Chapter 8

FUEL VALVE, TYPE FES

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Type FES/A/8F	Stores Ref. 27V/2737
Voltage	24 d.c.

Introduction

1. The slow running cut-off valve, Type FES (*fig. 1*) is used in conjunction with the fuel injection pumps of certain aero-engines as a means of stopping the engine without shutting off the fuel supply, thereby avoiding damage to the pumps which are lubricated by the fuel.

2. The valve is operated by a solenoid and opens only when the solenoid is energised, thus, in the event of a current supply failure, no interruption to the normal supply of fuel to the pump will occur.

DESCRIPTION

3. The valve (*fig. 2*) consists of three main sub-assemblies, a solenoid and housing, an armature and valve stem assembly, and a connector socket.

Solenoid and housing

4. The solenoid is secured in the housing by screws which are located in countersunk holes in the seating face; a dowel pin protruding from this face locates the valve when installed. A threaded extension of the solenoid lower pole-piece has two diametrically opposed holes to permit the flow of fuel.

Fig. 1. Fuel valve, Type FES

The opposite end solenoid core-piece is machined to form a shoulder which locates in a counter-bore in the cover name plate. The cover plate is positioned by rolling over the housing rim.

Armature and valve stem

5. The armature, which is in the form of a bullet-shaped plunger, has its butt-end bored to receive the valve spindle and operates in the solenoid core tube. A cheese-headed pin engages with a groove in the armature and prevents rotation of the assembly and limits the outward travel of the armature. The valve stem is retained in the armature by a cross pin, the position of which is determined during manufacture.

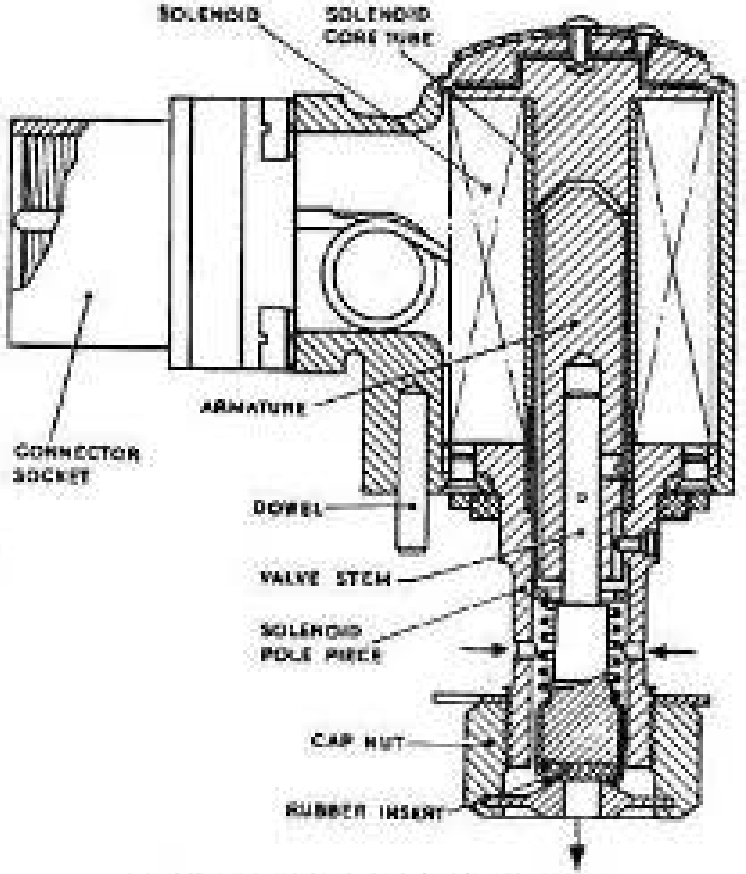

Fig. 1. General arrangement of valve

6. The other end of the stem forms the valve head the crown of which is recessed to receive a synthetic rubber insert forming the valve face; a steel ferrule is swaged over the head to retain the insert. A thrust spring and spring seat are carried on the stem, the spring seat registering against a shoulder on the extended pole-piece.

Cap nut

7. A cap nut is screwed to the extended pole-piece and an inner raised face forms the seat for the valve insert.

Connector socket

8. An electrical connector socket is secured to a boss on the housing by set-screws. The ends of the solenoid leads are soldered to the top of the connector socket and the cavity between the solenoid and the socket is filled with a sealing compound, thus avoiding the risk of damaged or broken leads due to excessive vibration.

