Chapter 13

PUMP, FUEL, PAC. 1200 SERIES

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF APPENDICES

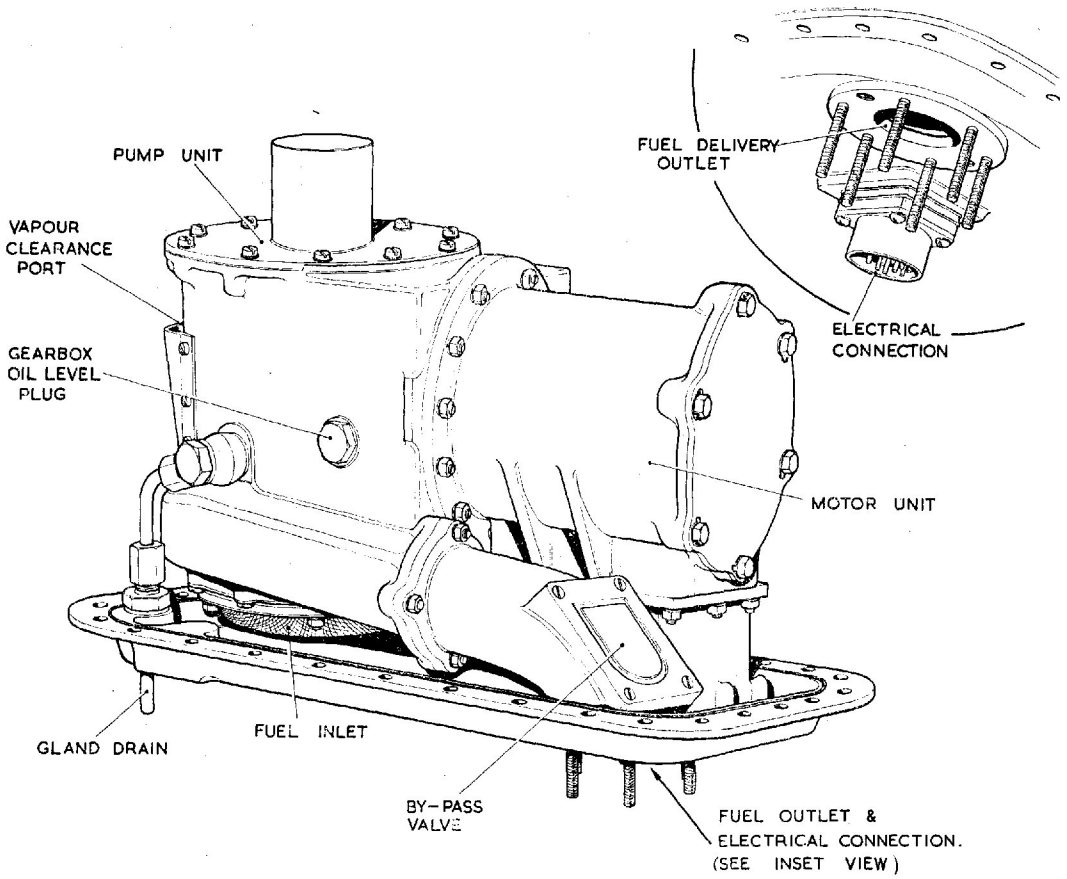

Fig. 1. General view of Type PAC. 1200 fuel pump

Introduction

1. Type PAC. 1200 fuel booster 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 of the sump mounting, right-angled drive type, with the fuel delivery, gland drain and electrical connections arranged below the mounting flange. The two speed motor unit is a fuel cooled fully submerged type, designed to operate on a 200V, 3-phase, 400 c/s aircraft supply, with the drive from the motor unit to the vertical pump unit taken through spiral bevel gearing. The two speeds are controlled electrically from the aircraft flight deck.

3. Differences between the various marks of the Type PAC. 1200 fuel pumps are detailed in the appendix to this chapter.

DESCRIPTION

General

4. General and sectional views of the complete pump are shown in fig. 1 and 2. The unit comprises mainly a horizontally mounted motor unit driving a vertical pump unit through right angle spiral bevel reduction gearing.

Motor unit

5. The pump is driven by a two speed motor operating from a 200V, 3-phase, 400 c/s supply. The rotor is supported at each end by ball bearings and the extended shaft carries the bevel pinion together with a mechanical seal preventing ingress of gear box lubricating oil into the motor unit. Speed change is effected by external switching. Rotation is anti-clockwise and motor speed 12,000 r.p.m. (high) and 8,000 r.p.m. (slow). Phase sequence is A. B. C.

