Chapter 15

UPLOCK ASSEMBLY

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Introduction

1. This assembly operates mechanically to lock an undercarriage in the fully retracted position and hydraulically to disengage the lock and allow the undercarriage to be lowered. It consists principally of a single-acting hydraulic jack, spring-loaded for the inward stroke, that controls a hooked latch for engagement with the undercarriage uplock roller. Hydraulic pressure is admitted through a shuttle valve from either the normal or emergency systems, and a micro-switch is actuated by the uplock roller to give electrical indication of the state of the lock. ◀A basic type of unit is described and illustrated in the chapter and variants are given in the appendices.▶

DESCRIPTION

Uplock unit (fig. 1)

2. The body of the unit houses a piston, piston rod and spring, and is flanged at one end for the attachment of the shuttle valve which is secured by two bolts. At the other end, the body receives a screwed end cap that houses a bush, with sealing ring, for the piston rod; at this end of the body two arms are bushed to hold the latch pivot pin, and lugs are provided for the attachment of micro-switch side plates. Lugs are also provided for the attachment of the unit to the airframe. A steel plate, with a shim pack interposed, is secured by countersunk screws to the lower face of each arm to protect the arm from damage by the impact of the undercarriage stop.

3. The piston, which is sealed in the body bore by a duplex seal and a split ring, has a spigot that enters the flanged end of the piston rod. A helical spring is mounted over the piston rod to bear on the flange and on the bush in the end cap. The rod has a bushed eye-end for a pin by which the latch is connected.

4. The latch is secured near its centre to the pivot pin by a threaded pin in which a grease passage is provided and into which a grease nipple is screwed. On either side of the pivot pin the latch is forked, the upper fork being slotted to receive the pin by which it is con-

