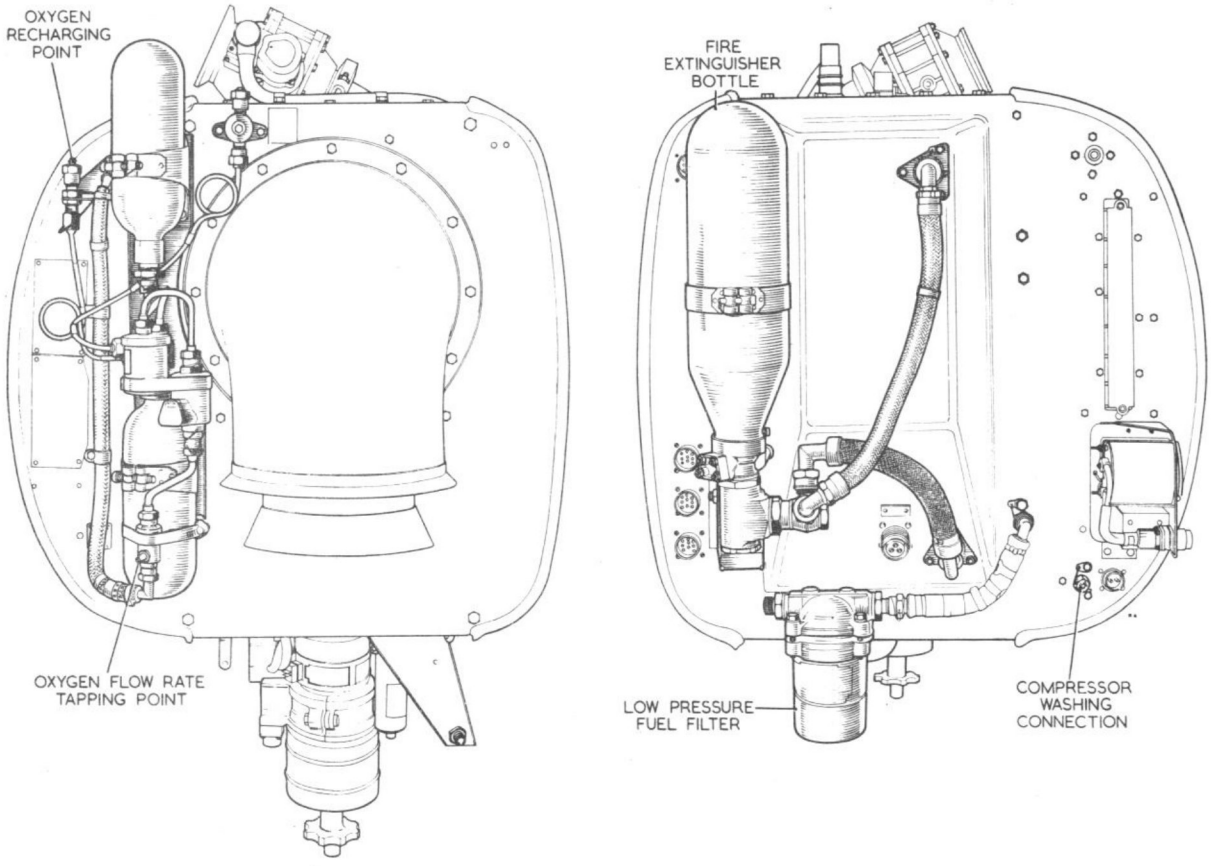

Fig. 3. Routine servicing points (sheet 3)

NACELLE

Removing and refitting the access doors

11. The two access doors are secured to the top and bottom rails of the nacelle by locking peg fasteners recessed into pockets within the doors. There are twelve fasteners to each door.

12. To release the fasteners, insert a screwdriver into the slotted head, push and turn in an anti-clockwise direction. When released, the slots in the fastener heads will be vertical and, conversely, when secured the slots will be horizontal.

ENGINE

Washing the compressor rotor (fig. 4 and 5)

13. Compressor cleaning should be carried out at the intervals called for in the servicing schedule and following shut-down whenever cartridge starting has been used.

Notes . . .

(1) 'Turbex' should always be used as the cleansing agent; however should Turbex be temporarily unavailable, it is permissible on isolated occasions to use a substitute consisting of aviation kerosine only, followed by a final wash with distilled water.

(2) Cold climates. When the ambient temperature is below $0^{o}C.$, it is recommended that industrial methylated spirit is added to the cleansing solution up to a maximum of 25 per cent of the total volume, to reduce the possibility of the solution freezing.

Proceed as follows:

(1) Remove the A.A.P.P. access doors (Sect. 4, Para.11).

(2) Remove the engine intake filter (if fitted).

(3) Remove the cartridge start breech caps and dummy cartridges (Sect. 4, Para. 36).

(4) Disconnect and blank off the following pipe from the engine main air casing:-

(a) Pre-mod. M.182:-The A.F.R.C. compressor delivery pipe.
(b) Post-mod.M.182:-The burner air assistance pipe.

(5) Using the tool Ref.No.64AF/14, remove the fuel drain valve (Sect. 5, Chap. 3).

(6) Connect the fuel drain union, and place the lower end of the pipe in a suitable container.

(7) Remove the split pin, nut and blank nipple from the compressor washing connection on the front end panel.

