

Chapter 8

ACCELERATION CONTROL UNIT

(Nene-aero-engine) 1232

TYPE BK15877

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Introduction

1. The acceleration control fitted to Nene aero-engines operates during rapid acceleration to reduce the fuel system servo pressure and thereby limit pump output to accord with the airflow through the engine. By this means the air/fuel ratio is maintained at a value acceptable to the engine, and excessive jet pipe temperatures and surge are avoided.

2. The control system consists of two separate units, an acceleration control unit and a metering valve unit. The metering valve unit provides a measure of fuel flow in terms of pressure difference. This pressure difference is transmitted to the acceleration control unit where it acts in opposition to compressor delivery pressure to control a bleed from the pump servo system.

3. The use of absolute compressor pressure as a controlling force ensures that the acceleration control will not be affected by changes in atmospheric pressure. This enables the acceleration control to remain fully effective at all altitudes.

Acceleration control unit

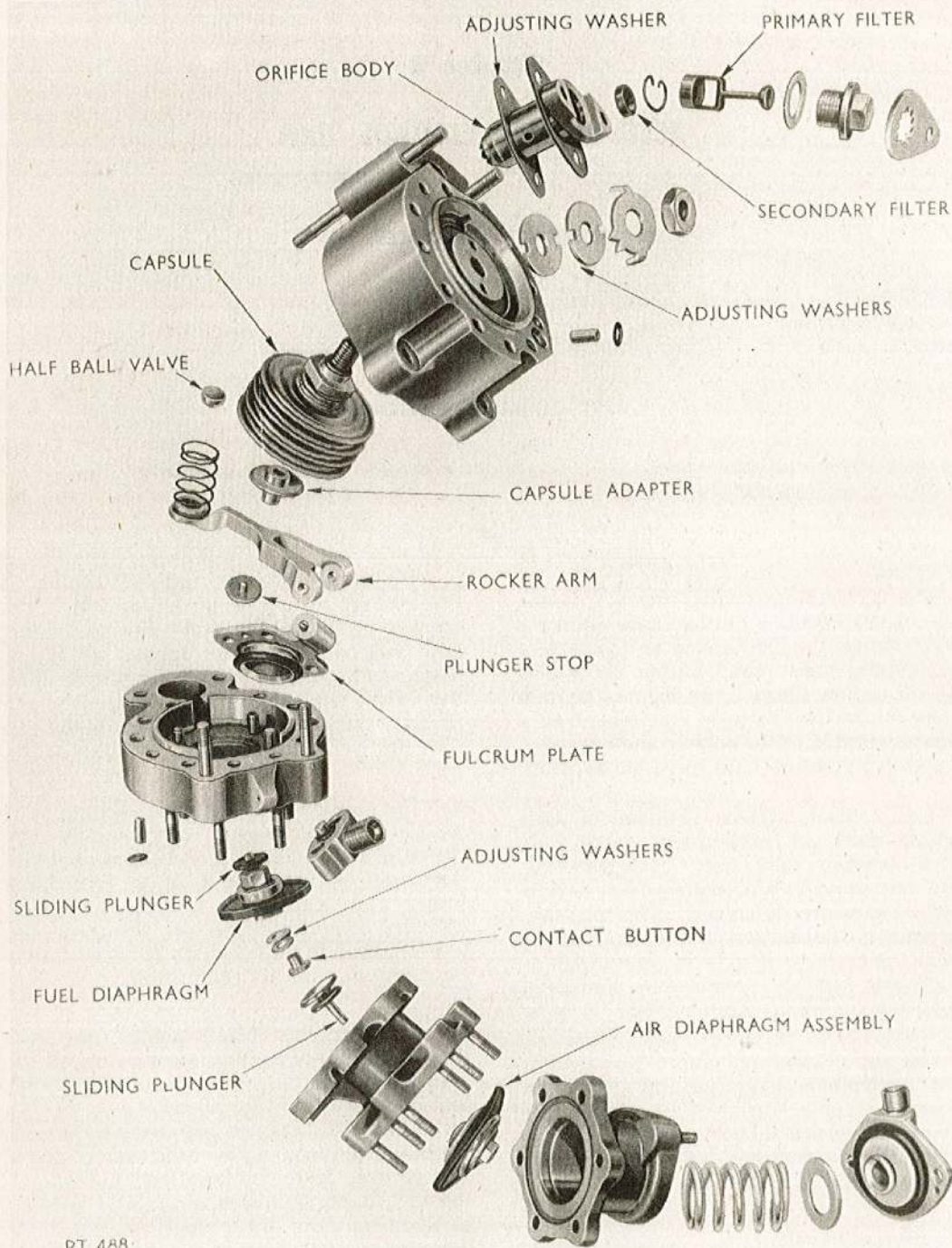
4. The acceleration control unit (fig. 1 and 3) contains a rocker arm which is pivoted at one end and carries a half-ball valve at the other to control spill from the pump servo system.