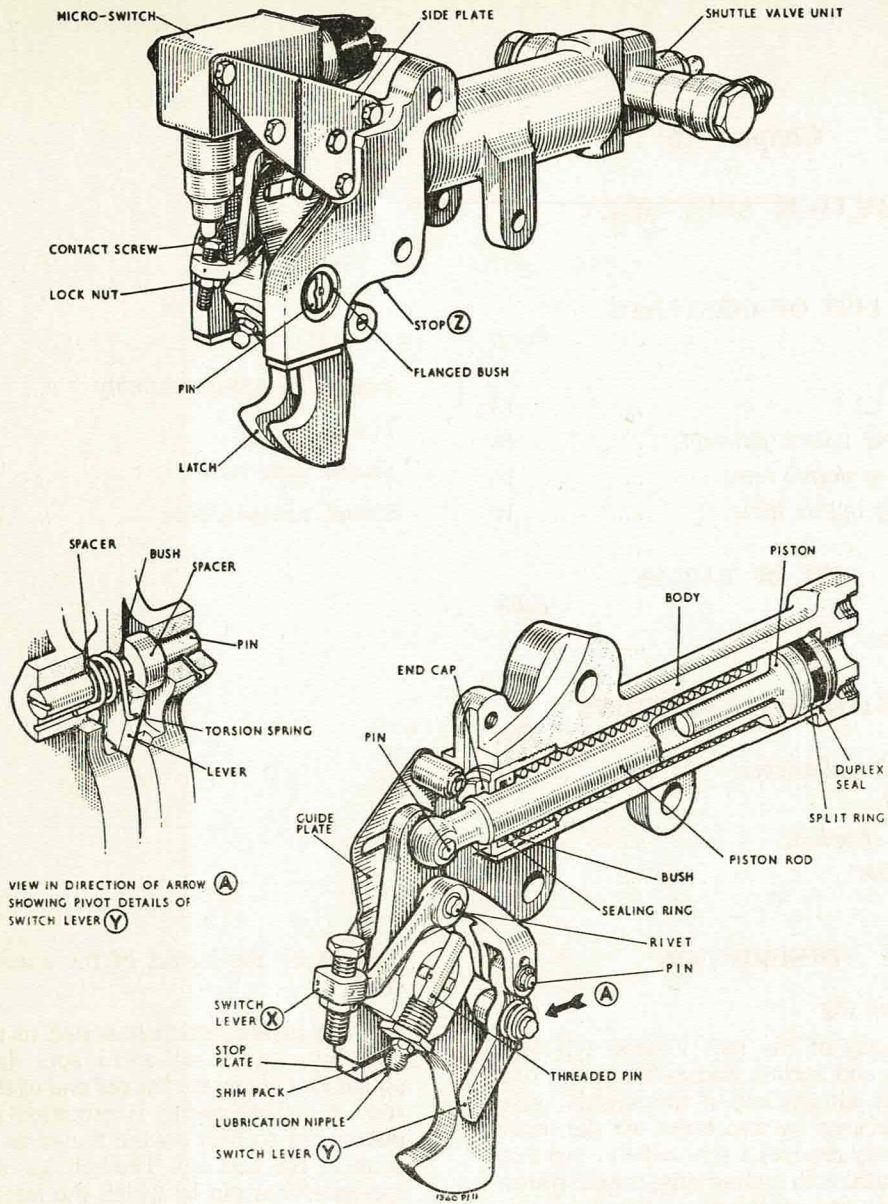


Fig. 1. Uplock unit and assembly

nected to the piston rod. The pin passes through slots in two guide plates, one on each side of the latch, that fit over the latch pivot pin and are secured at their upper ends by set screws to the micro-switch side plates. The set screws are screwed into the ends of a pin that carries a spacer and washers by which the guide plates are located correctly in relation to the latch and side plates.

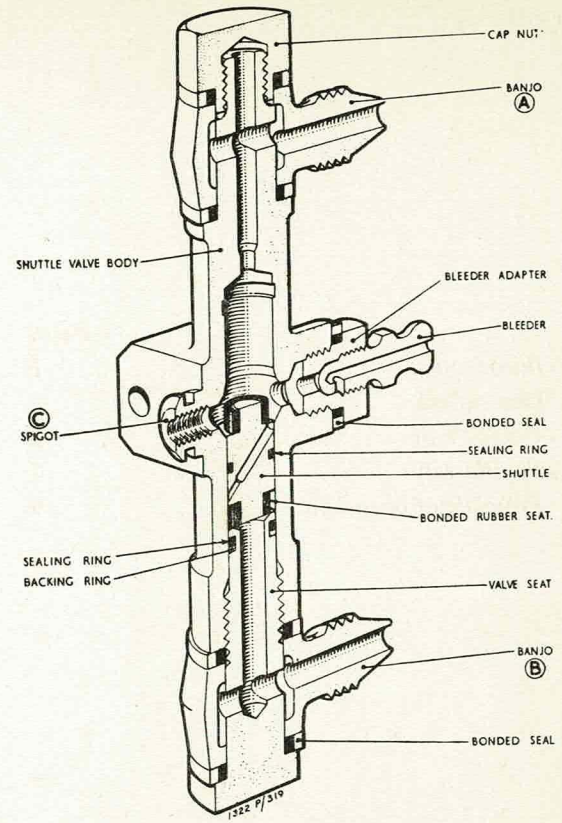


Fig. 2. Shuttle valve

5. The lower fork of the latch forms the hook for the uplock roller and between its arms a bushed switch lever is mounted on a pivot pin which carries two spacers and a torsion spring for the lever. One end of this lever forms a toe for contact with the uplock roller and its other end receives a pin by which the slotted fork end of a second switch lever is connected. This second lever is cranked and bushed to pivot on a countersunk rivet fitted in the latch; on its other end the lever carries an adjustable contact screw for switch operation.

6. The side plates between which the micro-switch is mounted are each secured to the body by two set screws and the micro-switch is secured by two bolts and nuts.

