Chapter 11

NOSE UNDERCARRIAGE JACK UNIT
Type No. 1.00490.001

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Introduction

1. This unit consists of a basic jack, together with shuttle valve and swivel pipe units (*fig.* 1); each pipe unit is secured to its respective boss by set bolts. The pipes carrying fluid to close the jack are duplicated for normal or emergency operation, and embodies a shuttle valve which functions to seal off the inoperative pipe line.

Description (*fig.* 2)

2. At the open end the cylinder receives a gland nut, and is formed with a fluid connection boss to which the spigot of the shuttle valve and swivel pipe unit is attached. A second boss is provided for a bleeder assembly. The closed end is also formed with a fluid connection boss to which the spigot of the single swivel pipe unit is attached and a bushed lug which receives an attachment pin. The gland nut fitted with a wiper ring for the piston rod, is screwed into the cylinder to retain a spacer against a shoulder in the cylinder bore. A 'U' ring seals the piston rod in the gland nut which is sealed by a sealing ring and a backing ring in the cylinder. The inner end of the piston rod is integral with a piston head fitted with a sealing ring supported on each side by a split piston ring. The outer end of the rod is slotted for a spanner grip and receives a screwed eye-end fitted with a lock-nut. The eye-end, which receives an attachment pin, is formed with an elongated slot, and a lug to which the down-lock mechanism is secured. The bleeder assembly comprises a bleeder screw and a bleeder banjo retained between bonded seals by a banjo bolt.

