Chapter 40

PUMP, FUEL, TYPE PDC.810

LIST OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

LIST OF APPENDICS

Introduction

1. The PDC.810 electrically driven fuel pump is designed for side-mounting on the inside of the fuel tank in a position as near to the bottom of the tank as is practical. The whole of the pump with the exception of the mounting flange face is immersed in the fuel.

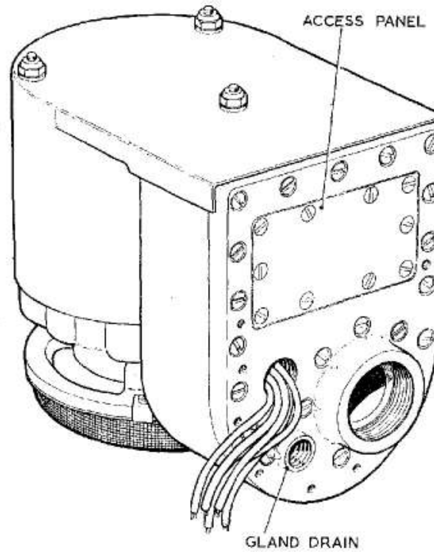

Fig. 1. External view of typical PDC.810 fuel pump

2. 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 the aircraft 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).

3. Details of the differences between the various PDC.810 mark numbers, together with the leading particulars, are given in an appendix to this chapter.

DESCRIPTION

Pump Unit

4. A typical pump assembly is shown in Fig. 2. A pump body casting, which forms a seating for the non-ventilated d.c. motor unit, houses the metallic bellows type gland which prevents fuel ingress into the motor unit. The vertically side mounted portion of this casting forms a housing for the radio interference suppressors, and for the speed trimming resistances.

5. The impeller is of the single entry, end-suction type and is mounted on the extended motor spindle. It rotates in an enclosing duct of volute form which is an integral part of the pump body casting. The fuel entry to the impeller system 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 formed vapour guide cone fitted around the inlet to the impeller system. A by-pass flap valve, fitted in the lower part of the delivery duct in the pump body casting, enables fuel to be drawn from the tank by the engine driven fuel pump when the tank pump is idle. This valve is normally held closed by fuel delivery pressure.

Motor unit

6. The driving motor is a two pole, compound wound, flameproof machine fitted with a high speed armature supported at each end by shielded bearings. These bearings are pre-packed during manufacture, with an anti-freeze/high melting point grease, and cannot be re-lubricated. The motor is not provided with a cooling fan; motor unit temperature being maintained within pre-determined limits by the cooling effect of the surrounding fuel. When the pump is operating, fuel is forced through a small bleed hole in the volute chamber and circulates around the inner motor casing, pump casing and inner motor top cover.

7. Brush gear is of unit construction, to facilitate assembly. The pump motor shunt field is fitted with three speed-control trimming resistances enclosed in a ventilated box. These resistances enable the five motor speeds detailed in para. 1 to be selected automatically according to flight requirements.

8 All external connections to the pumps are made to unions and plugs on the outer face of the vertical pump mounting flange. No electrical connection is fitted to the pump, connection being made at a point on the airframe away from the pump mounting position.