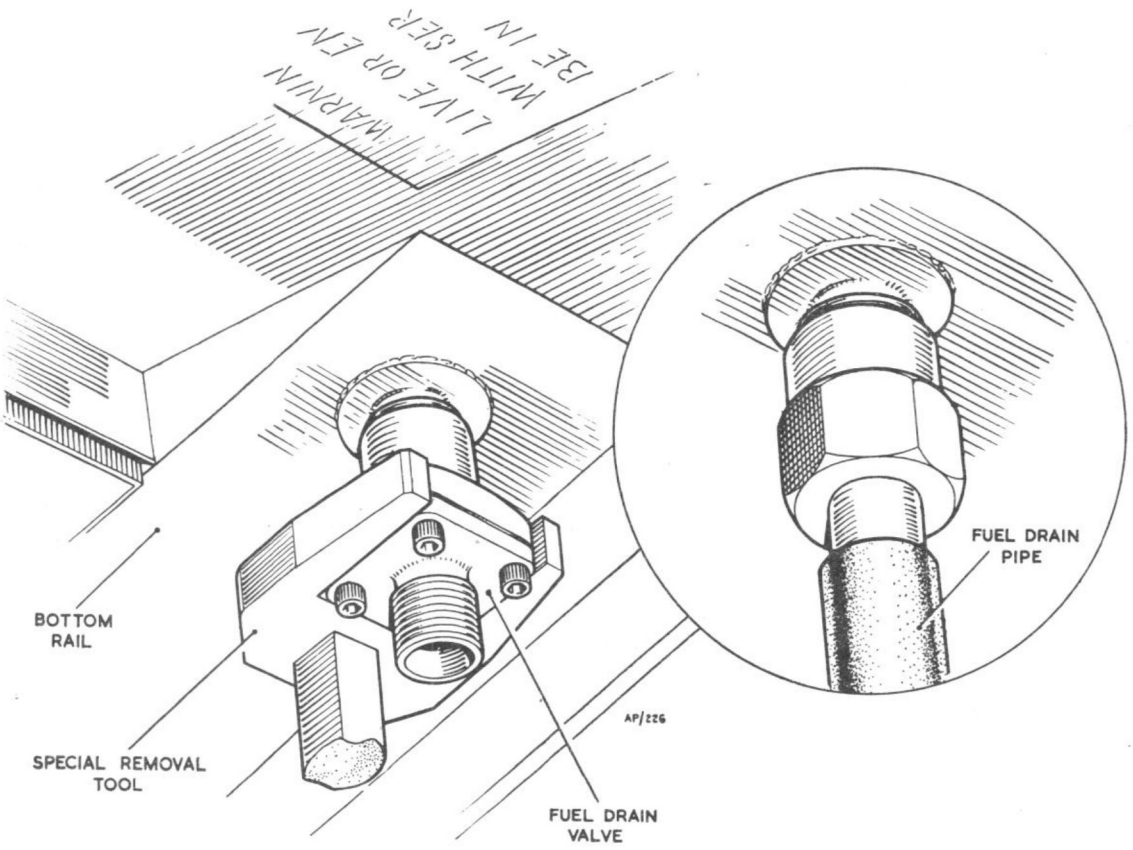

Fig. 4. Removing the fuel drain valve

Caution . . .

Before washing the compressor and diffuser, allow the engine to cool to within 50°C. of the temperature of the cleaning fluid, otherwise thermal cracking may occur.

(8) Prepare six and a quarter pints of cleaning fluid, in a pressurised replenishing can (Ref. No. 4G/5358) in the following proportions :-

Aviation kerosine	3 pints
Turbex (SQ25)	$\frac{1}{4}$ pint
Distilled water	3 pints

The Turbex must first be mixed with the kerosine and the distilled water added to the resulting emulsion.

(9) Shake the can thoroughly to ensure that the solution is well mixed and then pressurise the can to 30 lbf/in^2.

(10) Connect the replenishing can delivery pipe to the compressor washing connection on the front end panel, then dry-cycle the engine (as described in Sect. 3, Chap. 2 except with breech caps removed) while simultaneously injecting the cleaning solution. Continue injecting the solution until the engine ceases to revolve.

