Chapter 10

PUMP, FUEL, SPE. 2437, Mk. 1

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Pump. fuel SPE. 2437, *Mk.* 1	*Ref. No.* 5*UE*/6674
Operating voltage	200 *volt*, 3-*phase a.c.* (*r.m.s.*)
Frequency	400 *c.p.s.*
Nominal current	3·6*A max.*
Torque on load	77·5 *oz. in.*
Fuel delivery rate	1700 *g.p.h.*
Fuel delivery pressure	20 *lb. per in.*^{2}
Weight of pump complete	13·75 *lb.*

Introduction

1. The SPE. 2437, Mk. 1, electrically operated, submerged, fuel booster pump is designed to supply fuel under pressure to the aircraft main fuel supply line, under all conditions of fuel de-aeration, high altitude vapour formation and extremes of temperature.

2. The pump which is a side mounted, or hanging type unit is designed to meet aircraft requirements where the fuel tank depth is restricted, necessitating the motor driving the pump through right angle bevel gearing.

DESCRIPTION

General

3. This unit comprises a two stage centrifugal pump, driven through right angle bevel gearing by a 200 volt, 400 cycles per second 3 phase a.c. induction motor.

RESTRICTED

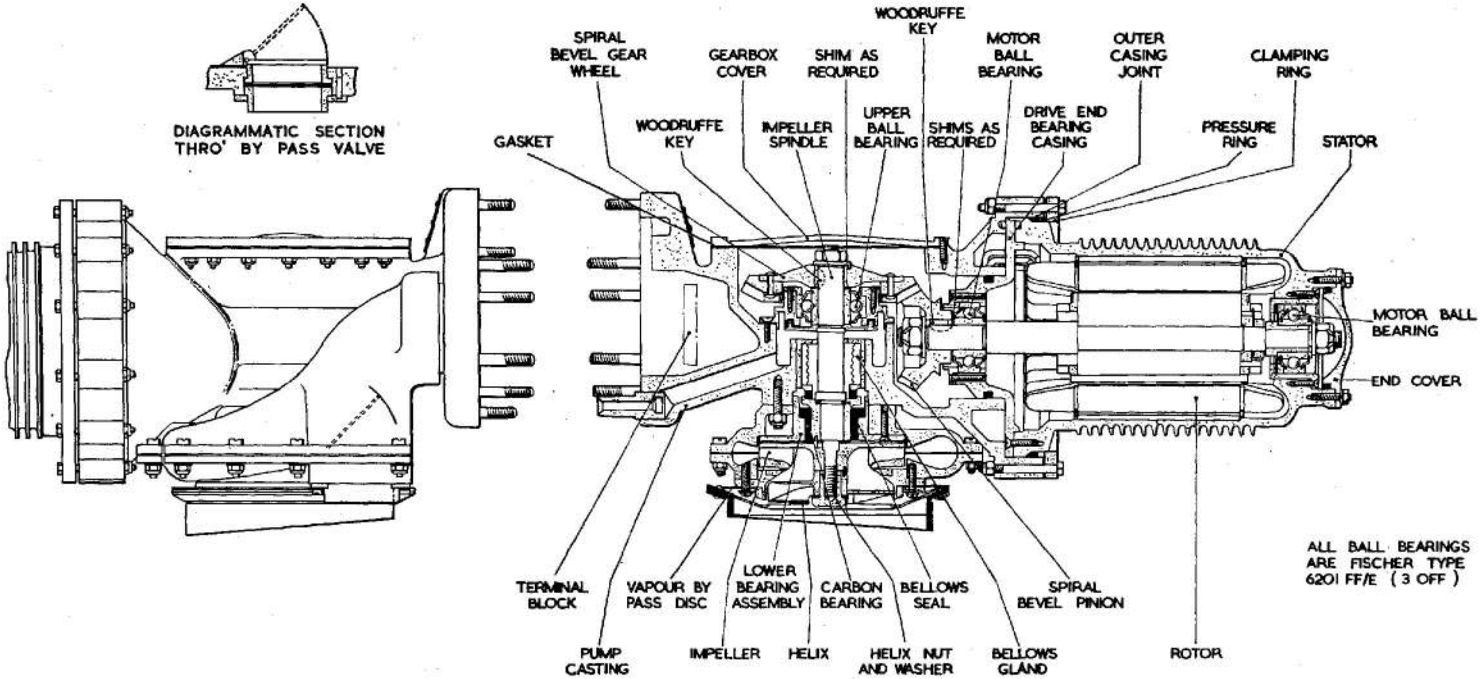

Fig. 1. Sectional view of pump

Pump unit

4. The complete unit consists of a horizontally mounted motor, driving a vertical impeller shaft, which is at right angles to it, the drive being established through reduction bevel gear. The estimated weight of the pump unit is 13¾ lb.