Shuttle valve (fig. 2)

7. The body, which houses a shuttle, is integral with a banjo post at one end to which a banjo connection is secured by a cap nut and two bonded seals. The body bore at this end forms a valve seat for the shuttle. At the other end the bore is screwed to receive a valve seat which also serves to secure a banjo connection and two bonded seals to the body. At approximately mid-length, lugs take the two securing bolts. Also located at this point there is a spigot, fitted with a sealing ring, that forms the hydraulic connection to the uplock and, diametrically opposite, a boss which receives a screwed adapter and bleeder screw.

8. The cylindrical shuttle has a flat rubber valve face bonded on each end and a sealing ring fitted in a circumferential groove. A hole with a restricted orifice runs diagonally through the shuttle to prevent a hydraulic lock during operation.

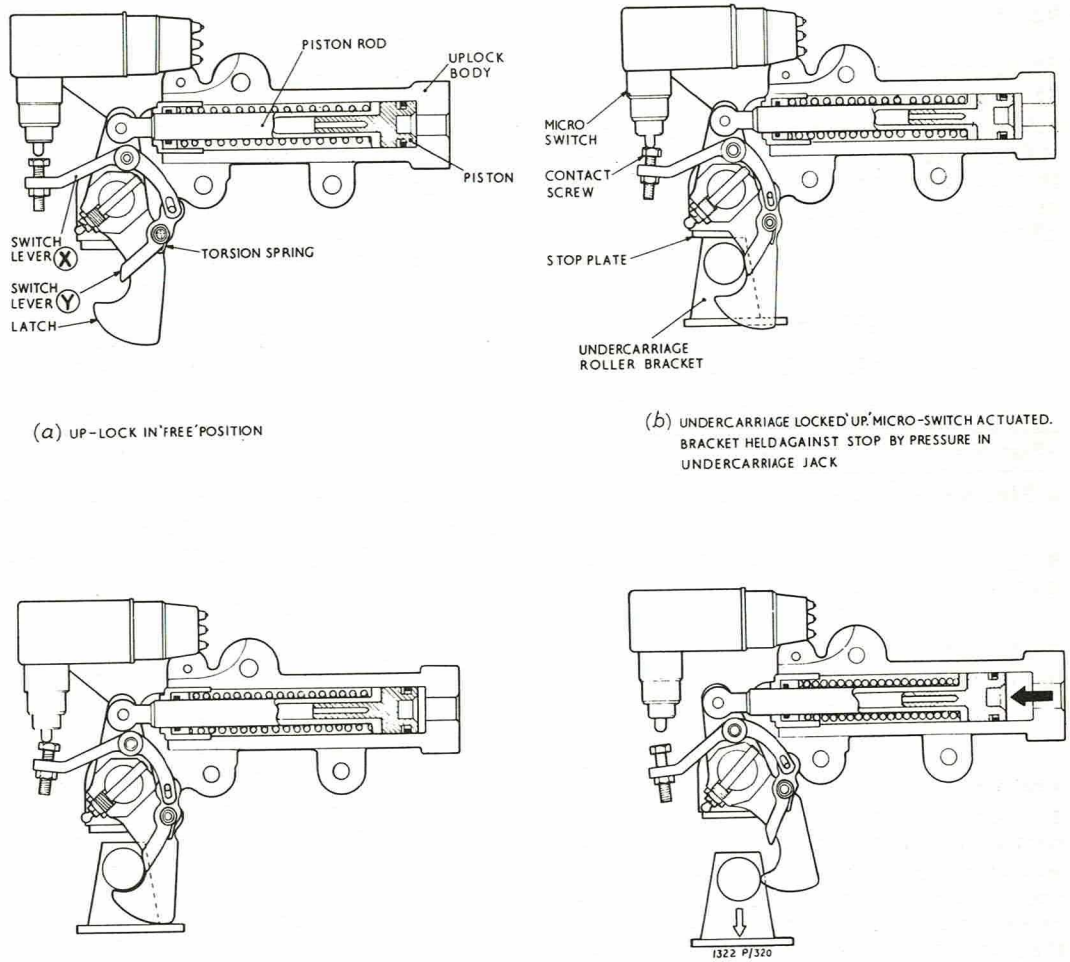
Principle of operation

Uplock unit (fig. 3)

9. The uplock is shown in "a" of fig. 3 in the "free" position, i.e. the latch is disengaged and hydraulic pressure is not applied. The spring holds the piston against the end wall of the body, and the torsion spring, through the levers X and Y, holds the contact screw clear of the micro-switch button.

