Chapter 18

UPPER FREIGHT DOOR JACK

Type No. 1.00472.001

(*incorporating*—Lock valve type No. 1.00503.001)

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LEADING PARTICULARS

Fluid	*Oil, OM.*15 (34*B*/9100572)
Lubricant	*Grease, XG.*315 (34*B*/9100519)

Introduction

1. This jack is incorporated in a specific aircraft hydraulic circuit and functions to operate the doors of a freight compartment. It differs from the normal type by the fitment of a lock valve to enable closure of the jack to be arrested at any desired point during travel. A thermal relief valve is embodied in the lock valve to cater for temperature variations.

DESCRIPTION

Cylinder assembly

2. The cylinder houses a piston assembly and is closed at one end by an end fitting, and at the opposite end by a gland assembly. The end fitting, which screws over the cylinder, is grooved for a sealing ring supported by a backing ring, and is formed with two bosses of different sizes to receive the bolts securing the lock valve to the jack. The larger boss, receives a bolt drilled for the passage of fluid, and communicates by a hole to the bore of the fitting, whilst the tapping in the smaller boss terminates in a blind hole. A spherical bearing, housed in a lug formed integral with the end fitting, provides for an airframe attachment point, and lubrication of the bearing is effected by a greaser screwed into the lug. Shims are fitted between the end fitting and a flange on the cylinder for alignment purposes.

3. The opposite end of the cylinder receives a gland nut which screws into the cylinder to retain a gland ring and a spacer against a shoulder in the bore. The gland nut is fitted with a wiper ring to prevent the ingress of dirt when the piston rod is retracted. A boss, formed on this end of the cylinder, receives a bleeder banjo bolt of a transfer pipe assembly the other end of which connects to an adapter on the lock valve.

Piston assembly

4. The tubular piston rod is closed at the inner end by a piston head screwed over the rod and soldered in position. The head is grooved for a sealing ring and supporting split rings, and a spacer, fitted with a sealing ring, is located against the piston head to limit the outward travel. The outer end of the rod is slotted to engage the tongues of a spanner grip and threaded for an eyebolt secured by a lock-nut. The eyebolt carries a spherical bearing and is adjustable to suit

