Chapter 1

PUMP, WATER SUPPLY SPE.180/W

LIST OF CONTENTS

	Para.		Para.
Introduction	1	*Routine inspection*	10
Description	2	*Electrical test*	12
Operation	4	*'No flow' test*	13
Removal and installation		*Operational test*	16
Removal	6	*Gland leakage*	17
Pre-installation checks	7	*Insulation resistance test*	18
Installation	8	*Prevention of corrosion*	19
Servicing			

LIST OF ILLUSTRATIONS

	Fig.
General view of SPE.180/W water supply pump	1
Sectional view of typical SPE.180/W water supply pump (SPE.180/W, Mk. 2)	2
'No flow' electrical test graph ...	3
Circuit diagram	4

LIST OF TABLES

	Table
Faults, possible causes and rectification	1

LIST OF APPENDICES

	App.
Pumps, water supply, Type SPE.180/W Mk. 1 & 2	1

Introduction

1. The type SPE.180/W pump is designed for installation in aircraft 'domestic' water supply systems and consists of a line-mounted single stage centrifugal pump unit directly driven by a 112V d.c. electric motor. Leading Particulars are included in appendices to this chapter.

DESCRIPTION

2. A general and sectional view of a typical pump are illustrated in Fig. 1 and 2. The unit comprises mainly a totally enclosed d.c. motor with extended armature shaft driving a centrifugal impeller. The armature is supported at each end by a

ball race pre-packed with a high melting/low freezing point grease. The main water flow is prevented from entering the motor unit by a rotating carbon ring in contact with the lapped bronze seating of a metallic bellows type gland. Additional seals prevent any slight leakage past this gland from reaching the motor unit and the fuel seepage is conducted away through a tapping on the side of the pump casing. The motor outer cover is finned to assist in the dissipation of heat generated in the motor unit.

3. The motor unit is a 112V d.c. compound wound machine of conventional 2-pole construction. Armature laminations are straight slotted. Brush gear is of unit construction to facilitate assembly and comprises two brushes. The electrical supply connection to the pump is through a socket on the top of the motor outer cover.

OPERATION

4. When the pump motor is energized, water from the storage tank is drawn into the pump by the centrifugal action of the impeller through an inlet suction pipe located at the lower end of the pump. It is then forced through the volute chamber and outlet elbow of the pump casting into the water supply line.

5. A pressure relief valve is normally incorporated in a return feed to the storage tank to limit the line pressure when the pump is operating under 'no flow' conditions.

REMOVAL AND INSTALLATION

Removal

6. Ensure that the electrical supply to the pump has been switched off. Drain the water from the supply system. The precise method of removing a SPE.180/W pump is detailed in the appropriate Aircraft Handbook. In general terms it will consist of disconnecting the inlet and outlet connection pipes and the electrical connection socket. The pump can then be detached from the aircraft frame by releasing the four fixing bolts.

