

ADMIRALTY
AIR MINISTRY

Chapter 4

STARTING VALVE

This chapter applies to the Goblin Mk. 2 aero-engine

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PRELIMINARY

1. Throughout all reconditioning operations on the starting valve extreme cleanliness must be observed.
2. Clean metal or wooden boxes should be available in which to place the component parts of each starting valve.
3. Upon removal, all parts such as joint washers, tab-washers, and split-pins must be discarded.
4. After preliminary cleaning operations, to remove external dirt and grease, a close visual examination must be made of each unit for external damage or deficiencies.

DISMANTLING

5. The starting valve (*fig. 1*) comprises a small box-shaped body, machined from the solid, to which is fitted a cast cover enclosing a diaphragm assembly. To dismantle the valve proceed as follows:—

- OP. 1. Unlock and remove the adjusting plug in the cover casting, thus relieving the diaphragm assembly of the spring loading.
2. Extract the inner and outer starting valve springs,

- OP. 3. Unscrew and remove the six nuts and spring washers from the starting valve bolts, securing the cover to the body.

4. Separate the cover from the body.

Note . . .

The diaphragm forms the joint washer between the cover and the body and since at separation the diaphragm must come away with the cover, special attention must be paid to the freeing of the diaphragm from any adhesion to the joint face of the body.

5. Separate the diaphragm assembly from the joint face of the cover.

Note . . .

The following operation will only be necessary if the diaphragm assembly is condemned at the strip inspection stage. Normally it is not necessary to dismantle the assembly.

6. Drill out the 1 mm. dia. peg locking the clamping screw in the diaphragm piston. Unscrew the piston, lift off the backing washer followed by the diaphragm, and finally remove the rubber washer from the bottom of the clamping screw,

This Amendment List No. 6 to Air Publication 4282, Volume 2, Part 3, Section 3. List of Chapters: delete "(to be issued later)" after the title of Chapter 4, and write "(A.L.6)" in the outer margin against the deletion. Insert this Chapter 4 to follow Chapter 3. Record the incorporation of this A.L. in the Amendment Record Sheet at the beginning of the book.

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FUEL SYSTEM COMPONENTS (GENERAL) FOR GAS-TURBINE AERO-ENGINES

OP. 7. Unscrew and remove the union connection, and the two flanged adapters from the valve body.

CLEANING

6. Each individual component must be cleaned thoroughly in kerosine and finally washed in gasoline. Only approved cleaning processes may be employed, and all passages and apertures of the body and cover must be blown through from an air line at a pressure of not less than 20 to 25 lb. per sq. in.

OP. 1. Examine generally for obvious damage and cracks.

2. Check the joint face with a straight edge for signs of distortion, which if apparent can be remedied by lapping the affected face on a suitable lapping plate. If either component is seriously distorted, or has deep indentations in the joint face that cannot be remedied by lapping, it must be replaced.

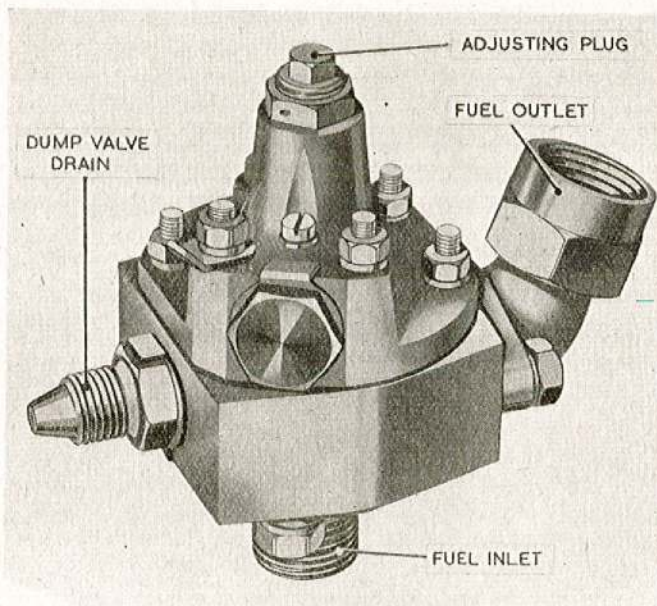


Fig. 1. Starting valve

7. The parts must then be laid out in clean and suitable work trays in readiness for the detailed strip inspection.

INSPECTION

8. At the detailed strip inspection the inspector concerned will be responsible for ascertaining the existing modification standard of the starting valve under consideration, and the amount of approved modifications requiring embodiment in order to bring the valve up to the latest standard.