5. The pump unit has a square mounting flange and is secured by studs and nuts to a similar shaped, strengthened flange on the inside of the fuel tank.

6. The motor outer casing, into which the motor stator is a shrink fit, is finned, and, being immersed in fuel, is designed to assist in dissipating heat, developed when the pump is in operation. The pump is hermatically sealed to prevent the ingress of fuel, except via the proper fuel inlets.

Motor

7. The pump is driven by a totally enclosed, consequent wound, four pole laminated induction motor. The rotor, (which rotates within the stator) is supported in ball bearings, and consists of a stainless steel shaft around the circumference of which are 26 equally spaced brass conductor rods; these rods are secured at their extremities by brass conductor rings.

8. The stator is shrunk into the light alloy, finned casing and is provided with 24 well insulated slots to accommodate the wound stator coils which are positioned in these slots.

9. The operational output of the pump is 1,700 gallons of fuel per hour at 20 lb/in² pressure, the maximum current consumption being 3·6 amperes.

Bearings

10. Two Fischer Type 6201 FF/E ball bearings are housed in the motor casing and drive end casing respectively. The bearings are prepacked with D.T.D. 866 low temperature grease by the manufacturers.

Pump assembly

11. The pump, without the driving motor comprises a number of sub-assemblies. Through the main pump casting is fitted the vertical impeller pump spindle, on which are mounted the metal bellows fuel sealing gland, and the 1st and 2nd stage impellers.

12. The impeller spindle is supported at its lower end in a fuel lubricated, plain carbon bearing, and at its upper end by a shielded Fischer Type 6201 FF/E ball race journal bearing. The upper bearing locates in a circular housing and is spaced with shims from the large steel spiral bevel gear keyed to the top of the impeller spindle and secured by a self-locking nut. An inspection or access cover with gasket surmounts the bevel gear and is secured to the pump casting by csk.hd. screws with their associated nuts and washers.

Impeller and delivery outlet

13. The carbon seat for the metal bellows fuel sealing gland forms a part of the bellows seal assembly, preventing ingress of fuel to the motor. The two impellers are closely contained, one above the other on the impeller spindle, within the spiral volute. The spiral volute is formed from two flanged castings bolted together and secured to the base of the pump casting. A short outlet connects the open end of the spiral volute to the delivery outlet in the pump casting, from which, by means of a further delivery outlet (not supplied by the pump manufacturers), fuel is supplied to the engine.

14. Fixed to the upper end of the impeller shaft is a spiral bevel gear wheel which engages with a bevel pinion on the motor armature shaft.

Gland drain

15. Shims are used to control the clearance between the impeller and the lower bearing assembly and between the impeller and the helix shroud assembly. A drain hole is provided in the pump casting to take away any fuel leakage past the fuel sealing gland to atmosphere. A ⅛ in. B.S.P. gland drain union is fitted to the end of the drain hole and allows a drain pipe to atmosphere to be fitted.

Fuel thrower ring

16. A fuel thrower incorporating a labyrinth seal is fitted on the impeller spindle above the fuel sealing gland as an added protection against fuel creepage up the pump spindle into the motor.

Protection of fuel intake

17. A vapour guide cone surrounds the inlet to the pump, and, in conjunction with the rotation of the helix, assists in separating air bubbles and fuel vapour evolved, before they reach the impeller and delivery line. The fuel intake is surrounded by a shroud which assists the booster pump to withdraw the maximum amount of fuel from the tank and assists in preventing large particles of foreign matter from entering the pump.

By-pass valve

18. A by-pass valve is incorporated in the pump design to prevent pressure drop when the fuel is being drawn from the tank by the engine driven pump with the booster pump idle. This valve takes the form of a simple hinged, circular flap plate, fitted to close on a machined seating, and is located near the fuel delivery outlet. A wire mesh filter prevents ingress of foreign matter from entering the pump through the by-pass valve.

19. The valve is normally kept closed by the pressure of fuel delivered by the booster pump, but is opened by the engine pump suction when the booster pump is idle.

Electrical connection

20. A terminal block assembly locates in the pump casting and is accessible from outside the tank. Aircraft 3 phase supply leads and the motor 3 phase leads are connected to the terminals of the terminal block (*fig.* 4).

OPERATION

21. Fuel enters through a wire mesh filter situated at the lower end of the pump, and is picked up by a 1st Stage helical impeller, which serves the dual purpose of de-aerating the fuel and of pressurising the fuel at the eye of the 2nd stage centrifugal impeller, which feeds the fuel to the volute chamber and thence to the delivery outlet passage. In this delivery outlet passage a by-pass valve is fitted to permit fuel to be drawn from the tank if the pump is idle.

