

Chapter I

MINIMUM BURNER PRESSURE VALVE, TYPE RVI SERIES

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Introduction

1. The minimum burner pressure valve Type RVI/1A is fitted to the Rolls-Royce Derwent Mk. 5 aero-engine, and ensures that the fuel supply to the burners is maintained when the engine is idling at altitude. As the aircraft climbs at constant r.p.m. the mass airflow through the engine becomes less, consequently the fuel supply to the burners has to be progressively reduced. At high altitude this pressure reduction, controlled by the barometric pressure control, would be such that the spray characteristic would suffer and flame extinction could occur if the throttle was suddenly closed. The minimum burner pressure valve eliminates this possibility by preventing the burner pressure dropping below the minimum necessary to ensure satisfactory combustion.

DESCRIPTION

General

2. The unit consists of a body casting having a fuel inlet in the form of an orifice upon which seats a half-ball carried in the socket of a rocker lever, one end of which is fixed to lugs on the end cover and the other end to a capsule stack open to atmosphere. Excessive movement of the rocker lever is prevented by a stop-screw in the centre of the bottom cover.

3. In each of the two fuel outlets from the body-casting a spring-loaded spherical valve is fitted into a holder in the casting. The spring of each valve is anchored at one end to the valve, and at the other end to a threaded adjusting fork which is located in the holder slots by a spring anchorage pin. An

adjusting nut on the end of the spring fork enables the tension of the spring to be varied as desired. The nut is locked by engaging notches in the nut with lips on the valve holder.

4. A ball valve, fitted to the lock-nut in the body casting above the capsule stack, acts as a safety device in the event of damage to the capsule stack.

5. The minimum burner pressure valve is shown in fig. 1 and reference should be made to this illustration during the description of the following sub-assemblies.

Body casting

6. The body is an aluminium-alloy casting (2), the interior of which forms the reducing chamber (9). One end of the chamber is sealed off by a steel end cover which also acts as a pivot for the rocker lever (14). The underside of the casting is sealed by a bottom cover (17) of light-alloy secured by five nuts and bolts, and the flange on the upper side houses the orifice body (8) which

forms the inlet connection. The rocker lever (14), the capsule stack (1), the ball valve assembly (4), and the two valve assemblies (24) in the outlet passages (23) and (26) are also housed in the casting.

Orifice body

7. The steel orifice body (8) is a triangular flanged union having a series of inlet holes to admit fuel into its bore. The bore of the body accommodates a cylindrical brass filter (7) which is retained by a helical spring, a spring plate and circlip.

8. Below the flange, the body projects into the reducing chamber to form a tapered landed extension. The bottom of this tapered extension forms an orifice on which seats the half ball (13) in the rocker lever (14).

Lever pivot union, rocker lever and capsule stack assembly

9. One end of the steel rocker lever (14) is supported by a pin passing through the lugs on the steel pivot union (10). The other end of the lever is pinned into a forked centre