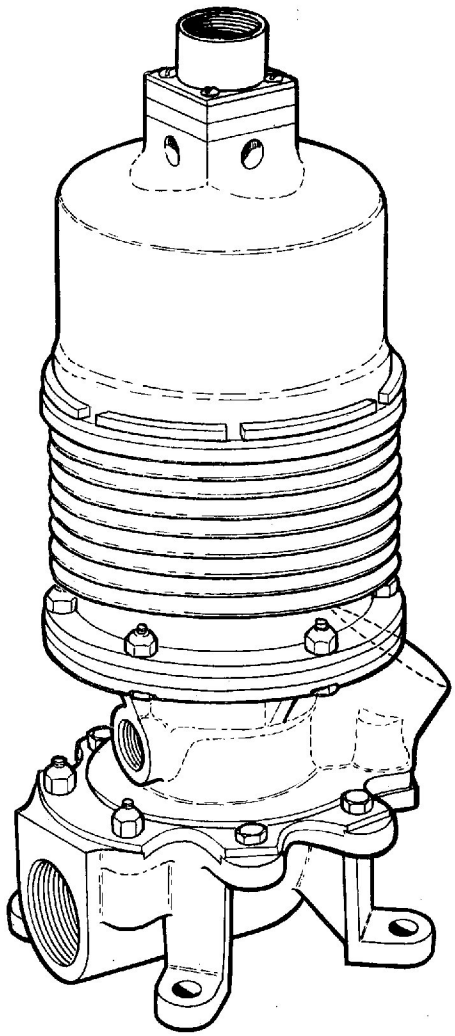

Fig. 1. General view of SPE 180/W water supply pump

Pre-installation checks

7. The installation of a new pump 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. twelve months in the original packing and carton as supplied by the manufacturer, or three 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 an approved protective finish (Chromic acid solution) to the unprotected area.

(3) Check that transit plugs have been removed from the delivery outlet, suction inlet, gland drain and electrical connection socket.

(4) It is advisable to make a starting check on the pump before installation. Apply a 112V d.c. electrical supply through the electrical connection socket. The pump must start immediately. Repeat the test several times. If the pump fails to start immediately it should be returned to an overhaul base for further serviceability testing using approved equipment.

Installation

8. 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 appropriate Aircraft Handbook.

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

(1) Securing the pump to the aircraft structure with four bolts. The pump must be fitted at a point below the storage tank, the unit being primed by gravity feed from the tank.

(2) Reconnecting the water inlet and outlet pipes.

(3) Reconnecting the gland drain pipe, ensuring that the open end of the latter faces towards the rear of the aircraft to prevent possible pressurisation in flight.

(4) Reconnecting the electrical supply to the pump socket on the top of the motor casing.

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

SERVICING

Routine inspection

10. At routine inspections the following procedure applies :—

(1) Inspect all the pipe connections and wire-locking to the pump.

(2) Test the pump as detailed in para. 12-18. 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.

11. 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

12. 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 under load, i.e. pumping water. The pump must be replaced by a new or reconditioned unit if there is any evidence of erratic performance, such as excessive current consumption.

'No flow' test

Note . . .

The following 'no flow' electrical test is only applicable to pumps in aircraft with the necessary instrumentation. Where no test panel is provided, particular attention should be paid to the electrical test (para. 12) and operational test (para. 16).

13. Ascertain the position of the aircraft pump test socket and switches by reference to the relevant Aircraft Handbook. Proceed as follows.

(1) Close the stop valve in the delivery line between the pump and the urns, toilet basins or other water supply points.

(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 errors.

