Chapter 38

PUMP, FUEL, TYPE PDC.808 SERIES

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Introduction

1. The PDC.808 electrically driven fuel booster pump is designed to maintain the required fuel supply to the aircraft engine-driven fuel pump under the varying fuel temperature and altitude conditions experienced in flight. The pump is designed for use on a 26V d.c. aircraft supply in a system in which the electrical switching is such that the pump speed can be varied automatically according to the requirements of the tank balancing controls and operating altitude. Five pump speeds are available and these will be referred to throughout this chapter as follows :— (1) slow speed, (2) low altitude medium speed (LAMS), (3) low altitude fast speed (LAFS),, (4) high altitude medium speed (HAMS) and (5) high altitude fast speed (HAFS).

2. The pump is a side mounted, hanging type unit which when installed is wholly within the fuel tank with the exception of the outer face of the mounting flange. Details of the differences between the various PDC. 808 mark numbers, together with the leading particulars, are given in an appendix to this chapter.

DESCRIPTION

Motor unit

3. A typical pump assembly is illustrated in fig. 2. The motor unit is a totally enclosed compound wound flameproof air ventilated machine designed to operate on a 24V d.c. supply. It is located in the pump casting and bolted in position through a flange on the lower motor casing. The armature is supported by shielded bearings, both of which are pre-packed with a anti-freeze/high melting point grease during manufacture and cannot be re-lubricated.

4. Brush gear is of unit construction, to facilitate assembly, comprising four brushes, two on each side in pairs, producing two brush tracks. Radio interference noise suppressors are included in the internal electrical circuit of the pump. The shunt field can be varied through three external resistors housed in a box on the external face of the pump mounting flange. These resistors enable five motor speeds to be selected automatically according to flight requirements. Motor cooling is effected by a fan fitted to the upper extremity of the armature shaft.

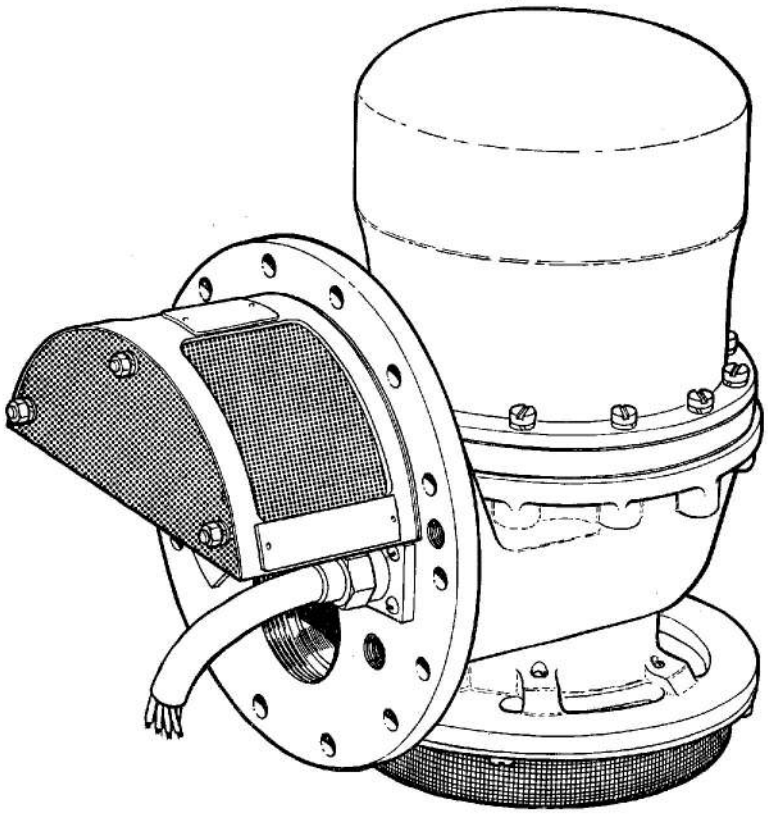


Fig. 1. External view of typical PDC.808 fuel pump

Pump unit

5. The pump unit comprises a shrouded, single entry, end-suction type impeller rotating in a volute housing, the latter being an integral part of the pump body casting. This casting also houses the main gland preventing fuel ingress into the motor unit. Any slight seepage past the gland will drain to atmosphere through a cored channel in the casting.