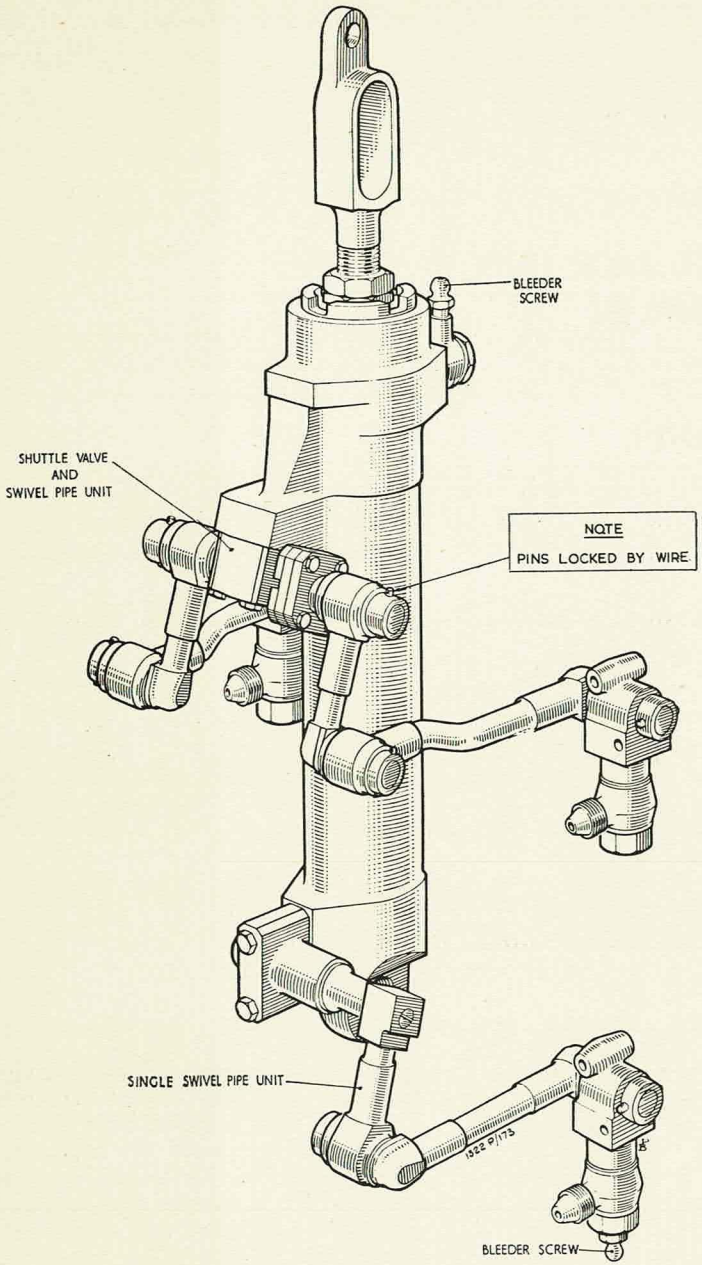

Fig. 1. Nose undercarriage jack unit

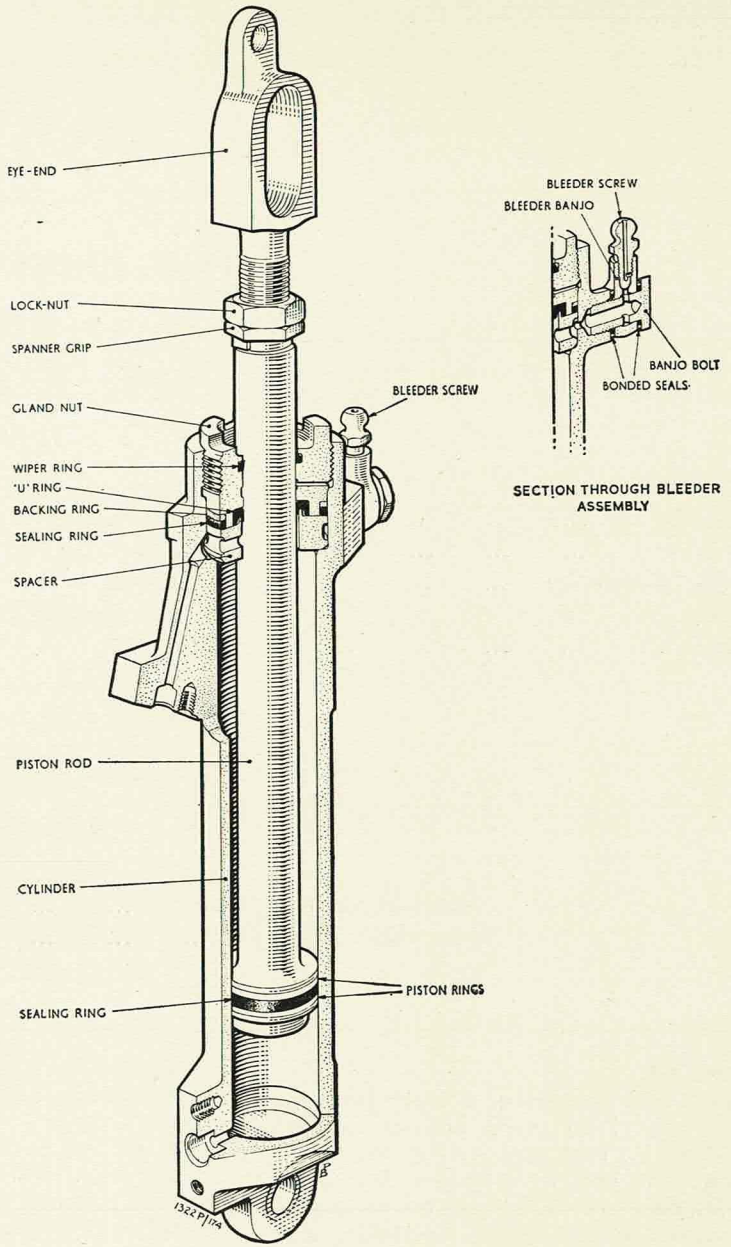

Fig. 2. Nose undercarriage jack

Shuttle valve and swivel pipe unit (*fig.* 3)

