

Chapter 19

NOSE UNDERCARRIAGE DOOR JACKS

Types 1.00488.001 (Port)

1.00488.002 (Starboard)

LIST OF CONTENTS

	Para.		Para.		Para.
<i>Introduction</i>	1	<i>Dismantling</i>	15	<i>Shuttle valve and swivel pipe units</i>	23
Description		<i>Jack</i>	16	<i>Swivel pipe unit</i>	24
<i>Jack</i>	3	<i>Indicator</i>	17	<i>Assembling components to jack</i>	25
<i>Indicator</i>	7	<i>Shuttle valve and swivel pipe units</i>	18	Testing	26
<i>Shuttle valve and swivel pipe units</i>	8	<i>Swivel pipe unit</i>	19	<i>Shuttle valve and swivel pipe units</i>	27
<i>Swivel pipe unit</i>	10	<i>Assembling</i>	20	<i>Swivel pipe unit</i>	28
<i>Functioning</i>	11	<i>Jack</i>	21	<i>Jack complete with component units</i>	29
Servicing		<i>Indicator</i>	22	<i>Installation</i>	30
<i>Leakage</i>	14				

Table

<i>Special tools</i>	1
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LIST OF ILLUSTRATIONS

	Fig.		Fig.
<i>Overall view of jack</i>	1	<i>Test circuit diagram</i>	5
<i>Sectional view and details of jack</i>	2	<i>Lock loading rig with spring box</i>	6
<i>Functional diagrams</i>	3	<i>Lock loading rig with slave jack</i>	7
<i>Adjustment of locks</i>	4		

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Introduction

1. These units operate the nose under-carriage doors and are similar in construction, the only difference is their handing to suit installation requirements; the illustrations show the port unit.

2. Each unit consists basically of a jack in which is incorporated a double internal lock that locks it in both the extended and closed positions; the locks are made mechanically and released hydraulically. To cater for the angular movement of the jack during operation, swivel pipe units convey fluid to each end of the jack. The swivel pipe unit at the extension end, consists of two identical units which are connected to a shuttle valve that controls the flow from them to the jack from either the normal or emergency system by blanking off the inoperative system. An indicator spindle protrudes into this end of the body where it actuates a micro-switch to give warning when the closure lock is engaged and dis-engaged.

DESCRIPTION

Jack

3. The body is formed at one end with two diametrically opposed bosses, one of which receives the shuttle valve, while the other houses the indicator spindle that projects into the body. A bracket is attached to the indicator by four bolts which also secure the indicator to the body. Attached to the bracket, with its plunger opposing the plunger of the indicator, is the micro-switch; slots in the bracket cater for its adjustment. An adapter, screwed at right angles into the shuttle valve boss, is sealed with a bonded seal and is fitted with a bleeder. The other end of the body is also formed with two diametrically opposed bosses, one receiving the other swivel pipe unit and the other an adapter also fitted with a bleeder.

4. Screwed on to one end of the body is an end cap which retains an end plug bushed for attachment, and a claw lock ring that forms the static portion of the closure locking device.

Sealing of the lock ring in the body and the end plug in the lock ring is effected by sealing rings and backing rings. A pin locates in a slot in the end of the body to lock the lock ring in position.

5. Closing the other end of the body is a gland nut that supports a piston rod during its travel and retains another claw lock ring in abutment with a shoulder in the body. This lock ring forms the static portion of the extension locking device. A spacer is located in the gland nut and supports a U ring which seals the piston rod, while an O ring and a backing ring seals the gland nut in the body. A wiper ring is also fitted to the gland nut to prevent the ingress of dirt during the closure stroke.

6. Fitted to the inner end of the piston rod are the moving portions of both locking devices, which consist of two spring-loaded opposing lock sleeves, each of which moves over a spacer and, during the locking operation, hold the claws of their associated lock