5. Movement of the half-ball valve is determined by opposing forces which are applied to the rocker arm. Spring loading and compressor pressure applied to the air diaphragm, produce a force tending to close the valve, but this force is opposed by the pressure difference across the fuel diaphragm plus the spring load exerted by the capsule.

6. The capsule is of the same effective area as the air diaphragm, consequently low pressure fuel which acts on both in opposite directions is neutralized as a controlling force. The capsule is evacuated so that effective compressor pressure acting on the unit is absolute and changes of temperature have no effect on its calibration.

7. A permanent bleed across the fuel diaphragm is provided to ensure that all air is expelled from the system on starting. Fuel leakage past the sliding plungers on each side of the fuel diaphragm is prevented by a sealing disc fitted to an undercut in each plunger. The plunger on the metered pressure side of the fuel diaphragm is made slightly smaller in diameter than the plunger on the high pressure side, to correct the out-of-balance loads that would otherwise occur due to the effect of servo pressure on the half-ball valve. In addition a sealing ring is fitted above the fulcrum plate to prevent fuel leakage from the high pressure side of the fuel diaphragm.

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Fig. 1. Acceleration control unit (exploded view)

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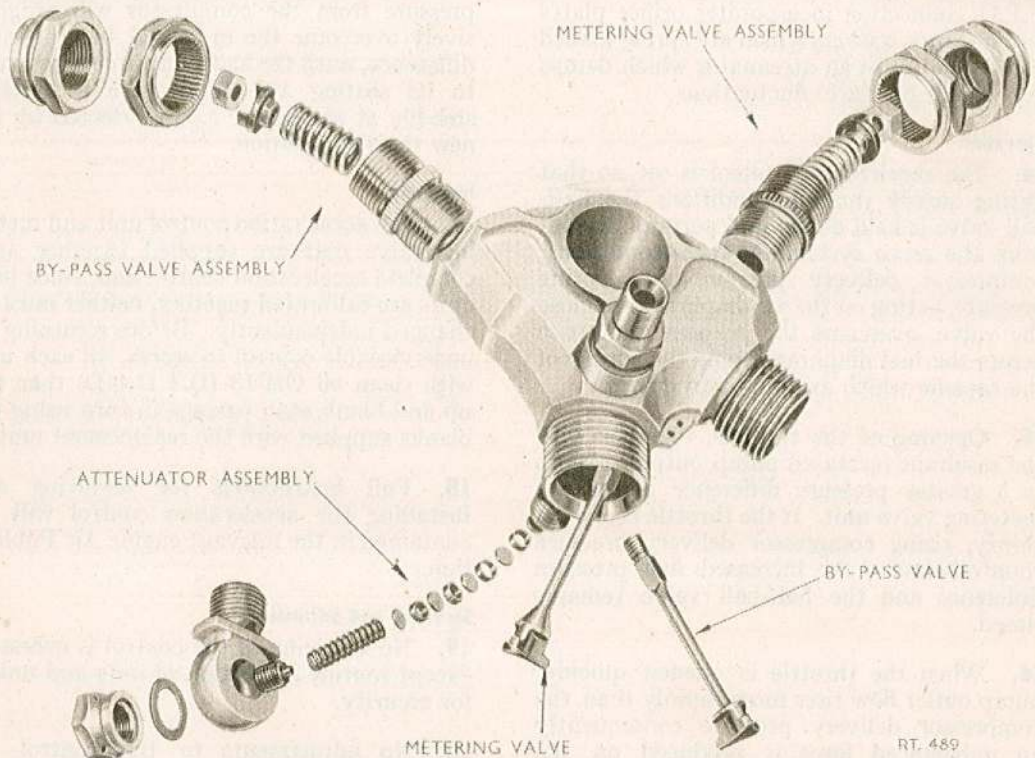