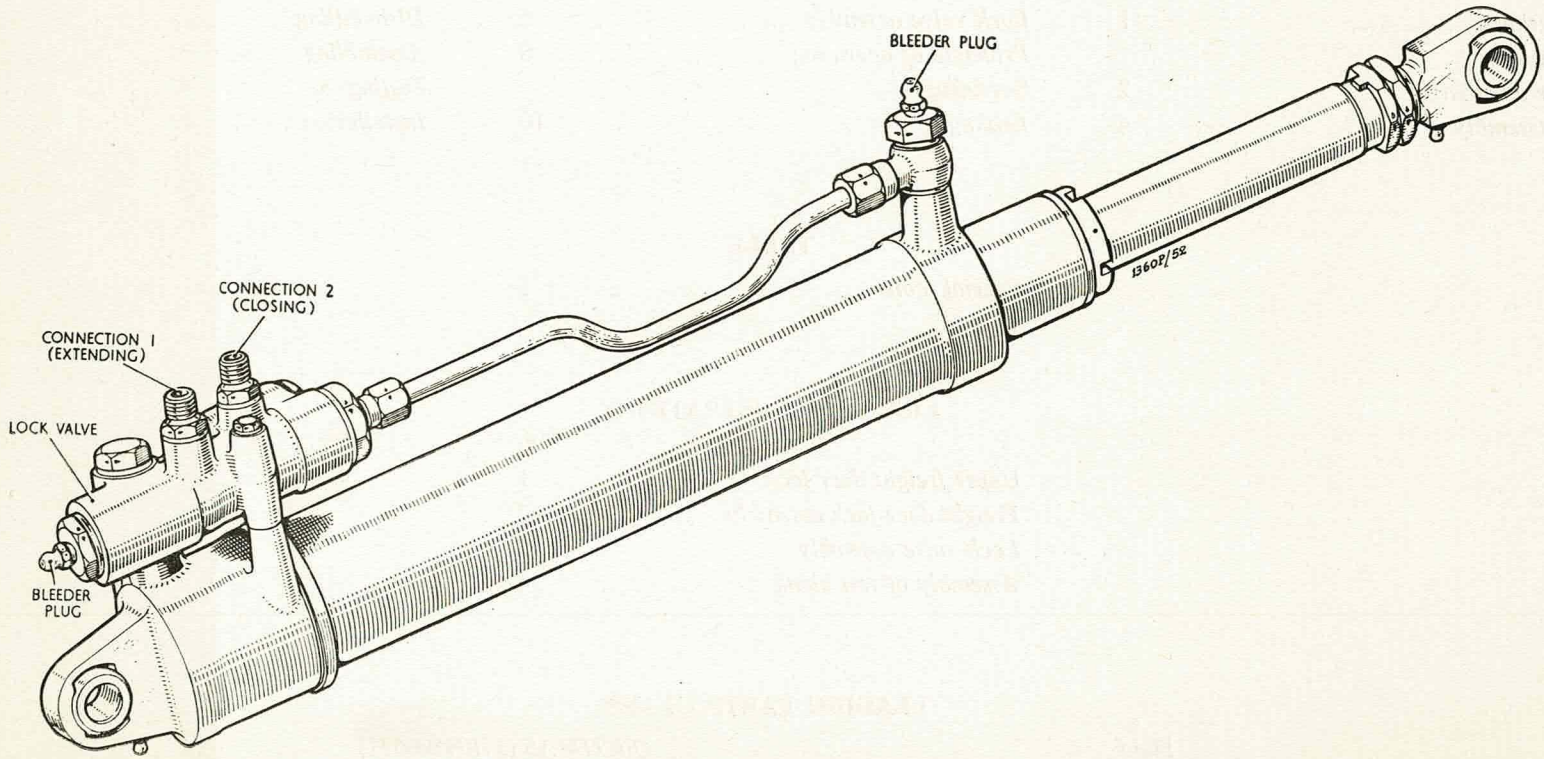

Fig. 1. Upper freight door jack

the points of attachment on the aircraft. A greaser is screwed into the eyebolt to provide for lubrication of the spherical bearing.

Lock valve assembly

5. The body of the lack valve is formed with bosses for attachment purposes and has two parallel bores housing a piston valve assembly and a thermal relief valve assembly respectively. Two other bosses on the body receive the service connections 1 and 2 for extending and closing the jack. Fluid passages in the body communicate with the bores, the connection bosses and the hole in the larger jack attachment boss. This boss is recessed at its lower end for a sealing ring and receives the hollow attachment bolt through which fluid passes to the bore of the jack.

6. The piston valve assembly consists of a flanged-piston spring-loaded away from a valve seat housing a fluted valve. The valve seat has radial holes which communicate with an annular recess in the body, and is grooved for a sealing ring supported by a backing ring. The valve is loaded to the seat by a spring compressed between the valve and a spring guide housed in an end plug, which screws into the body to retain the valve seat against a shoulder in the bore. The plug is grooved for a sealing ring and supporting backing ring, and carries a bleeder plug screwed into the outer face. Shims and a washer are fitted, as necessary, under the spring guide to limit the gap between the guide and the end of the valve stem. The piston, which is fitted with a Duplex seal, is retained by an end cap fitted with a sealing ring and screwed into the end of the body. The cap is formed with a pipe adapter to which is attached one end of the transfer pipe assembly.