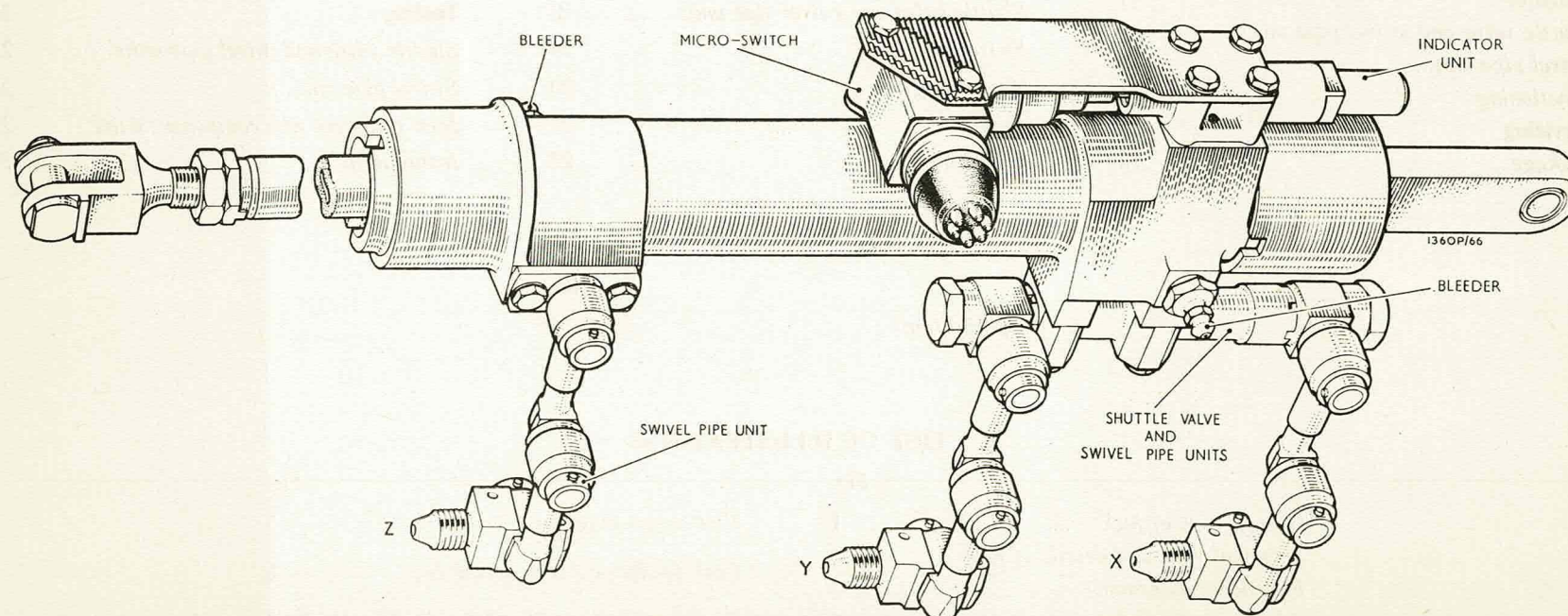


Fig. 1. Overall view of jack

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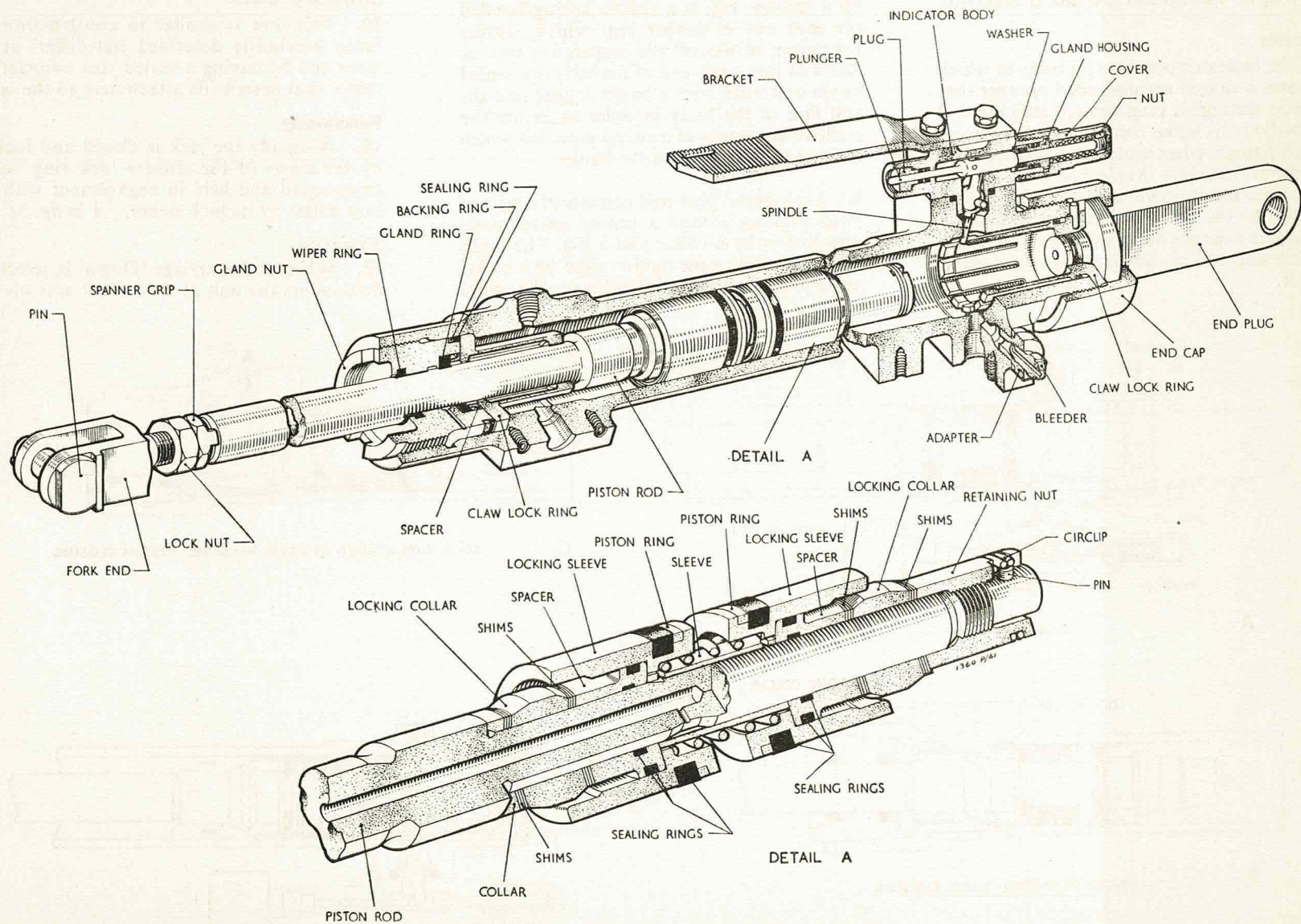


Fig. 2. Sectional view and details of jack

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ring in engagement with a lock collar. Shims are fitted on both sides of each lock collar and are adjusted to obtain a specified gap between the collars and the lock ring claws. The outer end of the piston rod is fitted with a fork end carrying an attachment pin and a lock nut.

Indicator

7. The indicator consists of a body in which operates a slotted spring-loaded plunger that projects through a plug screwed into the end of the body to make contact with the micro-switch plunger when moved by a spindle. The spindle projects into the slot and pivots about a pin inserted through the body. A cover is screwed to the body and encases the spring and a gland carrier fitted with inner and outer double seals to seal the plunger and the gland carrier.