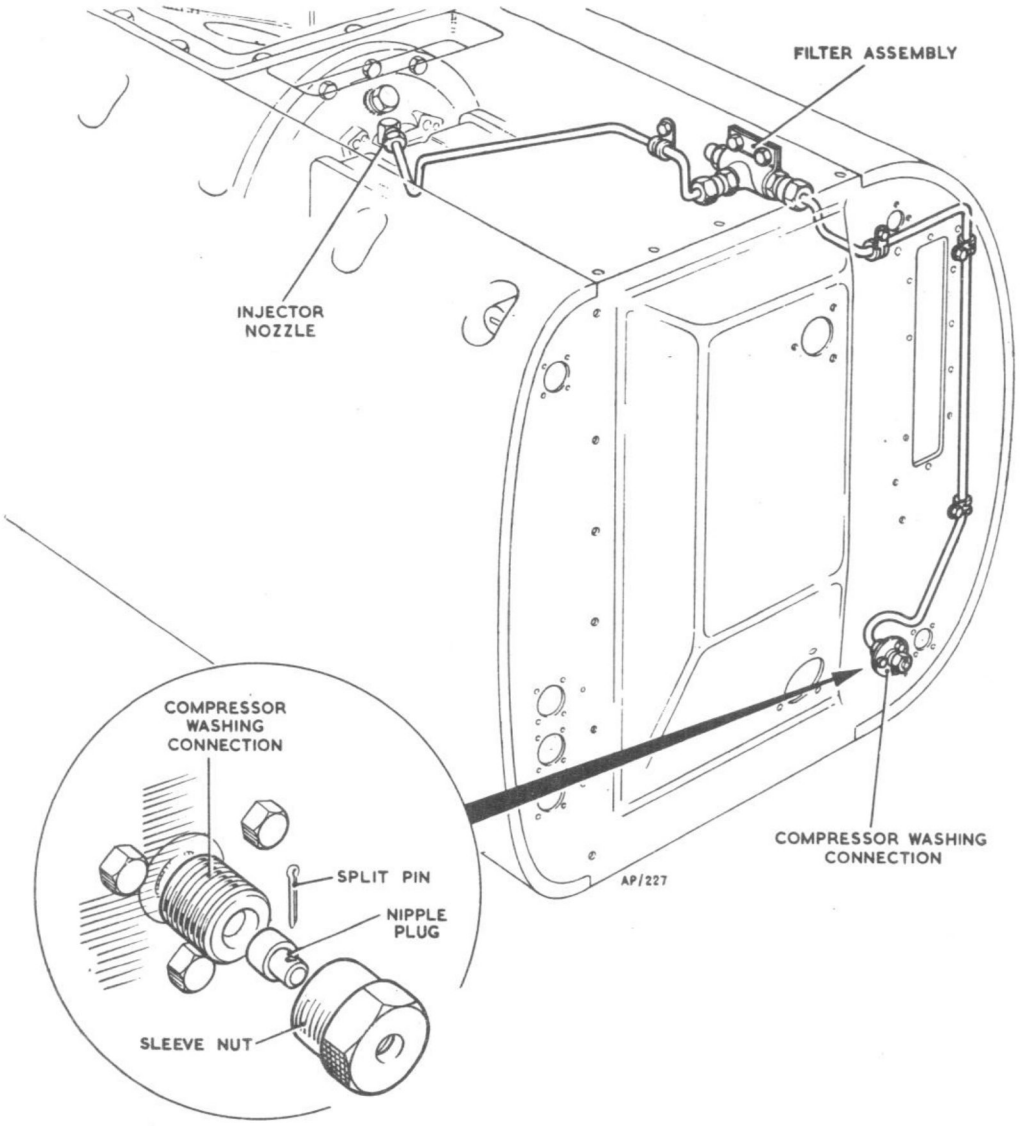

Fig. 5. Compressor washing details

(11) Allow a minimum period of 15 minutes for the cleansing solution to soak and drain, then drain the can and replenish with six pints of distilled water. Re-pressurise the can to 30 lbf/in^2 and repeat the foregoing operation.

(12) Replenish the can with a further six pints of distilled water, re-pressurise to 30 lbf/in^2 and again repeat the operation detailed in sub-para. (10).

(13) Disconnect the delivery pipe at the compressor washing connection, and wait approximately five minutes to allow the accumulated water to drain away; then dry-cycle the engine again as a drying operation.

Caution . . .

After three consecutive starts, dry or wet cycles, a period of not less than 30 minutes must elapse before attempting to re-energise the starter, otherwise the starter motor may be over-heated and rendered unserviceable.

(14) Refit the blanking nipple, nut and split pin to the compressor washing connection on the front end panel.

(15) Remove the drain pipe from the fuel drain valve union and refit the fuel drain valve (Sect. 5, Chap. 3).

(16) Remove the blanking plugs and reconnect the following pipe to the main air casing.

(a) Pre-mod M.182:-The A.F.R.C. compressor delivery pipe.
(b) Post-mod M.182:-The burner air assistance pipe.

(17) Refit the dummy cartridges and the cartridge breech caps (Sect. 4, Para. 38).

(18) Clean all surplus fluid off the A.A.P.P. then within a period of three hours following compressor washing, carry out a Ground Running Check (Sect. 3, Chap. 2).

(19) Refit the A.A.P.P. access doors.

Examining the compressor washing filter

14. Cut the locking wire and remove the pipe connection from the centre adapter, then unscrew the locking cap and withdraw the centre adapter and the filter. Carefully remove any traces of corrosion from the filter gauze. Fit the filter and a serviceable joint washer over the centre adapter and place a serviceable joint washer on the locking cap. Insert the centre adapter through the filter housing and fit the locking cap. Make the pipe connection to the centre adapter and wire-lock.

Examining the flame tube

15. At the specified periods, the combustion chamber must be removed and the flame tube removed and examined. Distortion or buckling may occur in the primary zone of the flame tube or in the region of the air dilution holes. Any degree of buckling will render a flame tube unfit for further service and it must be renewed.

16. Fig. 6 shows the type of distortion or buckling which should be looked for when examining the flame tube. Particular attention should be paid to the primary zone and the necked portion of the tube. It must be emphasized, however, that any degree of buckling will render the flame tube unfit for further service.

