Chapter 13

PUMP, FUEL, EP 1, Mk. 3

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Pump, fuel, EP 1, Mk. 3	Stores Ref. 5UE/2428-36, 2559
Nominal voltage	24 volts d.c.
Nominal current	3·5 amp.
Delivery rate	200 gallons per hour
Delivery pressure	10 lb. per sq. in.
Weight	2½ to 4½ lb.

Introduction

1. A general view of an immersed fuel pump, Type EP1, Mk. 3 is given in fig. 1 and a sectional view in fig. 2. It is a centrifugal pump driven by a high speed, compound-wound motor. Both the pump and the motor are enclosed in a tubular casing immersed in the fuel and extending to the bottom of the tank. The upper end of the casing is secured in a gland type flange by means of which the pump is mounted in the top of the tank. The length of the casing is suited to the installation, but small variations may be made by adjustment of the flange. Fuel is drawn through a grid into the eye of an impeller at the bottom of the casing, and is forced by the vanes through the space surrounding the electric motor, to the outlet pipe connection at the head of the pump casing above the tank flange.

2. A two-pole Breeze-type plug-in connector, located opposite the outlet, couples the electrical supply cable to the motor. The motor is sealed against the entry of fuel by a labyrinth type gland. A series of synthetic rubber rings, fitted in annular grooves, seals the fuel ducts at each joint in the casing.

DESCRIPTION

3. The EP1, Mk. 3 pump, described in this chapter, is basically the same as the EP1, Mk. 2, the main difference being in the shape of the impeller and insert. Also, the grid at the bottom of the earlier models is replaced by a strainer with fewer arms. The motor is rated at 24 volts, 3 to 3·5 amp., but it operates at a much lower speed than the earlier models. The overall length of these pumps is from 10 in. upwards to suit the installation requirements, the weight varying between 2½ and 4½ lb.

Centrifugal pump

4. The pump comprises an impeller and a pump body enclosed by a grid which screws on to the lower spigot of the pump body. The upper spigot is a press fit in the tubular outer casing. The pump is positioned at the lower end of the casing, and the body is secured by cheese-headed screws to the lower end of the motor housing. A fuel-tight gland is located between the motor bearing and the impeller, the latter being screwed to the armature shaft.