Shuttle valve and swivel pipe units

8. The shuttle valve body is formed with lugs for its attachment to the jack, and a spigot to which is fitted a sealing ring and a backing ring. Operating in the body, where it is sealed by a sealing ring, is a shuttle having bonded on each end a rubber seat which, during operation, blanks off the inoperative system. Screwed into each end of the body is a sealed banjo bolt fitted with a banjo dogged into the end face of the body in order to ensure the positive alignment of a swivel pipe unit which is fitted to the spigot of the banjo.

9. Each swivel pipe unit consists of a pair of pipes rotating around a central swivel post, retention is by a collar and a pin. The inner end is secured to the banjo spigot by a collar and a pin and a tangential drilling in the spigot

permits the passage of fluid from the pipes to the shuttle valve. The outer end is a swivel connection formed with an attachment lug and a cone connection.

Swivel pipe unit

10. This unit is similar in construction to those previously described but differs at its inner end by having a sealed jack connection spigot that permits its attachment to the jack.

Functioning

11. Normally the jack is closed and locked by the claws of the closure lock ring being compressed and held in engagement with its lock collar by its lock sleeve, (A in fig. 3).

Extension

12. When undercarriage 'Down' is selected, fluid enters the unit at B where it acts on the

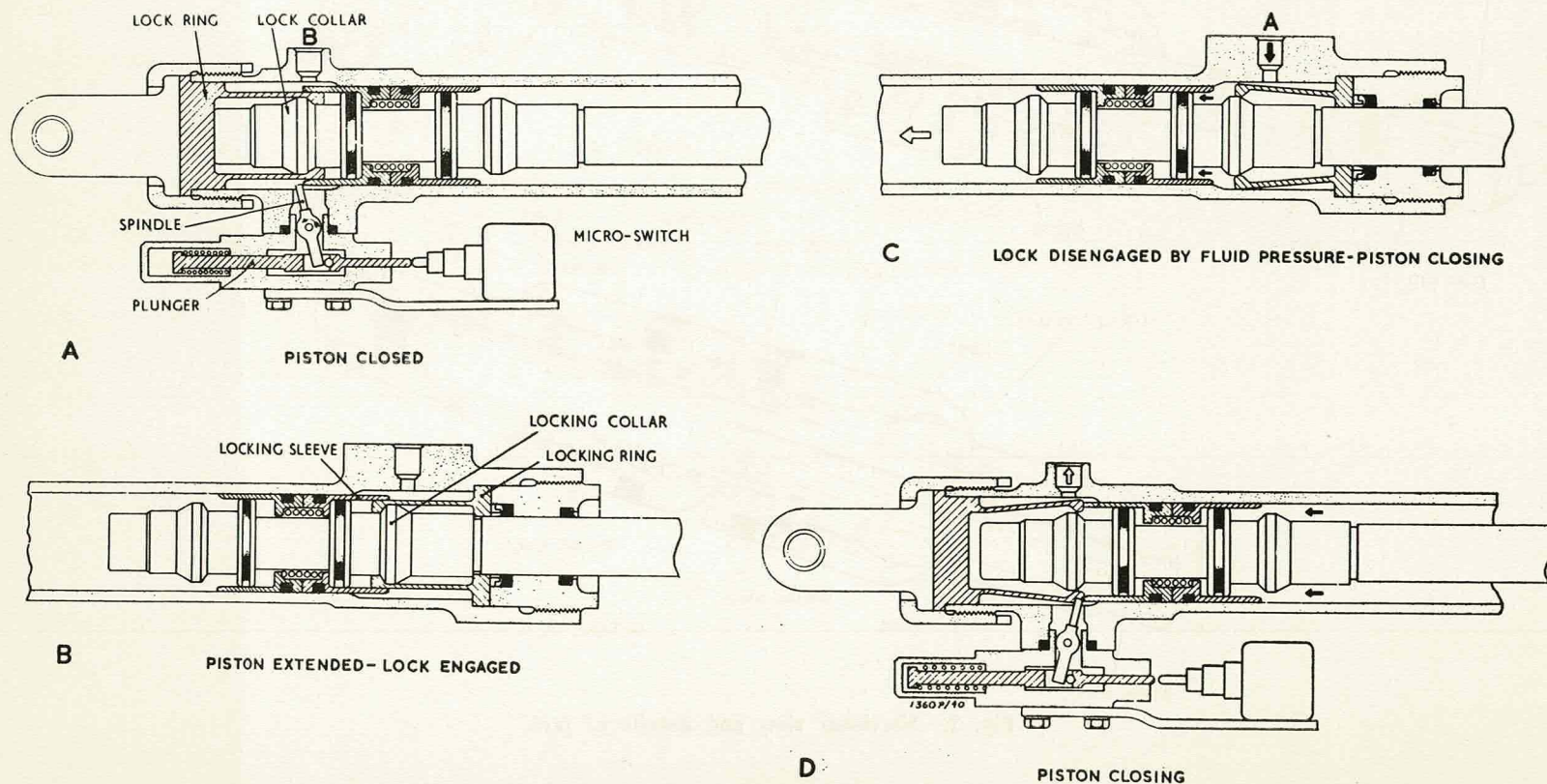


Fig. 3. Functional diagrams

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closure lock sleeve to move it against its spring. As the lock sleeve moves away from the lock ring the claws spring off the lock collar to release the lock and permit the fluid to extend the jack. As the piston nears the end of its stroke, the claws of the extension lock ring expand as the lock collar passes through it to arrest the movement of the lock sleeve until they engage over the lock collar. The lock sleeve then moves over the lock ring under the influence of its spring, to hold it in position and securely lock the jack in its extended condition (*B in fig. 3*).