Ground running checks

17. The servicing schedule calls for routine ground running checks to be made at specified intervals with the unit mounted either in the aircraft or in the ground running stand.

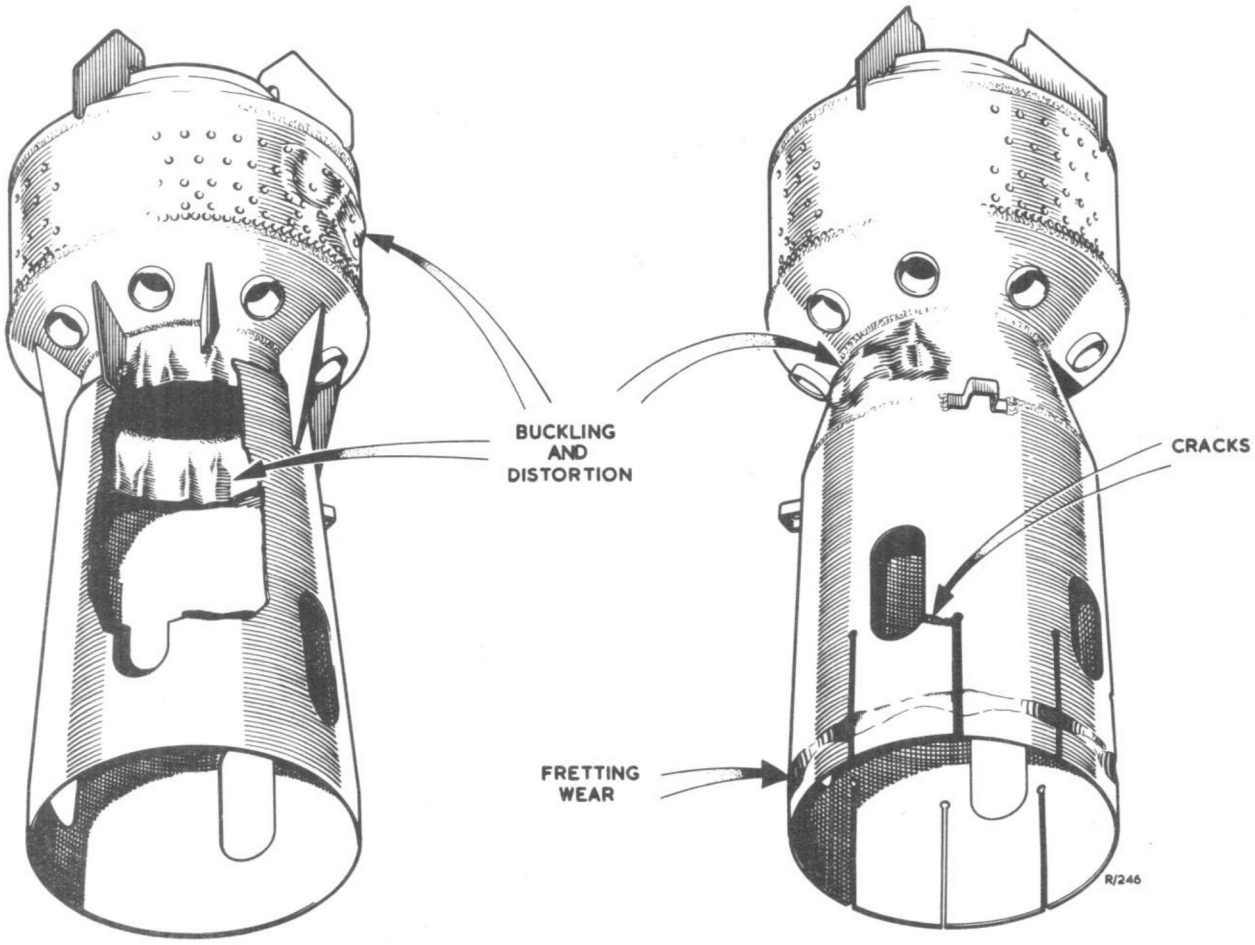

Fig. 6 Unacceptable damage to flame tube

18. For a description of the procedure for ground checking the unit when mounted in the aircraft, reference should be made to A.P.101B-1902-12. The procedure to be adopted for ground checking with the unit mounted in the ground running stand is detailed in Sect. 6 of this volume.

FUEL SYSTEM

Examining the low pressure fuel filter

19. The low pressure fuel filter must be checked periodically to ensure that there is no sludge or water deposit in the filter bowl.

20. To check the filter, cut the locking wire and release the drain plug in the base of the filter. Drain the contents of the filter bowl into a suitable container. Fuel drained from the filter bowl must be absolutely clean; if any trace of sludge or water is evident, the filter element must be changed.

21. Ensure that the drain plug washer is serviceable, then refit the plug and wire-lock.

Renewing the low pressure fuel filter element (fig. 7)

22. Unscrew the four bolts in the filter head, noting the four spring washers and the two wire-locking tabs for the inlet and outlet pipes, until the filter case complete with the retaining collar and filter element can be lowered from the filter head.

23. Extract the filter element and fit a new assembly. Examine the sealing O-ring in the filter head and renew if any signs of deterioration are present. Offer up the filter casing and the retaining collar, fit two wire locking tabs and the four spring washers, then secure the four retaining bolts.