22. Under conditions in which the pump is supplying fuel in excess of engine requirements, the impeller continues to rotate, but the pressure is held within pre-determined limits.

INSTALLATION

Preliminary examination

23. Examine the new pump to be fitted and ensure that it is clean externally. It is important that before installation all transit plugs are removed from the pump.

General instructions

24. General instructions on removing an old pump and installing a new pump is contained in A.P.4343, Vol. 1, Sect. 16, Chap. 1, also in the relevant Aircraft Handbook. The dimensions of the pump unit are shown on the installation drawing (*fig.* 2).

Gland drain

25. The $\frac{1}{8}$ in. B.S.P. gland drain should be taken to atmosphere via a suitable outlet pipe. Ensure that the end of the gland outlet pipe faces to the rear of the aircraft to prevent possible pressurisation of the gland drain during flight.

SERVICING

General

26. Very little attention to the motor should be necessary at the routine servicing period. Squirrel cage induction motors are very strong, robust machines, having no commutator slip rings, or carbon brushes, the risk of failure from moving contact surfaces is practically eliminated.

Bearings

27. The bearings cannot be examined, except during a motor overhaul, as access to them is only possible by dismantling the pump. If the bearings prove defective the pump should be returned to the manufacturers for overhaul.

Routine inspection

28. Inspect castings, electrical and pump connections and attachment assemblies for cleanliness, distortion, cracks, corrosion, leaks and security.

29. Ensure that the motor breather is unobstructed and that the gland drain pipe orifice to atmosphere is not distorted, or obstructed.

TESTING

Erratic performance

30. Test the pump unit for evidence of correct operation during engine ground running checks. If there is any indication of excessive current consumption or low fuel delivery pressure, the pump should