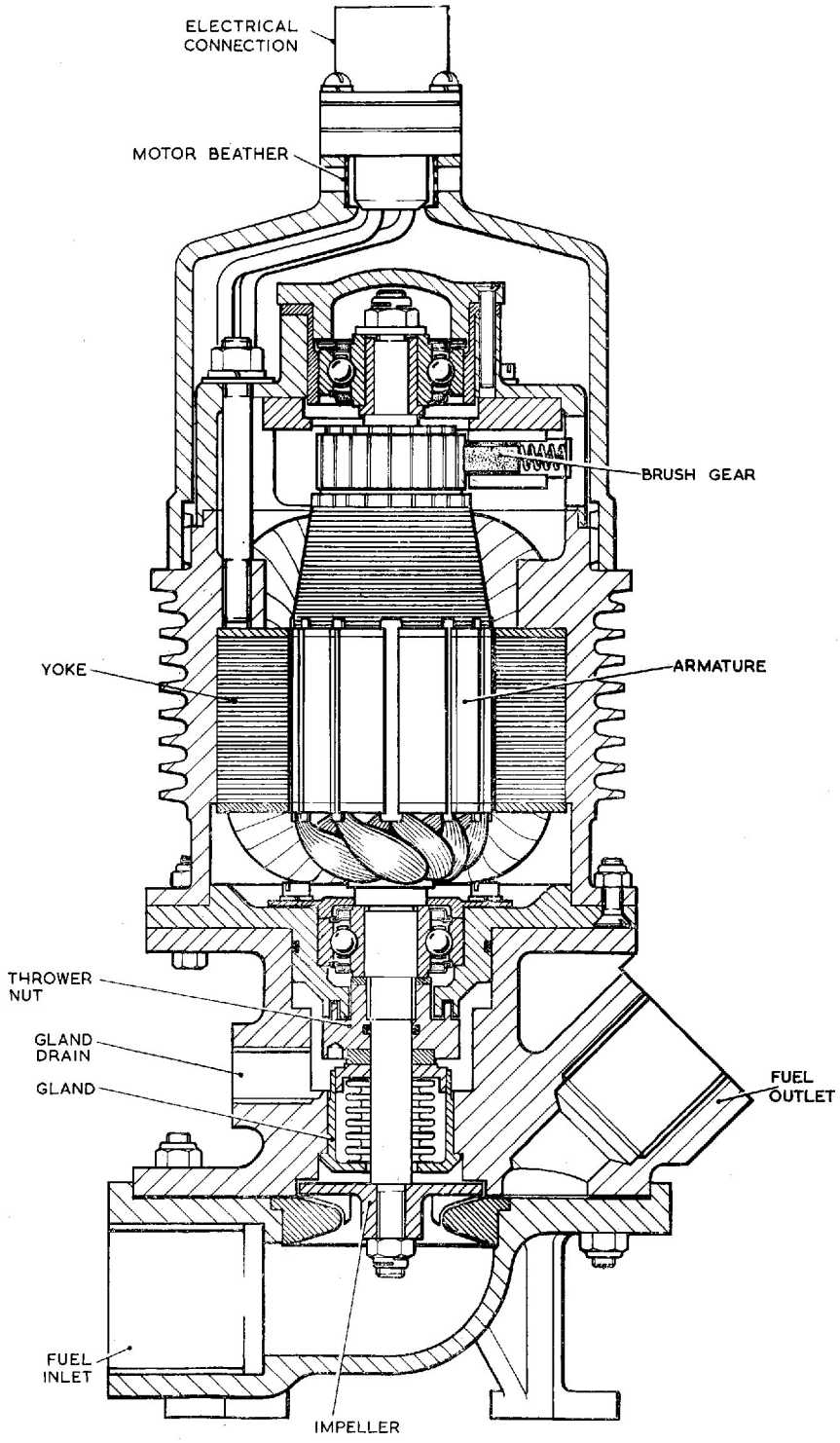

Fig. 2. Sectional view of typical SPE 180/W water supply Pump (SPE 180/W Mk. 2)

(3) 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.

14. Interpret the readings obtained as follows :

(1) A steady reading not exceeding that indicated by the graph (fig. 3) for the measured applied voltage, indicates that the motor unit is functioning satisfactorily.

Note . . .

The graph (Fig. 3) is provided as a guide to pump performance under 'no flow' conditions: the figures derived from it must not be interpreted as forming a part of the Acceptance Test Specification for the pump.

(2) Current consumption in excess of the graph reading 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 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.

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

Operational test

16. 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

17. During the above tests an examination should be made of the gland drain exit for water leakage. The leakage must not exceed a rate of $\frac{1}{2}$ cc. per hour while the pump is running or $\frac{1}{4}$ cc. per hour while stationary. Any leakage in excess of these figures will necessitate removal of the pump from the aircraft.

Insulation resistance test

18. Using a 500 Volt insulation resistance tester measure the insulation resistance between the electrical connection 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 the humidity conditions prevalent in aircraft at dispersal points, the minimum permissible insulation resistance is 50,000 ohms.