6. The fuel entry to the impeller is protected by a wire mesh filter against ingress of tank sediment into the main fuel delivery line. Air and fuel vapour, which may be evolved, are directed out of the main fuel stream by a combined baffle and vapour deflector fitted between the filter and the impeller. A by-pass flap valve at the delivery end of the integral cast volute in the pump body casting enables fuel to be drawn from the tank by the engine driven fuel pump when the booster pump is idle. This valve is normally held closed by pump delivery pressure.

7. All external connections to the pump unit are made to unions and plugs on the outer face of the vertical pump mounting flange. These connections comprise a $1\frac{1}{4}$ in. B.S.P. delivery outlet union, alternative $\frac{1}{4}$in. B.S.P. tappings for a gland drain connection and an adapter for retaining the electrical supply lead P.V.C. conduit.

OPERATION

8. When the pump motor unit is energised, fuel from the tank is drawn into the eye of the impeller and then forced through the volute duct in the pump base casting to the fuel outlet connection and to the delivery line.

9. Under conditions in which the flow from the pump is low due to reduced engine requirements, the impeller continues to rotate at approximately the selected speed without causing any excessive increase in fuel delivery pressure.

10. When the pump is idle, fuel delivery pressure on the by-pass flap valve in the bottom of the delivery duct is relieved. Fuel can then be drawn from the tank by the engine-driven pump without passage through the pump impeller system.

REMOVAL AND INSTALLATION

Removal

11. Before attempting to remove a pump, ensure that the tank has been drained of fuel below the level of the pump mounting flange and that the electrical supply of the pump has been switched off. The former can be checked by loosening the union nut on the delivery pipe, allowing any remaining fuel to have a free flow through the by-pass valve.

12. The precise method of removing a PDC. 808 fuel pump from a particular installation is detailed in the appropriate Aircraft Handbook. In general terms it will consist of disconnecting the fuel delivery and gland drain pipes and disconnecting the electrical supply. The pump can then be withdrawn by removing the fourteen nuts and washers from the tank stud ring. Two $\frac{1}{4}$in. B.S.F. screws can be used if necessary in the mounting flange tapped holes to assist in breaking the joint with the tank mounting ring.

Note . . .

The electrical supply leads are a continuous run from the supply socket to the motor unit internal connections and cannot be disconnected at the adapter securing the supply lead conduit to the pump mounting flange.

Pre-installation checks

13. The installation of all new pumps should be preceded by the following checks :—

(1) Ensure that the pump has not been stored for longer than the specified maximum period (i.e. 12 months in the original packing and carton as supplied by the manufacturer or 3 years where special packing has been provided). Pumps stored for periods in excess of these maxima must not be used without being dismantled, examined and tested as detailed in Vol. 6.

(2) Inspect exterior of pump for evidence of damage, security of locking wires, general cleanliness and corrosion. Blend out slight areas of corrosion and apply a protective finish (e.g. chromic acid solution) to the unprotected area.

(3) Check that transit plugs have been removed from the delivery outlet and gland drain connections, and that tape