Closure

13. When undercarriage 'Up' is selected, fluid is admitted to connection A (*C in fig. 3*), where it acts on the extension lock sleeve to move it against the spring, thereby allowing the lock ring to expand and release it from its engagement with the lock collar and permit the fluid to close the jack. As the piston nears the end of its stroke, the lock is made as previously described. During the final moment of locking, the lock sleeve causes the indicator spindle to rotate and the indi-

cator plunger to extend and actuate the micro-switch to give warning that the jack is closed and locked (*D in fig. 3*).

Leakage

14. External leakage indicates faulty sealing rings that must be renewed. Loss of pressure from one side of the jack or the other, with an accompanying sluggish operation of the piston, indicates faulty piston seals or piston rings, which must be renewed.

Dismantling

15. Before attempting to dismantle the unit, the lock must be released by applying a pressure at one or the other of the double swivel unit connections.

- (1) Remove the four bolts securing the indicator from the body. Remove the bracket from the micro-switch.
- (2) Unscrew the bolts securing the shuttle valve and swivel pipe units. Remove the shuttle valve complete with the swivel pipe units.
- (3) Remove the swivel pipe units from the other end.

SERVICING

TABLE 1

Special tools

Part No.	Description	
RS.181/18	} Mk. 3	'C' Spanner
ST.1214		Vice clamp
ST.2114		Assembly post
ST.2156		Tubular key spanner
ST.2157		Drift
ST.2379		'C' Spanner
RS.181/23		Tube key spanner
03186TAO1		Assembly post
03195TAO1		Assembly post
ST.1964		Test adapter
ST.2616		

Jack

16. (1) Remove the two bleeder screws.
- (2) Unscrew the gland nut and withdraw the piston rod complete.
- (3) Secure the piston rod in a vice. Remove the circlips securing the pin in the end of the rod; extract the pin.
- (4) Remove the complete locking device from the piston rod, making a note of the number of shims disposed each side of both lock collars.
- (5) Remove the split pin securing the pin in the fork end and lift out the pin.
- (6) Slacken the lock-nut and unscrew the fork end.
- (7) Remove the gland nut and the lock-ring.
- (8) Unscrew the end cap, and extract the end plug then the closure lock-ring.
- (9) Remove all sealing and piston rings.

Indicator

17. (1) Unscrew the cover from the body.
- (2) Tap out the pin retaining the spindle in the boss and withdraw the spindle.
- (3) Withdraw the plunger together with the gland carrier and the spring, from the body. Do not remove the plug unless the sealing rings have to be renewed.
- (4) Tap out the pin securing the spring retaining nut to the plunger. Unscrew the nut and remove the spring, gland housing and washer. Remove the sealing rings from the gland housing.

Shuttle valve and swivel pipe units

18. (1) Remove the collar securing each swivel pipe unit to the shuttle valve and withdraw it from the banjo.
- (2) Remove the other collars and withdraw the male swivel posts. Remove all sealing rings.

- (3) Unscrew each banjo bolt from the body and remove its banjo.
- (4) Extract the shuttle valve.
- (5) Remove all sealing rings, but do not remove the rubber seats from the shuttle.

Swivel pipe unit

19. Remove the retaining collars from the swivel posts and withdraw the posts from the female connections. Remove the sealing rings.

Assembling

20. All sealing rings must be lightly coated with Grease XG-315 (34B/9100519) before assembling. If new piston rings are being

fitted they must be gapped 0.009 to 0.012 in. After gapping, remove sharp edges on flat surfaces only, maximum radius $\frac{1}{64}$ in. The shuttle valve and swivel pipe units must have been fully tested before fitting them to the jack, para. 27 and 28. All leather backing rings must be assembled with their rough faces adjacent to the 'O'-ring.

Jack

21. (1) Fit the collar to the externally threaded end of the piston rod until it abuts the shoulder, with its counter-sunk face leading, followed by the locking collar, large chamfer leading, with shims on each side as previously noted.

Note . . .

If new parts of the locking device are being fitted, the shims should be equally disposed on each side of the locking collar.

(2) Fit the spacer to the piston rod with its flange trailing, followed by the locking sleeve, skirt leading. Then fit the sleeve and spring to the piston rod.

(3) With the shims on each side, as previously noted, fit the other locking collar to the piston rod with the large chamfer $\blacktriangle$ trailing. See Note in (1).

(4) Screw on the retaining nut to hold the complete assembly on to the piston rod.