10. As the undercarriage nears the retracted position a roller on the undercarriage deflects the latch and so compresses the piston rod spring, and in the fully retracted position ("b" in fig. 3) the roller overrides the hook until the roller bracket on the undercarriage is held against the uplock stop plates by the retraction jack which is pressurized until a "down" selection is made. In this position there is a clearance between the roller and the latch hook, and the roller deflects lever Y to actuate the micro-switch through lever X.

11. When undercarriage "down" is selected, pressure is released from the retraction jack



(*a*) UP-LOCK IN 'FREE' POSITION

(*b*) UNDERCARRIAGE LOCKED 'UP.' MICRO-SWITCH ACTUATED. BRACKET HELD AGAINST STOP BY PRESSURE IN UNDERCARRIAGE JACK

(*c*) UNDERCARRIAGE SELECTED 'DOWN.' PRESSURE IN UNDERCARRIAGE JACK RELEASED. ROLLER DROPS ON TO LATCH UNTIL UNDERCARRIAGE DOORS HAVE OPENED

(*d*) FLUID PRESSURE DIRECTED TO UP LOCK PISTON WHICH OPERATES LATCH TO RELEASE ROLLER

Fig. 3. Operation of uplock

and this allows the roller to drop on to the hook ("c" in fig. 3). When the undercarriage doors have opened fully, hydraulic pressure is admitted to the uplock to force the piston outwards, so turning the hook clear of the roller and releasing the undercarriage ("d" in fig. 3).

Shuttle valve

12. During normal operation the shuttle is held on the emergency valve seat by the normal system pressure. When emergency operation is selected the emergency system pressure moves the shuttle along the body bore to seal off the normal system.

SERVICING

TABLE 1

Special tools

Part No.	Description
03916TA01	Tube for spanner for end cap
◀ST.111 Mk. 24▶	Tommy bar for 03916TA01
4.60001.093	Sleeve for assembling piston in body
03213T001	Test adapter
◀03228TA01	Spring compressor ▶

Leakage

13. Leakage at a bonded seal may be rectified by checking that the cap nut, valve seat or adapter is tightened normally, but if this is ineffective the joint faces must be examined and the seal renewed. Leakage past the shuttle from the normal to the emergency systems or vice versa may be caused by a seat. Leakage from the end cap indicates foreign matter lodged between the shuttle and defective piston seal. In all cases examine the surfaces affected and renew any defective part.

Dismantling uplock assembly

14. (1) Remove the two bolts that secure the micro-switch and remove the micro-switch.

(2) Unscrew the six set screws that secure the side plates to the body and guide plates and remove the side plates.

(3) Remove the washers, pin and spacer from the guide plates.

(4) Remove the shuttle valve complete by unscrewing the two securing bolts.

(5) Extract the split pin and withdraw the pin that connects the piston rod to the latch.

(6) Extract the split pin and withdraw the pin and washer that connect the switch levers.

(7) Extract the split pin, withdraw the lever pivot pin and remove the lever, spacers and torsion spring.

(8) Remove the contact screw.

(9) Remove the grease nipple, unscrew the threaded pin, withdraw the pivot pin and remove the latch and guide plates.

Note . . .

The lever should not be removed from the latch unless the rivet or bush require renewal. Bushes should be removed from the body arms or the other lever, and the stop plates from the body only if they are unserviceable.

(10) Unscrew the end cap, extract the bush and remove the sealing ring.

(11) Withdraw the piston rod, spring and piston and remove the split ring and duplex seal from the piston.

