Chapter 9

PUMP, FUEL, SPE. 433A, Mk. 1

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Pump, fuel, SPE. 433A, Mk. 1	*Ref. No.* 5*UE*/6478
Operating voltage	200 *volt*, 3-*phase a.c.*
Frequency	400 *c.p.s.*
Nominal current	1·75 *amp. at* 10,350±100 *r.p.m.*
Torque	31 *oz. in.*
Delivery rate	400 *gallons per hour*
Delivery pressure	17 *lb. per sq. in.*
Weight of pump complete	6·25 *lb. (approx.)*

Introduction

1. The SPE. 433A, Mk. 1 fuel booster pump is designed to supply fuel under pressure to the aircraft main fuel supply line at all conditions of fuel de-aeration, high altitude vapour formation and extremes of temperature.

2. The pump is designed for vertical mounting in the base of aircraft fuel tanks, fuel collector box or sump, with the a.c. electrical motor submerged in the fuel.

3. When in service the body of the pump is inserted through a suitably reinforced hole in the base of the fuel tank, and the unit is secured in a vertical position (motor uppermost), by bolting the flange of the pump base to the tank flange, with its associated washer.

DESCRIPTION

General

4. A sectional view of the complete pump unit is shown (*fig.* 1), and comprises mainly a driving motor, running in ball bearings, supported in the upper end of the pump body, or portway casting, which in turn is secured to the pump base casting. The motor unit complete is located on to the portway casting by a dowel pin, which lines up with a hole in the motor casing base. Hermeticol or Wellseal jointing compound is used as a seal between the lower face of the portway casting and the upper face of the pump base. Twelve holes equally spaced around the pump base and fuel tank flange, allows the pump to be secured to the tank, together with its sealing washer.

5. The motor casing which is finned, to assist in dissipating heat when the pump is operating, is hermetically sealed to prevent the ingress of fuel.

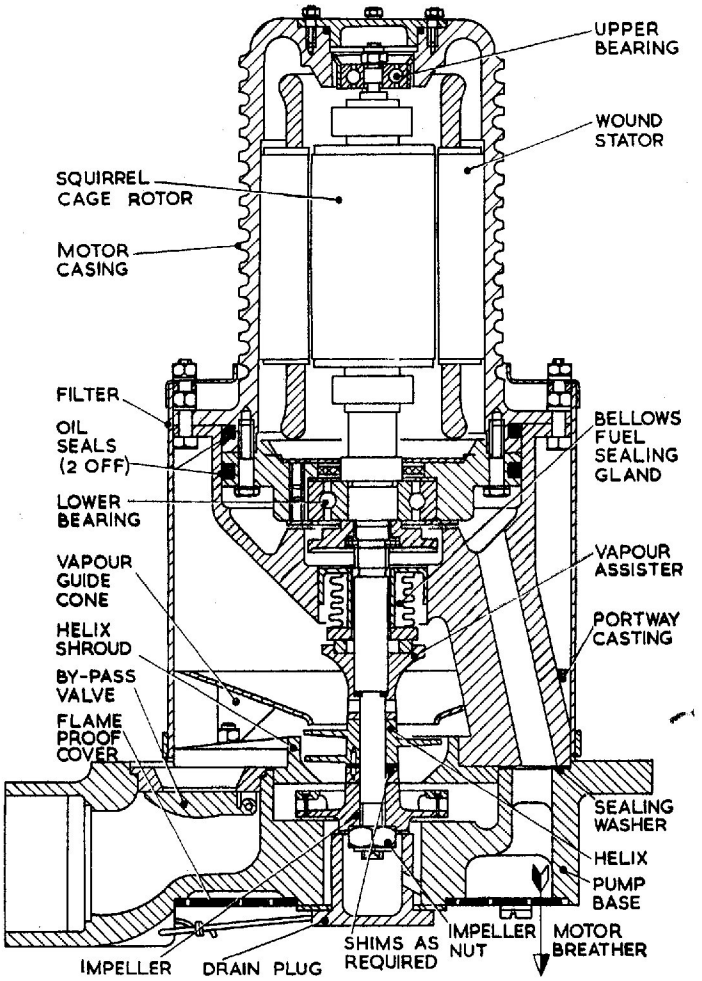

Fig. 1. Sectional view of pump

Motor

6. The pump is driven by a four pole squirrel cage induction motor operating from a 200 volt., 3-phase, a.c. 400 c.p.s. supply. The rotor comprises 13 equally spaced, brass conductor bars which are secured at their extremities by end rings. The nominal speed of the motor is 10,350 $\pm$100 r.p.m. when operating from the nominal 3-phase, a.c. supply, the load current being 1·75 amperes.

earings

7. The motor upper bearing is housed in the motor casing and is secured to the armature shaft by a pinnacle nut, whilst the motor lower bearing is housed in the motor base plate and is secured to the shaft by a special shaped nut, which acts as a thrower ring; this ring nut assists in preventing the ingress of fuel to the motor lower bearing and stator windings.

