Chapter 11

PUMPS, FUEL PAC. 100 SERIES

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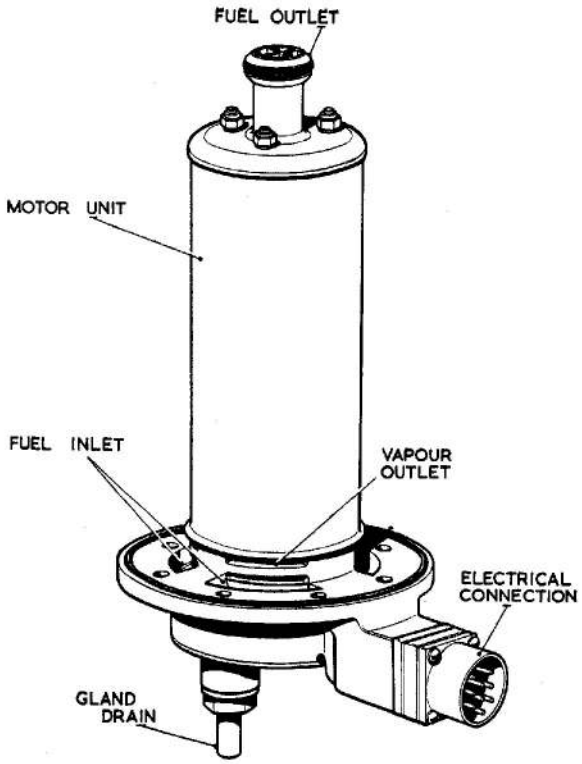

Fig. 1. General view of Type PAC. 100 fuel pump

Introduction

1. Type PAC. 100 fuel booster or transfer pumps are designed to supply fuel under pressure to the aircraft fuel supply line at all conditions of fuel de-aeration, high altitude vapour formation and extremes of temperature.

2. The pump is a bottom mounted unit with the fuel delivery carried over the outside of the motor unit within a casing to an O-ring connector arranged inside the aircraft tank. This arrangement provides fuel cooling of the motor unit. Electrical and gland drain connections are made to the pump base which is outside the tank.

3. Differences between the various marks of Type PAC. 100 fuel pumps are detailed in the appendix to this chapter.

DESCRIPTION

General

4. General and sectional arrangements of a typical pump are illustrated in Fig. 1 and 2. The unit comprises mainly an a.c. motor unit with extended rotor shaft driving a centrifugal high-altitude type impeller. The motor unit is enclosed in a casing and the fuel is pumped between the casing and motor unit to a connection at the top of the unit. A vapour clearing baffle fitted round the pump inlet directs the fuel and air vapour evolved away from the impeller, the inlet to which is protected by a wire mesh filter.

Motor unit

5. The pump is driven by a motor operating from a 200V, 3-phase, 400 c/s supply. The extended rotor shaft supported at each end by ball bearings, carries the impeller together with a mechanical seal preventing fuel ingress into the motor unit. Rotation is anti-clockwise when viewed from drive end with phases connected in sequence red (A), white (B), blue (C), from left to right. Electrical connection to the motor is by way of a 9-pole Breeze plug and is connected as shown in the circuit diagram (*fig.* 3).

6. A mechanical seal, the rotating carbon member of which is fitted to the upper surface of the impeller, prevents fuel access into the motor unit. Any slight leakage past the seal is drained through pump casing channels to the under surface of the pump base from