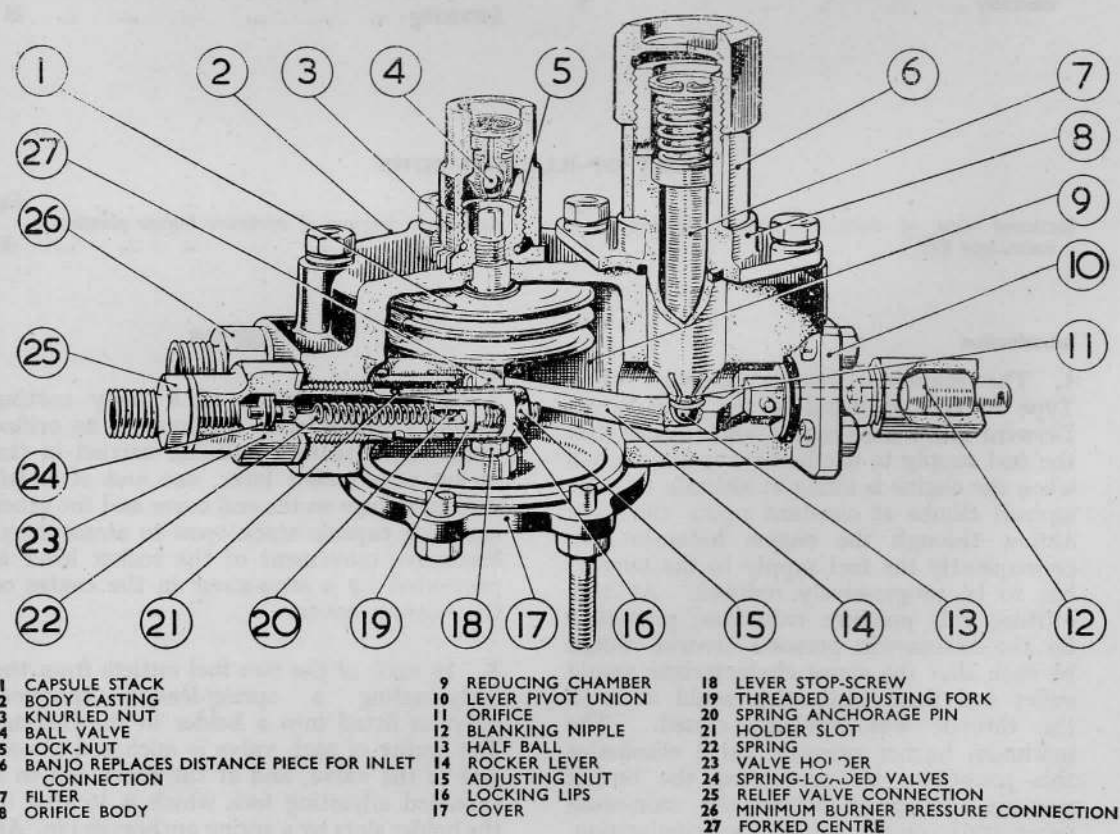


Fig. 1. Sectioned view of minimum burner pressure valve, type RV1

(27) of brass screwed into the centre of the underside of the capsule stack (1). A tungsten carbide half ball (13) swivels in a socket in the rocker lever and seats on the orifice (11). The upper end of the capsule stack has a brass centre open to atmosphere and is screwed into the lock-nut (5). The lock-nut also carries the ball valve assembly (4). Movement of the rocker lever is restricted by a stop-screw (18) in the centre of the cover (17).

Ball valve assembly

10. The ball valve assembly comprises a steel knurled outer nut (3) screwed on to the steel capsule lock-nut (5). The knurled nut has a flange to locate the steel inner ball valve assembly. The holder of the ball valve (4) is drilled right through and the inside of the holder forms a spherical seating for the hardened steel ball (4).

11. The inner ball valve assembly carries a flat circular gauze filter which is secured by a circlip engaging with a groove in the knurled nut (3).

Relief valve and minimum burner pressure valve assemblies

12. The relief valve assembly, which is screwed into an outlet of the body casting, comprises the steel valve holder (23) in which seats a steel valve (24); this valve is retained on its seating by a spring (22) attached to a steel anchorage pin (20). This pin slides in a slot (21) in the valve body and locates with a threaded adjusting fork (19) which has a knurled adjusting nut (15) at one end to enable the tension of the spring to be varied as desired. To enable the spring to be locked at the desired setting 'V' shaped notches are provided on the adjusting nut for engaging with lips (16) on the valve holder.

13. A steel relief valve connection (25) forms an additional adapter in the relief valve holder.

14. The minimum burner pressure valve assembly (26) is similar in construction to the relief valve, but differs in the spring setting, and the holder, which has a male screw thread for its external connection instead of a female thread, no additional adapter being fitted.

