

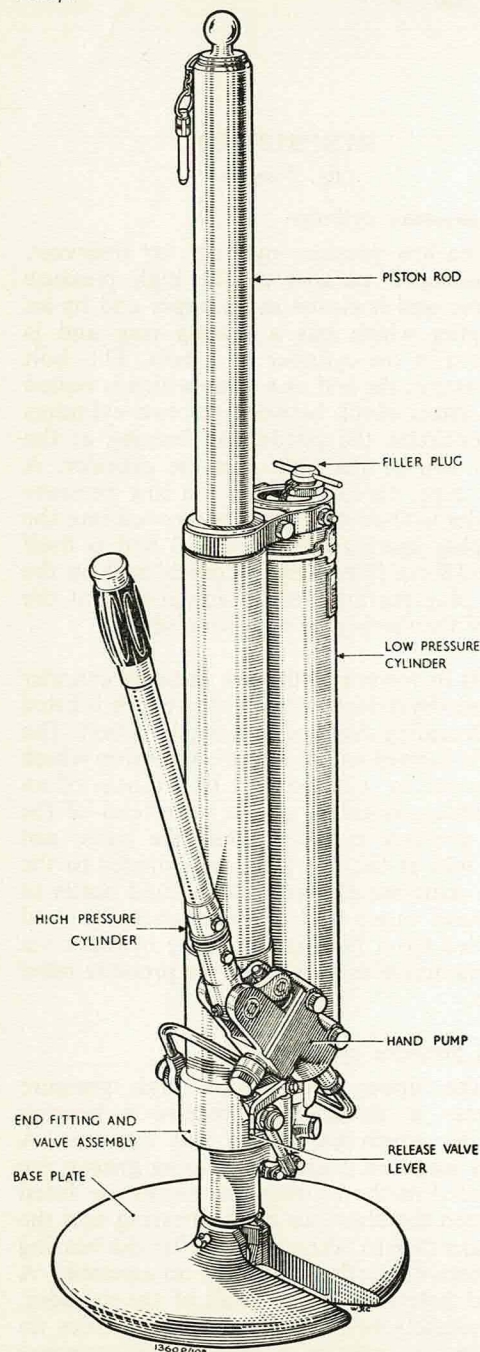


Fig. 1. Support strut

Chapter 23

SUPPORT STRUT
Type No. 2.00185.001

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Introduction

1. A pair of support struts are carried as ancillary equipment in a specific aircraft and are positioned between the rear fuselage and the ground to support the airframe during the loading or unloading of heavy freight.

2. The strut consists of a hand pump and two adjacent cylinders, (fig. 1) one a low pressure cylinder or fluid/air reservoir, the other a high pressure cylinder housing a piston which can be moved to an extended position by the

operation of the pump. Subsequent movement of the piston to the closed position is effected manually whilst operating a release valve which allows fluid below the piston to return to the low pressure cylinder. In the event of the strut being subjected to an excessive load, an automatic relief valve opens and allows the piston rod to close, fluid being returned to the low pressure cylinder. The description, operation and servicing particulars of the hand pump, Type No. U.M.C.501, are detailed in A.P.1803G, Vol. 1.

