Chapter 5

PUMP, FUEL, PUL 202, Mk. 1

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Pump, fuel, PUL 202, Mk. 1	Stores Ref. 5UE/6230
Delivery rate	200 gallons per hour
Delivery pressure	11 lb. per sq. in.
Nominal load	7 amp.
Nominal voltage	26 volts d.c.
Weight	9·25 lb.
Breeze plug (2-7 amp. pins)	Stores Ref. 5X/6720
Fuel used	100/130 Oct. Aviation Gasolene

Introduction

1. The PUL 202, Mk. 1 fuel pump is a hanging, side mounting type, booster pump, designed to meet aircraft installation requirements, where the fuel tank depth is restricted within thin wing sections.

2. The pump is designed for fitting to the interior of aircraft fuel tanks, and, being secured to a suitably reinforced, flanged hole, provided in the side of the tank.

3. The whole of the pump is immersed in the fuel, except the fittings on the pump side flange face, which are to atmosphere.

4. The pump is electrically driven, and self-contained, operating at 26 volts d.c., and is designed to maintain the fuel supply to the engine driven pump, under all conditions of fuel temperature, rate of climb, altitude, etc., which can be experienced in flight.

DESCRIPTION

5. A sectional view of the pump is shown (*fig.* 1), and consists mainly of a driving motor, supported in the upper end of the pump body. The motor is protected from the ingress of fuel by a liquid-tight cooling jacket, and top cover, which surrounds it; this cooling jacket which is corrugated, is immersed in fuel. The fuel provides the cooling agent, and the corrugations of the cooling jacket assist in dissipating the heat generated by the motor.

6. The cooling jacket, with cover, is secured by twelve 2 B.A. ch/hd. bolts, which pass through them, and screw into suitable tapped holes in the pump casting. Two $\frac{1}{4}$ in. B.S.F., diametrically opposite, tapped holes, in the pump side flange face, assist in breaking the joint, when it is necessary to remove the pump from the tank. Twelve $\frac{7}{32}$ in. clearance holes, equally