7. The thermal relief valve consists of a ball valve held against a valve seat by a spring

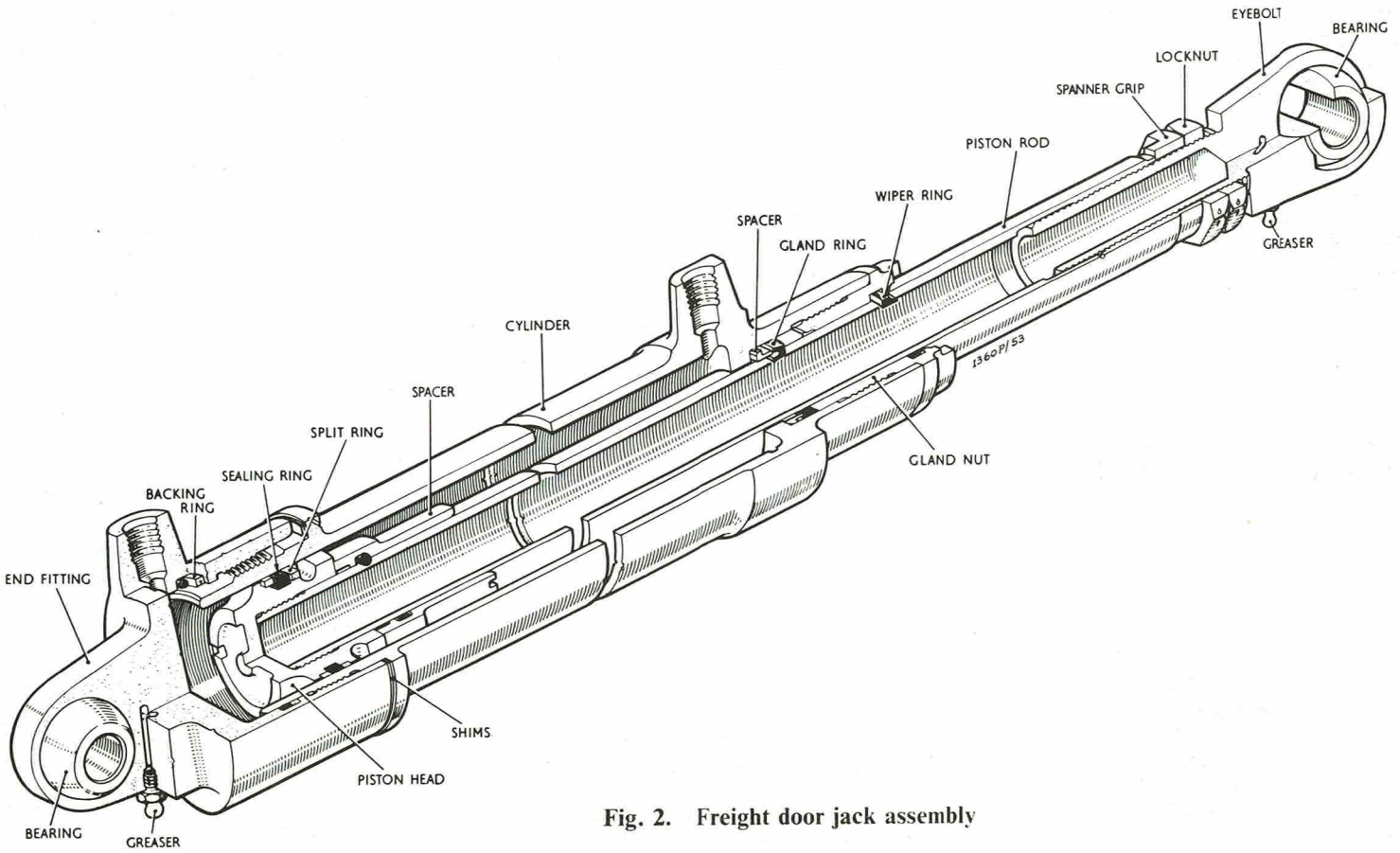

Fig. 2. Freight door jack assembly

compressed between a spring seat and a travel stop. Washers are fitted at one end of the spring and shims may be inserted between the washers and the head of the stop, if necessary, to obtain the requisite blow-off pressure. The valve seat is recessed for a sealing ring supported by a backing ring and, together with a chamfered washer is located at the inner end of the body bore. A ball guide fitted over the spring is permitted a small amount of linear and lateral movement to ensure the correct alignment of the ball to the seat. The complete assembly is retained in the body by a sealed end plug which is screwed in against a washer and shims fitted for adjustment purposes.

