# Chapter 1

# PUMP, FUEL, SPE 804, Mk. 2

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## LIST OF ILLUSTRATIONS



## LEADING PARTICULARS

| | |
|---|---|
| Delivery rate | 800 gall. per hr. |
| Pressure | 11 lb. per sq. in. |
| Operating voltage | 112V d.c. |
| Normal current | 2·5 amp. |
| Weight | 16 lb. 8 oz. |
| Radio noise suppression capacitors | 0·5μF (2 off) |

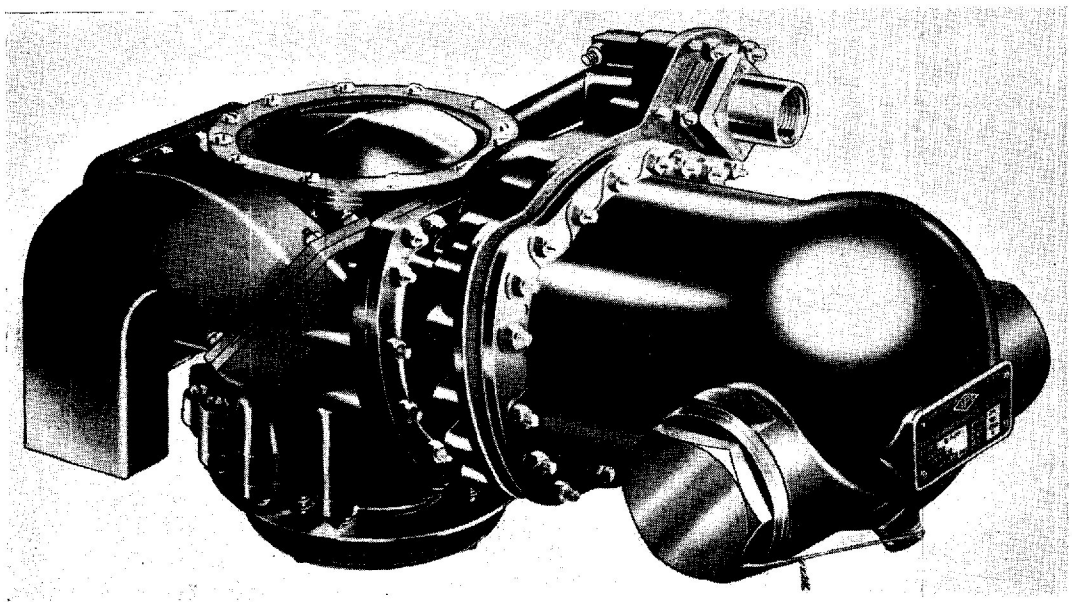

**Fig. 1. General view of SPE 804 pump**

### Introduction

**1.** The SPE 804 fuel booster pump is designed to meet aircraft installation requirements where the fuel tank depth is restricted within thin wing sections.

## DESCRIPTION

**2.** The SPE 804 pump is a side mounting unit consisting, in the main, of an electric motor, operating through a reduction bevel gear (*fig.* 2) to drive the pump impeller. The axis of the motor is at a right-angle with relation to the axis of the impeller shaft. A by-pass valve (*para.* 7) is fitted to allow fuel to be drawn through by the engine driven pumps when the SPE 804 is not operating. A feature of this unit is the provision of a cooling jacket, through which the fuel flow passes to cool the pump motor.

### Driving motor

**3.** The 112-volt d.c. motor is a totally enclosed, compound-wound, two-pole machine, which is fitted with two 0·5$\mu$F capacitors for radio noise suppression. Under normal conditions the motor speed is 9,750 r.p.m. with a current consumption of 2·5 amp.

**4.** The armature spindle is supported in shielded bearings with a self-locking nut at the commutator end to secure it in position. The drive end of the shaft is fitted with a suitable bevel gear to engage with the bevel gear of the pump spindle to provide a reduction of 2-1. The motor unit is totally enclosed in a thin metal casing which is clamped so that it protrudes horizontally from the pump body. An outer casing in the form of a bulbous casting is assembled over the inner casing, with two alternative delivery pump connections horizontally opposed at its end. Between the two outlets, at the bottom of the outer casing, is a $\frac{1}{8}$ inch B.S.P. water drain plug. Fuel passing through the space between the inner and outer casings serves to cool the motor.