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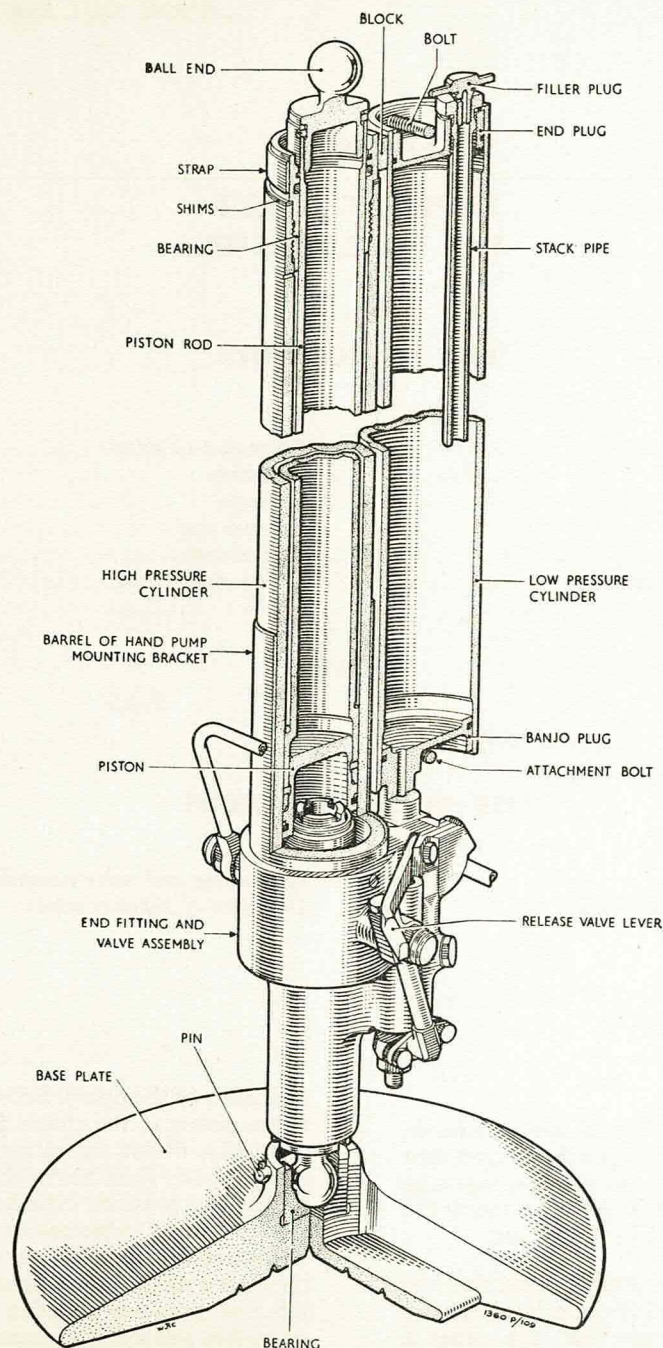


Fig. 2. Cylinders and piston rod details

DESCRIPTION

(fig. 2 and 3)

Low pressure cylinder

3. The low pressure cylinder, or reservoir, is positioned parallel to the high pressure cylinder and is closed at its upper end by an end plug which has a sealing ring and is retained in the cylinder by a bolt. This bolt also secures the end of a strap which is bolted to a spacer block between the two cylinders and encircles the piston rod bearing at the upper end of the high pressure cylinder. A stack pipe, through which the low pressure cylinder is filled with fluid, is screwed into the end plug against a bonded seal and is itself tapped for a filler plug, a conical seat on the filler plug mating with a similar seat at the top of the stack pipe to form a seal.

4. At its lower end the low pressure cylinder is closed by a skirted banjo plug which is fitted with a sealing ring and retained by a bolt. The plug is formed with a banjo connection which is secured by a banjo post to the boss of an end fitting assembly at the lower end of the high pressure cylinder. Thus the banjo not only locates the low pressure cylinder to the main strut but also provides a fluid outlet to the hand pump and a return path for fluid expelled from the high pressure cylinder via the manual release valve or the pressure relief valve.

High pressure cylinder

5. The upper end of the high pressure cylinder is threaded to receive a bearing through which the piston rod operates. A wiper ring and a grease-retaining groove are provided in the bearing and shims are fitted between the shoulder of the bearing and the cylinder face to take up slack after the bearing has been correctly positioned on assembly. A radial hole through the wall of the cylinder, immediately below the bearing, provides an air vent to prevent a build up of pressure during the operation of the piston.