Dismantling shuttle valve

15. (1) Remove the sealing ring from the spigot.

(2) Remove the bleeder screw, adapter and bonded seal.

(3) Remove the valve seat, banjo connection and bonded seals, and remove the sealing and backing rings from the valve seat.

(4) Remove the cap nut, banjo connection and bonded seals.

(5) Extract the shuttle and remove the sealing ring from it.

Assembling shuttle valve

16. Lubricate sealing rings with grease XG-315. The valve seat backing ring is to be fitted furthest from the inner face of the seat and its rough side is to be towards the sealing ring. Lubricate the body bore with oil OM-15.

(1) Fit the sealing ring on the shuttle and insert the shuttle in the body, with the larger diameter of the diagonal hole leading.

(2) Fit a bonded seal on the adapter and screw the adapter into its boss, tightening to a torque of 60/66 lb. in.; screw the bleeder screw into the adapter.

(3) Fit the backing and sealing rings on the valve seat.

(4) Assemble a banjo connection, with a bonded seal each side, on the valve seat, screw the seat into the body, and tighten it to a torque of 160/180 lb. in. Secure the banjo cone parallel to and facing the same way as the bleeder screw.

(5) With a bonded seal on each side of it, assemble a banjo connection on the banjo post and secure it with the cap nut, tightening to a torque of 95/105 lb. in.; the banjo cones are to be parallel.

(6) Test the shuttle valve as detailed in para. 18.

Assembling uplock assembly

17. Lubricate the sealing rings with grease XG-315. Charge the grease passages through the grease nipples and lubricate all bushes and slots with grease XG-275. Lubricate the body bore with oil OM-15

(1) Fit the split ring and the duplex sealing ring on the piston. If a new split ring is fitted, the gap is to be 0·009/0·012 in., and the sharp edges on the flat faces only are to be removed to a radius of $^1/_{64}$ in. maximum.

(2) Insert the piston spigot in the piston rod and, using the assembling sleeve, insert the piston and rod in the body.

(3) Insert the spring in the body to abut the piston rod flange.

(4) Fit the sealing ring in the bush, insert the bush in the end cap with the chamfered face leading, then screw and tighten the end cap in the body.

(5) Position the assembled latch and cranked lever, with a guide plate on each side of the latch, between the arms of the body and insert the latch pivot pin.

(6) Secure the latch pivot pin with the threaded pin and screw the grease nipple into the pin.

(7) Align the slot in the latch and the slots in the guide plates with the piston rod eye-end, insert the connecting pin and secure it with a split pin.

(8) Position switch lever Y (*fig.* 1) in the lower fork of the latch and connect the two levers with the connecting pin, washer and split pin.

(9) Turn lever Y towards the grease nipple, fit the short arm of the torsion spring in the hole in the latch, fit the smaller spacer in the spring, align the larger spacer with the pivot pin hole, turn the lever into position, insert the pivot pin and secure it with a split pin. Check that the long arm of the spring is engaged behind the lever.

(10) Screw the contact screw well into the switch lever and secure it temporarily with the lock nut.

(11) Fit a sealing ring on the spigot of the tested shuttle valve, then, with the bolt threads and joint face smeared with pigmented varnish joint compound, secure the shuttle valve to the uplock body with the two bolts.

(12) Apply pigmented varnish jointing compound to the mating faces of the side plates and body and secure the plates to the body with the four set screws.

(13) Position the spacer between the two guide plates, and the required number of washers between each guide plate and adjacent side plate to fill these two spaces, then insert the pin and secure it with the two set screws.

(14) Position the micro-switch between the side plates and secure it with the two bolts and nuts.

(15) Temporarily adjust the contact screw until the head just touches the switch button and lock it there. Final adjustment will be made on installation.

(16) Test the assembly as detailed in para. 19 and, on completion of tests, wire-lock as follows: — The end cap to body, the heads of side plate set screws together in threes, the switch securing bolt heads and nuts together in pairs, the shuttle valve adapter, cap nut and valve seat to body and the two securing bolt heads together.

