

Chapter 28 POWER PACK UNIT

Type No. 1.00547.001

incorporating:—

ELECTRIC MOTOR

Type No. CA.1401

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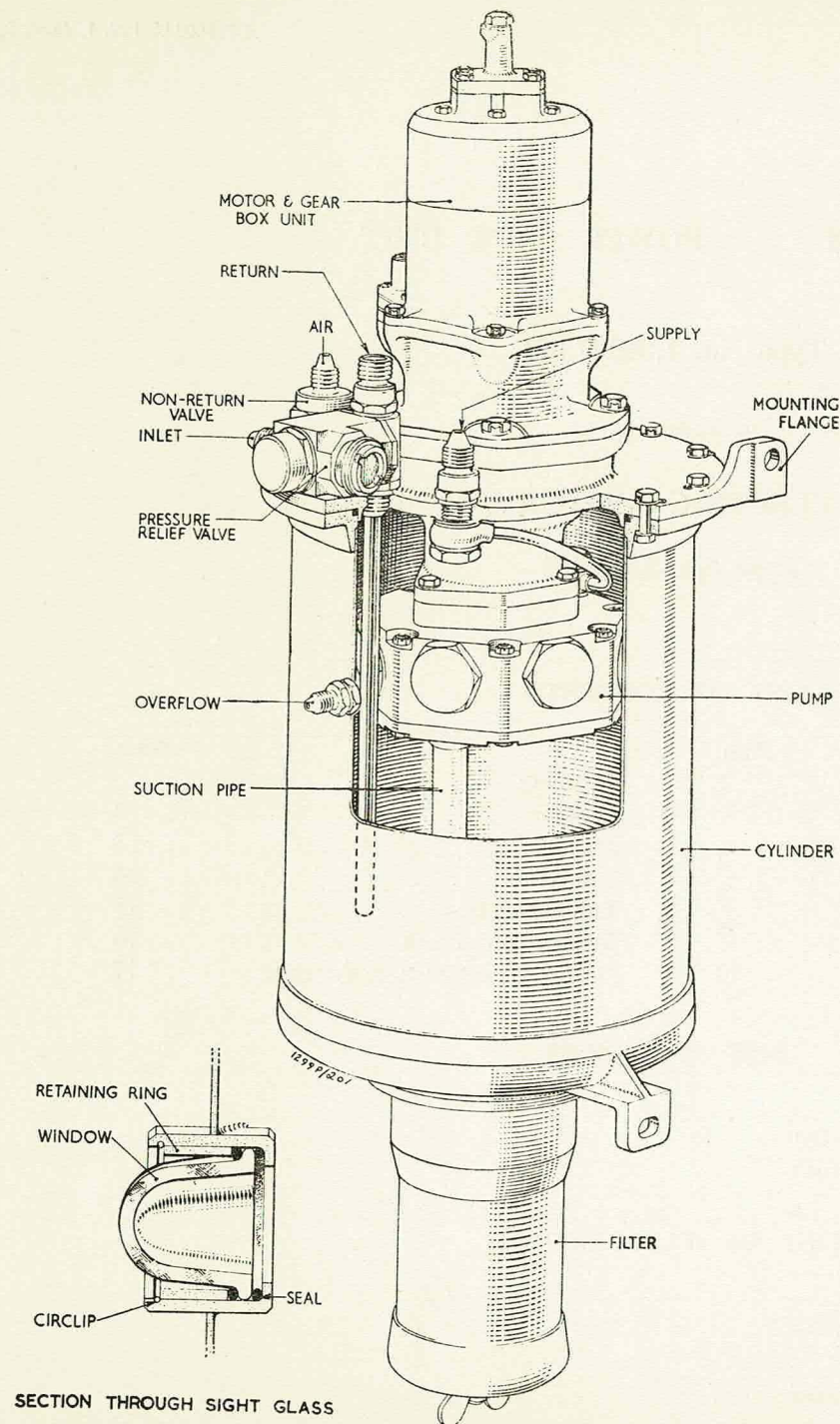