### Pump body

**5.** The main casting or pump body carries a vertical pump spindle, which is supported by a plain carbon bearing at the bottom and by a shielded ball-bearing at the top. The larger bevel gear (*para.* 4) is keyed at the top of the impeller spindle and secured with a self-locking nut. The central bore of the casting contains a bush in which are the metal bellows gland and the carbon bearing housing. The bush assembly may be removed complete and is retained in position by a series of screws. In a recess at the side of the pump body are two 0·5$\mu$F and two 1,500pF capacitors for radio noise suppression. An inspection cover at this location provides access to the electrical connections. Another inspection cover, situated on top of the casting, provides access to the gear components.

### Impeller

**6.** Below the carbon bearing (*para.* 5) is a spiral volute formed between two flat castings which are bolted together and secured to the base of the main casting on the lower end of the pump spindle. In the volute chamber is the combined helico-centrifugal impeller. The latter consists of a triple-bladed helix surmounted by a 5-vaned centrifuge and is secured on the spindle with a self-locking nut.

### By-pass valve

**7.** The by-pass valve consists of a seating ring to which is hinged a flap valve. The valve assembly is built into the pump base adjacent to the delivery outlet. When the pump is in operation, the flap is kept closed by the pressure of fuel in the delivery outlet, and opens by gravity when the pump is idle.

### Filter

**8.** In order to prevent the entry of foreign matter to the pump, a wire gauze filter surrounds the fuel intake below the impeller and is maintained on springs as a precaution against damage in handling. A thin metal flange or lip surrounds the top of the filter, this forming a trap for any foreign matter which may be drawn towards it from the tank floor and at the same time aiding the separation of air bubbles from the main fuel stream.

### Function

**9.** Fuel from the tank enters the pump through the gauze filter where the impeller helix, driven by the motor armature through right-angle gearing, draws the fuel stream into the centrifuge at the lower end of the impeller. From thence it is forced into the spiral volute and, via the pump outlet, to the fuel line.

**10.** 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.

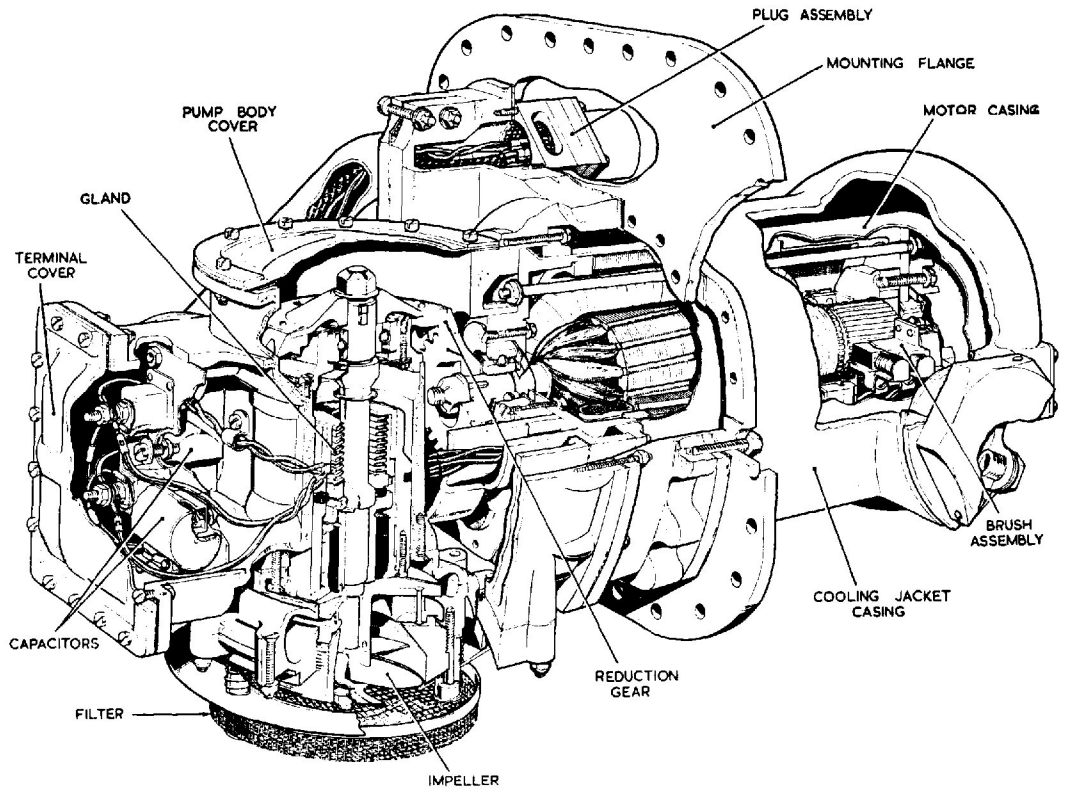


**Fig. 2. Sectional view**

**11.** When the pump is idle, the pressure on the under-side of the by-pass valve flap is relieved. As a result, the valve opens to allow fuel to pass from the tank directly into the outlet duct, drawn by the action of the engine-driven pump.