TESTING

Shuttle valve tests

18. A combined hand pump and power pump test rig, the test adapter, a suitable jack, a pressure gauge and a control valve Type No. C.515.Y or similar are required. Oil OM-15 is to be used. In the following instructions the banjo connections are denoted by A and B and the test adapter on the spigot by C.

(1) Secure the test adapter to C, connect the opposite service ports of the rig selector valve to A and B and connect a short open-ended pipe to C so that flow may be observed conveniently.

(2) Run the power pump and adjust the rig by-pass valve to maintain 100 lb/in² with the selector valve in neutral.

(3) Select pressure to A and oil should flow freely from A to C.

(4) Reverse the selection and oil should flow freely from B to C.

(5) Carry out the cycle of (3) and (4) at least three times to check that the shuttle is operating freely. Stop the power pump.

(6) Remove the pipe from C and blank off this connection; disconnect the pipe from A.

(7) Select pressure to B and operate the hand pump; an initial spurt of oil from A, due to movement of the shuttle, is permissible. Raise the pressure slowly to 300 lb/in² then gradually increase to 4,950 lb/in². Leakage is not permissible. Release the pressure.

(8) With C still blanked, the pipe reconnected to A, and B open to atmosphere, select pressure of 100 lb/in² to A. The shuttle should move across and this will be indicated by a spurt of oil from B and a subsequent build up of pressure. Raise the pressure slowly to 300 lb/in² then gradually increase to 4,950 lb/in². Leakage is not permissible. Release the pressure.

(9) With C still blanked, the pipe reconnected to B, and A open to atmosphere, select pressure of 100 lb/in² to B. The

shuttle should move across, and this will be indicated by a spurt of oil from A and a subsequent build up of pressure. Raise the pressure slowly to 300 lb/in² then gradually increase to 4,950 lb/in². Leakage is not permissible. Release the pressure.

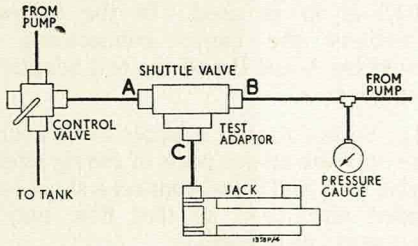


Fig. 4. Test diagram

(10) Carry out tests (8) and (9) alternately three times.

(11) Connect the unit to the system shown in *fig.* 4, i.e. with the control valve in the line from the test rig to A, the pressure gauge in the line from the test rig to B, and the jack connected to C.

(12) Move the shuttle to the position that permits flow from A to C, then set the control valve to trap oil at zero pressure at A. With the rig selector valve in neutral, run the power pump and adjust the by-pass valve to control pressure at 200 lb/in². Select pressure to B. The jack must then extend and a stable pressure be registered on the gauge. Operate the control valve to open A to tank. Leakage is not permissible except for an initial spurt of oil from A. Release the pressure. Carry out this test five times.

Uplock assembly tests

19. (1) Connect the test rig delivery lines to the shuttle valve banjo connections.

(2) Select pressure to one connection and with the hand pump apply a pressure of 4,950 lb/in². Leakage is not permissible. Release the pressure.

(3) Reverse the selection and apply a pressure of 4,950 lb/in² at the other connection. Leakage is not permissible. Release the pressure.

(4) In both tests (2) and (3) when pressure is applied the latch must open hard against stop Z (*fig.* 1) and on the release of pressure the latch must return immediately to the " free " position.

Appendix 1

UPLOCK ASSEMBLY

Type No. 1.00470.001

incorporating—Shuttle valve Type No. 1.00560.001

1. This unit is identical to that described and illustrated in the chapter.

Appendix 2

UPLOCK ASSEMBLY

Type No. 1.01054.001

incorporating—Shuttle valve Type No. 1.00560.001

1. This unit is identical to that described in the chapter except for dimensional differences in the latch assembly.

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