Pump assembly

8. The pump base is a casting in which is formed a volute chamber leading to the fuel pump outlet. A machine boss adjacent to the outlet provides a seating for a Breeze type plug which is the electrical connection for the input leads to the motor. At the side of the pump fuel delivery outlet is a $\frac{1}{4}$ in. B.S.F. tapped hole which drains away any fuel that may have seeped past the fuel sealing gland. At the centre base of the casting is an aperture which is tapped to take a water drain plug, allowing drainage of water from the fuel tank without having to remove the pump.

By-pass valve

9. A by-pass valve is incorporated in the pump base assembly and is located in the fuel delivery outlet duct. The valve is hinged to an annular seat. When the pump is operating the pressure of fuel passing through the pump prevents the valve from

opening. When the pump is idle the pressure on the underside of the valve is relieved, allowing the valve to open and the engine driven pump to continue to draw fuel from the tank.

Portway casting

10. The portway casting comprises two circular ends between which are three cored out ducts. One duct serves as a cable conduit for the motor input leads. The second duct drains away fuel that may have seeped past the fuel sealing gland. The third duct allows air to pass through the breather holes in the pump base for motor ventilation. The upper end of the casting is machined to receive the motor, and also houses the metal bellows fuel sealing gland. A flared cone, known as the vapour assister is fitted on the rotor shaft extension immediately below the fuel sealing gland. A three section vapour guide cone, located around the mouth of the impeller chamber, serves to carry away accumulations of fuel vapour and air, developed during high rates of climb to altitude.

Fuel sealing gland

11. This metal bellows gland comprises a brass backplate to which is sweated a brass bellows, at the end of which is a bronze seal ring. The seal is guided by four splines cut round its outer circumference and engaging with four lugs projecting from the backplate. These parts form a gland unit which is pressed into the pump casing. The bronze seal ring, which is stationary, rubs against a rotating carbon ring shrunk permanently into the back of the impeller.

Filter

12. A cylindrical wire gauze filter completely encloses the upper part of the pump body, which is immersed in the fuel tank; thus preventing the ingress of foreign matter from the tank into the pump.

OPERATION

13. Fuel from the tank enters the pump through the wire mesh filter into the eye of a combined helico-centrifugal type impeller driven by the extended rotor shaft of the motor. From here it is forced via a spiral volute in the pump base, through the delivery outlet duct into the delivery line, to the inlet side of the aircraft engine driven fuel tank.

INSTALLATION

14. General instructions on installing a new pump will be found in A.P.4343, Vol. 1, Sect. 16, Chap. 1 and also in the relevant Aircraft Handbook. The dimensions of the