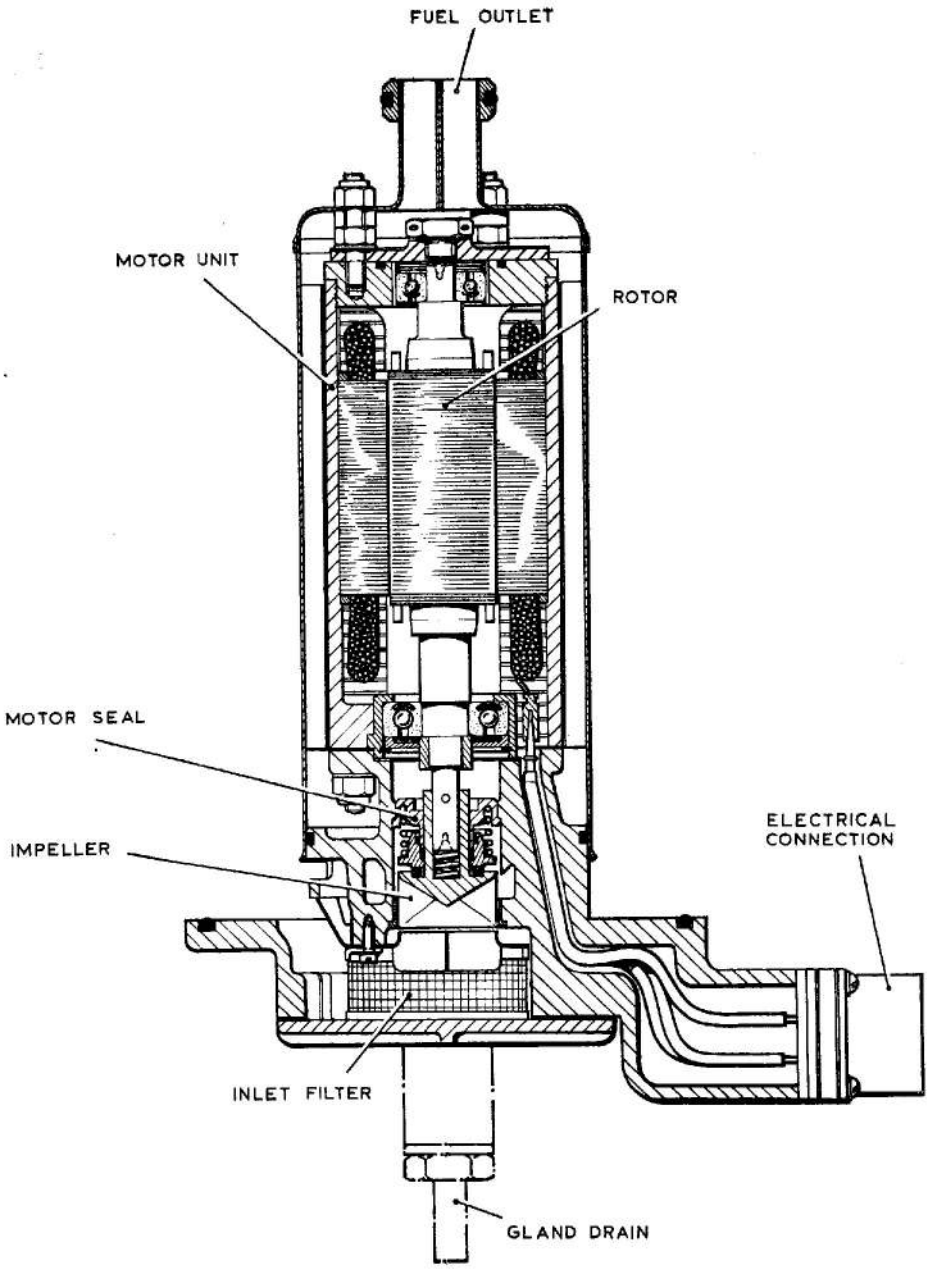

Fig. 2. Sectional view of Type PAC. 100 fuel pump

which a piped connection carries it to atmosphere.

7. The fuel inlet to the impeller is protected by a wire mesh filter and a suction baffle ensures that the fuel and air vapour evolved is directed away from the impeller and has free access back to the tank through ports in the pump casing.

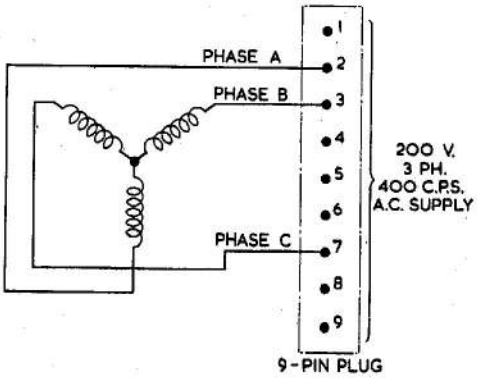

Fig. 3. Circuit diagram

Mounting

8. The pump unit is secured through a base flange to the reinforced stud ring in the base of the fuel tank, a synthetic rubber ring fitted between the pump and tank faces effects a seal when the unit is installed. The outlet connection at the top of the pump engages in a delivery pipe within the fuel tank and here also the seal is effected by an O-ring. The pump base casting provides a mounting boss for the nine-pin electrical connection and also carries the $\frac{1}{4}$ in. bore gland drain tube.

OPERATION

9. Fuel from the tank enters the pump through the wire mesh filter into the eye of an impeller driven by the extended rotor shaft. From here it is forced upwards through a spiral volute via the fuel chamber formed by the motor unit and outer casing, to the fuel outlet union, and finally into the delivery line.

REMOVAL AND INSTALLATION

10. Before attempting to remove the pump ensure that the tank has been drained of fuel and that electrical supply to pump motor unit has been disconnected. The precise method of removing the pump will be found in the appropriate Aircraft Handbook. In general terms it will comprise disconnection of electrical and gland drain connections and separation of the pump from the tank bolt ring. Care should be taken to support the weight of the pump during the latter operation. The fuel delivery connection will be automatically disconnected as the pump is drawn off the bolt ring.

11. Installation of a new pump should be preceded by the following checks:

(1) Ensure that the pump has not been stored longer than the specified maximum period (i.e. 12 months in original packing and carton as supplied by manufacturer or 3 years where special packing has been provided).

(2) Inspect the exterior of the pump for evidence of damage. Parts most susceptible to damage are the electrical connection and gland drain tube. Check for any signs of corrosion. Blend out slight areas of corrosion and apply a protective finish (e.g. chomic acid solution) to the unprotected area.

(3) Ensure that the pump is scrupulously clean externally.