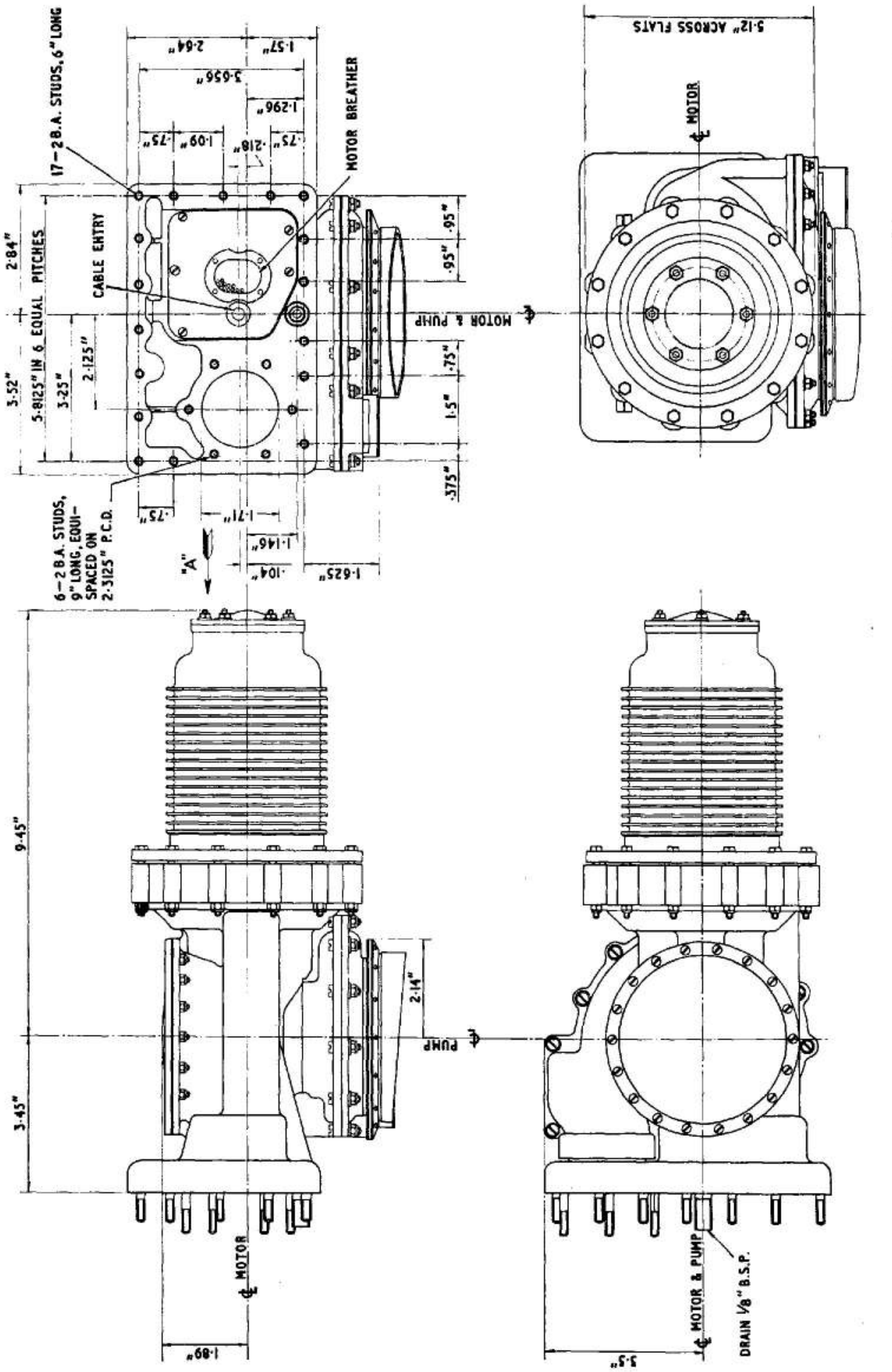

Fig. 2. Installation drawing

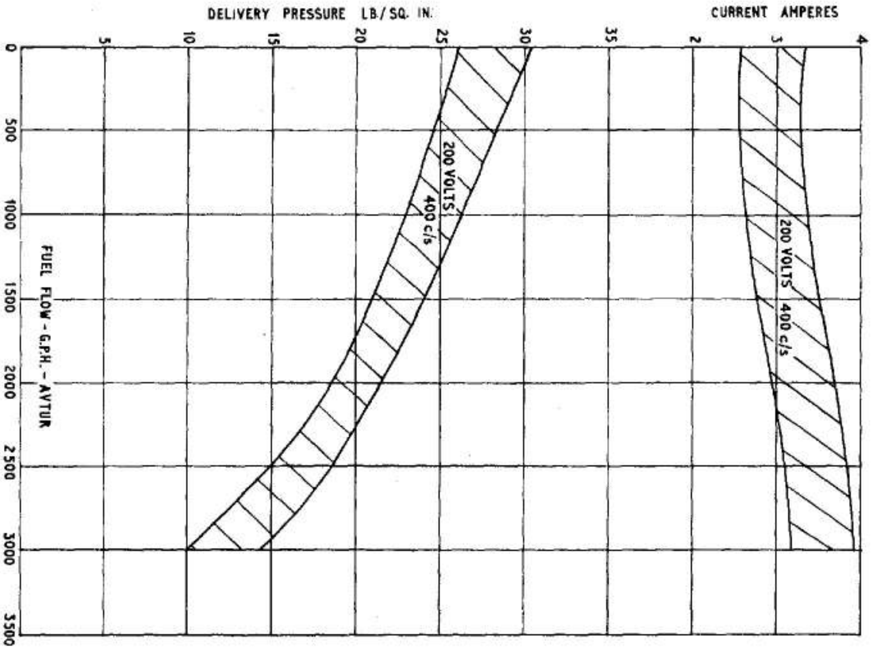

Fig. 3. Performance curves

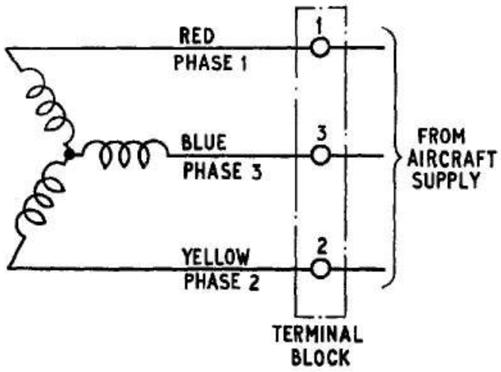

Fig. 4. Circuit diagram

be removed for overhaul. The current consumption with the pump at fuel delivery of 1,700 gallons per hour is 3·6A max.

Gland leakage tests

31. Examine the gland drain orifice for leakage, the maximum permissible leakage is 2 c.c.s. (approx. 50 drops) per hour with the pump running and 1 c.c. (approx. 25 drops) per hour with the pump stopped. Any leakage in excess of these figures will necessitate the removal of the pump for overhaul.

Maximum current at no fuel flow

32. With all fuel cocks closed the maximum current at no fuel flow is 3·4A.

Note . . .

*Instructions on the procedure for the no fuel flow test is described in A.P.*4343, *Vol.* 1, *Sect.* 16, *Chap.* 1.

Insulation resistance test

33. Using a 500-volt insulation resistance tester, measure the insulation resistance between the live parts and earth; it must not be less than 2 megohms on installation.

34. After installation of the pump, allowing for the increased humidity in the aircraft and at dispersal points, the minimum insulation resistance permissible is 50,000 ohms.