Principle of operation

8. When the jack is operated to close, the supply fluid enters at connection 2 and flows along the transfer pipe to the rod side of the piston. Simultaneously, the supply fluid acts on the piston in the lock valve to move the valve from its seat, thus allowing fluid behind the piston to escape via the open valve seat to the return line. The piston then moves to the closed position. The travel of the piston to the closed position may be arrested at any point by cutting off the supply fluid; this action permitting the lock valve to re-seat and so trapping fluid behind the piston.

9. To extend the jack, fluid applied at connection 1 moves the valve from its seat and flows into the cylinder to move the piston to the fully extended position. In the event of a rise in temperature, the thermal relief valve will operate to relieve excess pressure to the return line.

SERVICING

Leakage

10. External leakage will indicate a faulty gland ring or sealing ring which must be renewed. Internal leakage past the jack piston sealing ring, the piston valve seat or the thermal relief valve seat will result in the inability of the jack to lock and may be due to a faulty seal, a pitted valve seat or a damaged spring, or to dirt between the valve and seat. Clean or renew the appropriate item. A faulty Duplex seal must be renewed.

Dismantling

11. (1) Remove the lock valve and the transfer pipe assembly and remove the connections from the valve.

(2) Unscrew the lock valve end cap and remove the sealing ring.

(3) Withdraw the piston and the spring from the body. The piston is tapped $\frac{7}{16}$–20–UNF–2B to facilitate withdrawal. Remove the Duplex seal from the piston.

(4) Unscrew the end plug retaining the piston valve assembly and withdraw the spring guide together with the shims and the washer (if fitted) from the plug. (*Note the shims thickness.*) Remove the sealing ring and the backing ring from the plug.

(5) Withdraw the spring, the fluted valve seat from the body. Remove the sealing ring and the backing ring from the seat.

(6) Unscrew the end plug retaining the thermal relief valve details and remove the washer and the shims from the plug. (*Note the shims thickness.*)

(7) Withdraw the travel stop, the washers, shims, spring and spring seat, together with the ball guide and ball valve from the body.

(8) Withdraw the valve seat and the chamfered washer from the body. The washer is tapped 8 B.A. to facilitate withdrawal. Remove the sealing ring and the backing ring from the seat.

(9) Slacken the lock-nut and remove the eyebolt and the spanner grip from the piston rod. Remove the lock-nut and the spherical bearing from the eyebolt.

(10) Remove the spherical bearing from the end fitting. Unscrew the end fitting from the cylinder and remove the sealing ring and backing ring from the fitting. Remove the shims.

(11) Unscrew the gland nut from the cylinder and slide the nut off the piston rod. Remove the wiper ring from the nut

(12) Withdraw the piston assembly from the cylinder and remove the sealing ring and split rings from the piston head. Slide the spacer off the piston rod and remove the sealing ring from the spacer.

(13) Withdraw the gland ring and spacer from the cylinder.

Assembling

12. All sealing rings are to be lightly coated with Grease XG-315 before being assembled in the unit.

(1) Fit the sealing ring and the split rings to the piston head. If new split rings are fitted, they are to be gapped 0·009 to 0·012 in. on assembly and the sharp edges at the gap removed, on the flat faces only, by a maximum radius of 0·005 to 0·015 in.

(2) Fit the sealing ring to the spacer and slide the spacer, sealed end leading, over the piston rod, locating it against the piston head.

(3) Insert the piston assembly into the cylinder.

TABLE 1

Special tools

Ref. No.	Part No.	Description
27Q/13476	RS.181/18	'C' key spanner for gland nut
27Q/11099	ST.1213	'Apkoway' hub spanner for end fitting
27Q/	4.60001.078	Assembly tool for gland ring
27Q/	4.60001.079	Test adapter
27Q/	4.60001.080	Test blank for thermal relief valve