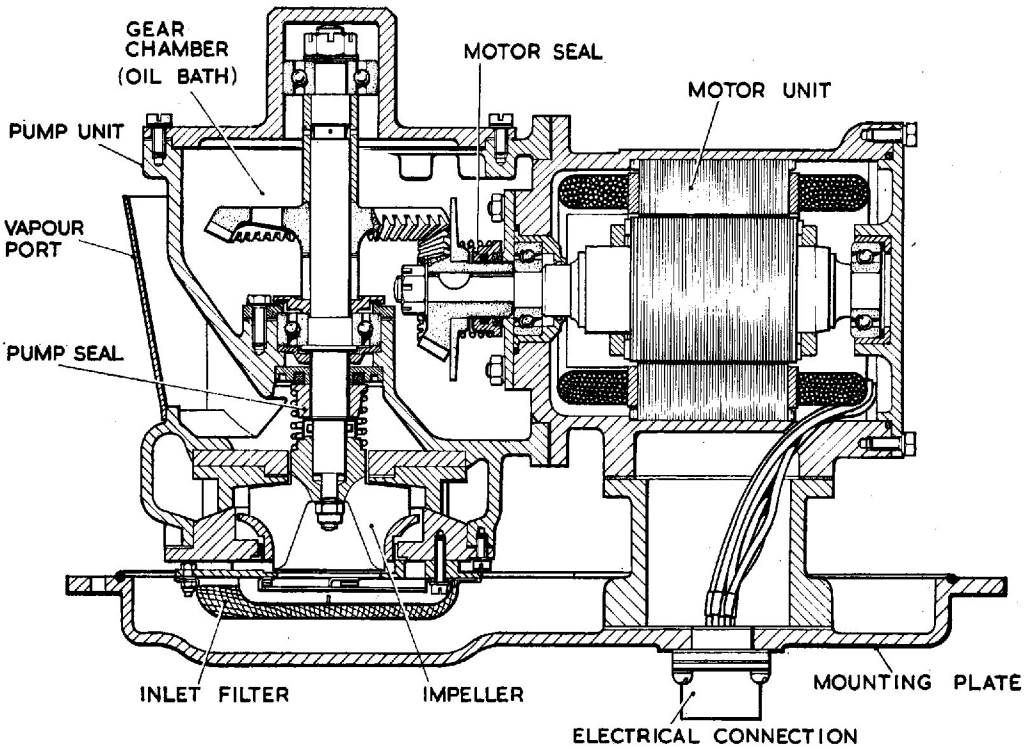

Fig. 2. Sectional view of Type PAC. 1200 fuel pump

Electrical connection to the motor is by way of a 9-pin Breeze plug, which is located on the underside of the sump mounting plate. Each lead is identified by a yellow cable marker sleeve giving the speed (H = high: L = low) coupled with the phase (A, B or C). The complete circuit diagram is shown in Fig. 3.

Pump unit

6. The vertical pump shaft is fitted with a cast light alloy high-altitude impeller at its lower end and a mechanical seal prevents fuel access to the shaft bearings and gear box. Any slight leakage past this seal is drained through pump casting channels and external pipe work to the undersurface of the pump mounting plate. A spiral bevel gear engaging the motor pinion is keyed to the shaft, which is supported at its upper end and centrally by ball bearings. The upper ball bearing housing is an integral part of the gear box cover.

7. Gear lubrication is by hydraulic oil Type OM-15. A labyrinth seal prevents oil access to the lower pump shaft bearing and a mechanical seal protects the motor unit.

8. The fuel inlet to the impeller system is protected by a wire mesh filter. Ports in the pump body casting allow the escape of air and vapour dissipated by the impellers.

Delivery outlet and by-pass valve

9. A delivery outlet casting connects the volute to the sump mounting plate and incorporates a simple hinged by-pass valve. This valve is normally held in the closed position by pump delivery pressure but in the event of pump failure, opens to allow the engine driven pump to draw fuel from the tank.

Mounting plate

10. The complete pump assembly is secured to a sump type mounting plate for bolting to a reinforced stud ring in the aircraft fuel tank. A synthetic rubber seal ring in the flange of this plate effects a seal between pump and tank when the unit is installed.

11. The lower surface of the mounting plate carries a 9-pin electrical connection, a gland drain pipe and a stud ring for attachment of a fuel delivery line.

OPERATION

12. Fuel from the tank enters the pump through a wire mesh filter into the eye of a centrifugal impeller driven by the motor unit through right-angle gearing. From here it is forced through a spiral volute into the delivery outlet duct, and thence into the delivery line and to the inlet side of the aircraft engine driven pump.

13. In the event of pump failure, loss of fuel pressure on the underside of the by-pass valve will cause it to drop and close the delivery passage from the pump. At the same time a direct port to the fuel tank is uncovered and the engine driven pump is able to draw fuel from the tank at a reduced rate and pressure.