3. The unit consists of two pairs of swivel pipes joined together by a shuttle valve body which is formed with attachment lugs and a spigot. The spigot through which the fluid passes to the jack is grooved for an 'O' ring and a backing ring. The cylindrical shuttle, which operates in the bore of the body, is fitted with a sealing ring and has a rubber seating ring bonded to each end. The provision of a diagonal fluid way through the shuttle is for the purpose of preventing a hydraulic lock. One set of pipes is secured by a spacer and pin to the spindle of a valve coupling, which in turn is secured to a flange integral with the shuttle valve body by four special bolts backed by two locking plates. The valve coupling spigot and spindle is fitted with sealing and backing rings. The second set of swivel pipes is retained on the spindle formed on the opposite end of the shuttle valve body by a spacer secured by a pin. The spindle is fitted with sealing and backing rings. The outer ends of the swivel pipes are terminated by a connection block, which incorporates attachment lugs and a pipe connection retained between bonded seals by a banjo bolt. Each swivel joint consists of a connection post rotating in a swivel connection, and a hole through the post is linked to an annular groove in the post which coincides with a similar groove in the swivel connection. The connection posts, fitted with sealing and backing rings, are retained in the swivel connections by a spacer secured by a pin.

Single swivel pipe unit (*fig.* 1 *and* 3)

4. The unit comprises two pipes, of different lengths, joined by a central swivel joint. The swivel joint consists of a connection post, fitted with sealing and backing rings, rotating in the bore of a swivel connection and retained by a spacer secured by a pin. A hole through the post is linked to an annular groove which coincides with a similar groove in the swivel connection. At the outer ends of the pipes the connection posts,