OPERATION

15. Fuel at a minimum pump delivery pressure of approximately 100 lb. per sq. in. is supplied through the inlet connection (4,

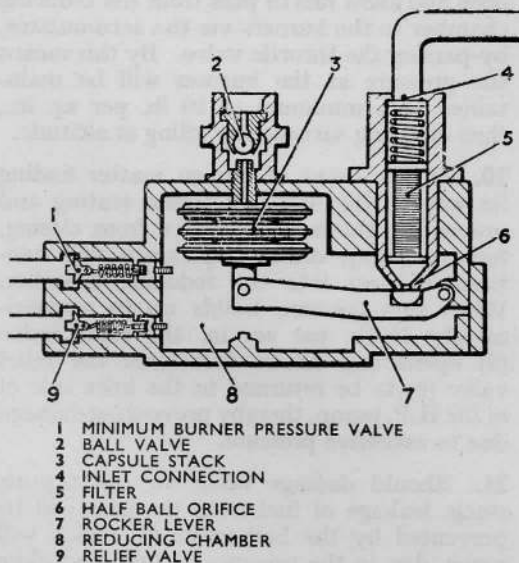


Fig. 2. Schematic diagram of minimum burner pressure valve

fig. 2) of the orifice body via the filter (5) and the half ball orifice (6) into the reducing chamber (8) of the unit.

16. As the fuel pressure builds up inside the chamber, the capsules (3) will become compressed and cause the rocker lever (7) to move upwards, thus causing the half-ball to close the orifice (6).

17. Under normal operating conditions the minimum burner pressure unit will therefore become a sealed unit and will remain so until either the fuel pressure downstream of the throttle valve drops below 10 lb. per sq. in. or the body pressure reaches a certain pre-determined maximum.

18. The pressure inside the reducing chamber is maintained at a constant value of approximately 35 lb. per sq. in., by the pre-determined areas and leverages of the capsule, orifice and the rocker lever.

19. Under idling conditions at altitude the nacelle pressure acting internally on the capsule stack is less, and the fuel pressure downstream of the throttle valve may fall to as low a value as 2 to 3 lb. per sq. in. at which pressure insufficient fuel is available to ensure satisfactory spray characteristics. As soon as the pressure drops below 10 lb. per sq. in., however, a pressure drop occurs across the minimum

urner pressure valve (1), and the valve will open and allow fuel to pass from the reducing chamber to the burners via the accumulator, by-passing the throttle valve. By this means the pressure at the burners will be maintained at a minimum of 10 lb. per sq. in., thus ensuring satisfactory idling at altitude.

20. In the event of foreign matter finding its way to the half ball orifice seating and preventing the half ball valve from closing, fuel at pump delivery pressure will continue to pass into the reducing chamber. When this pressure builds up to approximately 45 lb. per sq. in. the relief valve (9) opens and allows fuel from the relief valve (9) to be returned to the inlet side of the H.P. pump, thereby preventing damage due to excessive pressure.

21. Should damage occur to the capsule stack, leakage of fuel from the unit will be prevented by the ball valve (2) which will move, due to the pressure of fuel, and close the outlet to atmosphere.

INSTALLATION

22. The minimum burner pressure valve is mounted on a bracket and a stay attached to the compressor front casing just forward of No. 9 compressor delivery elbow. When installing the unit on the engine the bracket must first be assembled to the unit, with the two nuts fitted at the rear and securely tightened. The stay should then be fitted, the nut being left loose to allow the stay to be correctly aligned before finally tightening. The assembly must then be fitted to the studs in the compressor casing and the nuts tightened, the small nut retaining the stay to both bracket and unit being

tightened last. The three flexible pipes must then be securely fitted to their connections on the minimum burner pressure valve, as follows:—

(1) Flexible pipe from the pump delivery to the banjo connection on the orifice body of the unit.

(2) Flexible pipe from the fuel line downstream of the throttle valve to the minimum burner pressure outlet valve.

(3) Flexible pipe from the return to pump inlet line to the relief valve outlet of the unit.

23. When removing the unit, detach the three flexible pipes and remove the one large nut attaching the supporting stay and the two nuts retaining the bracket, then withdraw the assembly from the studs. To separate the unit from the bracket and stay, remove the three small nuts; only two of these retain the bracket, the third retains both bracket and stay.

INHIBITING AND PACKING

24. The inhibiting and packing procedure is described in Volume 2, Part 3, Section 9, para. 81 to 83.

SERVICING

25. When the unit is installed, no servicing is necessary except for a constant check of all pipe connections and unions for tightness, as no leakage is permissible.

26. Where leakage is evident, faulty joint washers or pipes must be renewed, but whenever pipes or joints are disturbed ensure the fuel system is primed as detailed in the relevant engine Air Publication.

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