Chapter 7

PUMP, FUEL, FB 160, Mk. 2

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Pump, fuel, FB 160, Mk. 2	Stores Ref. 5UE/5357
Nominal voltage	24 volts d.c.
Nominal current	9 amp.
Delivery rate	400 gallons per hour
Delivery pressure	10 lb. per sq. in.
Weight	14 lb.

Introduction

1. The FB160, Mk. 2 pump is intended primarily for use as a booster pump, but may also be used to transfer fuel from an auxiliary to a main fuel tank. It is electrically operated and its primary role is to maintain the supply from aircraft fuel tanks to the engine-driven pumps during aerobatics or at times when fuel temperatures are high.

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

DESCRIPTION

3. The electric motor which drives the pump is totally enclosed by a fuel-tight cover or canister and is mounted on the pump assembly. The body of the pump assembly has a large flange on its side whereby the complete unit is secured to a mounting ring on the fuel tank when the pump is installed. In operation the whole unit, except for the face on which the external connections are fitted, is immersed in fuel. A filter, secured over the fuel inlet at the lower end of the pump assembly prevents foreign matter 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 foreign matter entering the motor.

Driving motor

4. The driving motor of the FB160 pump (*fig.* 1) is a compound-wound machine. It operates on 24 volts d.c. and has a power output of approximately $\frac{1}{7}$ B.H.P. It has a high speed type of armature, the shaft of which rotates in ball bearings, lubricated with high-melting point, low freezing-point grease. The driving shaft is machined to receive the pump impeller and is of sufficient length to extend downwards to the impeller chamber at the lower end of the pump body.

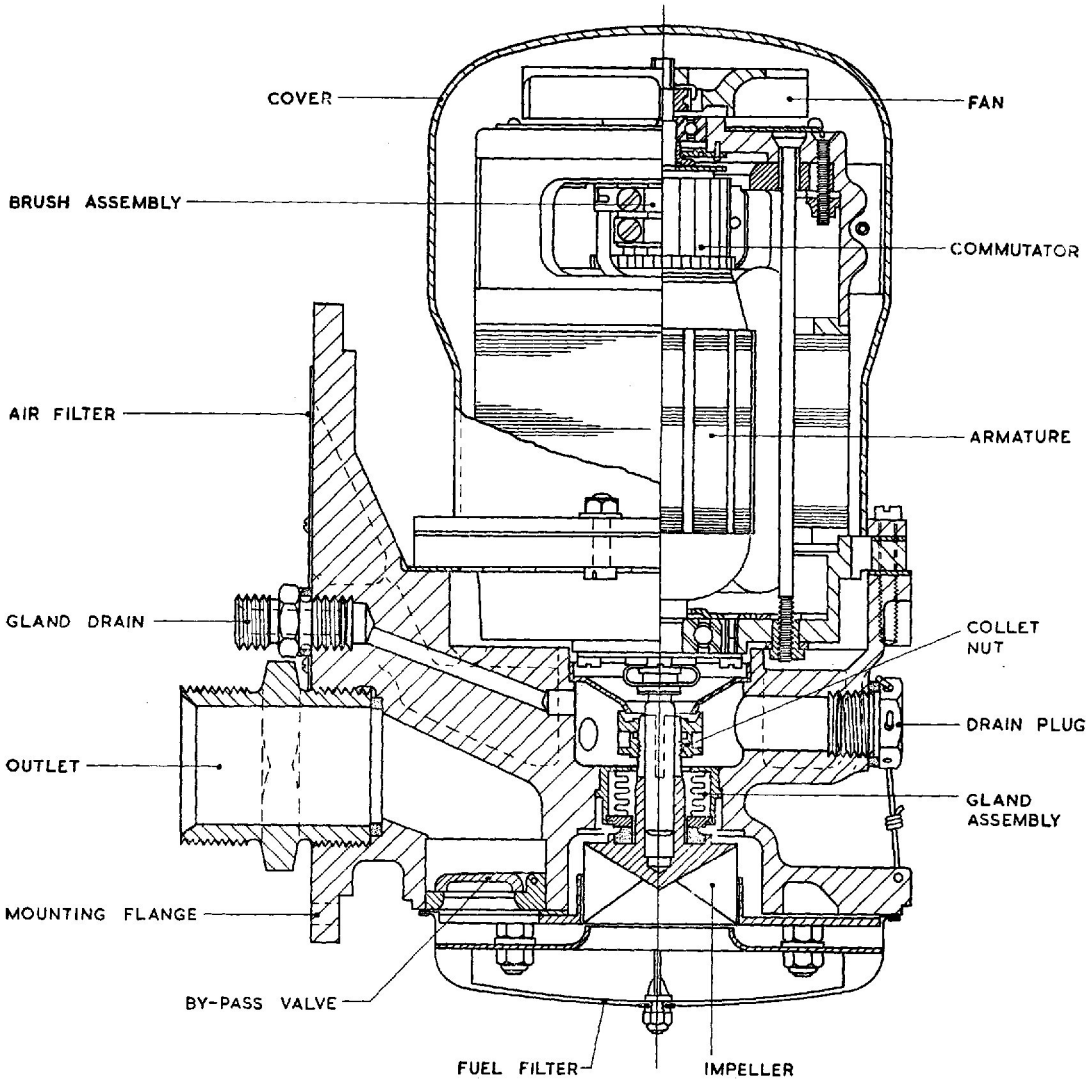

Fig. 1. Sectional view of FB 160, Mk. 2 pump

The upper and lower end frames, in which the bearings for the armature shaft are housed, are secured to the body of the motor by long bolts which pass through the body from one end frame to the other. The body s laminated, and together with the field winding, comprises the field assembly.