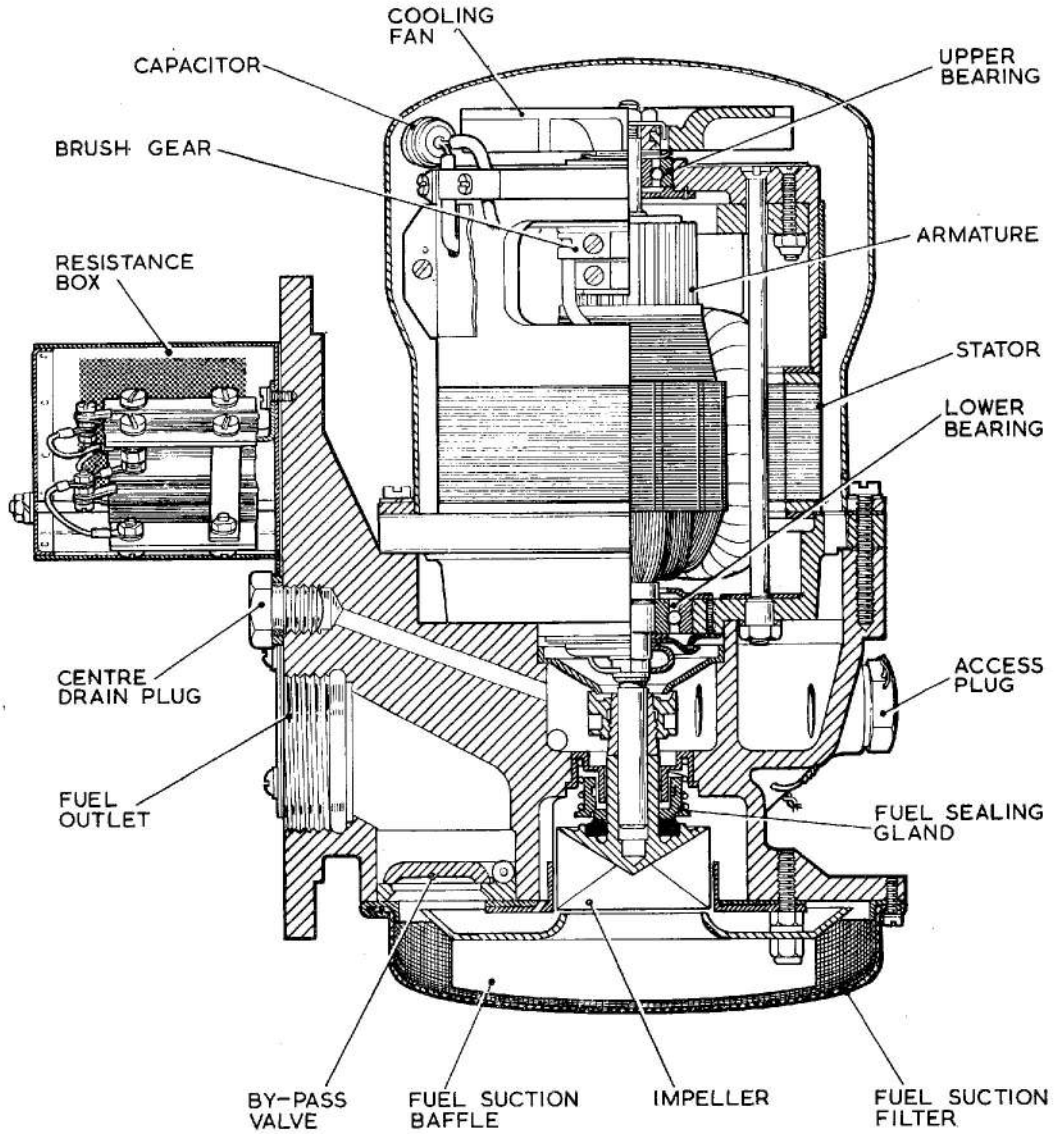


Fig. 2. Sectional view of PDC.808 Mk. 5 fuel pump

or other protective material has been removed from the inlet filter and breather gauze. Check that a blanking plug has been fitted in the upper of the two gland drain positions, when the pump is in the correct installation attitude.

(4) It is advisable to make a starting check on the pump before it is installed. Connect a 24V d.c. supply to the pump to complete, in turn, the five circuits given below, and switch the supply on and off several times for each speed condition. If the pump fails to start immediately, at any speed, it must be returned to a repair unit for further testing, using approved equipment.