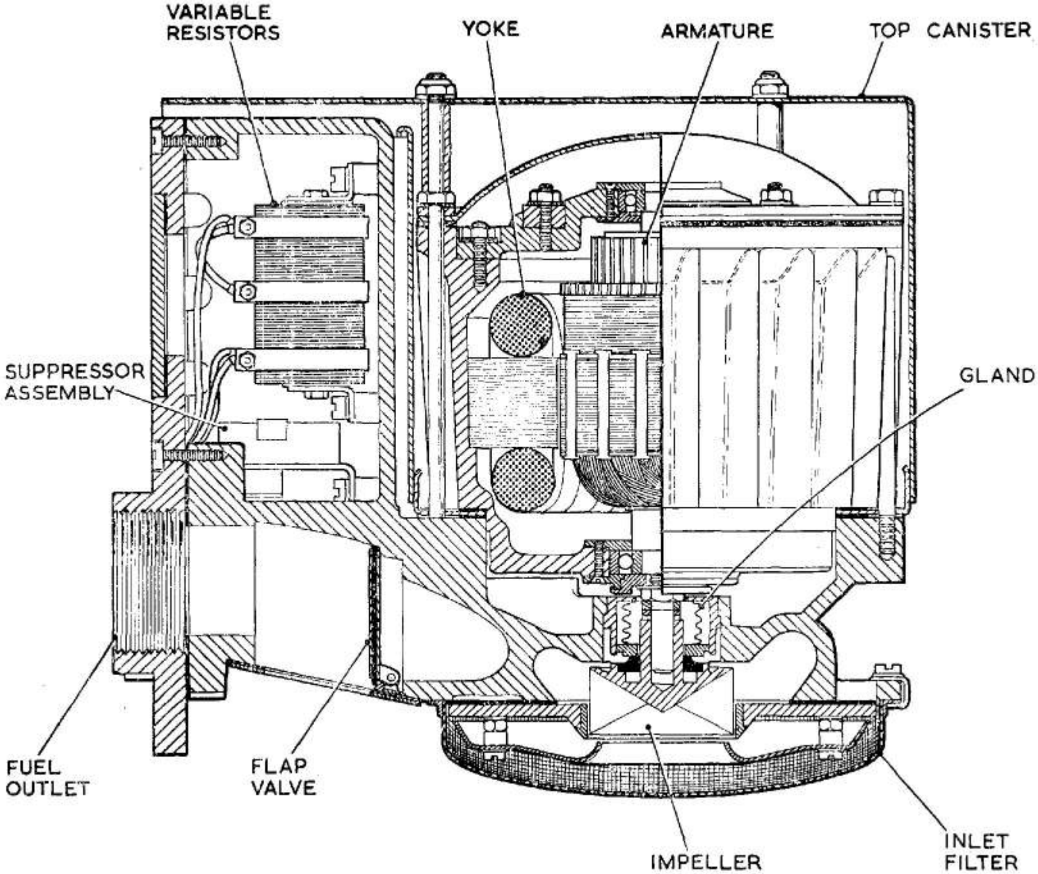

Fig. 2. Sectional view of PDC.810 Mk. 7 fuel pump

OPERATION

9. When the pump motor is energised with a 26V d.c. electrical supply, fuel from the tank is drawn into the eye of the impeller and then forced through the volute duct in the pump body casting to the fuel outlet connection and to the delivery line.

10. 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.

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

REMOVAL AND INSTALLATION

Removal

12. 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 to the pump has been switched off. The former should be checked by easing the joint of the fuel delivery pipe connection.

13. The precise method of removing a PDC.810 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. Note that the electrical supply leads are a continuous run from the remotely mounted electrical connection to the speed resistances of the motor unit, and cannot be disconnected at the face of the pump mounting flange. Remove the pump mounting plate complete with pump from the tank bolt ring.

Pre-installation checks

14. 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 suppiled by the manufacture 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 the exterior of the 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 remove tape or any other protective material from the inlet filter and electrical lead entry to the pump unit.

(4) It is advisable to make a starting check on the motor unit before installation. Join leads 1 and 5 together (App. 1, fig. 1), connect them to the positive terminal of a 26V d.c. electrical supply, and connect lead 2 to the negative terminal to test the slow speed circuit. The pump must start immediately. Repeat the test several times and if the pump fails to start it must be returned to a repair unit for further testing, using approved equipment. Carry out starting tests for each of the remaining four motor speeds, with the leads connected in the following manner :—

LAMS — leads 2 (-ve) and 1 and 4 joined (+ve).

LAFS — leads 2 (-ve) and 1 (+ve).

HAMS — leads 2 (-ve) and 1, 3 and 4 joined (+ve).

HAFS — leads 2 (-ve) and 1 and 3 joined (+ve).

Installation

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

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

(1) Fitting a new joint washer between the pump mounting plate flange and the tank bolting surface, using an approved jointing compound on both sides of the washer.

(2) Securing the pump, complete with mounting plate, to the tank bolt ring. For a particular installation refer to the relevant Aircraft Handbook.

(3) Reconnecting the fuel delivery and gland drain pipes, ensuring that, when relevant, the open end of the latter faces towards the rear of the aircraft in a low pressure area, to prevent possible pressurisation in flight.

(4) Reconnecting the plug on the flexible pump leads to the electrical supply socket.

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

SERVICING

Routine inspection

17. 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 the tank for leakage. Rectify as necessary.

(2) Test the pump as detailed in para. 19-25. 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 possible.

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

18. 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

19. A routine electrical test in accordance with the appropriate Servicing Schedule should be made to ascertain that the motor unit is functioning satisfactorily. These tests must be made with the motor unit on load—i.e. immersed in and pumping fuel a 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. 19) and operational test (para. 23).

20. Ascertain the position of the aircraft test socket and switches by reference to the relevant 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.