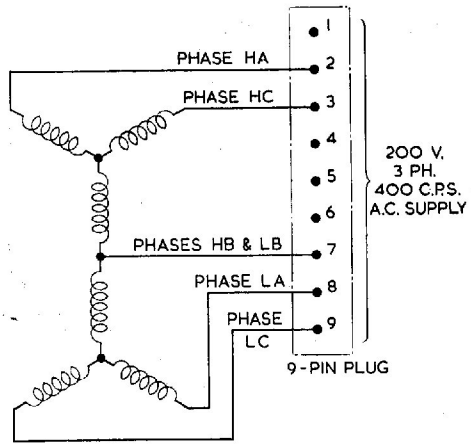

Fig. 3. Circuit diagram

REMOVAL AND INSTALLATION

14. Before attempting to remove a 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 the fuel delivery, electrical and gland drain connections and the removal of the pump mounting plate from the tank bolt ring. Care should be taken to support the weight of the pump during the latter operation.

15. 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 and security of locking wires. 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. chromic 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, the gland drain and by-pass valve.

(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 pouring a small quantity of fuel on to the gland or by partially immersing the pump. Take care that no fuel enters the gland drain or contaminates the electrical connection. Apply a 200V, 3-phase, 400 c/s supply through the Breeze plug using the approved mating socket. The pump should start immediately. Switch off the current 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.

16. 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 mounting plate is secure at all positions, clean and undamaged. This ring is fixed in position with a rubber cement.

(2) Connect the fuel delivery line to the stud ring; connect the electrical supply and gland drain connections after bolt-

ing the pump to the tank stud ring. Note that the 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 external connections to the pump assembly.

SERVICING

Routine inspection

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

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

(2) Ensure that the by-pass valve is functioning correctly. In a typical installation this could be done by turning on the tank selector cock and the appropriate engine master cock. Switch on the pump and observe the fuel pressure indicated by the aircraft fuel pressure gauge or warning light. Very low pressure on the gauge or failure to extinguish the warning light indicates that the by-pass valve may not be functioning properly. Check the warning-light setting before rejecting a suspect pump.

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

Operational test

19. Subject to the electrical tests being satisfactory, 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 cause of failure.

Gland leakage

20. During the preceding 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 one drop per minute while stationary. Any leakage in excess of these figures will necessitate removal of the pump.

Insulation resistance test

21. 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. 1200 Mk. 1, 2 and 3

LEADING PARTICULARS

Pump, fuel, Type PAC. 1200 Mk. 1	**Ref. No. 5UE/6351**
Pump, fuel, Type PAC. 1200 Mk. 2	**Ref. No. 5UE/**
Pump, fuel, Type PAC. 1200 Mk. 3	**Ref. No. 5UE/6849**
Operating voltage	200 *V*, 3-*phase a.c.*
Frequency	400 *c/s*
Motor unit	*Fuel cooled English Electric, Type AE.* 1161
Rated output	*High speed*—1200 *g.p.h.*
	Low speed—400 *g.p.h.*
Fuel delivery pressure at operating voltage	*High speed*—13·0/15·0 *lb/in*^{2}
	Low speed—7·5/9·5 *lb/in*^{2}
Maximum power input	700 *W*
No-flow delivery pressure	*High speed*—20·5 *lb/in*^{2}
	Low speed—9·5 *lb/in*^{2}
*Breeze plug, Plessey Type CZ.*50357	*Ref. No.* 5*X*/6182
Phase connections	*High Speed—HA to pin* 2
	HB to pin 7
	HC to pin 3
	Low speed—LA to pin 8
	LB to pin 7
	LC to pin 9
	(*Note: HB and LB both to pin* 7)
Motor unit and pump unit bearings	*Single-shielded—filled with XG/295 grease*
Gear box lubrication	190 *c.c. Hydraulic Oil OM/15, Ref. No.* 34*B*/9100572
Maximum shaft eccentricity when running in own bearings	0·001 *in. total reading*
Motor spigot concentricity to shaft	0·002 *in. total reading*
Delivery outlet connection	6 2-*B.A. studs on* $2\frac{1}{2}$ *p.c.d.: Outlet*—$1\frac{7}{32}$ *in. d.*
Gland drain	*Palin tube*—$\frac{3}{16}$ *in. o/d*
Weight of unit (all marks)	18·75 *lb.*

Note . . .

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

TYPE DIFFERENTIATION

Basic differences between the various marks of PAC. 1,200 pumps are as follows:—

PAC. 1200 *Mk.* 1 ...., ...	*Basic design*
PAC. 1200 *Mk.* 2	*Generally as Mk.* 1 *but gear box breather and motor gland spring re-designed*
PAC. 1200 *Mk.* 3	*Generally as Mk.* 2 *but gear box breather subject of further re-desing*