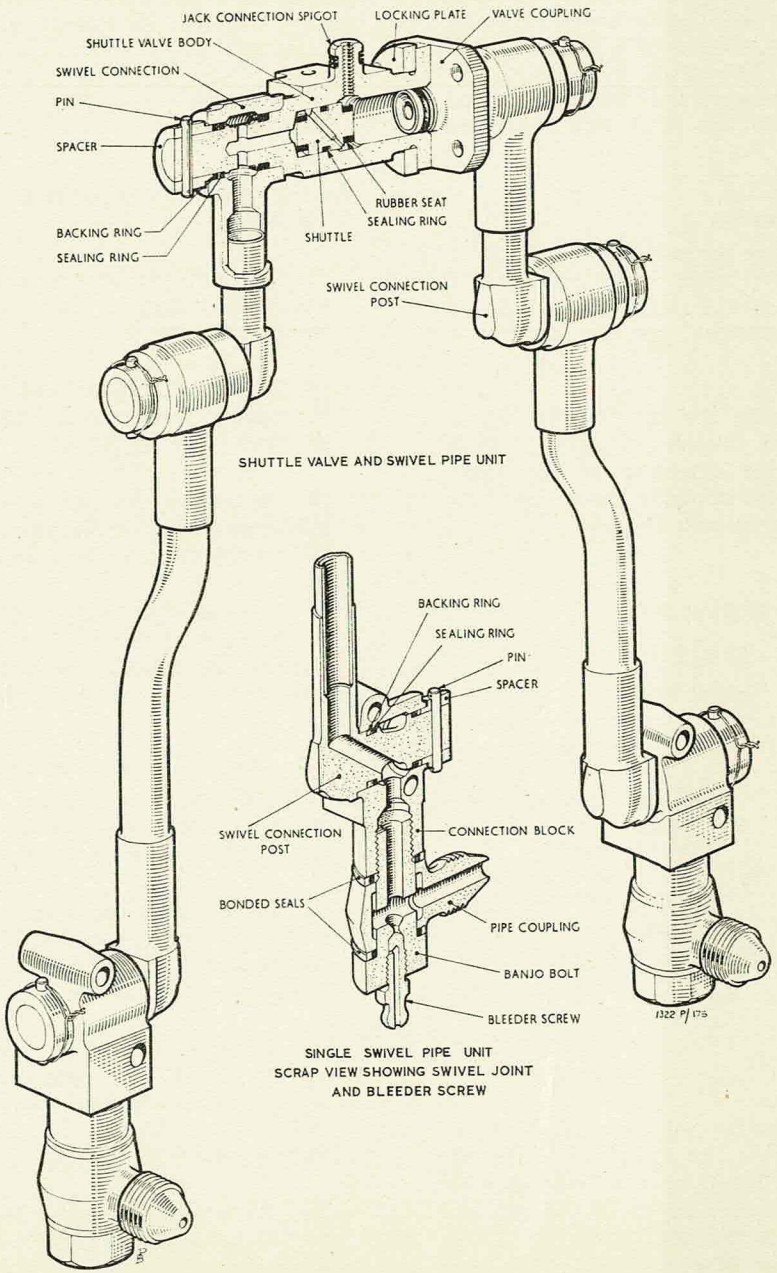

Fig. 3. Shuttle valve and swivel pipe units

similarly fitted with sealing and backing rings, rotate in a swivel connection and a swivel block respectively, each retained by a spacer secured by a pin. The swivel connection is formed with attachment lugs and a spigot which is fitted with a sealing and backing ring. The swivel block incorporates a pipe coupling retained between bonded seals by a banjo bolt fitted with a bleeder screw.

Principle of operation

5. Fluid entering the jack by the normal or emergency swivel pipe forces the shuttle along the bore of the shuttle valve body to seal off the inoperative pipe line and closes the jack.

6. Fluid entering the jack by the single swivel pipe unit, extends the jack and fluid displaced by the extension of the jack, passes through the operative line of the shuttle and swivel pipe unit.

SERVICING

TABLE 1

Special tools

Ref. No.	*Part No.*	*Description*
16239	ST.2302	'C' key spanner for gland nut.
16704	ST.2379	Drift for bush.
	4.60001.086	Sleeve for assembly of piston into cylinder.
	4.60001.087	Post for assembly of gland nut over piston rod.

Leakage

7. External leakage will indicate a faulty seal which must be renewed. Internal leakage past the piston head sealing ring will be shown by sluggish action of the jack in service or loss of pressure during test. Renew the sealing ring. Leakage past the shuttle may be due to dirt between the bonded rubber rings and the seats in the shuttle bore, or by scored seats. If the bonded rubber rings are damaged or worn, the complete shuttle must be renewed. Leakage past the sealing ring of the shuttle will necessitate a new ring.

Dismantling

Jack (fig. 1)

8. (1) Remove the swivel pipe units from the jack.

(2) Slacken the lock nut and unscrew the eye-bolt from the piston rod. Remove the spanner grip.

(3) Unscrew the gland nut and withdraw the spacer from the cylinder. Remove the seals from the gland nut.

(4) Withdraw the piston rod from the cylinder and remove the piston rings and the sealing ring from the piston head.

(5) Unscrew the banjo bolt and remove the bleeder assembly from the cylinder. Remove the bonded seals and unscrew the bleeder screw from the banjo.

Shuttle valve and swivel pipe unit (fig. 3)

9. (1) Remove the pins and spacers from the swivel joints and withdraw the swivel connections from the connection posts.

(2) Remove the sealing rings and backing rings from the connection posts, and the sealing ring and backing ring from the spigot connection of the shuttle valve body.

(3) Remove the bolts complete with locking plates and withdraw the spigot of the valve coupling from the shuttle valve body. Remove the sealing ring and backing ring from the spigot.

(4) Withdraw the shuttle from the body and, if necessary, remove the sealing ring from the shuttle. The rubber seats are bonded and must not be removed.

(5) Unscrew the banjo bolts from the swivel connection blocks and remove the pipe couplings and bonded seals.

Single swivel pipe unit (fig. 3)

10. (1) Remove the pins and spacers from the swivel joints and withdraw the swivel connections from the posts.

(2) Remove the sealing rings and backing rings from the connection posts, and the sealing ring and backing ring from the spigot of the swivel connection.

(3) Unscrew the banjo bolt from the swivel connection block and remove the pipe coupling. Remove the bonded seals and unscrew the bleeder screw from the banjo bolt.

Assembling

Single swivel pipe unit

11. All sealing rings, except bonded seals, are to be lightly coated with Grease XG-315 (34B/9100519) before being assembled in the unit.