Speed	Electrical connections Positive(+ve) connection	Negative(−ve) connection
Slow	Leads 1 and 2 joined	Lead E
LAMS	Leads 1 and B joined	Lead E
LAFS	Lead 1	Lead E
HAMS	Leads 1, A and B joined	Lead E
HAFS	Leads 1 and A joined	Lead E

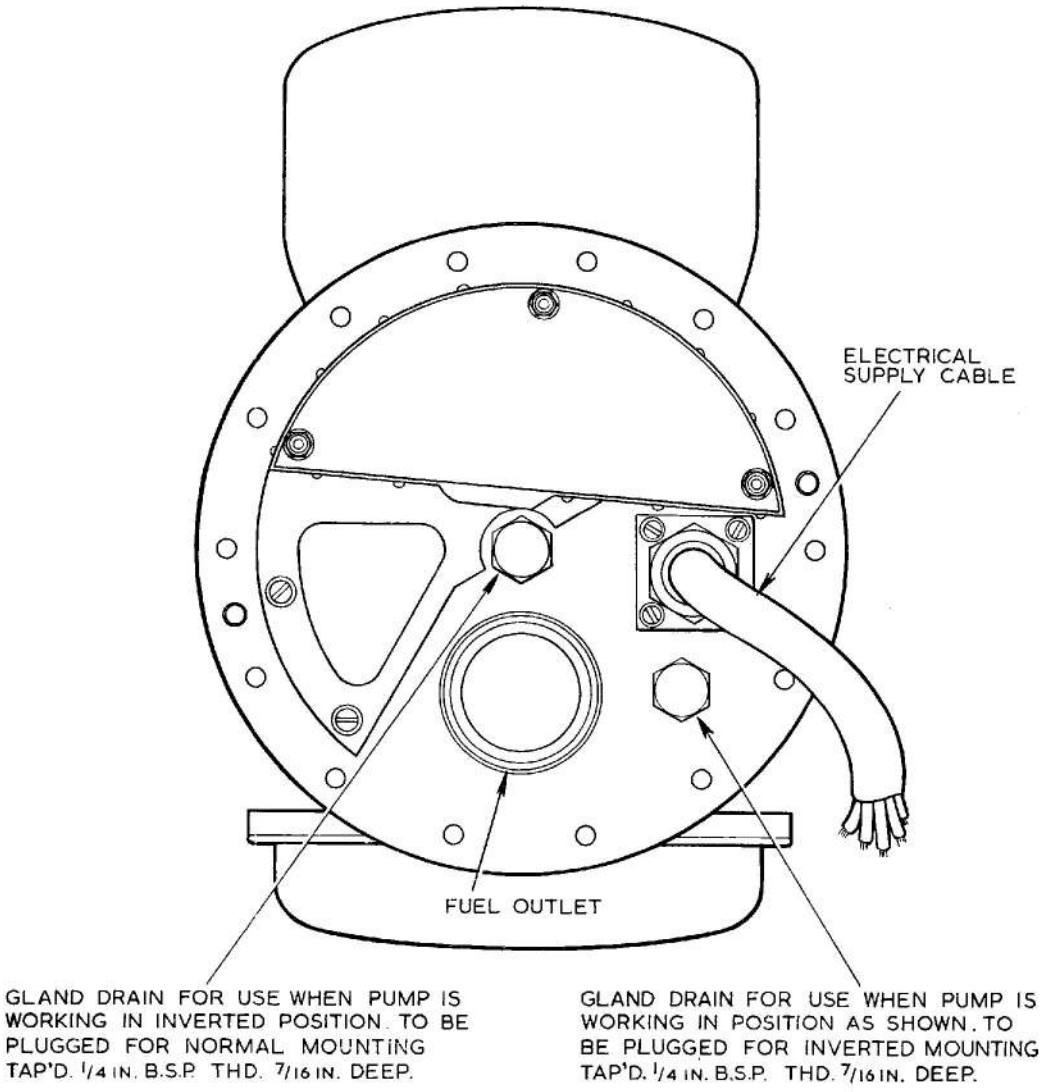


Fig. 3. General view of mounting flange

Installation

14. The pre-installation checks (para. 13) apply to all aircraft installations of these pumps. Detailed instructions for installation in a particular aircraft will be given in the relevant Aircraft Handbook.

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

(1) Fitting a new joint washer between the pump mounting flange and the tank stud ring, coating both sides of the joint washer with an approved type of jointing compound.

(2) Securing the pump with fourteen nuts and lockwashers.

(3) Re-connecting the fuel delivery and gland drain pipes, ensuring when relevant that the open end of the drain pipe faces towards the rear of the aircraft to prevent pressurisation in flight.