Operation

9. Fuel enters the extended pole-piece of the solenoid through the two diametrically opposed holes and with the solenoid de-energised the valve is held against the seat in the cap nut by the action of the thrust spring.

10. When the solenoid is energised the armature is drawn into the core lifting the valve off its seat and permitting the passage of fuel through the drilling in the cap nut.

Dismantling

11. Proceed as follows :—

(1) Energise the solenoid, or lift the valve from its seat by passing a suitable rod through the fuel outlet hole, and unscrew the cap nut.

Note . . .

This is necessary to avoid damage to the valve rubber insert when unscrewing the cap nut.

(2) Remove the tab-washer and the joint washer.

(3) Drill out the cheese-headed pin from the extended pole-piece, using a 0·046 in. drill, and withdraw the armature and valve assembly.

12. The valve stem will not normally require to be separated from the armature, but should this be necessary drill out the cross pin using a 0·046 in. drill; then with-

draw the valve stem, the spring seat and the thrust spring.

13. The construction of the valve is such that if the solenoid coil is faulty the solenoid and housing sub-assembly must be renewed as a complete unit.

Assembling

14. If the valve stem and armature have been separated during dismantling (*para.* 12), to obtain the specified valve lift proceed as follows :—

(1) Fit the thrust spring and spring seat to the valve stem and insert the stem into the armature.

(2) Insert a grub screw into the threaded hole in the armature so that although securing the stem, it does not prevent movement when the slightest pressure is applied to the valve head.

(3) Mount the housing in the setting fixture (Part No. AJT873) and insert the armature assembly into the core of the solenoid.

(4) Place a brass disc 0·180 in. dia. and 0·040 in. thick on the seating face of the cup nut and screw on the nut until the valve is gripped tightly on the fixture.

(5) Remove the valve from the fixture and withdraw the valve assembly from the solenoid core ; care must be taken not to disturb the setting of the valve stem.

(6) Tighten the grub screw and through the existing pin hole in the armature drill a 0·046 in. dia. hole through the valve stem.

(7) Fit a new cross pin and secure by peening over the edges of the hole ; remove all burrs.

(8) Remove the grub screw.

15. The valve may then be assembled as follows :—

(1) Insert the armature and valve stem assembly in the solenoid core.

(2) Fit a new choose-loaded pin into the hole provided in the extended pole-piece so that it enters the short groove in the armature. Peen over the metal at the edge of the hole using a star type punch.

(3) Position the joint washer and the tab-washer.

(4) Screw on the cup nut taking the precautions mentioned in para. 11 (operation (1)).

TESTING

Test conditions

16. Test (A) must be carried out using a suitable spacing collar or jig which provides the MINIMUM armature lift conditions possible on installations. Test (B) must be carried out on a jig which provides the MAXIMUM armature lift conditions possible on installation. Test (C) must be carried out using a test jig which reproduces the installation conditions including the use of the joint washer and the tab-washer.

Test (A)—armature lift

17. To ensure adequate flow through the valve, the armature lift must be not less than 0·033 in. To check this figure, invert the valve, and measure the armature movement between the energized and de-energized positions ; measurement may be made with a dial indicator held rigidly throughout the test.

Test (B)—functional

18. To ensure that the valve will operate satisfactorily at 21 volts d.c. in an ambient temperature of 80 deg. C. the valve when mounted vertically (coil uppermost) in an ambient temperature of approximately 20 deg. C must operate satisfactorily against an inlet air pressure of 20 lb. per sq. in. with an applied voltage of 16 volts d.c. (max.). The armature must return to the de-energised position when the voltage is reduced from 29 volts to not less than 1·5 volts d.c. without even momentarily interrupting the coil circuit.

19. There must be no leakage past the valve seat at air pressures from 0 to 20 lb. per sq. in. after operating the valve several times.

Test (C)—pressure

20. With the coil de-energized the valve must be leak-proof (including the joints between the valve and the jig) when subjected to an internal air pressure of 30 lb. per sq. in.

Note . . .

For this test the valve (excluding the solenoid casing) may be immersed in kerosene and, afterwards, dried with compressed air.

Test (D)—electrical

21. The insulation resistance when checked between the terminal points of the coil winding and the valve housing must not be less than 30 megohms.

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