Fig. 1. Power pack

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Introduction

1. A power pack unit is installed in a hydraulic system to provide an emergency supply to specific circuits or for ground operation. The unit consists of a high pressure radial pump embodied in a cylindrical casing to which a filter is attached. The pump is driven by a Rotax electric motor, which is described in A.P.4343D, Vol. 1, Book 4, Sect. 21. It is operated by an electrical supply controlled by a pressure switch Type No. C.1829Y Mk. 8, which is described in A.P.1803D, Vol. 1, Book 3, Sect. 8. The pump, Type No. C.6910Y is described in A.P.1803D, Vol. 1, Book 1, Sect. 2.

DESCRIPTION

Cylinder

2. The cylinder (fig. 1) is of all welded construction having a securing ring at the upper end and a bottom fitting at the lower end. A sight glass housing and a boss for an overflow connection are also welded to the cylinder. The sight glass housing contains a window which is held between two seals by a retaining ring. The ring is held by a circlip.

3. The securing ring provides for the attachment of a mounting flange against a sealing ring. This flange forms a mounting for the pump on the lower face and for attachment of the electric motor and gear box unit on the upper face. The flange also accommodates the necessary connections to the power pack.

4. The bottom fitting at the lower end is flanged and drilled for the attachment of the filter assembly against a sealing ring. Brackets formed on this fitting and on the flange are for mounting purposes.

Connections

5. Three tappings in the mounting flange accommodate the delivery, return, and air connections. The supply connection is an adapter, secured against a bonded seal by a banjo bolt screwed from the underside of the mounting flange. The banjo bolt also retains a pipe assembly from the delivery connection of the pump.