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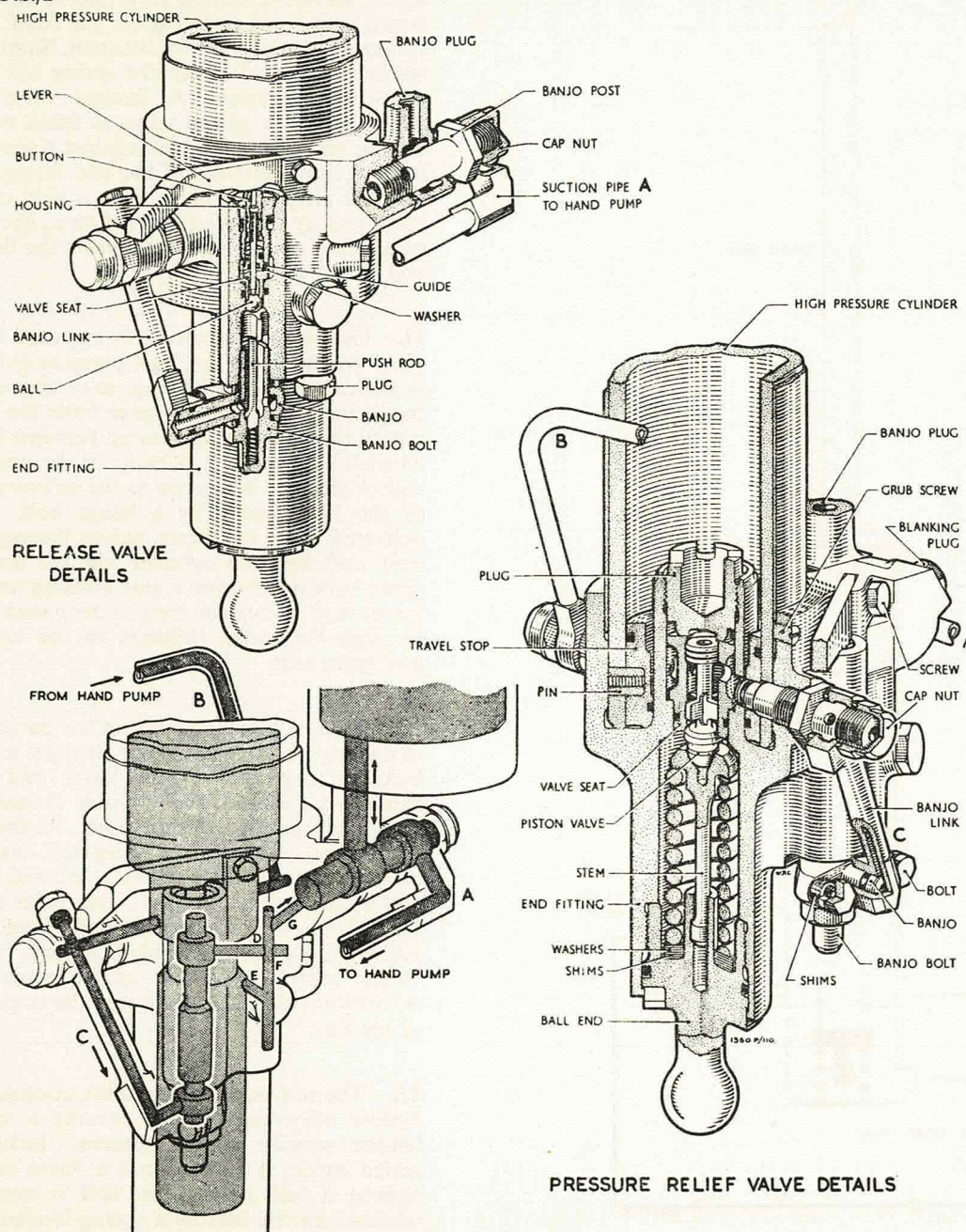


DIAGRAM OF FLUID WAYS

Fig. 3. End fitting and valve assembly

6. At its lower end the high pressure cylinder is spigoted into the combined end fitting and valve housing and is retained by two banjo posts which are screwed into opposing bosses of the end fitting. The ends of the posts pass through two of six radial drillings in the cylinder, the remaining four drillings receiving dowels which, together with the ends of the banjo posts, retain a travel stop positioned concentrically between the cylinder wall and the protruding housing of the pressure relief valve. Internal and external sealing rings on the travel stop, together with the sealing rings on the ends of the banjo posts, prevent leakage from the base of the cylinder.

7. An annular recess between the cylinder and the top of the end fitting receives the lower end of a tubular mounting bracket assembly to which the hand pump is secured by three bolts. Two diametrically opposed grub screws locate the barrel of the mounting bracket to the end fitting.

8. The piston rod assembly consists of a tubular rod, the upper end of which receives a ball end fitting for engagement in a socket of the air-frame. A pip-pin, attached by a chain to the ball end, is provided to retain the ball in the airframe socket during the operation of the strut. A bell-shaped piston is pressed into the lower end of the rod and is fitted with two piston rings. Both the piston and the ball end are locked by grub screws.

End fitting and valve assembly (fig. 3)

9. This assembly, which is attached to the lower end of the high pressure cylinder in the manner previously described, provides for the attachment of the base plate which supports the strut on the ground, houses the pressure relief valve and the manually operated release valve and provides for the various fluid connections.

10. The central bore of the end fitting houses the pressure relief valve assembly and is closed at its lower end by a threaded ball end