Starting valve body and cover

9. If cracks are suspected in either the body or the cover, the suspected area should be brushed with a thin mixture of methylated spirits and french chalk; this mixture dries rapidly and any cracks will be easily discernible due to oil exuding and staining the white surface.

3. Examine the threads of all tapped locations.

Diaphragm assembly

10. Visually inspect the diaphragm assembly for signs of damage, and if it is found to be unserviceable, the assembly must be dismantled as described in para. 5, OP. 6, and the faulty parts renewed.

Miscellaneous

11. The two flanged adapters, and the union connection fitted to the unit body must be in a serviceable condition, as also must the adjusting plug with its lock-nut and the two coil springs loading the diaphragm piston.

REASSEMBLY

First assembly stage

12. As indicated at the beginning of the chapter, the fitting of new parts falling into

the category of consumable spares is obligatory. It should be noted that those operations which relate to the diaphragm assembly will only apply if this assembly has been disturbed to permit unserviceable components to be renewed.

- OP. 1. Assemble the diaphragm, followed by a backing washer, to the threaded portion of the clamping screw; loosely screw on the diaphragm piston.
2. Insert the assembly in the cover so that the correct alignment and concentricity with the clamping screw can be ensured by the insertion of three slave bolts through the diaphragm and into the joint flange.
3. Carefully extract the bolts, and withdraw the assembly from the cover.
4. Grip the clamping screw firmly in a spring-jawed clamp and screw down the piston by using a thin tommy bar through the holes provided.
5. Lock the piston and clamping screw with a 1 mm. peg. Carefully rivet the ends of the peg and dress off flush. Care must be taken throughout this operation not to damage the piston.

Note . . .

Replacement pistons are supplied pilot-drilled one side only, and owing to the difficulty of picking up the hole in the original clamping screw, it will be found necessary to renew this component also. When drilling replacement parts it is important that a small countersink, corresponding to that provided at the entrance to the pilot hole, is repeated at the opposite end of the bore after drilling through.

6. With the peg fitted satisfactorily, return the assembly to the cover to ensure that the piston is a smooth sliding fit in its bore and fit a new rubber sealing washer over the button of the clamping screw.
7. Screw the adjusting plug into the cover with its lock-nut fitted loosely.

- OP. 8. Attach the two adapter connections, with their respective joint washers, and the union connection fitted with a new tab-washer, to the unit body.

13. Submit the components for internal inspection.

Internal inspection

14. Check that the issue number engraved upon the unit is amended to bring it into line with any modifications that have been incorporated in the starting valve.

15. Examine the diaphragm assembly closely, paying particular attention to the satisfactory fit of the pin locking the piston and clamping screw, and the cleanliness of the small ventilation hole under the shoulder of the piston.

16. When all parts are in a satisfactory condition and the standard of workmanship and general cleanliness acceptable, the starting valve must be returned to the fitting bench for complete assembly.

