Chapter 25

PUMP, FUEL, SPE 403, Mk. 1

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Pump, fuel, SPE 403, Mk. 1	Stores Ref. 5UE/6200
Operating voltage	24 volts d.c.
Normal current	10 amp.
Delivery rate	400 gallons per hour
Delivery pressure	10 lb. per sq. in.
Weight	7 lb. approx.

Introduction

1. The SPE 403, Mk. 1 fuel pump is designed for vertical mounting in the base of aircraft fuel tanks, fuel collector box, or sump. The pump is electrically driven, and self contained, operating at 24 volts d.c. and is intended primarily for use as a booster pump, 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. The pump may be used to transfer fuel from an auxiliary to a main supply tank. When in service the body of the pump is inserted through a suitable reinforced hole in the fuel tank, and the unit is secured in position by bolting the flange of the pump base to the bottom of the tank.

DESCRIPTION

2. A sectioned view of the pump is shown (*fig.* 2), and consists mainly of a driving motor, supported in the upper end of the pump body, or portway casting, which in turn is secured to the pump base assembly. Hermeticol or Wellseal jointing compound is used as a seal between the upper face of the pump base, and the portway casting, in addition to the fitted paper washer. Twelve holes, equally spaced around the flange, permit the unit to be bolted to the fuel tank unit, into which the body of the pump extends.

3. The motor casing which is completely immersed in fuel, is hermetically sealed, to prevent the ingress of fuel. The motor armature shaft, or spindle, extends downwards through the portway casting, and fuel sealing gland. The pump impeller, which is secured to the lower end of the pump spindle, is positioned within the volute chamber, formed by the portway and base castings.