6. The return connection is a union integral with a stack pipe which secures a pressure

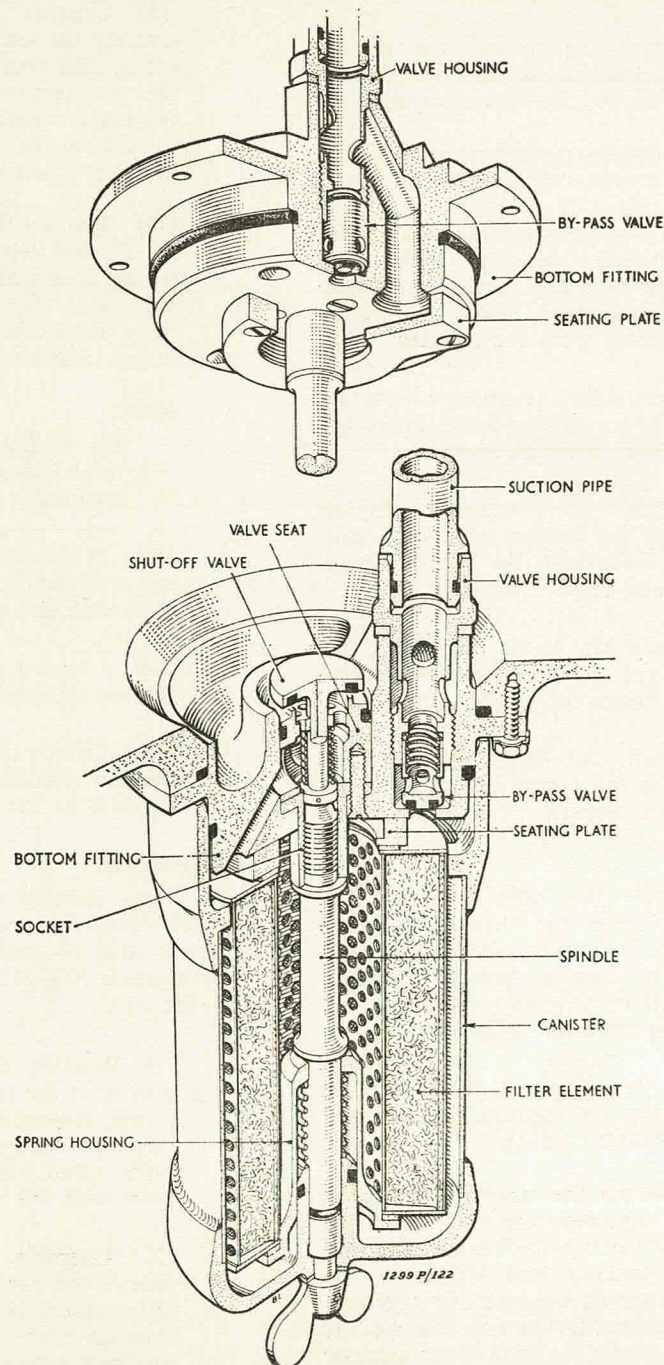


Fig. 2. Filter

relief valve between bonded sealing rings. A non-return valve provides for the air connection by which the unit is pressurized. The pressure relief valve and non-return valve are described in detail in A.P.1803D, Vol. 1, Sect. 9.

Filter

7. The filter element (fig. 2), with a felt washer bonded to each end, is contained within a canister and clamped between a spring-loaded housing and a bottom fitting by a spindle. The spindle screws into a flanged socket located in the bottom fitting and the opposite end protrudes through a central boss in the canister end fitting. A wing nut is pinned to this end and a seal is located in the spindle shank.

8. The bottom fitting engages in the canister top fitting and is sealed by a rubber washer located in a circumferential groove. A flange provides for the attachment of the filter assembly to the power pack cylinder and the fitting is shaped to house the shut-off valve and by-pass valve assemblies. A seating plate is secured to the inner face of the fitting by countersunk screws. The shut-off valve is a mushroom type with a sealing ring bonded to the underside of its head. The valve stem passes through a valve seat located in a central housing of the bottom fitting over a socket which receives the inner end of the spindle. The valve stem, being in contact with the end of the spindle, is lifted in the assembled condition. When the spindle is unscrewed by turning the wingnut anti-clockwise, the spring closes the shut-off valve as the canister is withdrawn from the bottom fitting. As the valve closes before the canister is entirely free from the sealing ring in the fitting, the canister can be withdrawn for examination or change of filter element, without loss of fluid from the power pack cylinder.

9. The by-pass valve has a seal bonded to one end which is thrust against an aperture by a spring located between the valve and valve housing. The valve housing is screwed in against a washer and the end of the housing

receives the suction pipe from the pump. During normal operation the by-pass valve is inoperative and fluid entering the filter canister through the open shut-off valve and the oblique drilling flows through the filter element and is drawn through the suction pipe to the pump via a drilling which communicates with the by-pass valve housing above the valve element. Should the filter element become choked, the fluid will build up sufficiently to open the by-pass valve, and prevent starvation of the pump.

Principle of operation

10. The power pack unit is installed in a system and is filled to a specific level from the system reservoir. A pipe line from the reservoir to the inlet connection to the pressure relief valve maintains the correct level as indicated by the sight glass. Excess fluid is returned to the reservoir via the overflow connection, which is piped to the return connection to the reservoir. The requisite pressure for satisfactory functioning of the unit is maintained in the cylinder by an air supply of approximately 15 lb/in² connected to the non-return valve.

11. When the motor is switched on, the pump, driven by the motor, draws fluid from the filter through the suction pipe and delivers it at high speed through the supply connection to a specific circuit. Fluid from the circuit entering at the return connection has access to the bore of the relief valve as it passes into the cylinder. If the pressure in the return line becomes excessive, the relief valve lifts and pressure escapes through the relief connection to the system reservoir.

SERVICING

TABLE 1

Special tool

Part No.	Description
ST.1664	Tool for assembling circlip to sight glass housing.