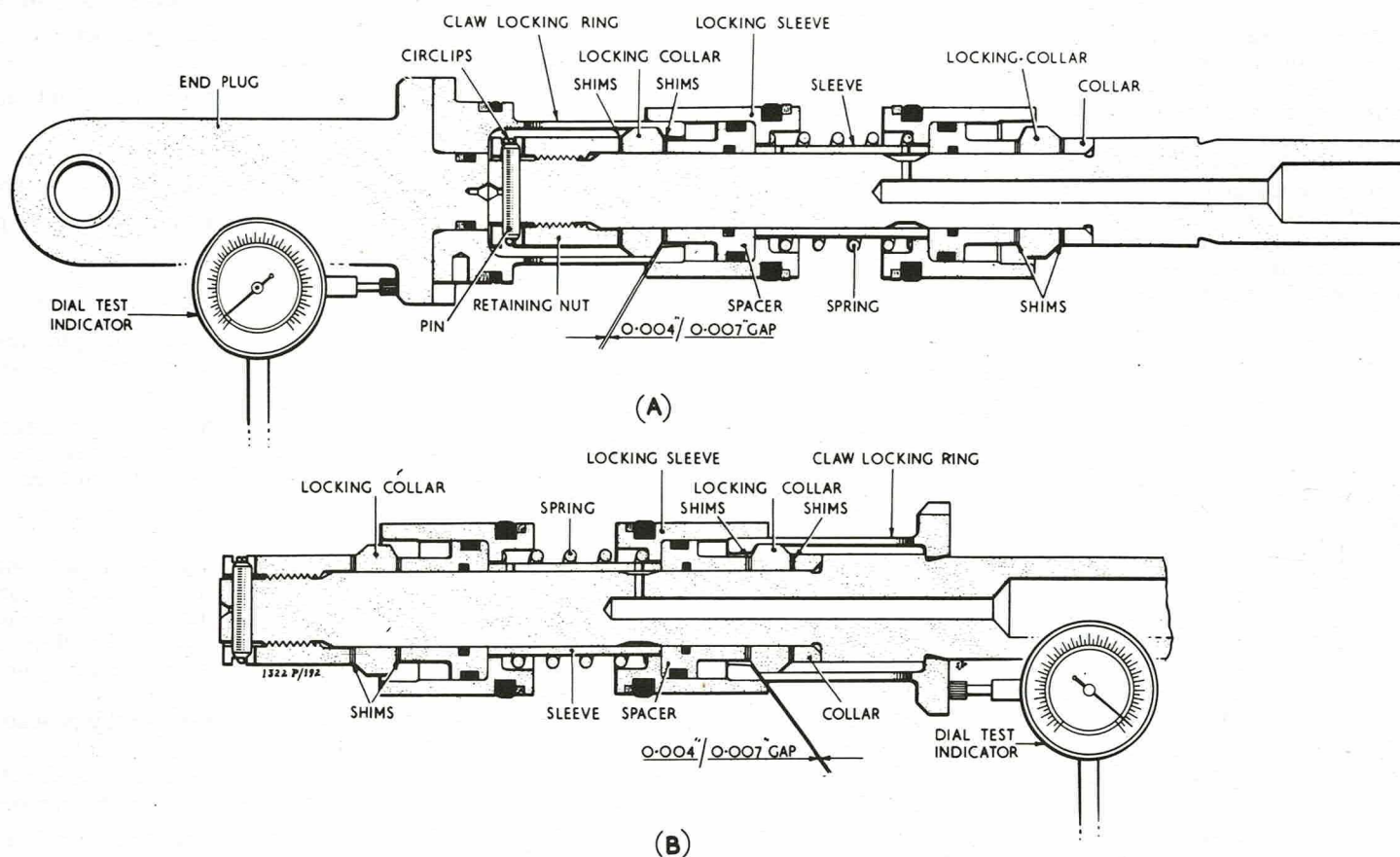


Fig. 4 Adjustment of locks

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Adjustment (fig. 4).

- (5) Pass the claw lock ring over the piston rod and engage its claws with the lock collar as shown in B of fig. 4. With a dial indicator, check the amount of movement of the lock ring, this should be 0.004 to 0.007 in. adjust the shims, if necessary, on each side of the locking collar in equal amounts to obtain a 0.004 to 0.007 in. gap between the lock collar and the lock ring.
- (6) Fit a backing ring and an O ring to the end plug, with the rough face of the backing ring adjacent to the O ring.
- (7) Insert the end plug into the other lock ring, and force the lock ring claws over the lock collar. With a dial indicator positioned as shown in A of fig. 4, check the movement of the lock ring, which should be 0.004 to 0.007 in. Adjust the shims equally each side of the locking collar to obtain the required gap between the claws and the locking collar.
- (8) Having obtained the correct gaps for both locking devices, fit the sealing rings to each of the spacers and a sealing ring and a piston ring to each of the locking sleeves.
- (9) Assemble both locking devices with the thick shim adjacent to the retaining nut, tighten the nut, and if necessary turn it back to the nearest locking position. Use extra shims part number 5740Y24, to eliminate any slack.
- (10) Insert the retaining pin and secure it with two circlips.
- (11) Remove the piston rod from the vice, and remove the lock ring.
- (12) Insert the piston rod half-way into the body, and insert the claw lock ring into the body until it abuts the shoulder.
- (13) Fit a backing ring and an O ring to the gland nut, and an U ring, supported by the spacer, into its bore. Insert the wiper ring, chamfered face trailing, into the outer groove.

- (14) Pass the gland nut over the piston rod and screw it into the cylinder to retain the lock ring.
- (15) Fit the pin into the fork end and retain it with a washer and split pin.
- (16) With the lock nut and spanner grip fitted, screw the fork end into the end of the piston rod. Do not tighten the lock nut until the unit is installed in the aircraft.
- (17) Fit a backing ring and an O ring to the closure lock ring and insert it into the other end of the body, locating the pin in the body slot.
- (18) Insert the end plug into the lock ring with the axis of the bush at right angles to the shuttle valve connection. Screw on the end cap. Fit both bleeder screws complete with adapters and seals.

Indicator

22. (1) Fit a backing ring and an O ring to the plug. Screw the plug into the body and lightly peen over metal to lock it.
- (2) Fit the pin in the plunger and peen over metal at each end to retain it,
- (3) Insert the plunger into the body followed by the washer. Fit a backing ring and an O ring to the periphery of the gland housing. Then fit a sealing ring and an O ring into the bore of the gland carrier; insert the gland carrier into the body.
- (4) Insert the spindle into the body, flat faces leading, to engage in the plunger slot. Align the pin holes and insert the pin, retain it by peening over both ends.
- (5) Pass the spring over the plunger and screw on the nut so that its flat face forms a seat for the spring, retain the nut with the pin. Lightly peen over the pin to lock it.
- (6) Screw the cover on to the body.

Shuttle valve and swivel pipe units

23. (1) Fit a sealing ring to the shuttle and insert it into the body.
- (2) Fit a backing ring and a sealing ring to each of the banjo bolts, then a single sealing ring each side of the radial groove.
- (3) Fit a sealing ring and a backing ring to the inner groove only of the banjo spigot.
- (4) Locate the banjos on the banjo bolts and screw the bolts in the body with the dogs of the banjo engaged in the slots.
- (5) Fit a sealing ring and a backing ring to the grooves in the swivel posts.
- (6) Insert the swivel posts into the female connections and secure them with the collars and pins.
- (7) Pass the connections of each swivel unit over the spigot of the banjos, and then fit a sealing ring and a backing ring in the connections.
- (8) Retain each seal with a collar and a pin.