21. Interpret the readings obtained as follows :—

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

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

Operational test

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

Gland leakage

24. 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 2c.c. per hour while the pump is running, or 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

25. 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 not be less than 2 megohms. After installation, due to the 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	Retification
Gland leakage	(1) Bad finish between gland seal faces. (2) Insufficient pressure 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 reconditioning.
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.810 MK. 1-7 INCLUSIVE

Pump, fuel, Type PDC.810 Mk.1	**Ref. 5UE/6349**
Pump, fuel, Type PDC.810 Mk.2	**Ref. 5UE/6704**
Pump, fuel, Type PDC.810 Mk.3	**Ref. 5UE/6704**
Pump, fuel, Type PDC.810 Mk.4	**Ref. 5UE/6704**
Pump, fuel, Type PDC.810 Mk.5	**Ref. 5UE/6759**
Pump, fuel, Type PDC.810 Mk.6	**Ref. 5UE/6847**
Pump, fuel, Type PDC.810 Mk.7	**Ref. 5UE/6888**
Voltage limits	22·0/28·0*V d.c.*
Rated voltage	... 26*V d.c.*
Rated output (LAMS) at 26V d.c.	900 *gal./hr.*
Delivery pressure at LAMS (26V d.c.)	10·5*lb.in*².
Minimum no flow delivery pressure at 26V d.c.	9·0 *lb.in*².
Maximum no flow current consumption	... 16·0 *Amp.*
Delivery outlet tapping	1¼ *in. B.S.P.*
Gland drain tapping	¼ *in. B.S.P.*
Weight of unit	... 14·75 *lb.*

General

1. All pumps are generally similar to that described in the basic chapter.

Type differentiation

2. Basic differences between the various marks of PDC.810 series pumps covered by this appendix are as follows :—

PDC.810 *Mk*.1	Design as originally introduced.
PDC.810 *Mk*.2	Generally similar to Mk. 1 pump but mica card resistances replaced by tubular units.
PDC.810 *Mk*.3	Generally similar to Mk. 2 pump but fixing of resistance units revised to provide a more secure assembly.
PDC.810 *Mk*.4	Generally as Mk. 3 unit but material of by-pass valve joint altered.
PDC.810 *Mk*.5	Basically as Mk. 4 pump but impeller unit bayonet slot deepened and casing redesigned to improve the impeller fixing on the shaft pin.
PDC.810 *Mk*.6	Basically as Mk. 5 pump but fitted with double shielded motor unit bearings.
PDC.810 *Mk*.7	Basically as Mk. 6 pump but fitted with a redesigned motor end-cover to meet flameproof test conditions.

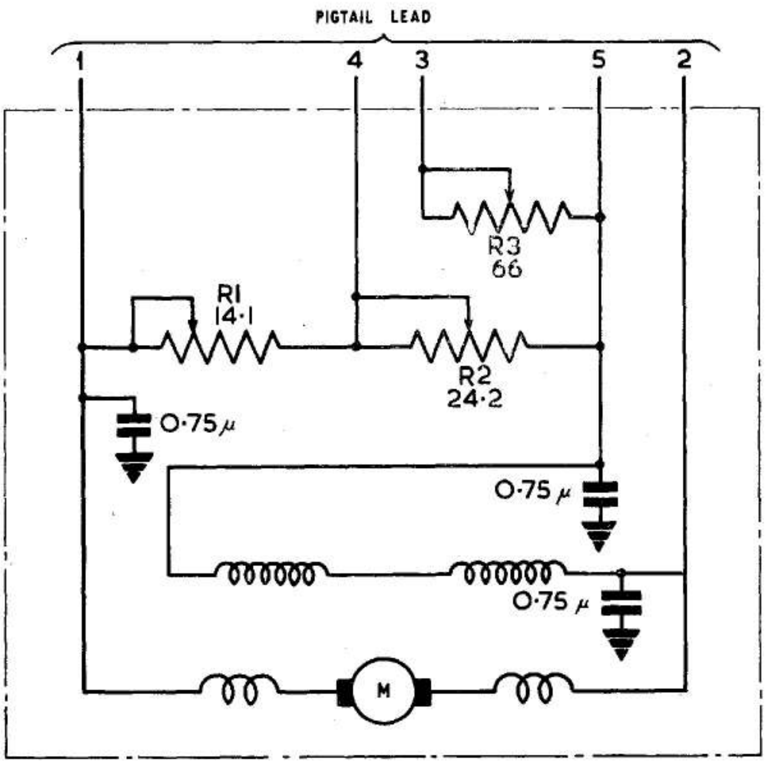

Fig. 1. Circuit diagram PDC.810 Mk. 7 fuel pump

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