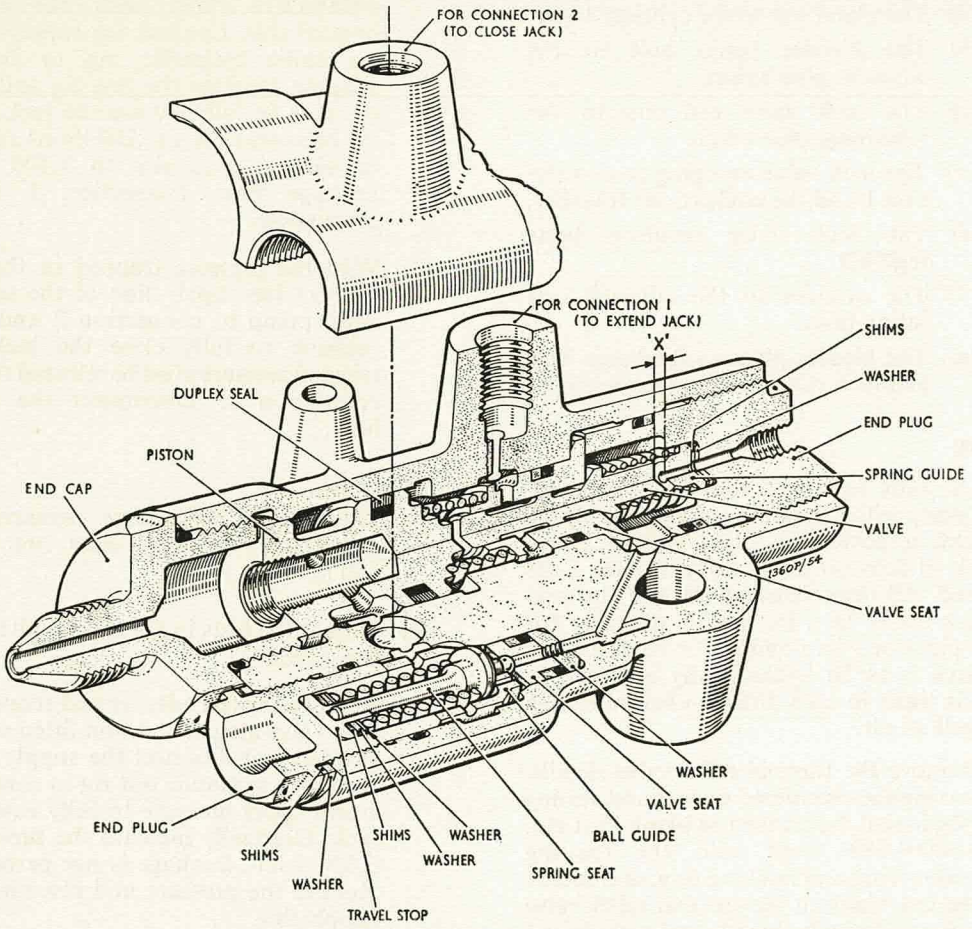

Fig. 3. Lock valve assembly

(4) Slide the spacer, followed by the gland ring, with the lips of the ring leading, over the end of the piston rod and ensure that they are correctly bedded together against the shoulder in the cylinder.

(5) Fit the wiper ring to the gland nut and screw the nut tightly into the cylinder.

(6) Fit the sealing ring and the backing ring to the end fitting. The backing ring should be adjacent to the threads with the rough face towards the sealing ring.

(7) Screw the end fitting hard on to the cylinder and check that the lug of the fitting, when viewed edgewise, aligns with the cylinder boss. If necessary, fit the shims to the requisite thickness between the end fitting and the cylinder flange to obtain this alignment.

(8) Screw the lock-nut fully on to the eye-bolt, locate the spanner grip to the slots in the end of the piston rod and screw in the eyebolt. The eyebolt will be finally adjusted and locked on installation of the jack in the aircraft.

(9) Fit the spherical bearing to the end fitting and the eye-bolt.

(10) If the greasers have been removed, ensure that they are free from obstruction and screw them into the end fitting and eye-bolt respectively.

(11) Fit the sealing ring and backing ring to the groove in the piston valve seat, with the rough face of the backing ring adjacent to the sealing ring.

(12) Insert the fluted valve into the valve seat and position the assembly in the lock valve body. Locate the spring over the valve stem.

(13) Fit the sealing ring and backing ring to the groove in the end plug, with the rough face of the backing ring adjacent to the sealing ring.