5. During operation, the impeller, which

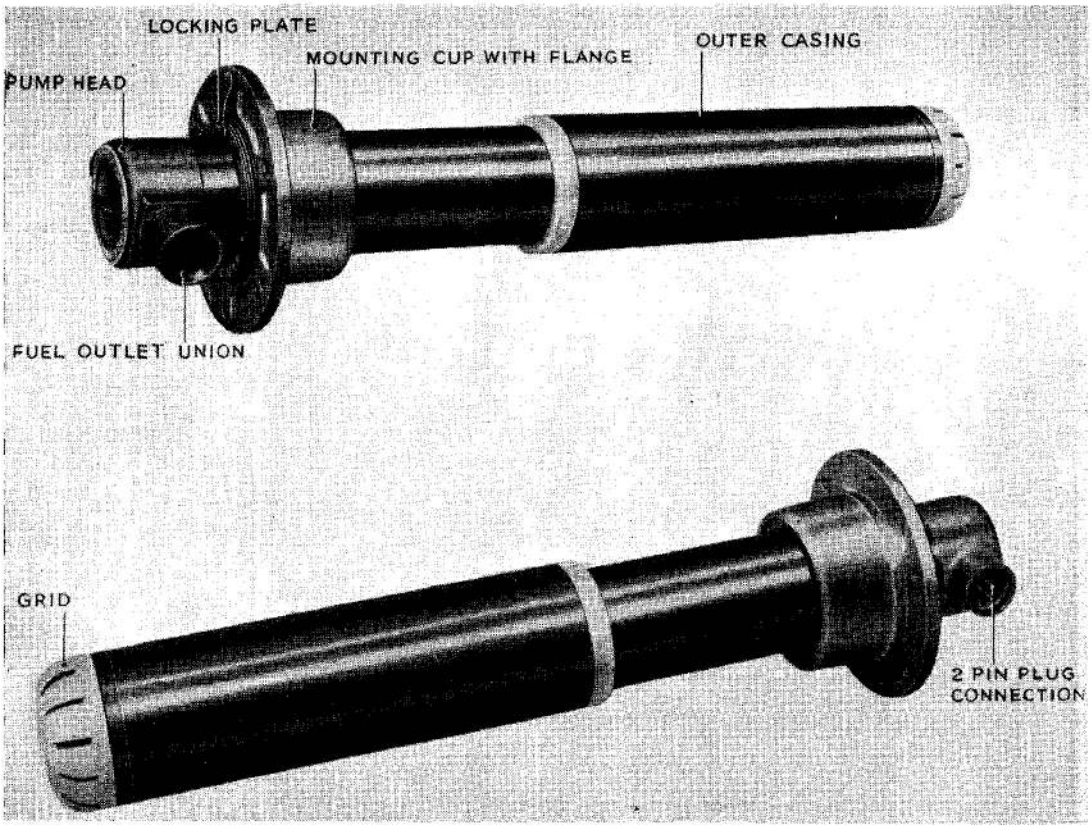

Fig. 1. General views of EP 1, Mk. 3 pump

is submerged, forces the fuel through the channels formed between the two parts of the body, up the outer ducts, and finally to the outlet at the head of the unit.

Electric motor

6. Mounted above the pump casing and grid, the electric pump is encased in a tube providing a passage for the fuel from the pump to the outlet. The motor is a compound-wound, totally enclosed machine, particulars of which are given in para. 3.

7. The field assembly is a shrink fit in the motor housing against a circlip fitted in a groove in the bore of the housing, one end of which is threaded internally for the reception of the lower bearing and gland housing. At the opposite end the housing is threaded externally for the reception of a sleeve enclosing the upper end of the motor and also the electrical contacts. The mating parts are rendered fuel tight by a synthetic rubber ring fitted on the lower bearing and gland housing.

8. The armature is carried in radial type ball-bearings, the lower locating the armature against end movement, and the upper allowing free movement of the armature spindle through the bore of the inner race, thus making allowance for axial expansion of the spindle. Both the bearings are provided with pressed steel cups and are fitted with dust shields. The brush holders are attached to the upper end of the housing by a disc of insulating material. It is recessed to accommodate the upper bearing and secured by screws which pass through the motor housing. Two spring-bladed contacts, also carried by the disc, are arranged one above and on the axis of the armature shaft, and the other mounted eccentrically. The former makes electrical connection with a fixed contact coupled to one of the supply cables, and the other with a contact ring wired to the remaining supply cable.

9. The upper end of the motor housing screws into a sleeve which carries the cable connections and the motor vent to atmosphere. The motor casing, tube and surrounding tube form the fuel duct to the

pump outlet. The terminals are carried in insulating bushes provided with glands, ring-nuts screwing on to the terminals to form a seal. Three discs of insulating material are placed between the contact ring, mentioned in the preceding paragraph, and the end of the sleeve.

Sleeve and pump head

10. As illustrated in the sectional drawing given in fig. 2, the upper end of the sleeve fitting over the motor housing is counterbored for the reception of two tubes, rubber rings forming a seal between the tubes and the sleeves. The other ends of the tubes are pressed on to spigots on the pump head and are similarly sealed. A fuel outlet is connected to the annular space between the tubes, the length of the complete pump being determined by the length of the tubes.

11. Webs extending from the inner centre of the head support a drilled boss, and a sleeve nut, which is a working fit in the boss, screws on to a stud screwed into the upper end of the motor housing sleeve. To enable the sleeve nut to be used for forcing the head of the motor unit apart when dismantling, the nut is slotted at the end, a flat spring washer is placed between its head and the boss, and the shank of the nut is fitted with a circlip. The nut has a limited axial movement in the boss, the pump head being firmly clamped against the ends of the tubes extending from the sleeve counterbores.

12. The centre bore in the pump head is fitted with an insulating bush, while a hollow boss is provided on the side of the head. A hole in the bush aligns with the bore of the boss, which is threaded internally to take a standard plug-in socket. The two-pin plug is held in position by a ring nut, and leads from the inner end of the plug are connected to the terminals on the upper end of the motor casing. The top of the head is fitted with a screw-in type cap secured by a vibration-proof rubber jointing washer. A hole drilled in the centre of the cap registers with the outer end of the vent pipe. The other end of the pipe is connected to the bore of a hollow screw in the upper end of the sleeve above the motor housing.