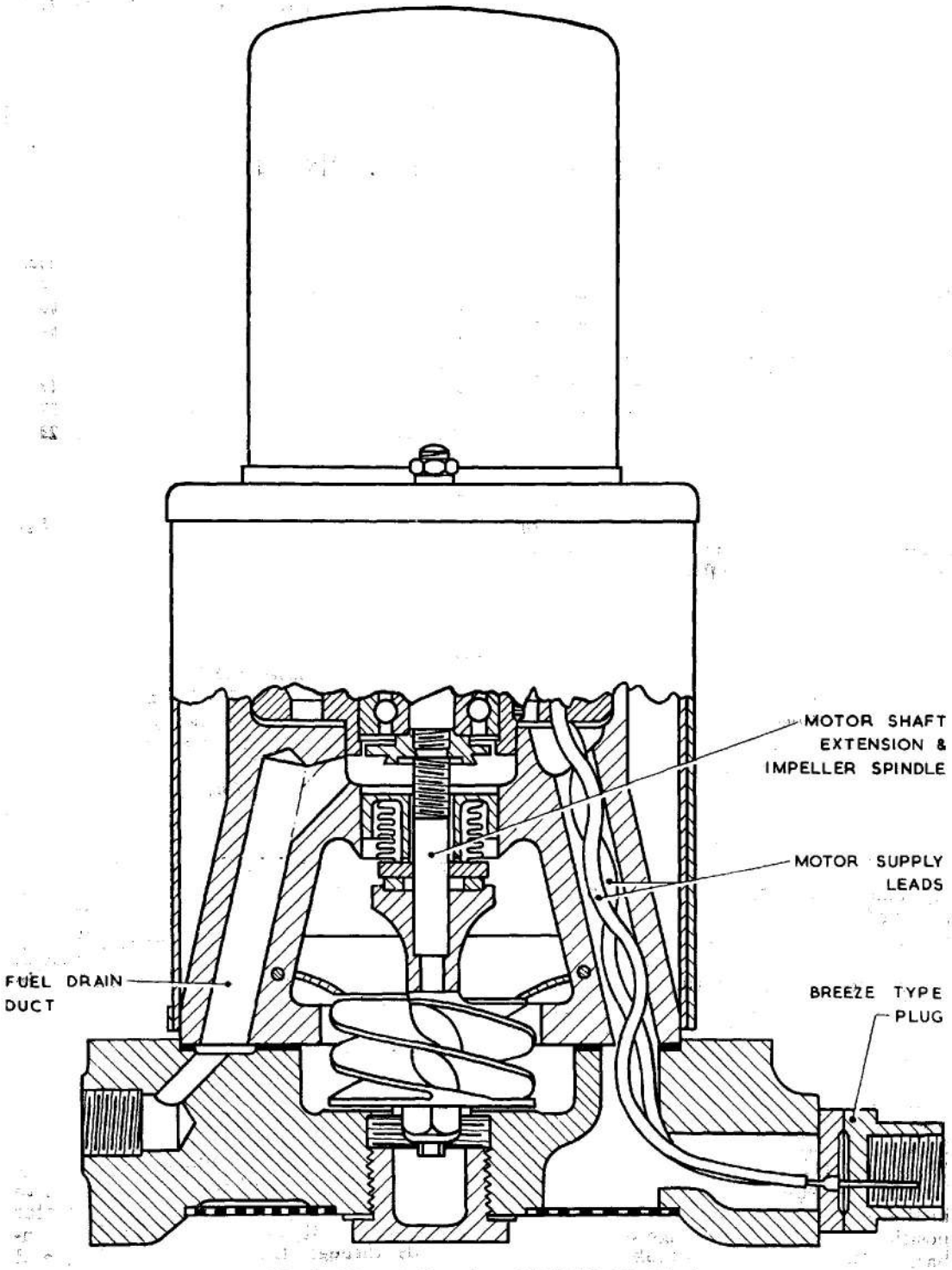

Fig. 1. Part section view of SPE 403, Mk. I fuel pump

Motor

4. The motor (*fig.* 2) is a totally enclosed, compound wound, two pole machine, with a speed of 7,500 ± 50 r.p.m. The motor armature rotates in ball bearings, the upper bearing being secured to the shaft by a pinnacle nut, whilst the lower bearing is secured to the shaft by a special shaped nut