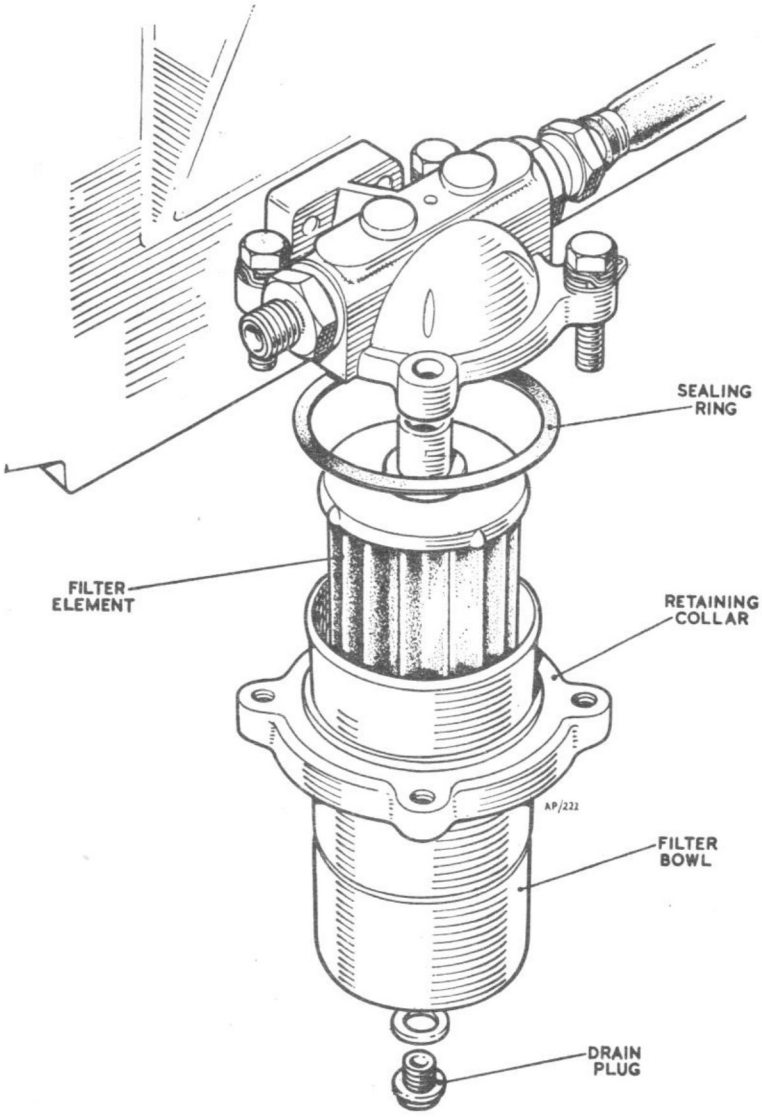

Fig. 7. Low pressure fuel filter

Examining the motorised air pump filter (Mod.M.182)
24. Using suitable pliers, remove the circlip retaining the filter assembly in the air pump inlet, then withdraw the two perforated discs with the felt element sandwiched between them. If the element appears dirty, it must be renewed.

OIL SYSTEM

Checking and replenishing the oil sump level (fig. 8)
25. Commence by removing the protective cap from the $\frac{1}{2}$ in. B.S.P. quick release coupling, underneath the pressure re-oiling valve. The cap is secured with a bayonet fixing.

Note . . .
Some loss of oil from the overflow pipe will occur when the oil delivery hose is connected to the re-oiling point before new oil is injected. This must be ignored as it is no indication as to the oil level in the sump. Additionally this small loss of oil can give a false indication of oil consumption and should not be taken into account when assessing the amount used.

26. Secure the oil delivery hose to the quick release coupling and supply oil to the re-oiling valve at a pressure not exceeding 10 lbf/in^2. Immediately oil commences to flow from the overflow pipe the sump oil level will be correct.

27. When satisfied that the oil level is correct, disconnect the oil supply hose from the quick release coupling as quickly as possible otherwise the oil may escape down the supply pipe. Replace the protective cap on the quick release coupling.

Oil sump heater and thermostat
28. At the intervals prescribed in the servicing schedule, the operation of the oil sump heater and thermostat must be checked. This operation should be made the first item of the servicing period to warm the oil whilst other servicing checks are carried out.

29. Select the electric supply to the sump heater in the aircraft (A.P.101B-1902-1A), and note the oil temperature rise on the gauge in the A.A.P.P. bay. The oil temperature should rise to between 45^{o} to 55^{o}C. before the thermostat is brought into operation and at this point the oil will be maintained at a steady temperature.

Replenishing the blower oil level
30. The oil level of the blower unit, situated on the forward end of the bottom rail, must be checked and replenished if necessary at the interval specified in the servicing schedule.

31. To check the blower oil level, sever the locking-wire and release the combined oil level and filler plug on the port side of the blower body. The oil must be level with the bottom of the plug hole.