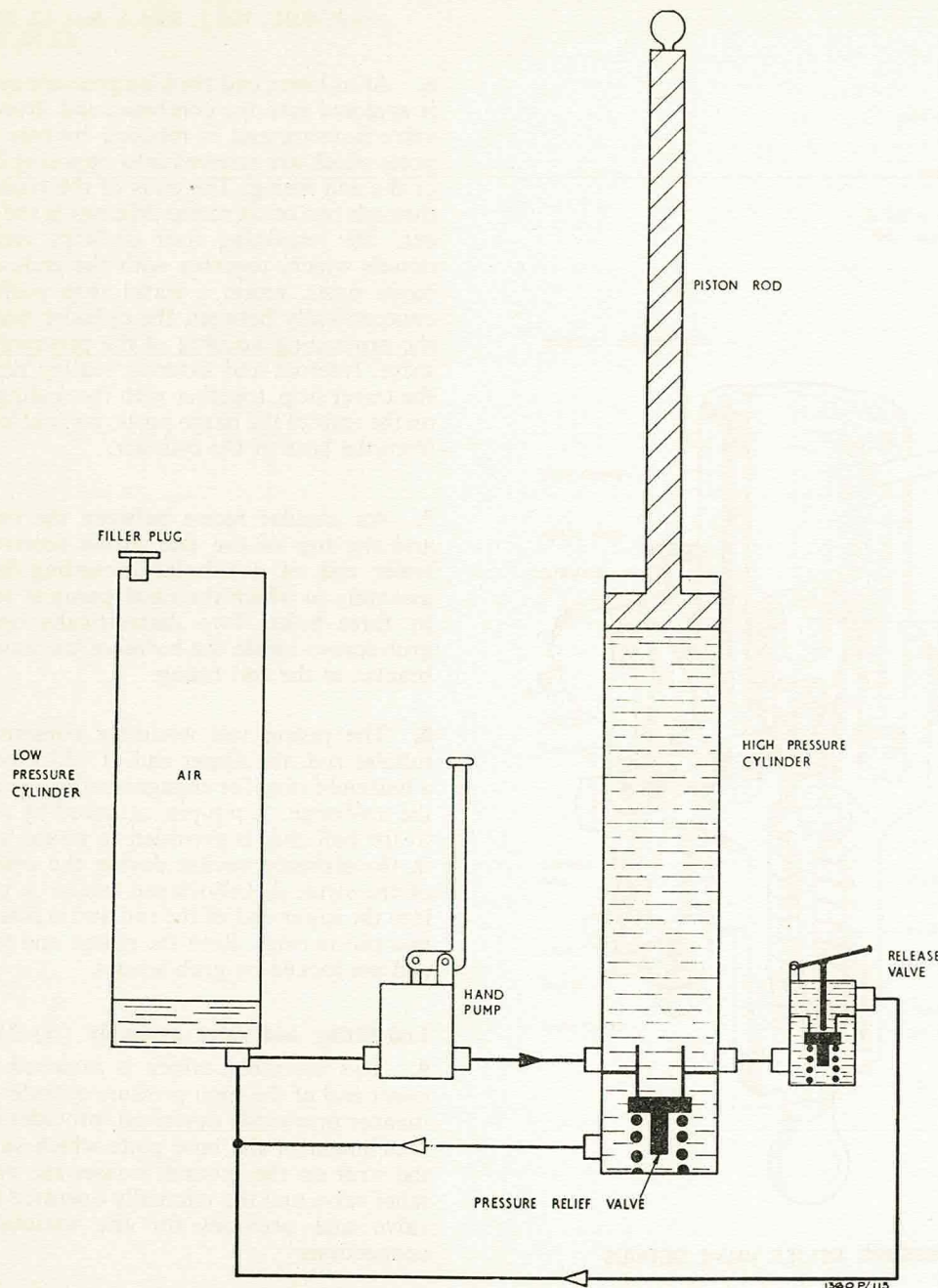


Fig. 4. Diagram of support strut

which carries a sealing ring and is counter-bored to provide a seating for the relief valve spring and a guide for a valve stem. Shims and washers are fitted under the spring for relief pressure adjustment. A flanged valve seat which houses a piston valve is fitted with a sealing ring and is retained against a shoulder in the central housing of the end fitting by a screwed plug. The piston valve is held on the valve seat by the spring-loaded stem, the head of which is countersunk to receive the domed end of the valve.

11. One of the diametrically opposed banjo posts which locate the high pressure cylinder in the cup of the end fitting, also receives the banjo end of the delivery pipe from the hand pump, the banjo being secured between bonded seals by a cap nut. A banjo at the opposite end of the pipe is secured to the delivery port of the hand pump by a banjo bolt. Fluid delivered from the pump passes through the post and into the cylinder via the annular space between the valve seat housing and the travel stop. It can also pass to the piston valve through the radial drillings in the housing and valve seat.

12. Retained by a cap nut on the banjo post at the opposite side of the end fitting is a banjo link carrying fluid to the lower end of a subsidiary vertical bore which houses the manually operated release valve. At this end the elbow of the link is spigoted over the sealed stem of a banjo which is secured to the end fitting by a banjo bolt. Two bolts attach the link elbow to the lugged body of the banjo and a shim pack is provided on each bolt to obtain correct alignment of the banjo link. A blanking plug is screwed into the upper end of the link.