Mounting

13. The head of the pump is held in a flanged mounting cup which fits into a hole in the top of the tank. Jointing material is fitted between the flange and the tank, and the flange is secured by six nuts. A gland built up of two packing rings with a distance piece between, and dished washers above and below them, is housed in the flange spigot. A ring-type gland nut tightens the packing rings on to a shoulder on the lower end of the spigot, and the gland nut is itself secured by a locking plate held by one of the flanged nuts.

INSTALLATION

14. When removing an old, and re-fitting a new or reconditioned pump, take the six nuts off the flange and take the old pump, complete with mounting flange, from the tank. After removing any adhesive tape covering the apertures of the new pump, the following procedure should be carried out :—

(1) Apply fresh jointing material and insert the pump in the hole in the tank. The gland locking plate should be released and the ring nut slackened off.

(2) Allow the pump to rest lightly on the tank bottom, raise to give $\frac{1}{4}$ in. to $\frac{1}{2}$ in. clearance, and tighten and lock the gland ring, ensuring that the outlet connection is in alignment with the pipe coupling and that the clearance at the tank bottom is maintained.

15. To obviate the removal of the mounting flange an alternative method of replacement may be employed :—

(1) Release the gland locking spring and unscrew the gland ring nut.

(2) Withdraw the pump complete with gland rubbers, distance piece and dished washers. In this manner the necessity for renewing the flange joint is obviated.

16. After the pump has been correctly fitted, the electrical connection should be made and the motor switched on, so that a small quantity of fuel can be delivered into a suitable container before coupling the outlet pipe. This precaution is necessary in order to remove any dirt or foreign matter from the interior of the pump.

SERVICING

Electrical tests

17. Before each flight, at each daily inspection, or as laid down in the Aircraft Maintenance Schedule, an electrical test should be made to ensure that the pump is