(14) Insert the spring guide into the recess of the end plug. The shims and washer should not be fitted at this stage. Screw the plug tightly into the valve body, ensuring that the spring is correctly seated against the shoulders of the valve and spring guide.

(15) Using a suitable depth gauge inserted from the open end of the valve body, depress the valve until its stem is felt to abut the spring guide. Then release the pressure on the valve and check the travel. The length of valve travel will coincide with the dimension of the gap 'X' shown in *fig.* 3. This dimension should be within the limits of 0·035 to 0·045 in. If necessary, add shims or the washer as required to obtain this dimension.

(16) Locate the spring over the valve seat. Fit the Duplex seal to the piston and insert the piston, sealed end leading, into the body. Fit a sealing ring to the end cap and screw the cap tightly into the body to retain the piston.

(17) Ensure that the bleeder plug is free from obstruction and screw it into the tapping in the end plug.

(18) Insert the washer into the thermal relief valve bore with the chamfered face innermost.

(19) Fit the sealing ring and backing ring to the valve seat. The backing ring should be innermost with its rough face adjacent to the sealing ring. Insert the valve seat, sealed end leading, into the body to abut the chamfered washer.

(20) Insert the ball valve into the body to rest on the seat and follow with the ball guide, carefully locating the guide over the ball.

(21) Fit the sealing ring to the groove in the body and position the spring seat in the body.

(22) Locate the spring over the stem of the spring seat. Fit the washers to the travel stop with the thinner washer outermost. Do not fit the shims under the head of the travel stop at this stage. The shims will be fitted and adjusted during testing.

(23) Insert the travel stop, with the washers in position, into the body and over the stem of the spring seat.

(24) Fit the washer to the end plug and screw the plug into the body until it is felt to bottom. Measure the gap between the washer and the plug flange and note this dimension. Unscrew the plug and fit shims between the washer and the plug flange equal in thickness to the measured gap +0·001 to 0·011 in. Then screw the plug tightly into the body.

(25) Insert the sealing ring into the recess of the lock valve attachment boss and locate the valve to the jack. Fit a bonded seal and a plain washer to the large and small securing bolts respectively, and screw in the bolts to secure the valve to the jack.

(26) Secure the banjo union of the transfer pipe assembly to the cylinder boss with the bleeder banjo bolt and bonded seals, and secure the opposite end of the assembly to the adapter of the lock valve.

(27) After final assembly and test, wire-lock the following:—

(*a*) The gland nut to the cylinder boss.

(*b*) The bleeder banjo bolt to the adjacent pipe union.

(*c*) The lock valve end cap to the remaining pipe union.

(*d*) The lock valve end plug to connection 1 and the connections together.

(*e*) The lock valve securing bolts together.

(*f*) The cylinder to the adjacent end fitting boss.

(*g*) The bleeder plugs to the banjo bolt and lock valve end plug respectively.

Testing

13. A static hydraulic test rig, a separate hand pump with a pressure gauge in the supply line and a power rig fitted with a pump capable of delivering 3·45 gal. per minute, are required. All pipes between the test rigs and the jack are to be $\frac{3}{8}$ in. outside diameter for metal pipes or $\frac{3}{8}$ in. nominal for flexbile hose. The jack is to be hydraulically operated at least six times in each direction before testing to expell all air.

(1) Remove the thermal relief valve details, leaving the chamfered washer and sealing ring in situ. Insert the test blank Part No. 4.60001.080 fitted with the existing sealing ring and backing ring, and secure the test blank in the thermal relief valve body with the ball guide and end plug as shown in *fig.* 4.

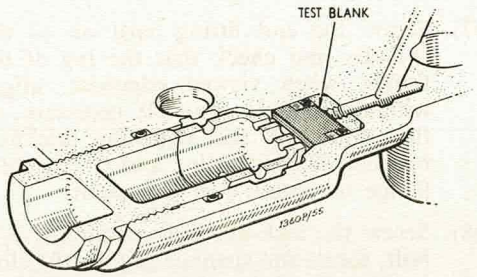

Fig. 4. Assembly of test blank

(2) Remove the large lock valve securing bolt and screw in the test adapter Part No. 4.60001.079 fitted with the existing bonded seal. Connect the supply line of the static hydraulic rig to the test adapter. Operate the test rig and apply pressure to fully extend the jack. Raise the pressure slowly to 200 lb/in² and then increase it gradually to 1,400 lb/in². Leakage from connection 1 is not permissible.