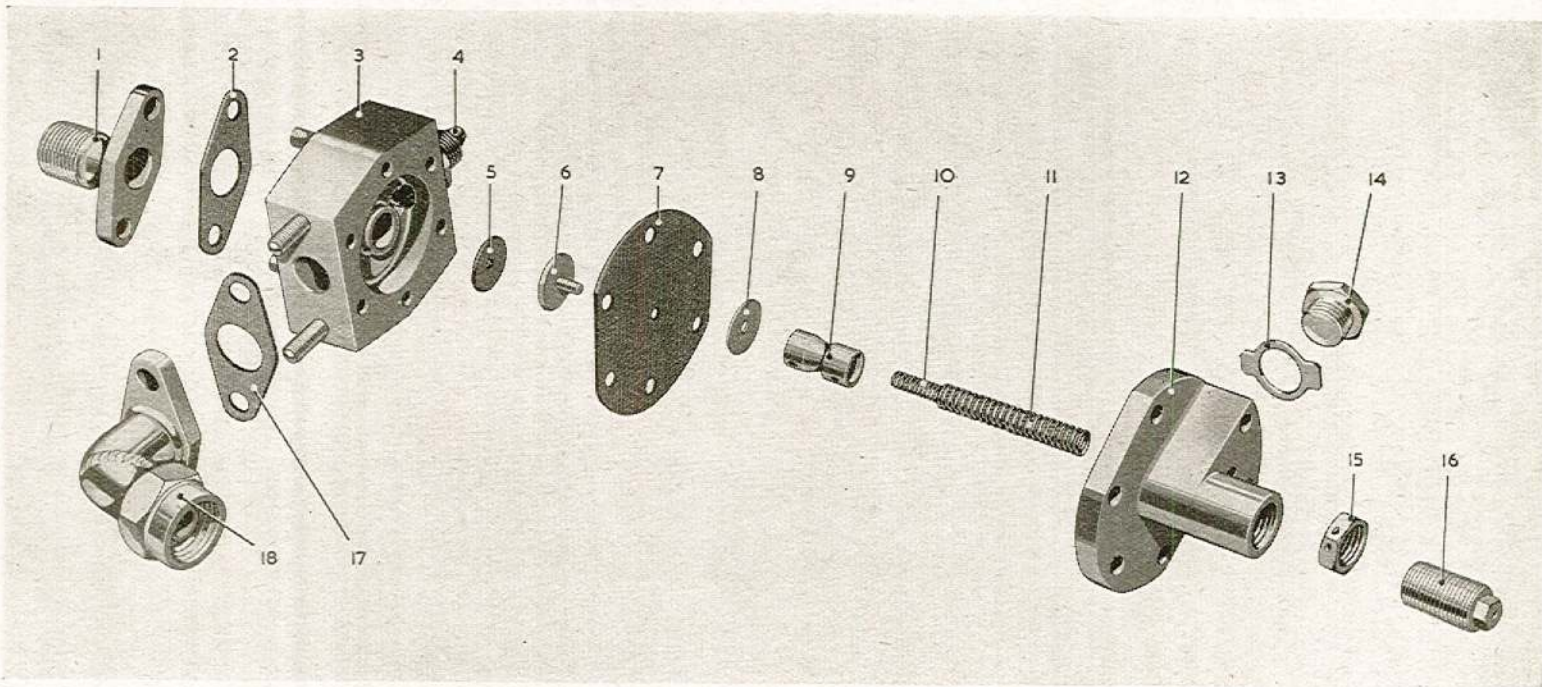
Complete assembly

17. Attach the two union adapters, with two new joint washers, securely to the body of the valve by their holding nuts and spring washers.

18. Position the dump valve union connection and tighten with the tab-washer fitted so that the smaller tab is turned down over the free face of the body, and the larger tab turned up to the hexagon.

19. Continue the reassembling operations as follows:—

- OP. 1. Insert the diaphragm assembly into the cover, and adjust the diaphragm so that the locating holes coincide with the six holes in the cover flange.
2. With the thumb and fingers hold the two sections of the starting valve together, ensuring that the common serial numbers, engraved on the body and the cover flange coincide.
3. Insert the six securing bolts through the body, the diaphragm and the cover flange, the holding nuts and washers being fitted to each bolt in turn. It must be noted that the small wiring plate must be fitted

