Chapter 3

PUMP, FUEL, FB 60, Mk. 5

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Pump, fuel, FB 60, Mk. 5	Stores Ref. 5UE/5795
Nominal voltage	24 volts d.c.
Nominal current	7 amp.
Delivery rate	200 gallons per hour
Delivery pressure	10 lb. per sq. in.
Weight	8·5 lb.

Introduction

1. The FB 60, Mk. 5 pump is electrically operated and is used to maintain the supply from aircraft fuel tanks to the inlet of the engine-driven fuel pumps during aerobatics or during periods when fuel temperatures are high. Although intended primarily as a booster pump, it may also be used to transfer fuel from an auxiliary to a main fuel tank.

2. This pump is of the inverted, side mounting type. In use it is fitted inside the aircraft fuel tank, with its electrical connection, outlet adapter and gland drainage connectors extending through the mounting orifice in the side of the tank.

DESCRIPTION

3. The complete pump (*fig.* 1) comprises an electric motor mounted on a pump assembly which has a large flange to permit the unit as a whole to be secured to the side of the aircraft fuel tank in which the unit is installed. In operation the whole unit, except for the face with the external connections, is immersed in fuel. The motor portion of the unit is rendered fuel-tight by a metal cover or canister which is clamped on to a gasket seating on the upper end of the pump assembly. A filter, secured over the fuel inlet at the lower end of the pump assembly prevents foreign matter from entering the pump, and another filter, over the air inlet on the face of the pump which is presented to the exterior of the fuel tank, prevents the ingress of foreign bodies to the electric motor.

Driving motor

4. The driving motor is a compound wound machine, which, operating on 24 volts d.c., has a power output of approximately $\frac{1}{8}$ B.H.P. It is fitted with a high speed type armature, the shaft of which rotates in ball bearings lubricated with high melting-point, low freezing-point grease. The driving shaft is of sufficient length to extend down through