(1) Fit the sealing rings and the backing rings to the narrow grooves in the connection posts.

Note . . .

The rough faces of the backing rings must be adjacent to the sealing rings in all instances.

(2) Pack the inner wide groove in the elongated post with grease XG-315 and locate the swivel connection incorporating a spigot over the post. Fit the sealing and backing rings to the post, then slide the spacer over the post with the reduced diameter leading and secure the connection with the pin. Wire-lock the pin in position.

(3) Locate the swivel connection and block over the connection posts of the pipe and fit the sealing and backing rings to the posts. Slide the spacers over the

posts and secure the connections with the pins. Wire-lock the pins in position.

(4) Position the pipe coupling on the connection block port, as shown in *fig.* 3, with a bonded seal interposed between the coupling and the port, and a bonded seal under the bolt head, screw the banjo bolt into the port and tighten. Screw the bleeder screw into the bolt and lightly tighten.

(5) Carry out the tests given in *para.* 15.

Shuttle valve and swivel pipe unit

12. (1) Ensure that the centre sealing ring is fitted to the shuttle and insert the shuttle into the body.

(2) Fit the backing ring and the sealing ring to the spigot of the valve coupling, with the backing ring adjacent to the flange and the rough face of the ring located against the sealing ring.

(3) Insert the spigot of the coupling into the bore of the body, align the bolt holes and secure in position with bolts and locking plates. Wire-lock the heads of the bolts.

(4) Fit the sealing rings and backing rings to the connection posts, with the rough faces of the backing rings adjacent to the sealing rings.

(5) Locate the swivel connections and blocks over the connection posts in the correct order (*fig.* 3), fit the sealing and backing rings to the posts. Slide the spacers over the posts and secure the connections with the pins. Wire-lock the pins in position.

(6) Position the pipe couplings in turn on the connection block ports, as shown in (*fig.* 3), and with a bonded seal interposed between the coupling and the port and a bonded seal under the bolt head, screw the banjo bolt into the port and tighten.

(7) Fit the backing ring and the sealing ring to the jack connection spigot on the valve body, with the backing ring adjacent to the body and the rough face of the ring located against the sealing ring.

(8) Carry out the tests given in *para.* 16.

Jack (*fig.* 2)

13. (1) Fit the sealing ring and the piston rings to the piston head. If new piston 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, to a radius between 0·005 and 0·015 in.

(2) Insert the piston into the cylinder, then fit the wiper ring, backing ring and sealing ring to the gland nut. Position the groove of the ' U ' ring on the stem of the spacer and insert the ' U ' ring into the nut.

(3) With the spacer leading, slide the gland nut over the end of the piston rod and screw the nut into the cylinder.

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

(5) Position the bleeder banjo on the boss, as shown (*fig.* 2), and with a bonded seal interposed between the banjo and the boss and a bonded seal under the bolt head, screw the banjo bolt into the boss and tighten. Screw the bleeder screw into the banjo and lightly tighten. Wire-lock the bleeder screw after installation of the jack into the aircraft.

(6) After the shuttle valve and swivel pipe units have been tested, secure the units to their respective bosses on the cylinder with the set-bolts. Tighten the set-bolts with a torque loading of 30 lb. in. Wire-lock the heads of the set bolts.

TESTING

Test equipment

14. The following equipment is required for testing the single swivel pipe unit, shuttle valve and swivel pipe unit, and the jack.

(1) A static hydraulic test rig and a power pump rig fitted with a pump capable of delivering 3·45 gal. per minute. All pipes between the rig and the unit under test are to be $\frac{3}{8}$ in. outside diameter metal, or $\frac{3}{8}$ in. nominal flexible hose. Reducing adapters must be fitted adjacent to unit under test.

(2) A test adapter 03025TA01 for the shuttle valve tests.

(3) A separate stop-cock and a pressure gauge for the shuttle valve tests.

Testing the single swivel pipe unit

15. (1) Connect the rig to one end of the swivel pipe unit and operate the pump. Fluid must flow freely from the opposite end.