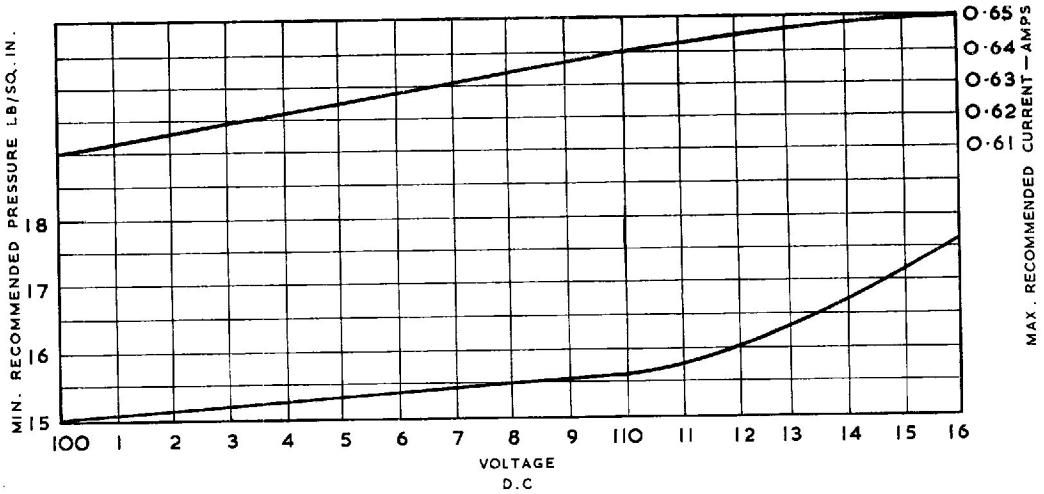

Fig. 3. "No flow" electrical test graph

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 reconditioning.
	(2) Insufficient pressure between gland seal faces.	
Excessive current consumption	(1) Excessive loading on metallic bellows gland.	
	(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 loading on metallic bellows gland.	
Low insulation resistance	(1) Dampness in motor windings.	

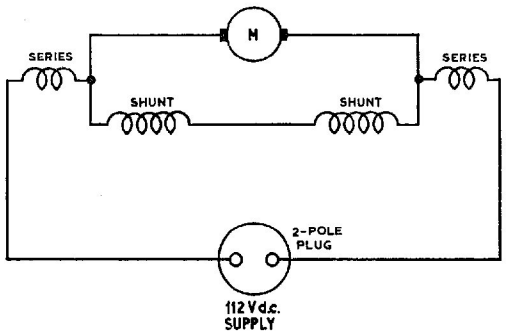

Fig. 4. Circuit diagram

Prevention of corrosion

19. If a pump, when installed, is allowed to be drained of water, air will enter the pump and corrosion may occur. Aircraft water tanks must not be emptied or allowed to remain empty unless suitable precautions are taken to avoid corrosive action in the pump. Pumps removed from aircraft must be flushed with clean water, drained, and dried using a dry air blast, before being passed to storage or packed for transit.

Appendix 1

PUMPS, WATER SUPPLY, TYPE SPE.180/W Mk. 1 & 2

LEADING PARTICULARS

Pump, water supply, Type SPE.180/W Mk. 1	**Ref. No. 5UE/6706**
Pump, water supply, Type SPE.180/W Mk. 2	**Ref. No. 5UE/6885**
Voltage limits	... 100/116*V. d.c.*
Rated voltage	110*V. d.c.*
Rated output at 110*V. d.c.*	180 *gall./hr.*
Minimum delivery pressure at rated output/voltage	10 *lb./in*^{2}.
Maximum current consumption at rated output/voltage	0·7*A*
Maximum 'no-flow' delivery pressure at 116*V. d.c.*	
Minimum 'no-flow' delivery pressure	*See Fig.* 3, *basic chapter*
Electrical connection (*Plessey* 2*CZ*.111223)	*Ref. No.* 5*X*/7139
Delivery outlet tapping	$\frac{1}{2}$ *in. B.S.P.*
Inlet tapping	$\frac{3}{4}$ *in. B.S.P.*
Gland drain tapping	$\frac{1}{4}$ *in. B.S.P.*
Weight of unit	3·5 *lb.* (*approx.*)

Type differentiation

1. Basic differences between the various marks of SPE.180/W pumps covered by this appendix are as follows :

SPE.180/W Mk. 1

Initial production design.

SPE.180/W Mk. 2

Generally similar to SPE.180/W Mk. 1 but with a redesigned impeller unit.

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