Swivel pipe unit

24. (1) Fit a backing ring and a sealing ring to the swivel posts.
- (2) Insert the swivel post of the jack connection in the inner housing and retain it with a collar and pin.
- (3) Insert the other swivel posts into their appropriate connections and retain them with the collars.
- (4) After satisfactory tests wire-lock the ends of the pins, with the wire passing around the collars.

Assembling components to jack

25. (1) Locate a sealing ring in the indicator bore in the jack body.
- (2) Fit a washer to each of the four indicator attachment bolts and pass them through the bracket and the indicator, with the

serrated face of the bracket facing outwards, and screw them into the body applying a torque of 30 lb. in.

- (3) Position the clamp plate on the bracket, serrated faces mating, then pass the bolts through the plate, bracket, and micro-switch with its connections pointing in the same direction as the adjacent bleeder screw. Screw the bolts into the screwed plate.
- (4) Attach the swivel pipe unit to the fork end of the jack with two bolts, each fitted with a washer, tighten the bolts applying a torque load of 30 lb. in.
- (5) Attach the shuttle valve and swivel pipe with the four bolts each fitted with a washer; tighten them applying a torque of 30 lb. in.

TESTING

26. The following equipment is required for testing this unit.

- (1) A combined static and power pump rig, with the piping between the rig and the unit $\frac{3}{8}$ in. o/d metal or $\frac{3}{8}$ in. nominal flexible hose. The fluid temperature must be within 10 deg. and 80 deg. C.
- (2) A lock loading rig Type 03260TA01 as described in AP.1803D, Vol. 1, Book 1, Sect. 1 together with eye bolt 0321TA01 and special fitting 03272TA01.
- (3) The micro-switch should be wired to a suitable circuit to give visual indication by lights of the correct functioning of the locking mechanism. Before commencing the tests, hydraulically operate the jack several times to expel all air via the bleeder screws. During one of the closure strokes, adjust the micro-switch so that there is an over-travel of 0.020 to 0.045 in. of the plunger after the switch has operated. Tighten the bolts and wire-lock them together.

Shuttle valve and swivel pipe units

27. Ensure that a sealing ring and a backing ring are fitted to the shuttle valve spigot. Bolt

test adapter ST.2616 to the spigot and screw in a suitable connection against the bonded seals.

- (1) Connect connections A and B to opposite ports of the test rig selector. A short length of pipe may be connected to C to enable flow from this point to be conveniently observed.
- (2) Run the power pump and adjust the bypass valve to control pressure at 100 lb/in² with the rig selector in neutral.
- (3) Select pressure at A, fluid should flow from A to C. Reverse the selector and fluid should flow from B to C. Repeat this test three times to ensure that the shuttle is operating freely. Stop the power pump.
- (4) Disconnect the pipe from C and blank off the adapter. Disconnect the pipe from A. Select to B and operate hand pump. An initial spurt of fluid from A, due to

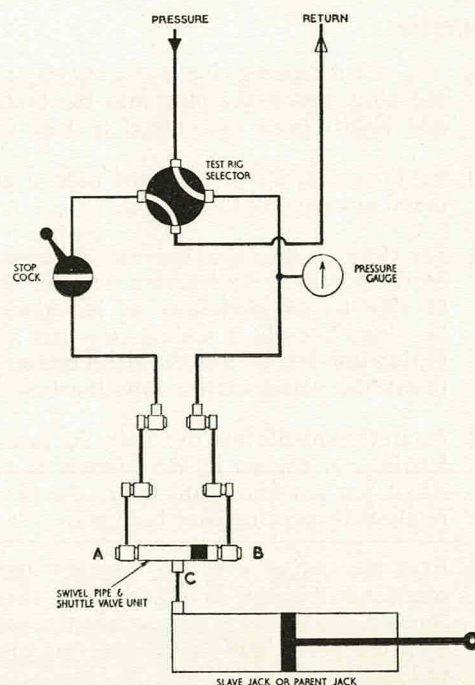


Fig. 5. Test circuit diagram

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the movement of the shuttle, is permissible. Raise the pressure to 300 lb/in², then gradually increase to 660 lb/in². There must be no leakage.

- (5) Connect A to the rig supply line. Disconnect B and select pressure to A. Operate hand pump to apply a pressure of 100 lb/in². The shuttle should move across evidenced by a spurt of fluid from B. Raise the pressure to 300 lb/in², then gradually increase to 6600 lb/in². There must be no leakage. Release the pressure.
- (6) Connect B to the rig supply line. Disconnect A and select pressure to B. Operate hand pump to apply a pressure of 100 lb/in². The shuttle should move across, evidenced by a spurt of oil from A. Raise the pressure to 300 lb/in², then gradually to 6,600 lb/in². There must be no leakage. Release the pressure.
- (7) Repeat tests (5) and (6) alternately three times.
- (8) Connect A and B to opposite ports of the rig selector. Remove the blank from C and ensure that the shuttle is in a position to give fluid flow from A to C. Connect C to the cylinder end of a suitable slave jack or the parent jack, fig. 5.
- (9) Close the rig stop cock to trap fluid at zero pressure at A. Select pressure to B and operate the pump. The jack must extend and the pressure gauge must register a stable pressure.
- (10) Open the stop cock to connect A to the return line. Leakage must not occur except for a possible initial spurt of fluid at A. Release the pressure.
- (11) Repeat tests (8), (9) and (10) five times.

Swivel pipe unit

Pressure tests

28. (1) Connect a hand pump to one end of the unit and operate the pump, there must be a free flow from the opposite end. Release the pressure.