Fig. 2. Metering valve unit (exploded view)

8. The light spring around the half-ball valve takes up the clearance between the capsule adapter and the plunger stop and thereby prevents vibration of the half-ball valve.

9. To obtain the specified clearances during initial assembly of the unit, adjusting washers are provided under the half-ball valve orifice body, under the contact button on the metered pressure side of the fuel diaphragm, and under the nut securing the capsule to its chamber base. During rig test calibration, the spring loading on the air diaphragm may be varied by the adjusting washer below the main spring.

Metering valve unit

10. The total pump outlet flow passes through the metering valve unit which contains two spring loaded valves, one a metering valve and the other a by-pass valve. The valves are opened progressively by fuel pressure on their conical seats, and are

calibrated to create a fuel pressure difference across the unit proportional to flow.

11. The metering valve is held open by pump output pressure throughout the engine operating range, but the by-pass valve only opens at high fuel flows when the engine will accept momentarily richer fuel/air mixtures without experiencing excessive jet pipe temperatures or surge. When the by-pass valve is open, the pressure difference across the unit rises more slowly in proportion to further increases in fuel flow so enabling the acceleration control to permit a more rapid rate of acceleration.

12. During rig test calibration the spring loading on each valve may be varied by adjusting the spring carrier, which is then locked in position by tightening the domed cap-nut down on the lock-nut.

13. Two external connections from the delivery side of the unit transmit metered

pressure to the barometric pressure control and to the acceleration control unit. The B.P.C. connection incorporates orifice plates and distance washers which are spring loaded together to form an attenuator which damps out small pressure fluctuations.

Operation

14. The acceleration control is set so that during steady running conditions the half-ball valve is held closed and permits no spill from the servo system. At these conditions, compressor delivery pressure and spring pressure, acting on the air diaphragm to close the valve, overcome the pressure difference across the fuel diaphragm plus the spring of the capsule which are trying to open it.

15. Opening of the throttle, together with the resultant increased pump output, results in a greater pressure difference across the metering valve unit. If the throttle is opened slowly, rising compressor delivery pressure counterbalances the increased fuel pressure difference and the half-ball valve remains closed.

16. When the throttle is opened quickly, pump outlet flow rises more rapidly than the compressor delivery pressure consequently an unbalanced force is produced on the acceleration control rocker arm which opens the half-ball valve and permits spill from the servo system; this limits pump stroke to the

maximum suitable for compressor delivery. As engine speed increases, the rising delivery pressure from the compressor will progressively overcome the increased fuel pressure difference, until the half-ball valve is returned to its seating and the engine is running steadily at the higher r.p.m. selected by the new throttle position.

Installing

17. The acceleration control unit and metering valve unit are supplied together as a complete acceleration control and, since both units are calibrated together, neither must be changed independently. Before returning an unserviceable control to stores, fill each unit with clean oil OM-13 (D.T.D.44D) then top up and blank each passage in turn using the blanks supplied with the replacement unit.

18. Full instructions for removing and installing the acceleration control will be contained in the relevant engine Air Publication.

Servicing and adjusting

19. No servicing of the control is necessary except routine inspection of nuts and unions for security.

20. No adjustments to the control are permitted in service—faulty units must be changed and a serviceable replacement unit fitted.