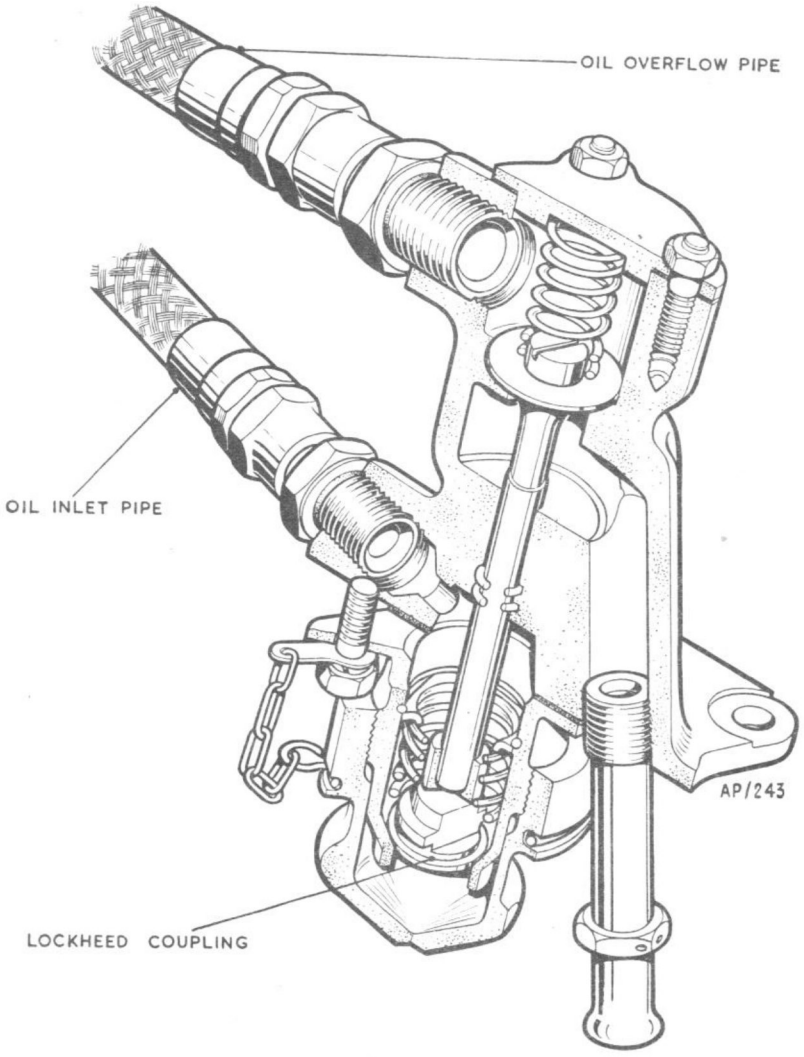

Fig.8. Pressure re-oil valve

32. To replenish the blower oil reservoir, remove the oil LEVEL and FILLER plug and insert a syringe, Tool No. 27VA/1253, filled with the correct grade of oil (see Leading Particulars) into the filler plug hole. Slowly inject the oil into the blower reservoir until it reaches the bottom of the hole and then refit the plug and washer and secure the locking wire.

OXYGEN EQUIPMENT

33. The oxygen equipment requires no servicing other than checking the rate of flow and examining and recharging the oxygen at the specified intervals.

34. The equipment incorporates a contents gauge connection (fig.9) and for details of the correct method of recharging reference should be made to A.P.101B-1902-1A.

Checking the oxygen flow rate

35. Connect the hose from the oxygen test set, Part No. U1624, to the Schrader connection on the oxygen equipment and check that the gauge reading is zero. Select the solenoid valve (A.P.101B-1902-1A) and if the flow is correct the gauge will read between 34 and 38 lbf/in^2. Finally shut off the solenoid valve and the gauge must return to zero.