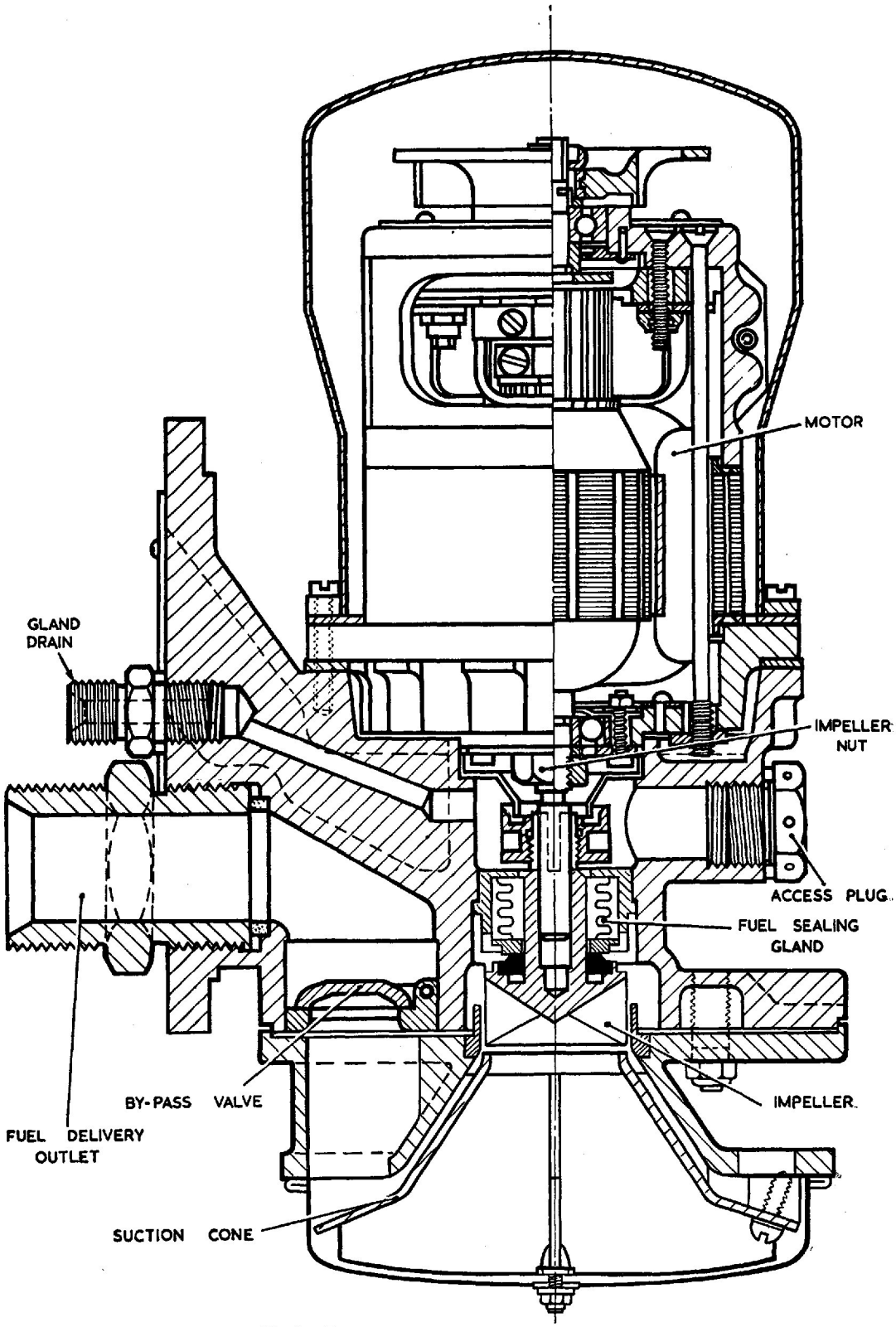

Fig. 1. Part sectional view of FB 60, Mk. 5 fuel pump

the pump body and is machined to receive the impeller. The upper and lower end-frames house the bearings for the commutator and impeller ends of the armature shaft and are secured to the motor body by bolts which pass through the body from one end-frame to the other. The body is made up from laminations, which, together with the field windings, comprise the motor field assembly.

5. The lower end-frame forms the base for the motor and seats on to a machined recess at the upper end of the pump body. It is provided with gauze covered apertures to permit air to be drawn into the motor interior. In addition, slots, which serve as air outlets, are disposed round the motor between the lower edge of the motor body and the seating for the fuel-tight cover enclosing the motor.

6. The upper end-frame encloses the commutator and twin sets of brushes. Apertures in the frame permit access to the brushes for adjustment and inspection. A fan is fitted to the armature shaft, externally to the upper end-frame. This fan draws air through the motor from outside the fuel tank via an air duct in the pump assembly body and the gauze-covered apertures in the motor lower end-frame. The air is then exhausted down the outside of the motor body through the slots in the flange of the lower end-frame. Finally the air passes through passages in the pump body and is expelled to atmosphere.

7. The motor is secured to the pump body by screws, fitted with spring lock-washers, and is completely enclosed by the motor cover. This cover is flanged at the bottom, where a fuel-tight joint is ensured by clamping the cover down on a gasket interposed between the cover and the flange on the lower end-frame. The motor is thereby isolated from the fuel in which the pump is immersed when it is in operation.

Pump assembly

8. The pump assembly is contained within a metal casting which is generally of cylindrical form, with a large flanged boss on its side. The flat face of the boss is that which is presented to the pump orifice in the fuel tank. This face is fitted with the delivery adapter for the connection of the aircraft fuel delivery pipe, the electrical connecting plug for the electrical supply and two gland drain adapters, one of which caters for drainage during periods of inverted flight.

9. A vertical, circular cavity through the casting is machined to accommodate the fuel gland which functions to prevent fuel passing to the motor mounted on the casting. The chamber formed at the upper end of the gland is that within which the impeller securing nut rotates. Access to this nut, for tightening and adjusting purposes, is by way of a hole extending to the exterior of the pump on the side opposite to the mounting flange. This hole is sealed off by a large plug, with sealing washer to prevent the ingress of fuel. The chamber below the fuel gland is the impeller chamber, and is machined to provide the necessary clearance for the impeller to function satisfactorily. This chamber communicates directly with the delivery outlet.

10. A by-pass valve is fitted in the passage between the impeller chamber and the delivery outlet. This valve consists of an annular seating ring with a hinged flap valve. The bearing surfaces of the flap and its seating are lapped to provide a fuel tight seal when they are in contact.

11. The apertures to the impeller chamber and the by-pass valve on the underside of the pump are covered by a domed filter. This prevents the ingress of foreign matter when fuel is being drawn through the pump.

Gland drainage

12. To prevent the accumulation of any fuel which might seep through the fuel gland, the Mk. 5 pump is fitted with two gland drains, one of which ensures drainage during periods of inverted flight.

Fuel gland

13. The fuel gland in the Mk. 5 pump is of the metal bellows type. The gland assembly consists of a brass cylindrical housing in which is sweated a brass bellows, with a bronze sealing ring sweated to the lower end of the bellows.

14. The bronze sealing ring is guided within the lower end of the housing by four splines on its perimeter engaging with lugs on the inner surface of the housing. The seal ring is polished on its lower surface to provide a working face and is maintained in rubbing

contact with the carbon ring on the impeller. The whole bellows assembly is a press fit in the central bore of the pump body casting.

Note . . .

The metal bellows type of gland is not interchangeable with the rubber and spring type.

Impeller

15. The impeller is of the single shrouded end suction type and has vanes designed to give maximum performance at high altitude. It is secured at the lower end of the motor shaft by a cone nut collet coupling device, which is similar to a chuck in operation.

Electrical connections

16. Electrical connection is by means of a Breeze 2-pole plug, which is mounted directly on to the pump body.

Operation

17. When the pump is switched on, the impeller draws fuel from the fuel tank and forces it, by way of the impeller chamber, to the pump outlet. The pressure of fuel passing through the pump whilst it is in operation maintains the by-pass valve in its closed position, but when the pump is idle the fuel pressure is relieved and the valve remains closed as a result of its own weight only. When fuel is being drawn from the fuel tank by the aircraft engine driven pumps the pressure on the underside of the valve is then sufficient to lift the flap of the valve.