(2) Blank off one end and gradually apply a pressure of 6600 lb/in² at the opposite end with the unit remaining static. There must be no leakage. Release the pressure.

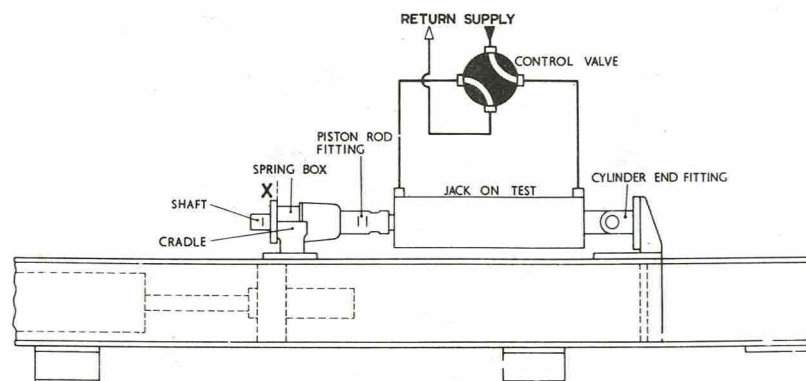
(3) With one end still blanked off, apply a pressure of 100 lb/in². Rotate each swivel joint 180 deg. and back, ten times, then through 360 deg. ten times (five clockwise and five anti-clockwise). Where full movement is obstructed, rotate the pipes as far as possible. There must be no leakage.

(4) Repeat test (3) with a pressure of 4400 lb/in². There must be no leakage. The torque required to rotate each swivel joint must not exceed 25 lb. in.

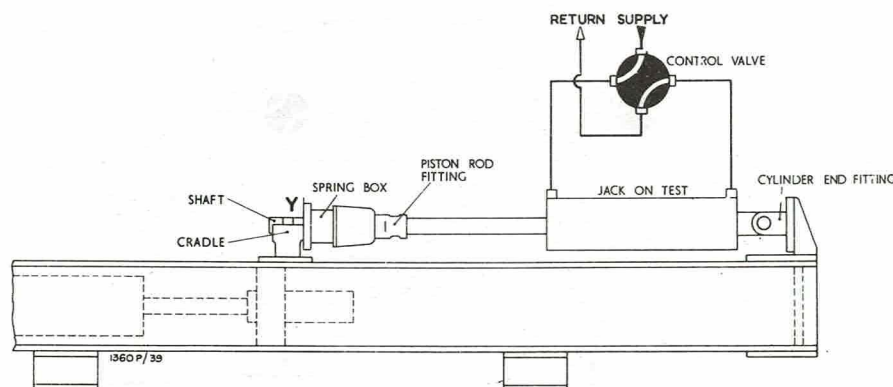
Jack, complete with component units

Static tests

29. (1) Connect the hand pump to connection X and apply a pressure to fully extend the jack. Release the pressure. Gradually apply a pressure of 300 lb/in²; checking for leakage between 0 and 100



(a) JACK FULLY COMPRESSED



(b) JACK FULLY EXTENDED

Fig. 6 Lock loading rig with spring-box

lb/in², then slowly increase the pressure to 4950 lb/in². There must be no leakage.

(2) Apply the pressure at connection Z to fully close the jack. Release the pressure. Gradually apply a pressure of 300 lb/in², check for leakage between 0 and 100 lb/in², then slowly increase the pressure to 4950 lb/in². There must be no leakage. Release the pressure and disconnect the supply line.

(3) Connect the supply lines of the power pump to both connections X and Y. Operate the pump, and simultaneously apply a pressure alternating between 0 and 330 lb/in² at both connections. Release the pressure and disconnect the supply lines.

Functioning tests

(4) Connect supply lines of the power pump to connection X and apply a pressure of 240 lb/in² to disengage the lock. This figure must not be exceeded. Release the pressure immediately the disengaged condition is obtained.

(5) Apply pressure to extend the jack from the disengaged position. Pressure required under no-load conditions to extend the jack prior to engagement of the lock in the fully extended position, must not exceed 140 lb/in² and the time required must not exceed four seconds.

(6) Apply a pressure to close the jack. Pressure required to close the jack prior to engagement of the lock must not exceed 180 lb/in² and the time required must not exceed four seconds. Release the pressure and disconnect the supply line.

(7) Connect the special fitting 03272-TA01 to the lock loading rig 03260TA01.

(8) Mount the jack on the rig and connect the end plug to the special fitting 03272TA01.

(9) Connect the power pump supply lines to connections X and Z.

(10) Apply a pressure to extend the jack and engage the lock. Pressure required to engage the lock under no-load conditions must not exceed 210 lb/in². Release the pressure.

(11) Apply a pressure to release the lock. Pressure required to release the lock under no-load conditions must not exceed 210 lb/in². Release the pressure.

(12) Apply a pressure to fully close the jack and engage the lock. Pressure required to engage the lock under no-load conditions must not exceed 210 lb/in². Release the pressure.

(13) Apply a pressure to extend and release the lock. Pressure required to release the lock under no-load conditions must not exceed 210 lb/in². Release the pressure.

(14) Remove the fork end from the piston rod and screw in the special fitting 03270TA01.

(15) Remove the spring box assembly from the lock loading rig and screw the threaded end of the spring-box into the special fitting 03270TA01.

(16) Apply a pressure to close the jack and engage the lock.

(17) Adjust the jack attachment bracket so that face X of the spring-box abuts the cradle, see (a) in fig. 6.

(18) Adjust the position of the spring-box on the rig to compress the springs in the box up to 475 to 525 lb load graduation on the special fitting 03270TA01.

(19) Apply a pressure to release the lock and apply a pressure to engage the lock against the 475 to 525 lb end load. Note the pressure required to engage the lock and then apply a pressure to release the lock.