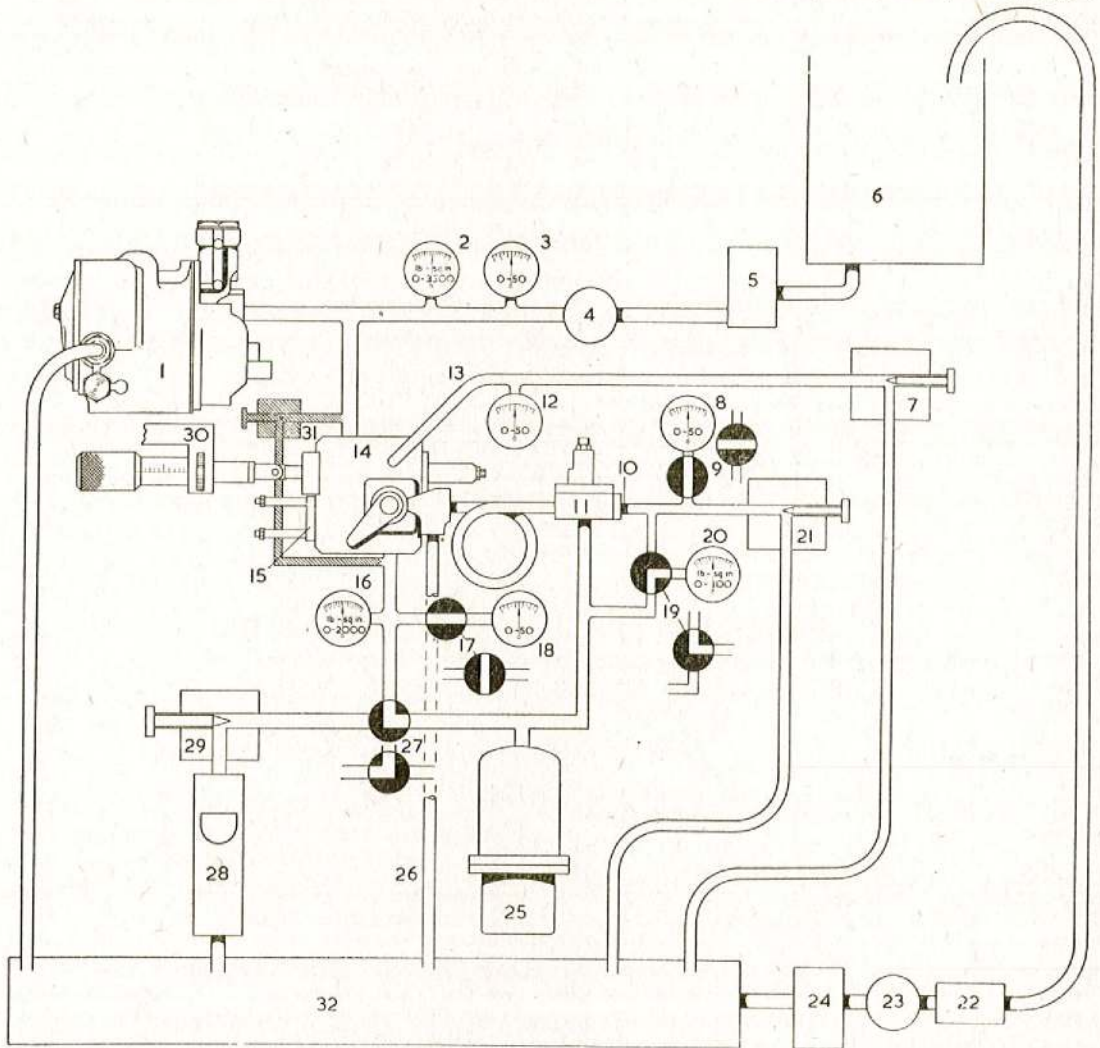


- 1 OUTLET ADAPTER
- 2 JOINT WASHER
- 3 STARTING VALVE BODY
- 4 DUMP VALVE DRAIN
- 5 WASHER
- 6 CLAMPING SCREW

- 7 DIAPHRAGM
- 8 BACKING WASHER
- 9 DIAPHRAGM PISTON
- 10 INNER SPRING
- 11 OUTER SPRING
- 12 COVER

- 13 LOCKING WASHER
- 14 BLANKING PLUG
- 15 LOCK-NUT
- 16 ADJUSTING PLUG
- 17 JOINT WASHER
- 18 INLET ADAPTER

Fig. 2. Exploded view of starting valve



- | | |
|--|---|
| <p>1 ADJUSTABLE RELIEF VALVE OR BAROSTAT SET AT 1030-1090 lb. per sq. in. with 160 gall. per hr. spill</p> <p>2 PRESSURE GAUGE, 0-3500 lb. per sq. in.</p> <p>3 TEMPERATURE GAUGE, 0-50 deg. C.</p> <p>4 PUMP</p> <p>5 FILTER</p> <p>6 HEADER TANK</p> <p>7 REGULATING VALVE</p> <p>8 PRESSURE GAUGE, 0-50 lb. per sq. in.</p> <p>9 ISOLATING COCK</p> <p>10 STARTING VALVE OUTLET CONNECTION</p> <p>11 STARTING VALVE</p> <p>12 PRESSURE GAUGE, 0-50 lb. per sq. in.</p> <p>13 ANTI-HAMMER CONNECTION</p> <p>14 CONTROL BOX</p> <p>15 P.L.V. FACE BLANKED OFF</p> <p>16 PRESSURE GAUGE, 0-2000 lb. per sq. in.</p> <p>17 ISOLATING COCK</p> | <p>18 PRESSURE GAUGE, 0-50 lb. per sq. in.</p> <p>19 TWO-WAY VALVE</p> <p>20 PRESSURE GAUGE, 0-100 lb. per sq. in.</p> <p>21 REGULATING VALVE</p> <p>22 COOLER</p> <p>23 PUMP</p> <p>24 FILTER</p> <p>25 FUEL ACCUMULATOR</p> <p>26 DUMP VALVE DRAIN RETURN TO TANK</p> <p>27 ISOLATING COCK</p> <p>28 DE-AERATOR AND FLOW METER, 0-6500 lb. per hr.</p> <p>29 REGULATING VALVE</p> <p>30 MICROMETER ADJUSTMENT FOR CONTROL VALVE PLUNGER TRAVEL</p> <p>31 ADJUSTABLE NEEDLE VALVE (Shaded). Required when testing control boxes not fitted with a bleed screw or variable characteristics valve.</p> <p>32 SUPPLY TANK</p> |
|--|---|