(4) Re-connecting the plug, on the flexible pump conduit, to the electrical supply socket.

(5) Wire locking all pipe connections, union nuts, etc.

SERVICING

Routine inspection

16. At routine inspections the following procedure applies :—

(1) Inspect all the pipe connections and wire locking to the pump. Check the joint between the fuel pump and tank for leakage. Rectify as necessary.

(2) Test the pump as detailed in para. 18-24. If the pump performance is found to be unsatisfactory in any way, the pump must be removed from the aircraft and a new or reconditioned unit fitted. No in-situ maintenance is posble.

(3) Ensure that the by-pass valve is functioning correctly by completing any relevant tests detailed in the appropriate Aircraft Handbook.

17. At the periods laid down in the appropriate Servicing Schedules all pumps are to be replaced by new or reconditioned units drawn from Stores. Faulty and time expired pumps must be returned to a Maintenance unit or to the manufacturer for repair.

Electrical test

18. A routine electrical test in accordance with the appropriate Servicing Schedule should be made to ascertain that the motor unit is functioning satisfactorily. This test must be made with the motor unit on load—i.e. immersed in and pumping fuel at the motor speed automatically selected by the tank balancing controls. The pump must be replaced by a new or reconditioned unit if there is any indication of erratic performance (e.g. excessive current consumption).

"No-fuel flow" test

Note . . .

The following "No fuel flow" electrical test is only applicable to aircraft with the necessary instrumentation. Where no test panel is provided, particular attention should be paid to the electrical test (para. 18) and operational test (para. 22).

19. Ascertain the position of the aircraft test socket and switches by reference to the Aircraft Handbook. Proceed as follows :—

(1) Close all fuel cocks between the pump and engine to ensure that no fuel can flow.

(2) Connect a suitable portable ammeter to the socket on the test panel.

Note . . .

When using a clip-on type ammeter the tongs should be opened and closed smartly prior to use to reduce the hysteresis error.

(3) Apply a 26V d.c. supply and switch on the pump by depressing the switch on the test panel Observe the ammeter reading for a period of not less than 30 seconds

20. Interpret the readings obtained as follows :—

(1) A steady reading not exceeding that specified in the appropriate appendix to this chapter indicates that the motor is functioning satisfactorily.

(2) Current consumption in excess of that specified in the appropriate appendix indicates either a faulty motor unit, a rise in torque loading due to the obstruction of moving parts or a restriction of the fuel flow.

(3) A fluctuating reading indicates faulty contacts, defective brushes, faulty commutation or that bearings or other rotating parts are binding.

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

21. When the above tests have been completed release the test switch and disconnect the ammeter.

Operational test

22. Subject to the electrical test being completed satisfactorily, the pump should be tested where possible for proof performance and checked against the performance figures quoted in the appropriate appendix to this chapter. Refer to the relevant Aircraft Handbook for procedure details. For possible causes of failure to obtain the required performance see Table 1.

Gland leakage

23. During the above tests an examination

should be made of the gland drain exit for fuel leakage. The leakage must not exceed a rate of 2 ccs per hour while the pump is running or of 1 cc per hour while stationary. Any leakage in excess of these figures will necessitate removal of the pump from the aircraft.

Insulation resistance test

24. Using a 250 volt constant pressure insulation resistance tester, measure the insulation resistance between the socket pins and earth. When a new pump is drawn from stores the insulation resistance must be not less than 2 megohms. After installation, due to humidity conditions prevalent in aircraft at dispersal points, the minimum permissible insulation resistance is 50,000 ohms.

TABLE 1

Faults, possible causes and rectification

Fault	Possible cause	Rectification
Gland leakage	(1) Bad finish between gland seal faces.	All these conditions require that the pump is removed from the aircraft and returned to a Maintenance Unit or to the pump manufacturer for re-conditioning.
	(2) Insufficient pressure between gland seal faces.	
Excessive current	(1) Excessive gland loading.	
	(2) Faulty motor unit.	
	(3) Fouling of impeller by foreign matter.	
Low delivery pressure	(1) Faulty motor unit.	
Pressure surge	(1) Tight or pre-loaded bearings.	
	(2) Excessive gland loading.	
Low insulation resistance	(1) Dampness in motor windings.	