INSTALLATION

18. When fitting a new or reconditioned pump in place of an existing pump ensure that the fuel tank is empty. When this has been done disconnect the fuel delivery pipe, the fuel drain pipe (or pipes) and the electrical supply cable. Next remove the bolts securing the pump to the wall of the fuel tank and carefully remove the pump from its seating.

19. To fit the new pump it is only necessary to offer the pump mounting flange to the mounting ring on the tank and tighten up the securing screws. Before doing this, however, care should be taken to ensure that the pump is clean externally. When the pump has been mounted and is ready for connection remove any blanking plugs which may be present in or over any of the external orifices.

20. Before putting the new pump into operation ensure that it is internally clean. This may be done in the following manner:—

Connect the electric supply cable to the pump, temporarily plug the delivery outlet, and pour a small quantity of fuel into the tank, after placing a receptacle (sufficiently large to receive the fuel in the tank) below the delivery outlet. Then switch on the pump and remove the plug from the outlet. The pump will this be flushed and any foreign matter in the pump will be carried away. The pump should then be switched off and the fuel supply line connected to the pump outlet.

21. Ensure that the gland drain outlet is free from obstruction. Omission to do so may result in fuel, which may have seeped through the fuel gland, accumulating and washing away grease from the motor bearings, thereby possibly causing serious damage.

SERVICING

Electrical test

22. Periodic tests for correct functioning of the pump must always be undertaken with the unit on load. Therefore ENSURE THAT THE PUMP IS IMMERSED IN FUEL.

23. Ascertain the position of the aircraft fuel pump test panel by reference to the appropriate Aircraft Handbook and proceed as follows :—

(1) Close all fuel cocks between the pump and engines so that no fuel can flow.

(2) Connect a suitable portable ammeter to the socket on the test panel.

(3) Switch on the pump by pressing the switch on the test panel (NOT THE NORMAL FUEL PUMP SWITCH) for a period of not less than thirty seconds and note the current readings on the ammeter.

24. The readings obtained from the test given in the preceding paragraph should be interpreted as follows :—

(1) A steady reading of approximately 6·5 amp. shows that the pump motor is satisfactory.

(2) A reading in excess of 7 amp. is an indication of a fault in the unit.

(3) A fluctuating reading will probably be due to faulty contacts but may be an indication that the fuel gland is defec-

tive, or that the impeller is fouling the walls of the impeller chamber.

(4) A zero reading is consistent with a blown fuse, defective wiring, or in extreme cases, complete motor failure.

Functional test

25. When the electrical test has been satisfactorily completed, the pump should be tested for fuel output pressure and rate of delivery. The pressure should be approximately 10 lb. per sq. in. at a rate of 3·3 gallons per minute. Failure to obtain these results will probably be an indication of a faulty impeller or fuel gland. The fuel gland drain should be checked for leakage. A leakage in excess of two drops per minute when the pump is idle or five drops per minute when the pump is in operation will indicate that the gland is faulty.

Faulty pumps

26. In the event of a pump proving faulty it must be removed and replaced by a pump which is known to be serviceable. Faulty pumps must not be dismantled by Service Units but must be sent to a Repair Depot for appropriate action.

Periodic inspection

27. At the periods specified in the relevant Aircraft Servicing Schedule the pump will be inspected in accordance with the following instructions :—

(1) Remove the pump from the tank; inspect the gauze filter over the fuel inlet and clean it if necessary.

(2) Ensure that the fuel gland drainage is free from obstruction.

(3) Replace the pump in the tank, taking care to ensure that the gasket on the mounting flange is in good condition and that all connections and securing screws are tight. Also examine the filter over the air inlet to ensure that it is clean and free from obstruction.

(4) Test the pump in accordance with para. 22 to 25.

(5) Ensure that the by-pass valve is functioning correctly by adopting the following procedure. Turn on the tank selector cock and the appropriate engine master cock. Then, after ensuring that there is sufficient fuel in the tank to immerse the pump, switch on the pump and observe the fuel pressure as indicated by the aircraft fuel pressure gauge or fuel pressure warning lamp. It should be noted that in certain aircraft installations the warning lamp may be set to operate at a higher pressure than that at which a single pump is rated. This point should be checked before judging a pump to be unserviceable. It is unlikely that the pump is faulty if the fuel delivery pressure exceeds 9 lb. per sq. in.

Note . . .

It is important that the idle [cut-off control should be in the cut-off position throughout the functional test when it is applied to installations incorporating engines which are fitted with Bendix or similar type injection carburettors.

Lubrication

28. During manufacture the motor bearings are packed with sufficient lubricating grease to last the normal life of the pump. No additional lubrication or attention should therefore be necessary except in instances where fuel has seeped through the fuel gland and washed the grease from the lower bearing. Where new lubricating grease is necessary the operation will only be undertaken at a Repair Depot.