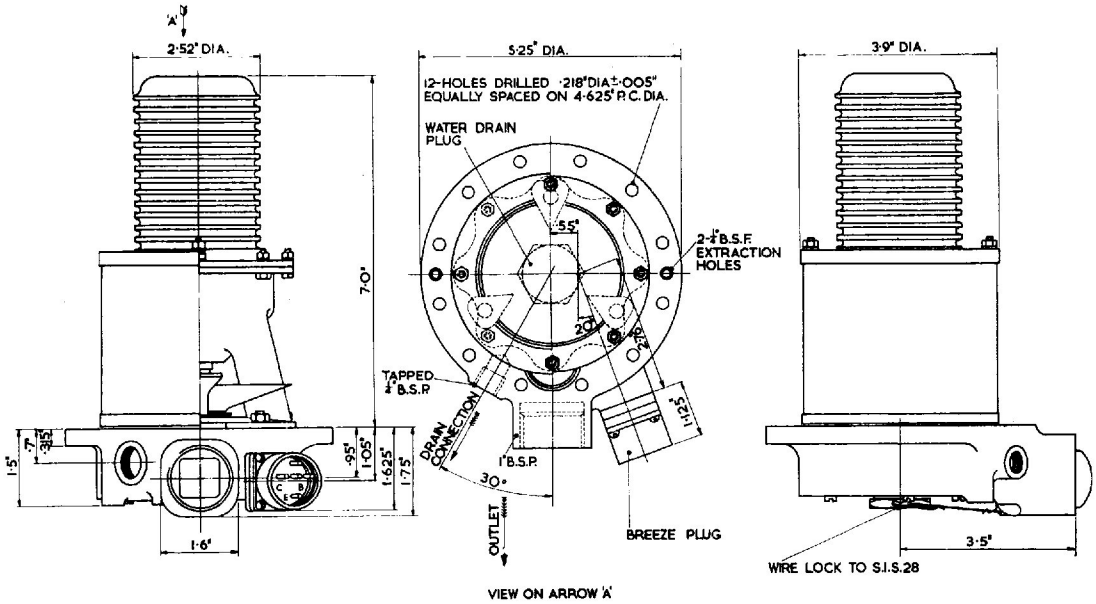

Fig. 2. Installation drawing of pump

pump are shown on the installation drawing (*fig.* 2).

SERVICING

15. Very little attention to the motor will be necessary at the routine servicing period. Squirrel cage induction motors are very strong robust machines, having no commutator, slip rings or carbon brushes. Being high speed machines the rotor bearings should have special attention at the routine servicing periods.

16. General instructions on servicing will be found in A.P.4343, Vol. 1, Sect. 16, Chap. 1 and in the relevant Aircraft Handbook.

TESTING

Motor setting

17. The motor speed and current consumption at 200 volt, 3-phase a.c. 400 cycles per second shall be measured and recorded when the machine is subjected to a torque of 31 oz. in. applied by means of a suitable calibrated fan or dynamometer and shall be within 10,350 $\pm$100 r.p.m. with a maximum current of 1·75 amperes whilst the motor is at normal temperature.

" No flow" current

18. The current consumption under "no flow" conditions (when the pump is running on a voltage of 210 volt, 3-phase, a.c. at a frequency of 420 c.p.s.) must not exceed 2 amperes.

Gland leakage tests

19. The pump is to be fully primed under a one foot head of fuel over which a superimposed air pressure of 16 lb/in² is to be applied. Under these conditions with a voltage of 210 volt., a.c. at 420 c.p.s. applied to the motor and no fuel flow, the pump is to be run for 15 minutes. During the running of the pump and also when stationary, observations are to be made for:—

(a) External leakage of fuel

(b) Gland leakage of fuel.

20. The allowable rate of leakage past the gland is two c.c.s per hour running and one c.c. per hour stationary. No other leakage is permissible.

21. An air pressure of 10 lb/in² is to be applied for 5 minutes internally to the pump casing, gland housing, etc., with the pump at rest, but submerged in fuel. This air pressure is to be applied slowly, through the motor breather and the gland drain simultaneously. No leakage of air bubbles is permissible.

Insulation resistance test

22. Measure the insulation resistance of the motor between the live parts and earth. The insulation resistance of the machine, before installation is an aircraft must not be less than 2 meghoms. After being installed in an aircraft the insulation resistance must not be less than 50,000 ohms.

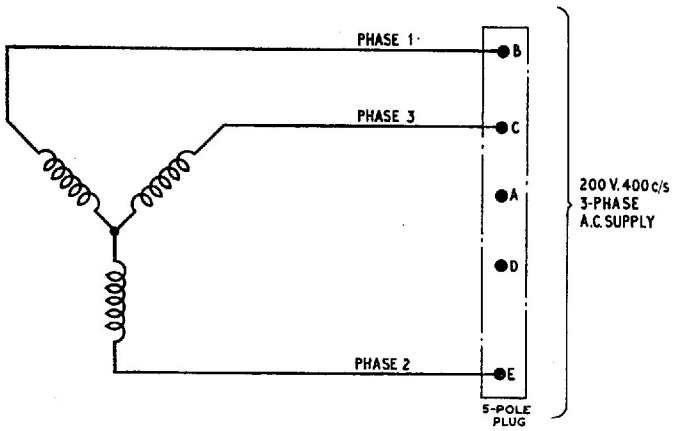

Fig. 3. Circuit diagram