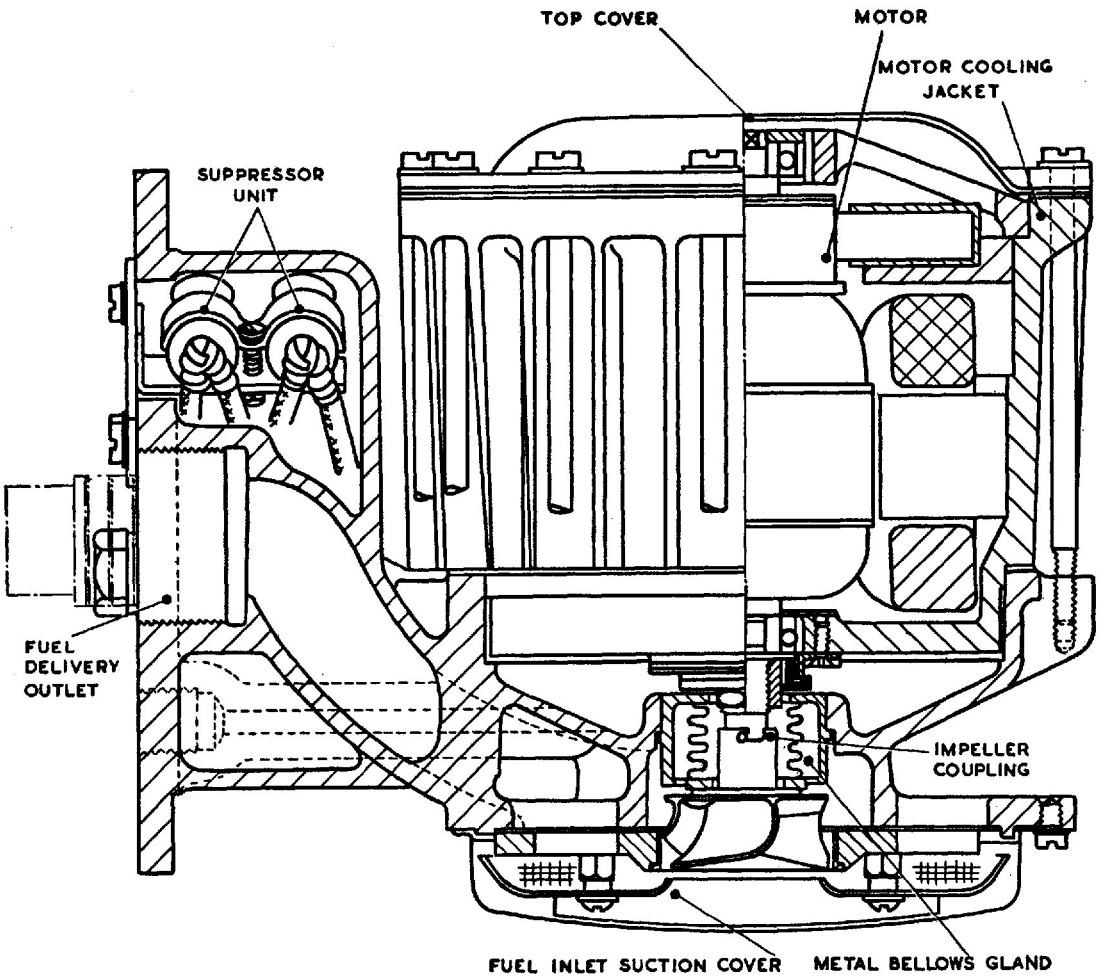

Fig. 1. Sectional view of pump

spaced around the pump side flange, permit the pump to be bolted to the wall of the fuel tank. The motor is also protected from below the lower bearing by a metal bellows fuel sealing gland.

7. The driving shaft extends downwards through the fuel sealing gland, and is coupled to the impeller by a bayonet-joint connection (*para.* 13). The impeller is positioned within a volute chamber, formed by the design of the pump casting. A suction cover is fitted below the impeller, and a gauze filter, to prevent the ingress of foreign matter from the tank to the interior of the pump.

Motor

8. The motor is a two-pole, compound wound, flame-proof machine, its temperature rise being restricted by being immersed within its cooling jacket in the fuel of the tank. The motor is fitted with a high speed armature, the shaft of which, rotates in ball bearings, lubricated with high melting, low freezing point grease. The driving shaft extends down through the pump body, and is coupled to the impeller.

9. The commutator-end frame houses the upper bearing, and brush gear, access to the brushes being provided, on removal of the top cover. The drive-end bearing is supported by the cooling jacket ; a machined recess being provided in its lower centre, for housing the bearing, together with its inner and outer bearing caps. A felt washer fitted below the outer bearing cap, ensuring a fuel tight joint.