(4) Remove any transit plugs, caps or other protective material from the delivery outlet, the electrical connection and the gland drain tube.

(5) It is advisable to make a starting check on the pump before installation. To do this the carbon shaft bearing should be first lubricated by inverting the pump and partially immersing it in fuel. Take care that no fuel enters the gland drain or contaminates the electrical connection. Apply a 200V, 400 c/s supply through the Breeze plug using the approved mating socket for pump plug. The pump should start immediately. Switch off the supply and repeat the test several times. If the pump fails to start immediately it should be returned to base for further serviceability testing using approved equipment.

Note . . .

The above pre-installation instructions apply to all aircraft installations of these pumps. For detailed procedure covering installation in a particular aircraft reference should be made to the appropriate Aircraft Handbook.

12. As a general example installation in the aircraft will comprise the following operations:—

(1) Ensure that the joint ring in the flange groove of the base is secure at all

positions, and that it is clean and undamaged. This ring is fixed in position with rubber cement.

(2) Check that the joint ring is in position at the delivery outlet. Line up the pump over the tank bolt ring and take care to ensure that the delivery outlet connects with the delivery pipe in the tank as the pump is pressed into position. Connect the electrical supply socket and the gland drain connection after the pump is installed. Note that any pipe connection from the gland drain tube on the pump must face towards the rear of aircraft to prevent possible pressurisation in flight.

(3) Wire lock all the external connections to the pump assembly.

SERVICING

Routine inspection

13. At routine inspections care should be taken to conform to the following procedure:—

(1) Inspect all pipe connections and wire locking to the pump. Correct as necessary. If the pump is found to be defective in any way a new one must be fitted. No in situ maintenance is possible.

14. At the periods laid down in the appropriate servicing schedules, all pumps are to be replaced by new or reconditioned pumps drawn from Stores. Faulty or life expired pumps must be returned to a maintenance unit or the manufacturer for repair.

Operational test

15. In accordance with the appropriate handbook the pump should be tested for proof of performance, and checked against the figures given under Leading Particulars. Failure to obtain the quoted pressures and rate of fuel delivery could be caused by a faulty motor unit, damaged impeller or an incorrect loading of the pump unit gland. The pump should be removed to ascertain the cause of failure.

Gland leakage

16. During the above tests examination should be made of the gland drain exit for fuel leakage. Leakage must not exceed two drops per minute while the pump is running or 1 drop per minute while stationary. Any leakage in excess of these figures will necessitate removal of the pump.

Insulation resistance test

17. Using a 500V insulation resistance tester, measure the insulation resistance of the pump between live parts and the frame. The insulation resistance tester used for this check should be fitted with an electrical socket to suit the pump Breeze plug. When a new pump is installed the insulation resistance should not be less than 2 megohms. After installation for operational service, due to the humidity prevalent in aircraft at dispersal points, the minimum insulation resistance permissible is 50,000 ohms.

Appendix 1

PUMPS, FUEL, PAC. 100 Mk. 1, 2 and 3

LEADING PARTICULARS

Pump, fuel, Type PAC. 100 Mk. 1 .... **Ref. No. 5UE/6352**
Pump, fuel, Type PAC. 100 Mk. 2 .... **Ref. No. 5UE/**
Pump, fuel, Type PAC. 100 Mk. 3 .... **Ref. No. 5UE/6850**

Operating voltage	200 *V*, 3-*phase a.c.*
Frequency	400 *c/s*
Motor unit	*Fuel cooled English Electric Type AE*.1159 *Mk.* 1
Rated output	100 *g.p.h.*
Fuel delivery pressure at operating voltage	12-14 *lb/in*^{2}
Maximum power input....	118 *W*
No-flow delivery pressure (max)	16 *lb/in*^{2}
Breeze plug, Plessey Type CZ. 50357....	*Ref. No. 5X/6182*
Phase connections	*Red (A)—to pin* 2
	White (B)—to pin 3
	Blue (C)—to pin 7
Maximum shaft eccentricity when running in its own bearings	0·001 *in. total indicator reading*
Motor spigot concentricity to shaft	0·002 *in. total indicator reading*
Motor unit bearings	*Upper—filled with* 0·13/0·17 *c.c. of XG/295 grease*
	Lower—filled with 0·31/0·42 *c.c. of XG/295 grease*
Delivery outlet	*Special O-ring seal to tank attachment*
Gland drain	$\frac{3}{8}$ *in. o./d.* × $\frac{1}{4}$ *in. i./d.*
Weight of unit (all marks)	4·5 *lb.*

Note . . .

Dismantling the above pumps to inspect or renew bearings will necessitate full re-testing of the unit in accordance with the approved Schedule of Acceptance Tests.

TYPE DIFFERENTATION

Basic differences between the various marks of PAC. 100 pumps are as follow:

PAC. 100 *Mk.* 1	*Basic design*
PAC. 100 *Mk.* 2	*Generally as Mk.* 1, *but gland drain size increased and impeller fitted with loading spring*
PAC. 100 *Mk.* 3	*Generally as Mk.* 2 *but gland drainage vents added*