(2) Blank off the open end and raise the pressure gradually to 6,600 lb/in^2. Leakage is not permissible. Release the pressure.

(3) Raise the pressure to 100 lb/in^2 and rotate each swivel joint, through 180 degrees and back ten times. Then rotate each joint through 360 degrees ten times. (Five clockwise and five anti-clockwise). Where full rotation is prevented, rotate

the joint as far as possible. Leakage is not permissible.

(4) Repeat the test in *sub-para.* (3) but with a pressure of 3,300 lb/in^2. Check the torque required to rotate each swivel joint at this pressure. The torque must not exceed 25 lb. in. Leakage is not permissible Release the pressure, remove the blank from the unit and disconnect from the rig.

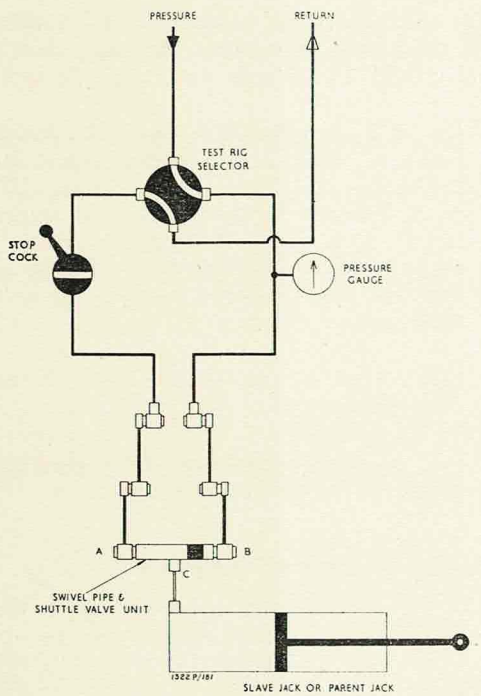

Fig. 4. Test circuit

Testing the shuttle valve and swivel pipe unit

16. Proceed as follows, referring to *fig.* 4.

(1) Connect the delivery lines of the static rig to the pipe couplings A and B. Select flow to A and operate the hand pump. Fluid must flow freely from the spigot C.

(2) Select flow to B and operate the hand pump to move the shuttle along the bore of the valve body. Fluid must then flow freely from the spigot C.

(3) Bolt the test adapter 03025TA01 over the spigot and fit a blanking cap to the adapter to prevent flow from C.

(4) Raise the pressure at B gradually up to 6,600 lb/in^2. Leakage is not permissible. Release the pressure.

(5) Select flow to A and repeat the test in *sub-para.* (4). Leakage is not permissible. Release the pressure.

(6) Raise the pressure at A to 100 lb/in^2 and rotate each swivel joint, through 180 degrees and back ten times. Then rotate each joint through 360 degrees ten times. (Five clockwise and five anti-clockwise). When full rotation is prevented, rotate the joint as far as possible. Leakage is not permissible.

(7) Repeat the test in *sub-para.* (6) with 100 lb/in^2 applied at B. Leakage is not permissible.

(8) Repeat the tests in *sub-para.* (6) and (7) but with a pressure of 3,300 lb/in^2. Check the torque required to rotate each swivel joint at this pressure. The torque must not exceed 25 lb. in. Leakage is not permissible. Release the pressure, remove the blanking cap from the test adapter and disconnect the static rig lines.

(9) Couple the pipe couplings A and B to the delivery lines of the power rig and connect a short length of pipe to the test adapter, to enable the fluid flow from C to be conveniently observed.

(10) With the test rig selector in the neutral position, (i.e. no flow to connections A and B), start the pump of the rig and adjust the supply pressure to 100 lb/in^2. Select pressure to A and fluid must flow from A to C. Reverse the selector and fluid must flow from B to C. Repeat this test three times to ensure that the shuttle is operating freely. Stop the power pump and disconnect the delivery lines from the swivel pipe couplings.