Pump body assembly

10. The pump body is designed to hold the bellows fuel sealing gland, through which the motor armature shaft extends,

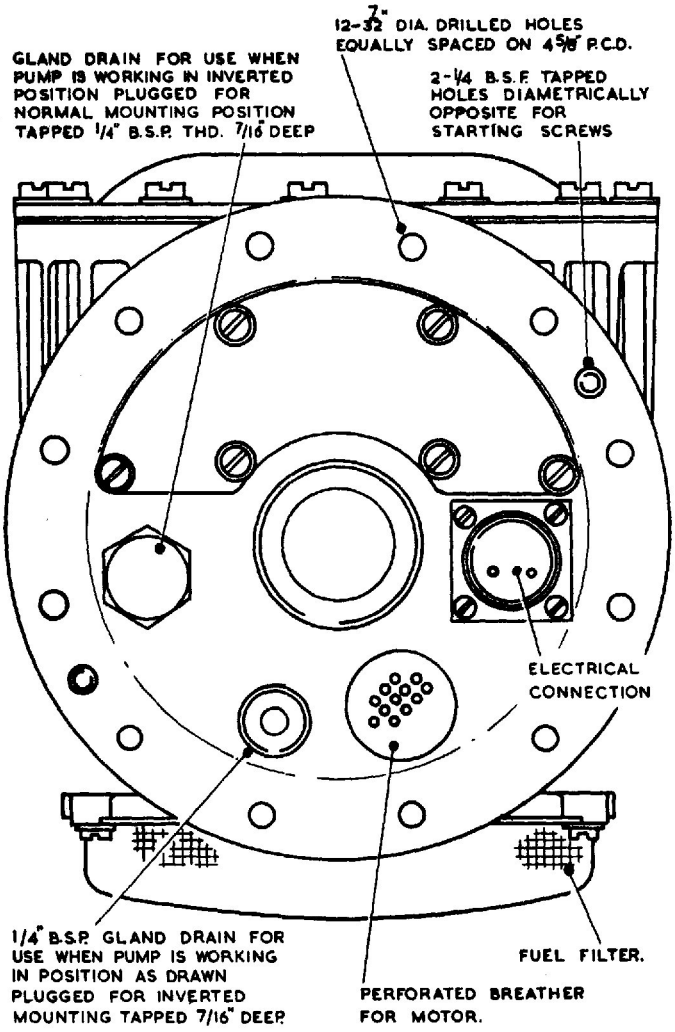

Fig. 2. End view of pump

and is coupled to the impeller. Passages are cored out in the casting to provide ducts for the gland drains, motor ventilation, and fuel delivery.

11. Fitted to atmosphere in the pump side flange face are the 1 in. B.S.P. fuel delivery centre connection, the machined boss, which carries the two-pin Breeze plug for electrical supply to the motor, the ventilation duct for the motor, and the two B.S.P. gland drains. The gland drains take away any fuel which seeps past the bellows gland. When the pump is operating, only one gland drain is required, either for normal, or inverted mounting, the outlet not in use being provided with a blanking plug.

Metallic bellows gland

12. This fuel sealing gland is located around the armature shaft, directly above the impeller, and is fitted to prevent fuel seeping through to the motor lower bearing. The gland comprises a brass backplate, to which is sweated a brass bellows, with a bronze seal ring to the other end. The seal ring is guided by four splines, cut around its outer circumference, and engaging with lugs projecting from the backplate. These parts form a gland unit, which is pressed into the pump casing. The stationary bronze seal ring runs on a rotating carbon ring, shrunk permanently into the back of the impeller.

Impeller

13. The impeller is of the single entry end-suction type, and is designed for operation at high altitudes; particular care has been exercised during manufacture in smoothing the fuel suction passages, to ensure the minimum disturbance of the fuel when passing through the pump. A vapour deflector is fitted inside the suction cover, adjacent to the base of the impeller. To connect the impeller to the motor driving shaft, push the base of the shaft into the impeller hub, then feel for the pin in the bayonet slots, press home and turn the impeller hub to the right, release the impeller, when it should be held in position by the gland pressure. The motor cover may be removed to hold the motor shaft, by means of the flats at the upper end, whilst fixing the impeller. Two locating screws are provided to hold the motor and pump together, when the screws holding the motor cover are removed. The apertures to the impeller chamber on the underside of the pump are covered by a domed filter.

Note . . .

When replacing the motor cover, ensure that the

joint between cover and cooling jacket is perfectly fuel tight.

Suppressor unit

14. The suppressor unit comprises two 0·75 micro-farad capacitors, which are fitted into a recess formed by the design of the pump casting, and are included in the motor circuit for radio noise suppression.

Filter

15. A suction strainer, or, domed fuel filter, is fitted at the fuel inlet to the impeller, at the base of the pump, to prevent foreign matter being drawn from the tank into the pump.

OPERATION

16. The impeller, driven by the motor, accepts fuel from the tank, and as the pressure builds up to its performance value, forces fuel through the delivery outlet, and thence to the fuel line.

17. Under conditions when the pump is supplying fuel in excess of engine requirements, the impeller continues to rotate, but the pressure is maintained within predetermined limits.

18. The type of impeller used in the pump, ensures maximum performance, under conditions of sudden, and rapid de-aeration, due to high rates of climb, or other manoeuvres. It also assists in quick recovery from vapour locking, caused by the temporary removal of fuel from the vicinity of the impeller.

INSTALLATION

19. When fitting a new pump, ensure that the fuel tank has been emptied, before removing the old pump, by easing off the joint of the fuel delivery pipe.

20. When it is certain that the tank is empty, disconnect the fuel delivery pipe, and the electrical supply from the Breeze plug connection. Next, remove the studs and associated nuts and washers securing the pump to its seating on the side of the fuel tank, and carefully withdraw the pump from the tank. Suitable bolts screwed into the two $\frac{1}{4}$ in. B.S.F., tapped extractor holes provided in the pump flange will assist in this operation.