**12.** Under conditions of sudden de-aeration, due to high rates of climb and other manoeuvres, a temporary removal of fuel from the vicinity of the impeller is quickly overcome by the action of the centrifuge.

## INSTALLATION

**13.** Whenever it is necessary to fit a new pump, it is important to ensure that the tank has been emptied of fuel and that the electrical circuit has been rendered dead. Removal of the drain plug in the fuel tank will empty the tank and only a small quantity of fuel will remain inside the fuel jacket casing of the motor. The fuel jacket can be emptied after the pump has been removed from the tank.

**14.** Having ensured that the fuel tank is emptied, disconnect the fuel delivery pipe, the gland drain pipe and the electrical supply cable from the breeze plug.

**15.** Remove the securing nuts from the studs protruding through the pump flange and, taking care to support the weight of the pump during this operation, carefully remove the pump through the tank aperture.

**16.** Examine the new pump to be fitted and make sure that it is clean externally. Remove all transit covers and any protective material which may be present when received from Stores, and insert the pump carefully through the aperture in the fuel tank, locking the maintaining studs through the holes in the flange. Screw on and tighten the securing nuts equally all round. After attaching the delivery pipe, gland drain pipe and electrical connection, make sure that all unions, union nuts, etc. are locked, employing wire-locking where appropriate.

**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 relevant Aircraft Handbook.*

## SERVICING

### Electrical test

**17.** A periodic electrical check, in accordance with the appropriate Servicing Schedule, should be made to ascertain that the pump motor is functioning satisfactorily. The pump must be renewed if there is any indication of erratic performance, such as excessive current consumption or low insulation resistance. These tests are to be made only with the motor under load. It is therefore ESSENTIAL THAT THE PUMP IS IMMERSED IN FUEL.

**18.** Before applying the electrical test, ascertain the position of the aircraft pump test socket and switches by reference to the appropriate Aircraft Handbook. When this has been done 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 test socket on the test panel.

(3) Switch on the pump by depressing the test push-switch on the test panel and note the reading of the ammeter for a period of not less than half a minute.

**19.** The interpretation of the readings obtained in the test detailed in the previous paragraph is as follows :—

(1) A steady reading not exceeding 3·25 amp. indicates that the motor is satisfactory.

(2) A reading in excess of 3·25 amp. indicates a faulty motor or a rise in torque loading due to obstruction of the moving parts from the fuel flow.

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

(4) A zero reading indicates an open circuit and is consistent with a blown fuse, defective switch, faulty wiring or, in extreme cases, complete motor failure.

**20.** When these tests have been completed, release the test push-switch on the test panel and disconnect the ammeter from the test socket.

### Functional test

**21.** Subject to the electrical tests being satisfactory, the pump should be tested for pressure and rate of fuel delivery. The pressure at 13·3 gallons per minute should be 11 lb. per sq. in. Failure to obtain this pressure and rate of delivery can be caused by a faulty motor, a damaged impeller or an incorrect loading on the bellows gland, and measures should be taken to ensure the cause of failure.

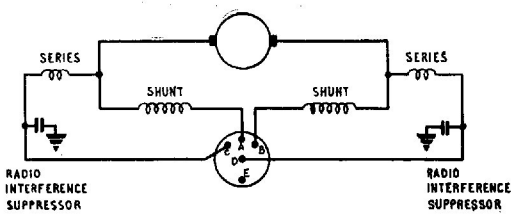


**Fig. 3. Wiring diagram**

### Routine inspection

**22.** When making routine inspections, care should be taken to conform with the following points :—

(1) Check all pipe connection joints of the pump and tighten them if necessary ; also examine the joint between the pump and fuel tank for leakage, correcting the fault if necessary.

(2) Test the pump as detailed in para. 18 to 21. If the pump is found to be defective, it must be renewed.

(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 aircraft 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 functioning efficiently. In certain installations, the fuel pressure warning light may be set to operate at a pressure higher than that at which the pump is rated. The light setting for the particular installations should therefore be checked before rejecting the suspected pump.

**23.** At the period laid down in the appropriate Servicing Schedules, all pumps are to be replaced by new or reconditioned pumps drawn from Stores. When this is done, the procedure will, in general, be as described in para. 13 to 16. Old or faulty pumps MUST be returned to a Repair Depot or to the manufacturers for reconditioning.