Fig. 3. Diagrammatic layout of test rig

under the holding nut to the short bolt located adjacent to the dump valve union connection.

OP. 4. Assemble the two piston loading springs, one inside the other, and insert above the piston. Secure by

the adjusting plug.

OP. 5. Screw the adjusting plug approximately half-way in, and screw on and tighten the lock-nut.

6. Tighten the six retaining nuts evenly all round.

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RIG TESTING

General

20. The fuel used throughout the following tests is aviation kerosine to specification D.Eng.R.D.2482, to which 1 per cent. by volume of lubricating oil to specification D.E.D.2472 B/O has been added. The fluid must be passed through a fabric or fine mesh filter and its temperature must be maintained between 20 deg. C. and 25 deg. C.

21. The tests must be carried out in conjunction with the control box on a suitable rig, the diagrammatic layout of which is shown in fig. 3. The supply pressure must be maintained at 1,030/1,090 lb. per sq. in. when the spill quantity is 160 gall. per hr. Care must be taken to isolate the low-pressure gauges before high-pressure tests are carried out.

22. Before connecting up the valve, check that the valve itself is free to move the full extent of its travel without sticking. This can be done by inserting a suitable rod into the inlet connection and pressing on the valve.

Pressure drop test

23. To obtain a reliable reading of pressure drop, a single pressure gauge should be used with a two-way valve having a connection on either side of the starting valve, as close as possible to the valve (fig. 3). With a flow of 3,500 lb. fuel per hour, measure the pressure drop across the starting valve. This pressure drop must not exceed 20 lb. per sq. in.

Fuel leakage test

24. With the burner ring, the dump valve connections, and the regulating valve (fig. 3(14)) closed, apply a fuel pressure of 1,000 lb. per sq. in. Maintain this pressure for 5 minutes and examine for external leaks.

Adjusting the starting valve

25. Uncouple the outlet connection (fig. 3(10)) so that any flow through the valve can be easily observed. Close the dump valve connection, and with the outlet to the burner ring open, apply a gradually increasing fuel pressure at the inlet connection. Hold this pressure at 30 lb. per sq. in. and adjust the starting valve so that a slight fuel leakage (denoted by a rapid series of droplets) occur at the burner ring connection. Lock the spring adjustment.

Burner ring leakage test

26. Shut the starting valve and apply a fluid pressure of 28 lb. per sq. in. at the inlet connection. There must be no leakage from the burner ring connection.

Function test

27. Throughout these tests the outlet pressure is controlled by the regulating valve.

28. Increase the inlet fuel pressure to 35 lb. per sq. in. and restrict the outlet flow gradually until the valve moves to the fully open position. The outlet pressure at which this occurs must not exceed 2 lb. per sq. in. and the opening of the valve must be instantaneous. Full opening of the valve is indicated by a rapid increase in outlet pressure to a value equal to the supply pressure.

29. Gradually reduce the fuel pressure at the inlet to the valve and establish the pressure at which the valve commences to close. This pressure must not be less than 8 lb. per sq. in.

30. Check the operation of the valve three times by applying and reducing the inlet fluid pressure.

31. Remove the valve from the rig, drain off any surplus fuel and flush through with inhibiting oil to specification D.T.D.44D, after which each connection point must be protected with a suitable cap.

FINAL CLEARANCE

32. Having passed the foregoing tests satisfactorily the unit must be submitted for final inspection. This consists of a careful visual examination for general condition, particular attention being paid to the correct turning of tab-washers. Wire locking will not be carried out until installation.

33. When prolonged storage or despatch overseas is probable the units should be sprayed or brushed over with anti-corrosive fluid to specification D.T.D.121 latest issue.

34. For transit between operational units or repair bases, the starting valve must be carefully packed in a suitable wooden packing case.

35. Enter the current issue number and any relevant information on the job card, which must then be signed for final clearance.

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