Appendix 1

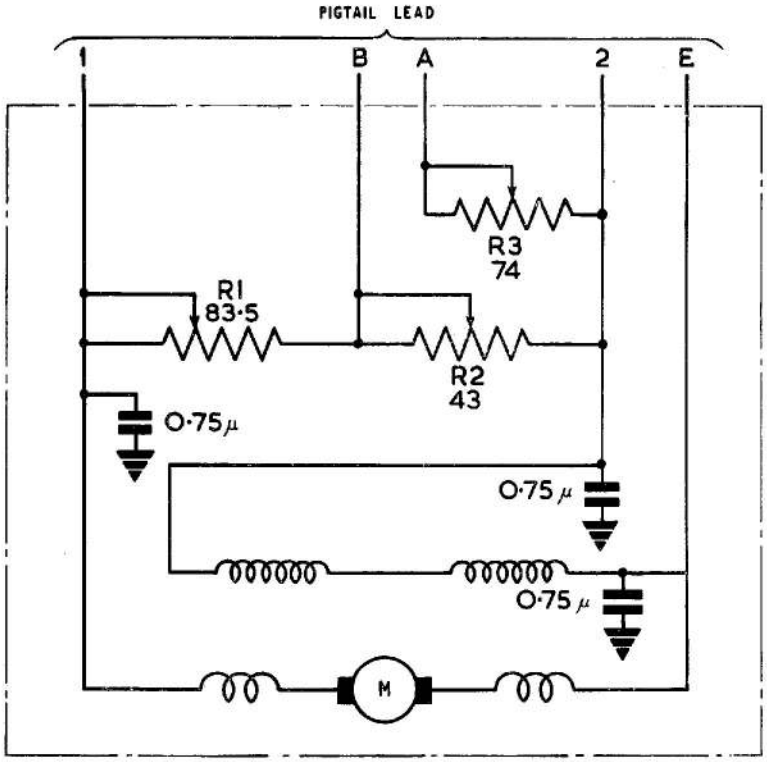
PUMPS, FUEL TYPE PDC.808 Mk.1, 2, 3, 4 and 5

Pump, fuel, Type PDC.808 Mk. 1	**Ref. 5UE/6348**
Pump, fuel, Type PDC.808 Mk. 2	**Ref. 5UE/6670**
Pump, fuel, Type PDC.808 Mk. 3	**Ref. 5UE/**
Pump, fuel, Type PDC.808 Mk. 4	**Ref. 5UE/6846**
Pump, fuel, Type PDC.808 Mk. 5	**Ref. 5UE/6889**
Voltage limits	22·0/28·0*V d.c.*
Rated voltage	26*V d.c.*
Rated output (LAMS) at 26V d.c.	900 *gal./hour*
Delivery pressure at LAMS (26V d.c.)	10·5 *lb. in.*^{2} *min.*
Minimum no-flow delivery pressure at 26V d.c.	9·0 *lb. in.*^{2}
Maximum no-flow current consumption	16·0 *amps.*
Delivery outlet tapping	1¼ *B.S.P.*
Gland drain tapping	¼ *in. B.S.P.*
Weight of unit	13·25 *lb.*

Type differentiation

1. Basic differences between the various marks of PDC.808 series pumps covered by this appendix are as follows :—

PDC.808 Mk.1	Basic design covered in this chapter.
PDC.808 Mk.2	Generally similar to PDC.808 Mk.1, but the commutator is slightly larger.
PDC.808 Mk.3	Generally similar to PDC.808 Mk.2, but the pump is fitted with stainless steel throat washers.
PDC.808 Mk.4	Generally similar to PDC.808 Mk.3 but the drive end motor unit bearing is of the double shielded type.
PDC.808 Mk.5	Generally similar to the PDC.808 Mk.4 fuel pump but incorporating a redesigned cover plate to effect flameproofing between the resistance box and the pump unit.



App. 1. Fig. 1. Circuit diagram