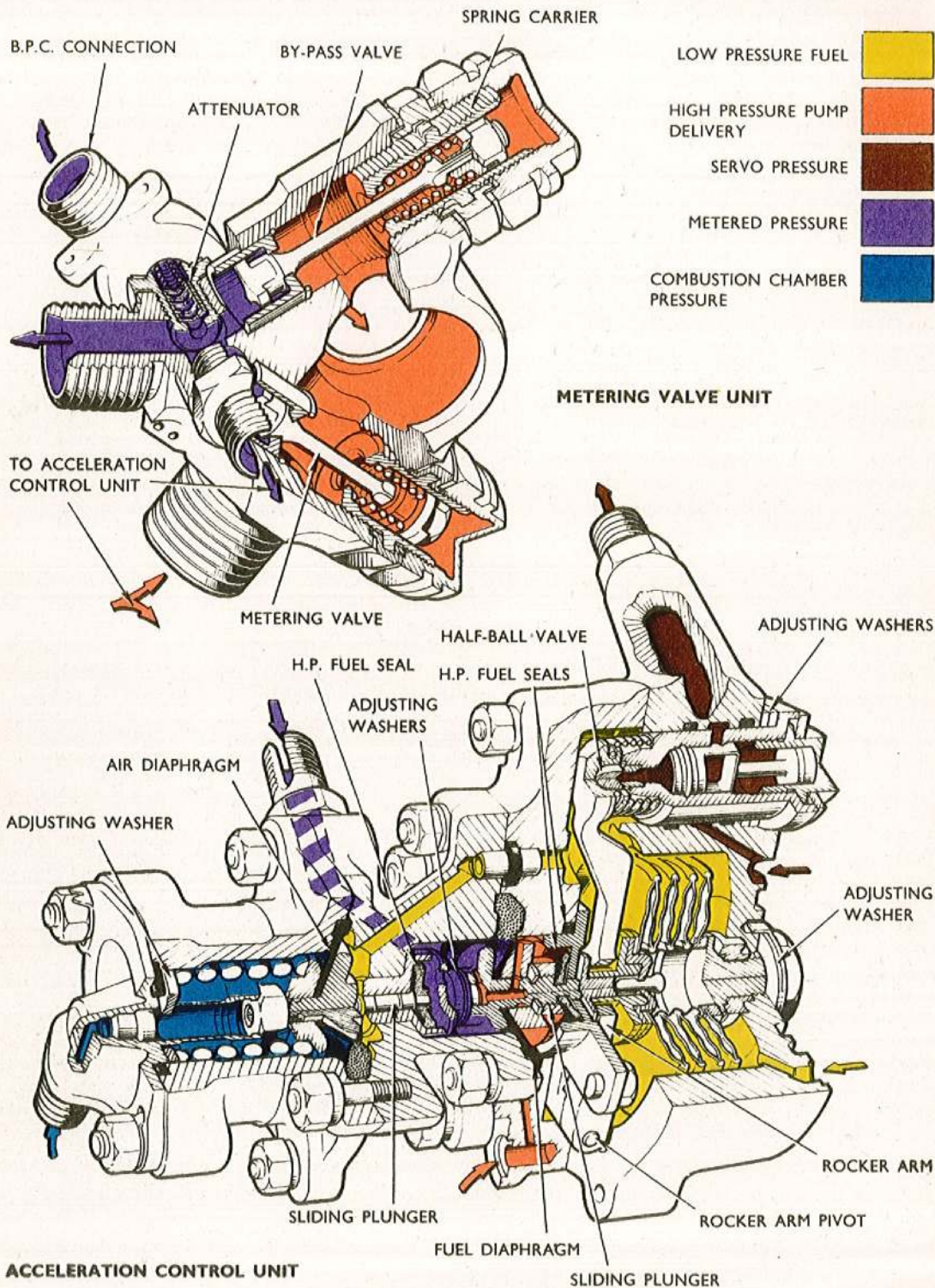


Fig. 3 Acceleration control and metering unit (cut-away showing flows)

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