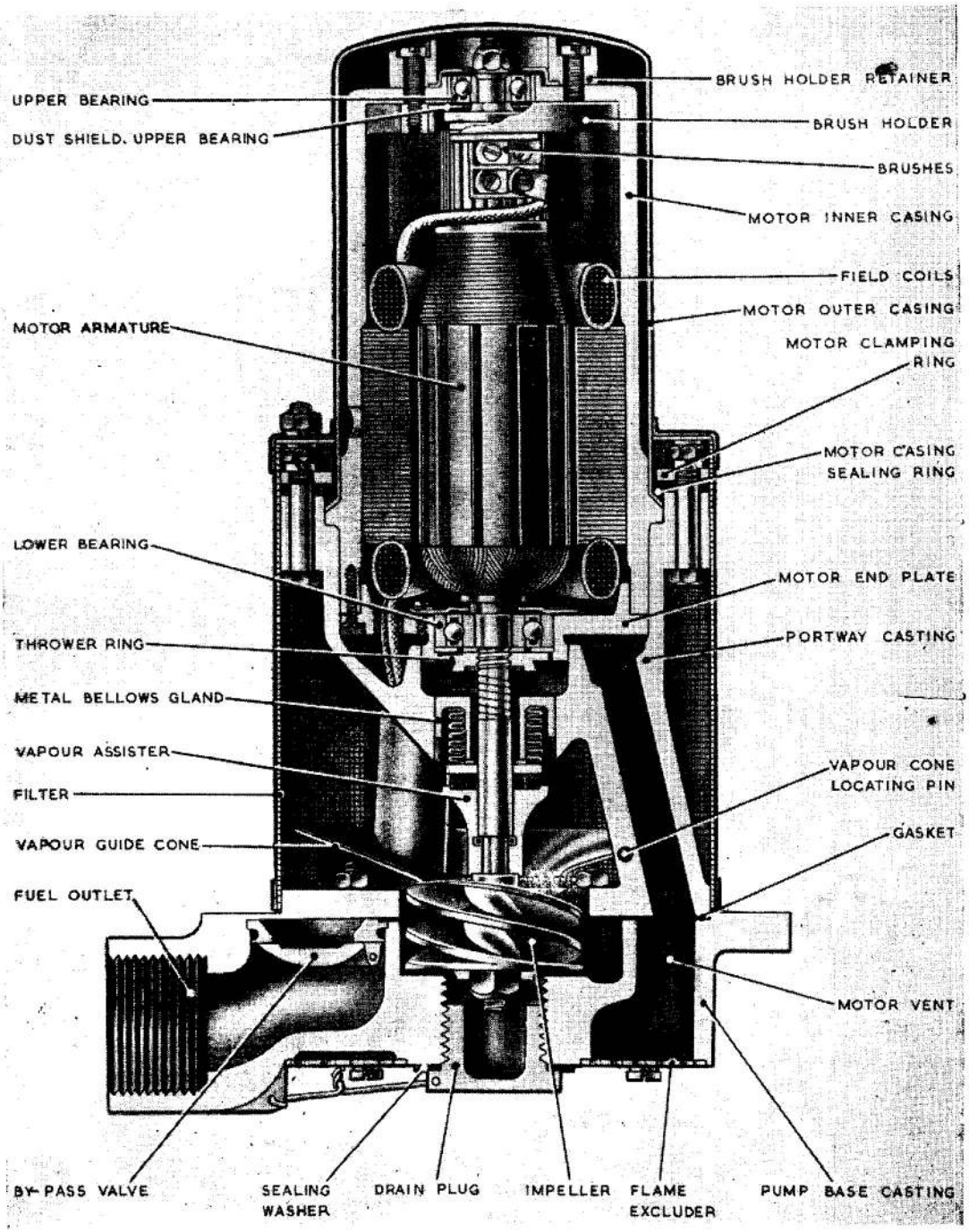

Fig. 2. Sectional view SPE 403, Mk. I fuel pump

which act also as a thrower ring. The upper bearing is housed in the motor inner casing, between the brush-box retainer and the brush box, whilst the lower bearing is housed in the motor casing base plate. The base plate is flanged to permit the accurate location in the end of the motor casing, and is provided with three elongated holes. Two of these holes provide ventilation for the motor, and the third hole serves as an entry for the electrical wiring to the motor.

Portway casting assembly

5. The portway casting, or pump body, upon which the motor is mounted, comprises two circular ends separated by three cored out pillars. One of these pillars serves as an electrical cable conduit for the motor input leads (*fig.* 1). The second pillar acts as a drain duct, from the space between the lower motor bearing, and the upper surface of the bellows gland. The third pillar allows air to pass to the motor breather holes in the motor base plate. The upper end of the casting is machined to receive the motor, and also houses the metal bellows fuel sealing gland. When the pump is assembled, a flared cone, known as the vapour assister, is fitted on the motor shaft extension, immediately below the bellows gland. A three section vapour guide cone, located around the mouth of the impeller chamber, serves to carry away accumulations of fuel vapour and air, developed during high rates of climb to altitude.

Impeller

6. The impeller is a twin-bladed spiral fan, fitted adjacent to the vapour assister on the motor spindle. It is secured to the spindle by a hexagon nut.

Pump base assembly

7. The pump base is a casting in which is formed a volute chamber leading to the fuel pump outlet. A machined boss, adjacent to the outlet provides a seating for a two-pole Breeze type plug which is the electrical connection for the input leads to the motor (*fig.* 1). At the other side of the pump outlet is a $\frac{1}{4}$ in. B.S.F. tapped hole which is the exit from the gland drain duct.