5. The lower-end frame serves as the base for the motor and seats on to a machined recess at the upper end of the pump body. Gauze covered apertures in the frame allow filtered air to be drawn into the motor, and slots, which serve as air outlets, are disposed around the motor. These slots are located 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 set of brushes. Apertures in the frame permit inspection and adjustment of the brushes. A portion of the motor shaft extends through the end frame and is fitted with a fan. This fan draws air through the motor from the outside of the fuel tank, via an air duct in the pump body assembly. The air is exhausted through the slots in the flange of the lower end frame and is expelled to atmosphere via passages in the pump body.

7. The motor is secured to the pump body

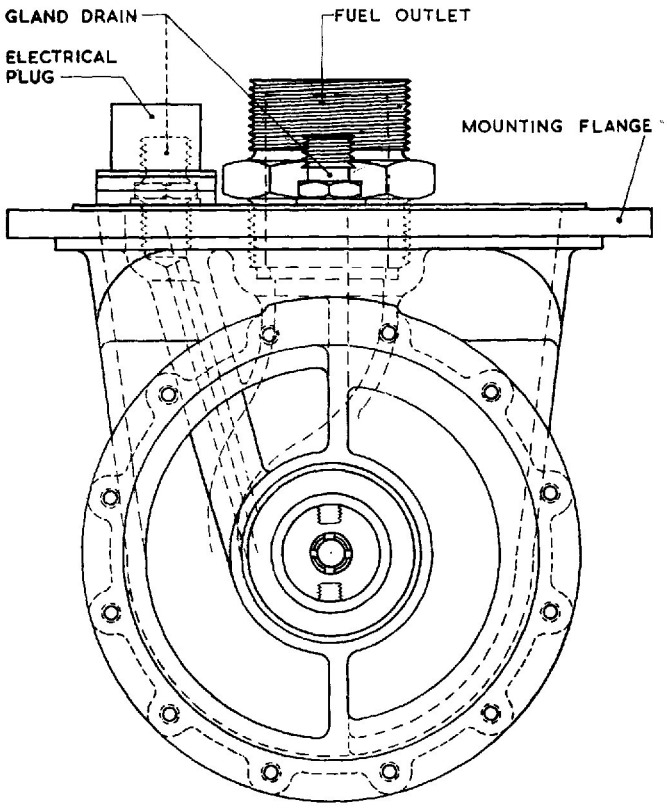

Fig. 2. Plan view of pump, without motor

by screws fitted with lock-washers, and is completely enclosed by the motor cover. This cover is flanged at its lower end, 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, contained within a metal casting of generally cylindrical form, has a large flanged boss on its side. The flat face of the boss is that which is presented to the pump orifice in the side of the fuel tank. This face is fitted with the electrical supply plug for the motor, the delivery adapter for connection of the aircraft fuel delivery pipe and two gland drain adapters. One of the drain adapters caters for drainage during normal flight and the other for inverted flight drainage.

9. The fuel gland is housed within the vertical central bore of the casting. Its function is to prevent fuel passing from the pump assembly to the motor. The chamber formed at the upper end of the gland is that in which the impeller retaining 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 to prevent the ingress of fuel. The chamber below the fuel gland is the impeller chamber and is dimensioned to provide the necessary clearance for satisfactory operation of the impeller. This chamber communicates direct with the fuel delivery outlet.

By-pass valve

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

Fuel filter

11. The apertures to the impeller chamber and to the by-pass valve on the underside of the pump body are covered by a domed gauze filter. This prevents any foreign matter which may be in the tank being drawn into the interior of the pump assembly when the pump is in operation.

Gland drainage

12. The aperture or chamber in which the impeller nut is accommodated is provided with two drain passages (*fig.* 2) to permit any fuel which may seep through the fuel gland to drain away. One of these drain passages slopes upwards and the other slopes downwards towards the lower end of the pump. This arrangement permits drainage to continue during periods of inverted flight.

Fuel gland

13. The fuel gland in the FB160, Mk. 2 pump is of the metal bellows type. It

consists of a brass cylindrical housing in which is sweated a cylindrical brass bellows, with a bronze sealing ring sweated to the lower end of the bellows.

14. The bronze sealing ring, which maintains the bellows central within its housing, is guided within the housing by four splines on its perimeter engaging with lugs on the inner surface of the housing. The sealing 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.

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.

Operation

16. 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 oulet. 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

17. 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 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.

18. 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.

19. 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 thus 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.

20. 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

21. 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.

22. 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.

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

(1) A steady reading of approximately 9·0 amp. shows that the pump motor is satisfactory.

(2) A reading in excess of 9·5 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 defective, 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

24. 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 6·6 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

25. 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

26. 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. 21 to 24.

(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

27. 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.