(20) Set the test rig by-pass valve to the pressure noted in (19) plus 100 lb/in².

(21) Apply a pressure to engage the lock, close the supply valve of the power pump and reverse the position of the control valve. The lock must not release

until the power supply valve is opened. Repeat this operation six times. Release the pressure.

(22) Remove the spring-box from the cradle, and then apply a pressure to extend the jack and engage the lock.

(23) Adjust the position of the jack attachment bracket so that face Y of the spring-box abuts the test rig cradle, see (b) in fig. 6.

(24) Adjust the position of the spring-box on the cradle to compress the springs in the box up to 900 to 1100 lb load graduation on the special fitting 03270TA01.

(25) Apply a pressure to release the lock and then apply a pressure to engage the lock against the 900 to 1100 lb end load. Note the pressure required to engage the lock and then apply a pressure to release the lock.

(26) Set the test rig by-pass valve to the pressure noted in (25) plus 100 lb/in².

(27) Apply a pressure to engage the lock, close the supply valve of the power pump and reverse the position of the control valve. The lock must not release until the power supply valve is opened. Repeat this operation six times and then release the pressure.

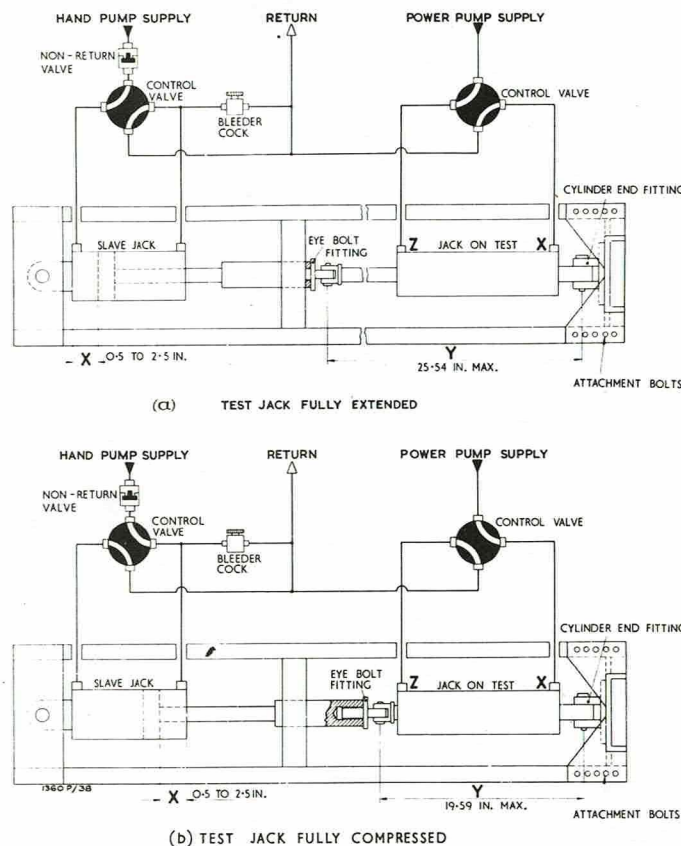


Fig. 7 Lock loading rig with slave jack

- (28) Remove the spring box and the special fitting 03270TA01 from the piston rod and refit the fork end, adjusting and locking it.
- (29) Mount the unit in the lock test rig as shown in fig. 7 by screwing special eye-bolt fitting 03271TA01 to the piston rod of the test rig slave jack and connect the fork end to the special fitting.
- (30) Adjust both jacks until dimension X is within the limits of 0.5 to 2.5 in. and dimension Y does not exceed 25.54 in. (a) in fig. 7.
- (31) Select the power pump control valve to the supply fluid connection. Operate the hand pump to extend the slave jack and close the test jack 2.5 to 3.0 in. Simultaneously, operate the power pump to supply fluid to the jack. Discontinue operation of the pumps and close the bleeder cock of the hand pump line.
- (32) Apply a pressure to extend the test jack raising the pressure to 2200 to 2250 lb/in². Gradually open the bleeder cock to allow the test jack to extend slowly. When the lock commences to engage, travel of the test jack will be momentarily

arrested, open the bleeder cock still further to allow the jack to fully extend and engage the lock.

- (33) Release the pressure to the test jack and check that its lock has fully engaged by applying a pressure of 82 lb/in² to extend the slave jack.
- (34) Repeat tests (31), (32) and (33) three times and check that the lock is engaged satisfactorily each time.
- (35) Operate both the hand pump and power pump to fully compress the test jack, (b) in fig. 7.
- (36) Adjust both jacks by means of the jack attachment bolts until dimension X is within the limits of 0.5 to 2.5 in. and dimension Y does not exceed 19.59 in.
- (37) Select the control valve of the power pump to supply fluid to connection Z. Operate the hand pump to close the slave jack and extend the test jack 2.5 to 3 in. Simultaneously operate the power pump to supply fluid to the test jack. Discontinue operation of the pumps and close the bleeder cock of the hand pump line.

- (38) Select the power pump control valve to compress the test jack and apply a pressure of 1000 to 1050 lb/in². Gradually open the bleeder cock to allow the test jack to compress slowly. When the lock commences to engage, the travel of the test jack will be momentarily arrested, and the bleed cock must open still further to allow the jack to fully compress and the lock to engage.
- (39) Repeat tests (37) and (38) at least three times and check that the lock is engaged satisfactorily each time. Release the pressure.
- (40) Disconnect the supply lines and remove the jack from the rig.

Installation

30. When the jack is installed in the aircraft, the fork end is to be adjusted to suit the aircraft pick-up points. In the closed position the pin centres must be 19.475 ± 0.12 in. Finally tighten the lock nut against the spanner grip and wire-lock the fork end, the lock nut and the spanner grip together.



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