(3) With the pressure trapped in the jack, connect the supply line of the separate hand pump to connection 2 and apply pressure to fully close the jack. The trapped pressure must be released through connection 1. Disconnect the supply lines.

Note . . .

The pressure required to commence and fully close the jack must not exceed 150 *lb/in².*

(4) Repeat the tests in (2) and (3) alternately five times.

(5) Remove the test adapter and screw in the lock valve attachment bolt fitted with the bonded seal. Connect the supply line of the static hydraulic test rig to connection 1 and apply pressure to fully extend the jack. Gradually increase the pressure to 2,600 lb/in². Leakage is not permissible. Release the pressure and disconnect the supply line.

(6) Connect the supply line to connection 2 and apply pressure to fully close the jack. Gradually increase the pressure to 2,600 lb/in². Leakage is not permissible. Release the pressure and disconnect the supply line.

(7) Connect the supply line of the power pump rig to connection 1 and operate the rig to fully extend the jack. The pressure required to extend the jack must not exceed 300 lb/in² and the time required to complete the stroke must not exceed 9 seconds. Release the pressure and disconnect the supply line.

(8) Connect the supply line to connection 2 and operate the rig to fully close the jack. The pressure required to close the jack must not exceed 210 lb/in^2 and the time required to complete the stroke must not exceed 10 seconds. Release the pressure and disconnect the supply line.

(9) If leakage occurs at either of the connections during operations (5) to (8) it may be due to a faulty sealing ring of the jack piston or lock valve piston. To determine the source of leakage carry out the following procedure.

(*a*) Disconnect the transfer pipe from the lock valve connection and blank off this connection. Ensure that the piston rod is fully extended.

(*b*) Connect the test rig supply line to connection 1 and gradually apply a pressure of 2,600 lb/in^2. Leakage from the open transfer pipe will denote a faulty jack piston seal which must be renewed. Release the pressure and disconnect the supply line.

(*c*) Connect the supply line to connection 2 and apply pressure as in (*b*). Leakage from connection 1 will denote a faulty lock valve piston seal which must be renewed. Release the pressure, disconnect the supply line and reconnect the transfer pipe to the lock valve connection.

(10) Remove the lock valve attachment bolt and screw in the test adapter fitted with the bonded seal. Remove the test blank and replace the thermal relief valve details. Connect the supply line of the static hydraulic test rig to the test adapter. Slacken the relief valve end plug a quarter to half a turn and apply pressure.

(11) Check and adjust the relief pressure of the thermal relief valve, carefully screwing in the plug until it is felt to bottom and the valve relieves at a pressure of 1,500 to 1,550 lb/in^2. This will be indicated by a trickle of fluid from connection 2. The re-seating pressure should be not less than 1,300 lb/in^2. If necessary, fit shims under the travel stop *(fig.* 3) to obtain these conditions.

(12) Remove the test adapter and screw in the lock valve attachment bolt fitted with the bonded seal. Connect the test rig supply line to connection 1 and apply pressure to fully extend the jack. Gradually increase the pressure until the thermal relief valve relieves at a pressure of between 1500 and 1550 lb/in^2 and check for leakage past the seals of the adapter bolt. Disconnect the supply line.

(13) Connect the test rig supply line to connection 2 and apply pressure to fully close the jack. Disconnect the supply line.

Installation

14. When the jack is installed, the eyebolt is to be adjusted to suite the airframe pick-up points. The dimension between the pin centres must be within the limits of 23·85 to 24·35 in. with the jack in the fully closed position. The piston travel is 10·31 to 10·49 in. After adjustment, wire-lock the eyebolt, the lock-nut and the spanner grip together.