(11) Connect the hand pump delivery line to coupling B, remove the short pipe from C and blank off the test adapter. Operate the hand pump to apply pressure at B. An initial spurt of fluid from A, due to the movement of the shuttle is permissible. Raise the pressure at B to 300 lb/in^2 then gradually increase it to 6,600 lb/in^2. Leakage is not permissible. Release the pressure.

(12) Disconnect the delivery line from B and connect it to A. Operate the hand pump to apply a pressure at A of 100 lb/in^2. The shuttle must move across, indicated by a spurt of fluid from B. Raise the pressure to 300 lb/in^2 and then increase it gradually to 6,600 lb/in^2. Leakage is not permissible. Release the pressure.

(13) Disconnect the delivery line from A and connect it to B. Operate the pump to apply a pressure of 100 lb/in^2 at B. The shuttle must move across, indicated by a spurt of fluid from A. Raise the pressure to 300 lb/in^2, then gradually increase it to 6,600 lb/in^2. Leakage is not permissible. Release the pressure.

(14) Repeat the tests in *sub-para.* (12) and (13) alternately three times. Finally, remove the blanking cap from the test adapter and ensure that the shuttle is positioned for flow from A to C.

(15) Connect the shuttle valve and swivel pipe unit to the power rig (*fig.* 4), with a stop-cock in the delivery line to A and a pressure gauge in the delivery line to B. Connect the test adapter at C to the cylinder end of any convenient slave jack or, alternatively, remove the test adapter and bolt the shuttle valve body to the parent nose undercarriage jack. The pipe lines and jack must be bled of air and the piston rod must be fully closed.

(16) Close the stop-cock to trap fluid at zero pressure at A. With the rig selector in neutral, start the power/pump and adjust pressure to 200 lb/in^2. Select pressure to B. The jack must extend and a stable pressure must be registered on the gauge. Open the stop-cock to connect A with return. Leakage is not permissible except for an initial spurt of fluid from A. Release the pressure and repeat the test five times. When the tests have been completed disconnect the unit from the test rig and remove the test adapter.

Testing the jack

17. With the shuttle valve and swivel pipe units attached to the jack, proceed as follows:

(1) Connect the hand pump delivery lines of the static hydraulic test rig to each jack connection and operate the selector valve to close the jack, raise the pressure slowly to 300 lb/in^2 paying particular attention for leaks over the pressure range zero to 100 lb/in^2, then increase gradually to 4,950 lb/in^2. There must be no leakage. Release the pressure.

(2) Reverse the selector valve on the test rig to fully extend the jack, and repeat the test in *sub-para.* (1). Release the pressure and disconnect the hand pump delivery lines.

(3) Connect each jack connection to the delivery lines of the power rig. Select flow to both jack connections simultaneously and raise the pressure to 3,300 lb/in^2, then release the pressure. Continue to alternate the supply pressure from zero to 3,300 lb/in^2 for 200 cycles. Release the pressure.

(4) Repeat the tests in sub-para. (1) and (2).

(5) With the selector in neutral, start the pump and adjust the pressure to 120 lb/in^2. Select flow to extend the piston rod. At a pressure not exceeding 120 lb/in^2 the piston rod must extend fully in 5 seconds maximum.

(6) With the selector in neutral, adjust the pressure to 180 lb/in^2. Select flow to close the piston rod. At a pressure not exceeding 180 lb/in^2 the piston rod must close fully in 5 seconds maximum. Stop the power pump, release the pressure and disconnect the unit from the rig.

Installation

18. When installing the jack, the nose undercarriage must be fully locked down and the jack fully closed, with the piston bottomed. The eye-bolt is to be adjusted to suit the airframe pick-up points, then screw the piston rod on to the eye-bolt half a turn. The pin centre dimension of the jack in the fully closed position, piston bottomed, must not be adjusted outside the limits of 13·325 to 13·575 in. The pin centre of the eye-bolt should be no less than 2·28 in. from the adjacent face of the lock-nut. The travel is 7·38 to 7·42 in. After adjustment, tighten the lock-nut against the spanner grip and wire-lock the eye-bolt, the lock-nut and the spanner grip together.