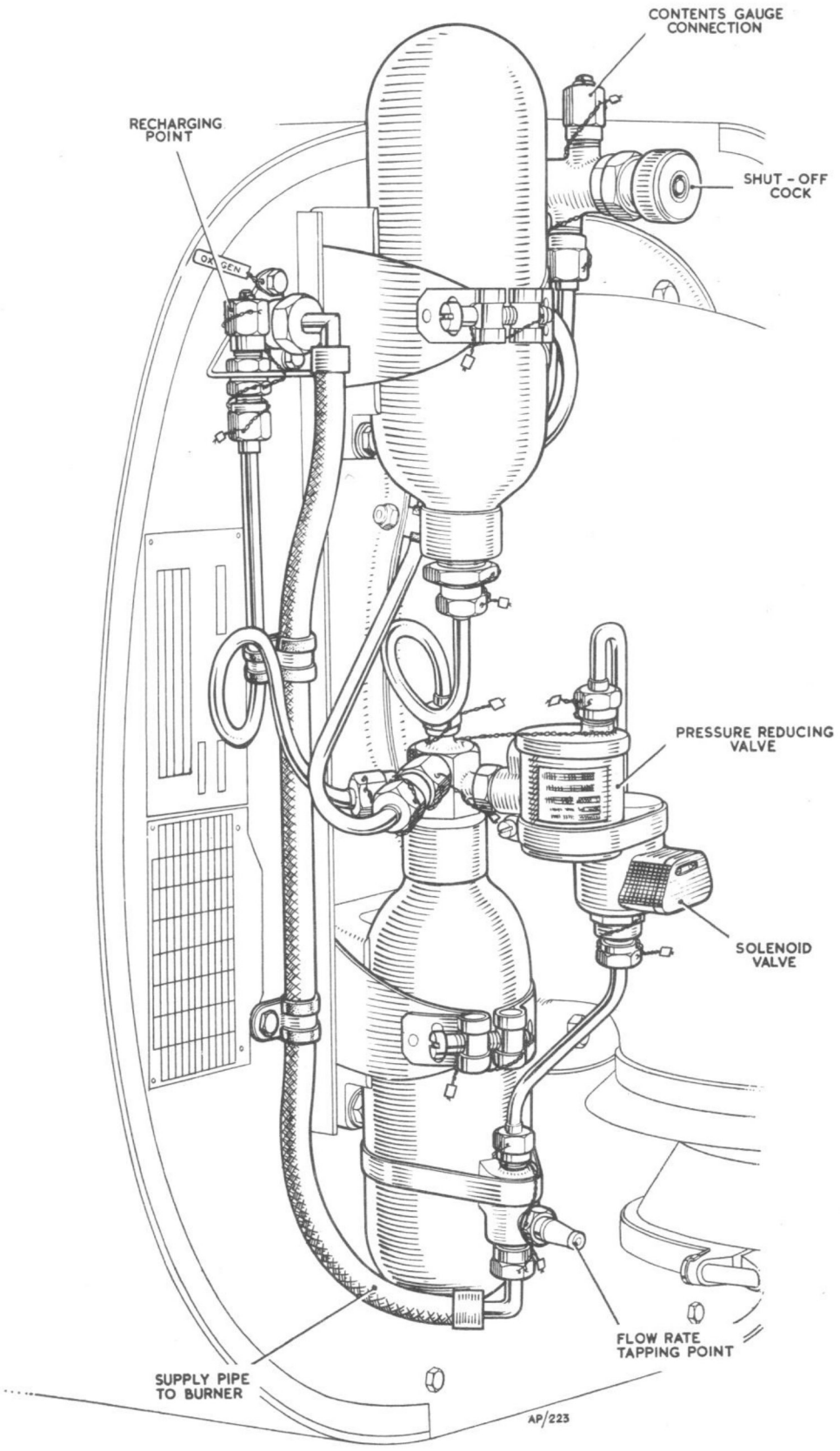

Fig. 9. Oxygen equipment

CARTRIDGE STARTING EQUIPMENT

36. In the interest of safety the cartridge starter must always be treated as though it is loaded. Live cartridges must only be placed in the breeches during the Before Flight servicing check. Never allow live cartridges to remain in the breeches unless their possible use is anticipated.

37. It is important, however, that both breeches contain, at all other times, a blank cartridge complete with a sealing O-ring. The condition of the O-ring is important and the cases used should be inspected periodically to ensure that the seal has not deteriorated. Live cartridges are supplied complete with a new O-ring and care must be taken to ensure that the seal is in place when loading the breeches.

Caution . . .

It is vital that at all times a cartridge case complete with sealing O-ring remains in the cartridge barrel, otherwise exhaust gases will pass from the turbine rotor through the breech assemblies and seriously damage both the barrel heater mats and the firing mechanism. If the sealing O-ring is omitted and the cartridge is live, the turbine exhaust gases may cause premature detonation.

Loading the cartridge breeches

38. To load the starter, depress the large central plunger in each breech cap and unscrew the cap from the barrel. Remove the external transportation cover from the cartridge mouth. Fit the cartridge into the breech cap, pushing the cartridge right home so that the two extractor claws clip over the cartridge base, then insert the assembly into the breech barrel. Screw the breech cap fully home by hand, finger tight only: this is important as overtightening may cause jamming and subsequent difficulty in removal after firing.

Unloading the cartridge breeches

39. Before attempting to reload the breeches refer to the warning notes which follow para.40.

40. To unload, depress the central plunger and unscrew the breech cap from the barrel, then depress the two spring-loaded extractor claws which grip the rim of the cartridge case so that this can be withdrawn from the breech cap. A check should be made to ensure that no loose residue is left in the breech barrel.

WARNINGS . . .

1. Before reloading after the cartridges have been fired, an interval of 10 minutes must be allowed for the breeches to cool. If these cartridges are then immediately fired the next interval before reloading must be extended to 20 minutes to ensure adequate cooling of the breeches.

2. If, at any time, it is necessary to work or make adjustments on the engine or starter, or to check electrical circuits except as detailed in para.43, ensure that none of the breeches contains a live cartridge.