21. Before installing the new pump, make sure that it is clean externally, and that any adhesive tape, or plugs, serving as protection over the pump apertures have been removed. In addition, ensure that the jointing ring on the mounting flange of the pump is in good condition, if in doubt replace with new. Insert the pump through the reinforced flanged hole in the fuel tank, and tighten up the securing nuts, with their associated washers, to the studs which are provided for securing the pump to the tank.

22. To ensure that the pump is free from foreign matter, prior to finally connecting the fuel supply pipes, the electrical supply cable should be connected to the pump, and the motor switched on. A small quantity of fuel put into the tank will be delivered by the pump, into a suitable receptacle, and in passing through the pump the fuel will carry any impurities with it. When this has been done the pump outlet may be connected with the fuel supply line.

23. When received from Stores the gland drain exit will be fitted with a plug. When the pump has been installed, and tested, this plug should be removed, and a drain pipe fitted. This pipe should be installed in such a manner, that the level of the pipe is at no point higher than the connection, when the aircraft is on the ground, or in level flight. The outlet end of this pipe must be external to the aircraft, and should terminate in a low pressure area. The end of the pipe should be cut at 45 degrees with the chamfer facing aft. Failure to fit this pipe may result in fuel, which may have seeped through the bellows gland, washing away the grease from the motor lower bearing, and may cause possible failure of the bearing.

Note . . .

In all instances where any doubt exists with regard to the method of installing or removing a pump from the aircraft, reference should be made to the appropriate Aircraft Handbook.

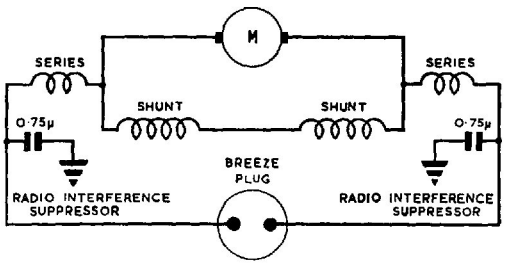

Fig. 3. Circuit diagram

SERVICING

Electrical test

24. A routine electrical test must be made to ascertain that the motor of the fuel pump is operating correctly. ENSURE THAT THE PUMP IS IMMERSED IN FUEL, WHEN THESE TESTS ARE IN PROGRESS.

25. Having ascertained the position of the aircraft fuel pump test socket and switches, by reference to the appropriate Aircraft Handbook, proceed as follows :—

(1) Close all fuel cocks between pumps and engines to ensure 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 half a minute.

During this period the current consumption of the motor should be noted, and the readings, as registered by the ammeter, should be interpreted as follows :—

(a) A steady reading of not more than 7 amp. indicates that the motor is satisfactory.

(b) A reading in excess of the figure given in (1) indicates that the pump motor is faulty.

(c) A fluctuating reading indicates faulty contacts, defective brushes, or faulty commutator.

(d) A zero reading is consistent with either a blown fuse, defective wiring or switch, or complete motor failure.

26. When these tests have been satisfactorily completed, release the test switch, and disconnect the ammeter from the test sockets.

Operational test

27. When the electrical tests have been completed, the pump should be tested to observe the pressure of fuel being delivered. The pressure should be 11 lb. per sq. in. minimum. If this pressure is not obtained, the fault may probably be traced to a damaged impeller, or incorrectly loaded gland bellows.

Routine inspection

28. When examining the pump at the appropriate inspection periods, care must be taken to conform with the following points :—

(1) Examine the fuel outlet pipe coupling, and Breeze plug connection for fuel tightness.

(2) Test the pump as detailed in para. 21 to 24. If the pump is found to be faulty it must be returned to Stores, and a replacement fitted.

(3) The pump is unlikely to be defective if it delivers fuel at a pressure in excess of 10 lb. per sq. in.

29. At the periods laid down in the appropriate Servicing Schedules, all faulty pumps are to be replaced by new, or reconditioned pumps drawn from Stores. Old pumps are to be returned to the Manufacturers for reconditioning.