8. A by-pass valve is incorporated in the pump base assembly. The valve is hinged to an annular seat let into the pump base just above the fuel outlet, and is clamped in position when the portway casting is secured to the base. During the operation of the pump, the pressure of fuel passing through the pump outlet, prevents the valve from opening. A screwed plug, located centrally in the pump base, allows drainage of water from the fuel tank without having to remove the pump. A large perforated washer fitted on the lower end of the pump base assembly, prevents fire from entering the pump.

Filter

9. A cylindrical wire gauge filter completely encloses the portway casting, and prevents the ingress of foreign matter to the interior of the pump. The filter is fitted to the pump body by utilising two of the extended bolts which are used to secure the motor joint clamping ring, and is held in position by two 2 B.A. nuts.

Operation

10. The impeller, driven at constant speed, draws fuel from the tank, and forces it, via the spiral volute in the base casting, to the pump outlet and thence to the fuel line.

11. 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.

12. When the pump is idle the pressure on the underside of the by-pass valve is relieved, and therefore opens to allow fuel to pass from the tank through the sump, when the engine driven pump is drawing fuel from the tank.

13. The type of impeller used in the pump ensures maximum performance of the pump 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

14. Before removing the old pump, ensure that the fuel tank has been emptied by easing off the joint of the fuel delivery pipe. If there is any fuel left in the tank, it will have a free passage through the by-pass valve, which will be open when the pump is idle.

15. When it is certain that the tank is

empty, disconnect the fuel delivery pipe, and the electrical supply cable from the breeze plug. Next remove the nuts securing the pump to its seating on 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 in the pump base, will assist in this operation.

16. Before fitting 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. Insert the pump through the hole in the fuel tank, and tighten up the securing nuts around the pump mounting flange.

17. 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 then 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.

18. 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 at no point is 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.

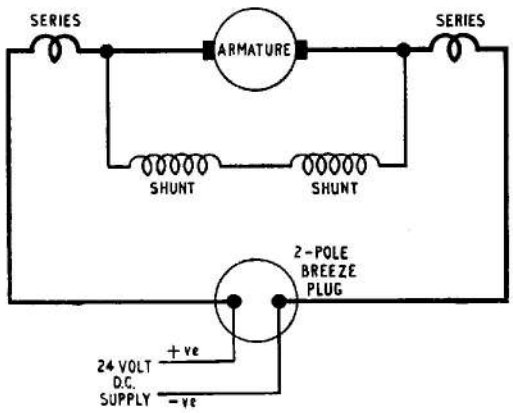

Fig. 3. Wiring diagram

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.

SERVICING

Electrical test

19. 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.

20. 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 reasings, as registered by the ammeter, should be interpreted as follows :—

(a) A steady reading of not more than 10·5 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.

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

Operational test

22. When the electrical tests have been completed, the pump should be tested to observe the pressure of fuel being delivered. The pressure should be 10 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

23. When examining the pump at the appropriate inspection periods care should be taken to conform with the following points :—

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

(2) Test the pump as detailed in (para. 20 to 22). If the pump is found to be faulty it must be returned to stores, and a replacement fitted.

(3) Ensure that the by-pass valve is functioning correctly. To do this turn on the tank selector cock, and the appropriate engine master cock ; then switch on the pump and observe the fuel pressure, as indicated by the fuel pressure gauge, or fuel pressure warning light. Very low pressure, or failure to extinguish the warning light, indicates that the by-pass valve is not operating correctly. In certain installations the fuel pressure warning light is set to operate at a pressure higher than that which the pump can deliver. Therefore observe the light setting before rejecting a suspected pump. The pump is unlikely to be defective if it delivers fuel at a pressure in excess of 10 lb. per sq. in.

Note . . .

It is essential that the idle cut-off control should be in the cut-off position throughout this test, when it is applied to installations where the engines are fitted with Bendix, or other type injection carburettors.

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