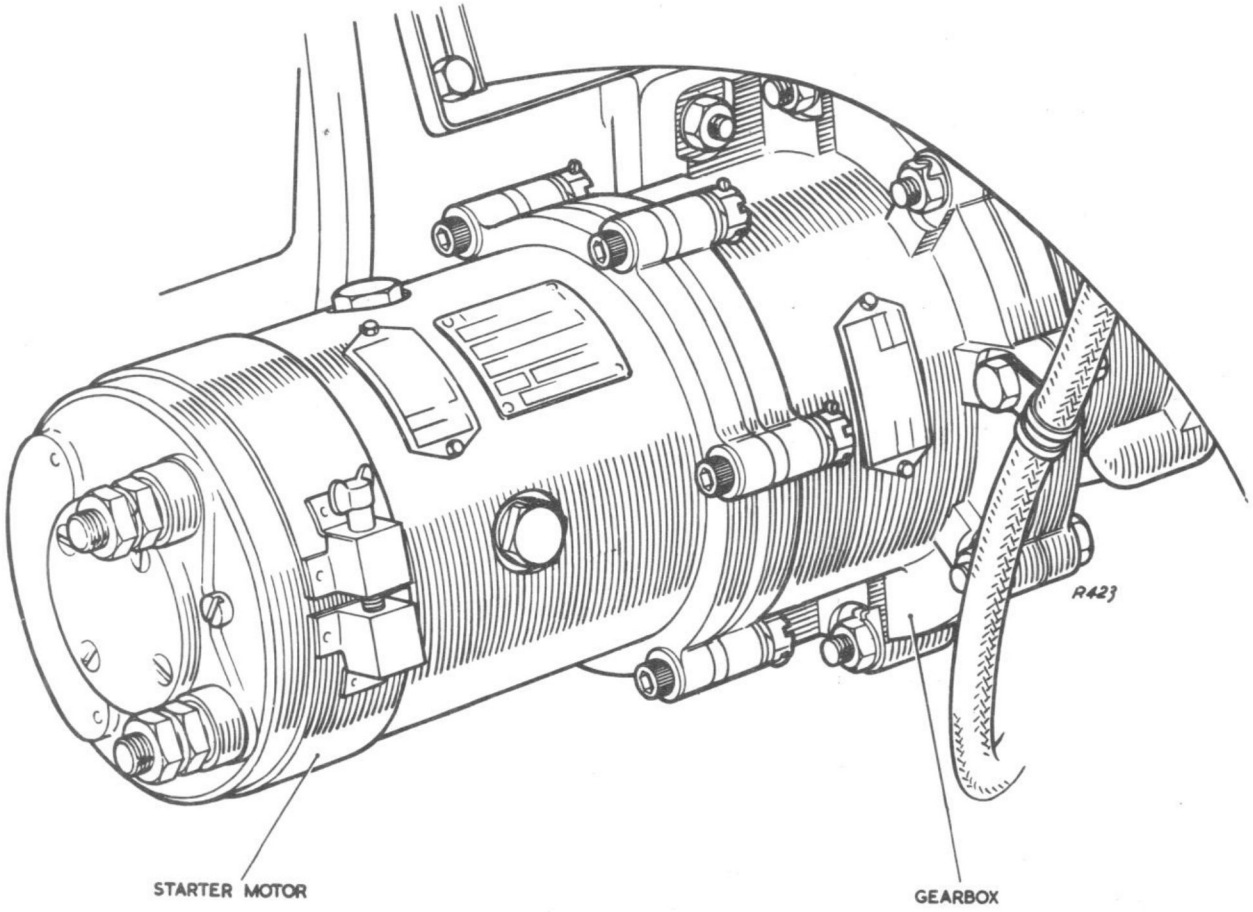

Fig 10 Starter Motor

WARNINGS (cont'd) . . .

3. If a cartridge which has failed to fire, or the remnant of a partly burned cartridge has to be removed from any of the breeches, this must be disposed of in accordance with the safety precautions laid down for the handling of explosives.

41. The cartridge cases are reclaimable after use and care must be taken to avoid damage to these during removal or storage.

Examining the cartridge firing circuit

42. Disconnect the electrical supply cables from the aircraft at the plug connectors on the cartridge barrel connection housings, select the aircraft supply (A.P.101B-1902-1A) and with a test lamp check the supply circuit for continuity: when satisfied that the circuit is correct, switch off the aircraft supply but do not reconnect the supply cables to the plug connectors.

43. Load both breeches with the live cartridges that are to be carried during flight, ensuring that each cartridge has a sealing O-ring, and check each breech circuit and cartridge for continuity with a pyrotechnic fuse tester Ref. No. 37F/12034. When satisfied that the circuits are correct, reconnect the supply cables to the barrel plug connectors, but before doing so make quite certain that the aircraft supply is switched off.

Examining the cartridge heater mat circuit

44. The cartridge heater mat circuits must be checked at the intervals specified for continuity and resistance.
The resistance values are as follows:-

Measured

	From	To	Value
No.1 breech	neutral on cartridge terminal box	No.1 terminal block	214 ± 5 ohms
No.2 breech	neutral on cartridge terminal box	No.2 terminal block	

FIRE EXTINGUISHER

45. The fire extinguisher system requires no servicing other than security and continuity checks at the periods specified.

STARTER MOTOR

46. The only routine servicing specified for the starter motor is a periodic check of the starter brush wear (fig.10). A description of the servicing and examining procedures for the starter motor will be found in A.P.4343D, Vol.1, Book 1, Sect.1, Chap.10 and this publication must be referred to before carrying out any work on the starter.

47. The brushes on the starboard side of the motor are not accessible whilst the unit is mounted on the engine but their condition can be gauged by the rate of wear of the port side brushes.

ROTARY ACTUATORS

48. The rotary actuators embodied in the a.a.p.p. must be periodically given a functional check. If the unit is mounted in the aircraft, reference should be made to A.P.101B-1902-12 for a description of the correct operating procedure: conversely, if the unit is mounted in the ground running stand the correct procedure will be found in Sect.6 of this volume.

49. During the 'before flight' maintenance period a check must be made to ensure that the air bleed valve actuator is in the closed position. For details of this operation reference should be made to A.P.101B-1902-12.