Leakage

12. If external leakage occurs, the faulty seal, indicated by the seepage, must be renewed.

Dismantling

13. (1) Unscrew and remove the return connection and remove the bonded seal. This will free the pressure relief valve.

(2) Unscrew the non-return valve complete, and remove the bonded seal.

(3) Open the tab-washers locking the mounting flange securing bolts and remove the nuts and bolts. Withdraw the motor, mounting flange and pump as an assembly from the cylinder.

(4) Withdraw the suction pipe from the cylinder. Do not remove the sealing rings from the pipe unless necessary.

(5) Unscrew the supply adapter and remove the bonded seal. Withdraw the banjo bolt from the pressure pipe assembly and remove its seal.

(6) Unscrew the banjo bolt from the pump to free the pressure pipe assembly, and remove the bonded seals.

(7) Unscrew the bolts securing the gear box to the pump and remove the tab-washers. Separate the pump from the gear box.

(8) Unscrew the bolts securing the bottom fitting of the filter assembly to the cylinder and remove the tab-washers. Remove the bottom fitting, complete with the filter assembly. Remove the sealing ring from the cylinder.

(9) Turn the wing nut of the spindle anti-clockwise to separate the canister from the bottom fitting.

(10) Drive out the taper pin from the wing nut, unscrew the nut from the spindle and remove the washer. Remove the filter canister and withdraw the spring and spring housing. Now remove the filter element. Do not remove the sealing ring from the base of the canister unless necessary.

(11) Unscrew the countersunk screws securing the seating plate to the bottom fitting and remove the plate. Unscrew the countersunk screws retaining the valve and withdraw the seat and shut-off valve from the bottom fitting. Withdraw the screwed socket.

(12) Remove the pin from the collar on the shut-off valve, remove the collar and spring, then withdraw the valve from the valve seat. Do not remove the sealing rings from the valve seat or bottom fitting unless necessary.

Note . . .

The sealing rubber of the shut-off valve is bonded to it and cannot be removed.

(13) Withdraw the by-pass valve housing and spring. The rubber valve seat is bonded and cannot be removed.

(14) Unscrew the overflow adapter and remove its bonded seal.

(15) Detach the circlip and remove the window retainer, sealing rings and window of the sight glass.

Assembling

14. The electric motor, pump, pressure relief valve and non-return valve are to be tested, and all sealing rings lightly coated with grease XG-315 before being assembled in the unit.

(1) Position the sealing ring in the groove at the top face of the assembled pump. Assemble the pump to the gear-box and secure it by screwing in the bolts, fitted with tab-washers. Lock the bolts with the washer tabs.

(2) Assemble a bonded seal to each face of the banjo unions of the pressure pipe assembly. Insert a banjo bolt through each of the unions, then screw one bolt into the tapping in the pump casing and the other into the mounting

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flange. Assemble a bonded seal to the supply adapter and screw the adapter on to the exposed end of the relevant banjo bolt.

(3) Before further assembly, apply a pressure of 6000 lb/in² to the supply adapter. Leakage is not permissible. Wire-lock each pressure pipe banjo bolt to the pipe.

(4) Ensure that a sealing ring is fitted to each end of the suction pipe, then insert one end of the pipe into the boss on the pump cover.

(5) Ensure that a sealing ring is fitted to the top of the cylinder, then lower the pump assembly into the cylinder. Insert the retaining bolts through the mounting flange, fit tab-washers to the bolts, and screw on the nuts. Lock the nuts with the washer tabs.

(6) To assemble the filter, ensure that the sealing ring is fitted to the shut-off valve seat, then insert the stem of the valve through the end of the seal carrying the sealing ring. Assemble the spring over the valve stem, fit the collar over the stem and insert the locking pin. Lock the pin by centre-punching once at each end.

(7) Insert the screwed socket into the bottom fitting. Insert the valve seat into the fitting to abut the socket. Rotate the parts as necessary to align the screw holes, then screw in the retaining screws. Lock the screws by centre-punching.