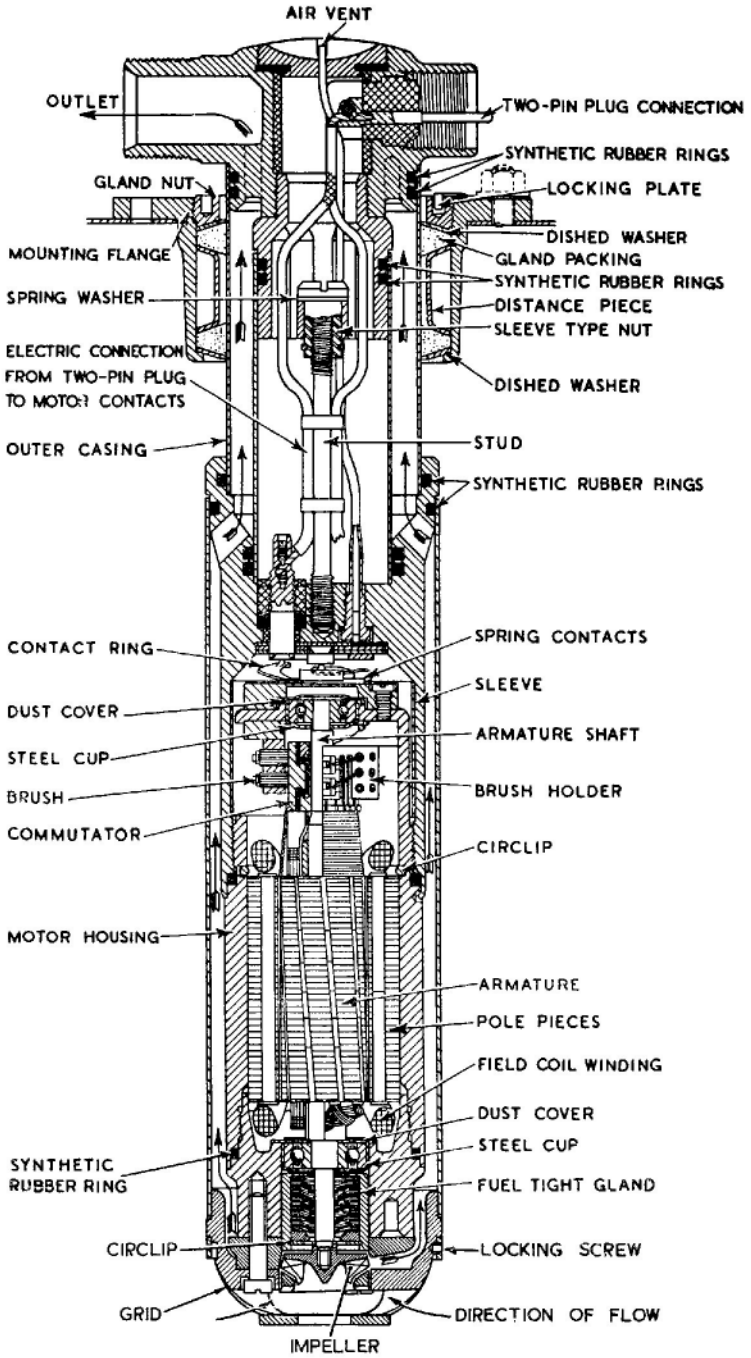

Fig. 2. Sectional view of EP 1, Mk. 3 pump

working correctly. Do not run the pump unless it is immersed in fuel.

18. When testing, the following points should be observed :—

(1) Close all fuel cocks between the immersed pumps and the engine, so that no flow takes place.

(2) Remove the two-pin plug, Type F, from the ammeter test socket and plug in a portable ammeter (Stores Ref. 5Q/2477).

(3) Switch the immersed pumps on one at a time, observing the current consumption of each over a period of at least half a minute. The ammeter readings may be interpreted as follows :—

(a) A steady reading of not more than 4 amp. for the EP1 (24-volt pump), indicates that the pump motor is working satisfactorily.

(b) A current consumption in excess of these figures indicates that the pump is unserviceable ; the failure is probably caused by the pump seizing owing to bearing trouble.

(c) Fluctuating current consumption (ammeter needle oscillates) indicates that the pump is filled with fuel due to gland failure, and that it is unserviceable.

(d) A zero reading of the ammeter indicates one of the following : blown fuse, defective switch, defective wiring, or complete electrical failure of the pump.

(4) On completion of the test, remove the ammeter and replace the two-pin plug, Type F (Stores Ref. 5CY/596). Failure to replace this plug which has its pins shorted, will render the pump inoperative.

19. The 10-0-10 amp. portable ammeter and the two-pin plug, Type F, can be obtained packed together in a leather case.

20. In the event of results given in para. 18, sub-para. (3), (b), (c) or (d), the pump must be returned to stores as unserviceable and a new or reconditioned one installed in its place.

Inspection

21. Examine the pump periodically at the inspection periods laid down in the Servicing Schedule, and check the following points :—

(1) See that the electrical connections are tight and free from corrosion.

(2) Check the gland nut and six flange nuts for tightness and tighten down if necessary. If the pump has worked loose ensure that it clears the bottom of the tank by the correct amount (*para.* 14).

(3) Test as detailed in para. 18, before each flight or during each daily inspection. If the pump is defective return it to Stores and replace with a new one.

(4) When fitting a replacement pump, ensure that there is $\frac{1}{4}$ in. to $\frac{1}{2}$ in. clearance at the bottom of the tank, and that the grid end, if the pump is a long one, is located in the claw provided in the bottom of the tank.

(5) When the pump is removed from the aircraft the inlet and outlet should be covered with clean rag to prevent the ingress of foreign matter. Do not grip the pump in a vice.

(6) The strainer at the base of the tank in which the pump locates should also be cleaned periodically.

22. After the period laid down in the Servicing Schedule, replace the pump with a new one drawn from Stores. THE PUMP CANNOT BE DISMANTLED SAFELY UNLESS SPECIAL TOOLS ARE USED, and careful adjustment is required before a rebuilt pump is rendered fit for service. For this reason old pumps should always be returned to Stores for reconditioning.

23. Filling the pump casing with oil is not necessary, and the motor may become unserviceable through oil penetration. THIS PRACTICE IS TO BE DISCONTINUED. The new procedure is to be followed and the instruction given on filler caps of early production models should be ignored.

Lubrication

24. The bearings, when assembled, are packed with sufficient grease to last the normal life of the pump, before despatch for reconditioning ; no additional lubrication is therefore required.