(8) Insert the spring into the by-pass valve and fit the valve into the screwed end of the valve housing. Position a bonded seal against the shoulder on the housing, screw the housing, complete with valve, into the bottom fitting and wire-lock the two together. Ensure that a sealing ring is fitted in the groove of the valve housing.

(9) The sub-assembly of the parts detailed in sub-para. (6), (7) and (8) is now to be assembled in test fixture 6786Y38A as shown in fig. 3 and tested as stated in para. 16.

(10) Dismantle the test fixture together with the adapter and its sealing ring from the sub-assembly.

(11) Secure the seating plate to the bottom fitting with the countersunk screws.

(12) Ensure that a sealing ring is fitted to the spindle, screw the spindle into the socket and fit the filter element over the spindle to rest on the seating plate.

(13) Position the spring housing over the spindle in the filter element, insert the spring in the housing and fit the canister, securing it by fitting the washer and wing nut on the end of the spindle. Tighten the wing nut and lock it to the spindle with the taper pin. Lightly rivet over the small end of the pin.

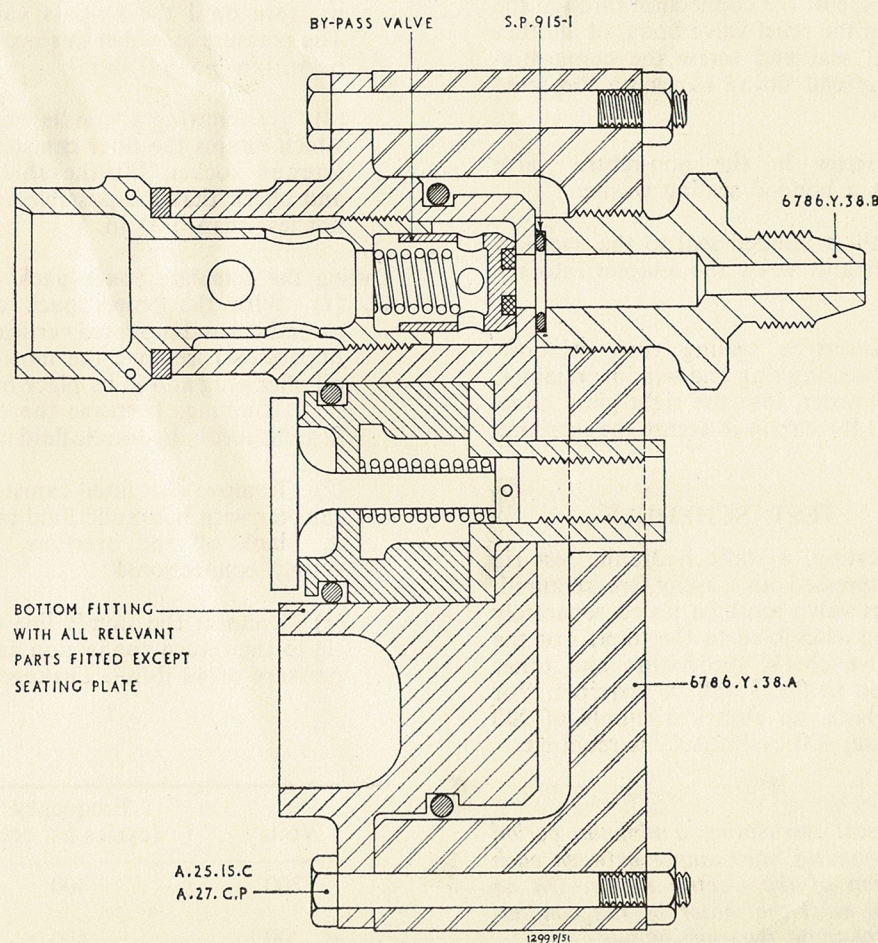


Fig. 3. Test fixture

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(14) Ensure that the sealing ring is fitted to the base of the cylinder. Position the bottom fitting so that the valve housing will align with the suction pipe in the cylinder, then insert the bottom fitting into the cylinder, ensuring that the pipe engages in the valve housing.

(15) With tab-washers fitted to the securing bolts, screw the bolts into the bottom fitting and cylinder. Lock the bolts with the washer tabs.

(16) Assemble a bonded seal to the return connection, insert the integral stack pipe of the connection through the boss on the relief valve body, fit another bonded seal and screw the connection into the end fitting to secure the relief valve.

(17) Screw in the non-return valve against a bonded sealing washer.

(18) Fit a bonded seal to the overflow adapter and screw the adapter into the boss.

(19) Insert a sealing ring, window, second sealing ring and window retainer, in that order, into the sight glass housing. Fit the circlip to secure the retaining ring.

TEST SCHEDULE

15. For testing, a static hydraulic test rig and a compressed air supply are required. The by-pass valve must be tested separately before being assembled to the filter. For the by-pass valve check, the fixture and other parts quoted in fig. 3 will be required. For functional tests, an electrical supply of 200 volts 3 phase, 400 cycles A.C. is required.

Note . . .

To prevent overheating, a minimum period of 20 minutes must elapse between each operation of the electric motor. On no account must the motor be run continuously for more than one minute.

By-pass valve check

16. (1) Assemble the bottom fitting, complete with by-pass valve and shut-off valve, in the test fixture (as shown in fig. 3) so that the $\frac{5}{8}$ in. B.S.P. tapped hole is opposite the by-pass valve orifice.

(2) With the sealing ring positioned in the counterbore of the adapter, screw the adapter into the test fixture so that a leak-proof joint is obtained. Do not over-tighten the adapter.

(3) Connect the supply line of the test rig to the adapter and gradually apply pressure until the by-pass valve opens. The pressure at which this occurs should be within 3.5-6.0 lb/in².

(4) By screwing a spindle, such as that which retains the filter canister, into the screwed socket, lift the shut-off valve and check that the possible valve lift is not less than 0.09 in.

Testing the complete power pack

17. (1) With the power pack completely assembled and mounted vertically (motor uppermost), remove the motor gearbox oil filler plug and in its place fit a flexible hose coupling. Immerse the end of the flexible hose in hydraulic fluid oil OM-15.

(2) Remove the filter canister, fill the canister with hydraulic fluid and replace it. Blank off the overflow, relief and supply connections.

(3) Connect the supply line of the test rig to the return connection and apply a pressure of 40 lb/in². Leakage must not

occur from the power pack or non-return valve and no air bubbles should appear from the flexible hose.

(4) Release the pressure, disconnect the supply line and remove the filter canister. No appreciable leakage of fluid should occur from the power pack.

(5) Drain the power pack by screwing a spindle, such as that which retains the filter canister, into the screwed socket, thus lifting the shut-off valve. With the filter canister empty, replace it on the power pack and refit the motor gearbox oil filler plug. Blank off the return connection.

(6) Connect an air line to the non-return valve and apply an air pressure of 30 lb/in². Disconnect the air line and immerse the power pack in kerosine or hydraulic fluid oil OM-15, taking care to ensure that the electric motor is *not immersed in the fluid*; this is important. Leakage must not occur from the power pack or non-return valve.

(7) With the power pack mounted vertically, fill the motor gearbox with Xylene, OX-23, connect the motor to the relevant electrical supply, connect the compressed air supply to the non-return valve, apply a pressure of 15 lb/in² and functionally test the power pack to meet the requirements given in the Table.

(8) On completion of functional tests, drain the motor gearbox of oil. The box is to be refilled with oil after installation in the aircraft.

TABLE 2
Test details

Volts	Frequency (cycles per sec.)	Amps. (max.)	Pressure (lb/in ²)	Min. delivery (gal. per min.)
200	400	32	3,900	2.2
200	400	12	500	2.5

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