13. The release valve assembly consists of a hollow operating button, housing a spring-loaded spindle which operates through a sealed guide, a washer and a valve seat to oppose a ball valve. The ball is normally retained on the seat by a spring-loaded push rod. A housing which carries a sealing ring, is screwed into the upper end of the bore to retain the guide, the washer and the valve seat

against a shoulder in the bore. Operation of the release valve button is facilitated by a lever which pivots on a screw in a slot of the end fitting.

14. A vertical drilling, adjacent to that housing the release valve, terminates, via a short diagonal drilling at the top, in a boss to which the low pressure cylinder fluid connection banjo and the hand pump suction pipe are attached by a banjo bolt and a capnut respectively. Two horizontal drillings, one from the pressure relief valve bore and one from the release valve bore, intersect the vertical drilling and provide a passage for the return of fluid, relieved through either valve, back to the low pressure cylinder. The open end of each drilling is tapped and fitted with a blanking plug.

15. The ball end at the bottom of the end fitting swivels in a bearing which is pressed into the base plate; the plate being retained by a pin and split pins. A radial slot in the plate enables it to be folded in line with the strut to facilitate stowage in the aircraft.

Operation of strut (fig. 3 and 4)

16. A diagram of the fluid ways is shown in fig. 3. Operation of the hand pump draws fluid from the low pressure cylinder through the suction pipe A and delivers it to the high pressure cylinder via the pipe B. Fluid can pass from the high pressure cylinder to the lower end of the release valve via the banjo link C. Fluid relieved through the release valve or the pressure relief valve passes through the drillings D or E respectively, to the vertical bore F from whence it returns to the low pressure cylinder via the diagonal drilling G and the banjo of the banjo plug.

17. The low pressure cylinder is initially filled until fluid is visible in the stack pipe, with the piston rod in the closed position. Before the filler plug is fitted, the piston is moved to the fully extended position by the operation of the hand pump which causes the level of fluid in the low pressure cylinder to fall. The filler plug is then fitted and tightened, thus trapping air in the cylinder at atmospheric pressure. This condition is shown diagrammatically in fig. 4,

and it is in this condition that the strut must always be stowed in the aircraft.

18. When it is required to reduce the length of the strut to position the unit under the airframe, the release valve lever must be depressed to open the valve whilst simultaneously moving the piston rod by hand to the closed position. This action forces fluid back into the low pressure cylinder thus compressing the air content. If the piston cannot be easily held in the closed position whilst the ball valve is engaged in the airframe socket, it will be necessary to release compressed air by slackening the filler plug on the low pressure cylinder. In this case the filler plug must not be re-tightened until the strut is removed from the airframe socket preparatory to stowing in the aircraft. Having attached the ball end in the airframe socket by means of the pip-pin, the strut can then be extended to the required length by operating the hand pump. Before stowing the unit in the aircraft the piston rod must be in the fully extended position and the filler plug tightened.

TABLE 1
Special tools

Ref. No.	Part No.	Description
	RS.181/11	'C' spanner for relief valve plug
	RS.181/16	'C' spanner for relief valve ball end
	S.T.4.60001.096	Spanner for release valve button housing
	S.T.4.60001.273	Test adapter for attachment of test pressure gauge
	RS.181/27	'C' spanner for piston rod bearing

SERVICING

Leakage

19. External leakage will indicate a faulty seal which must be renewed. Leakage past the filler plug may be due to dirt or damage. Cleaning, repair or renewal of the parts will be necessary. Failure of the strut to support a load will indicate a faulty piston seal or a badly seating pressure relief valve or release valve. Renewal of the piston seal and cleaning

or renewal of the faulty seats will be necessary.

Dismantling

WARNING . . .

Slacken the filler plug to release air pressure before dismantling.

20. (1) Unscrew the filler plug and the stack pipe from the low pressure cylinder. Operate the release valve lever and

manually move the piston rod to the closed position. Drain the fluid from the low pressure cylinder.

- (2) Remove the base plate from the end fitting.
- (3) Unscrew the banjo bolt to free the pipe at the delivery port of the hand pump. Unscrew the cap nut from the banjo post and remove the pipe from the end fitting.

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- (4) Disconnect the suction pipe from the hand pump, unscrew the cap nut to release the opposite end of the pipe from the end fitting.
- (5) Remove the hand pump from the strut and unscrew the reducing union from the suction port.
- (6) Unscrew the banjo post which secures the low pressure cylinder banjo plug to the end fitting.
- (7) Remove the nut and bolt which secures the strap to the upper end of the low pressure cylinder. Remove the cylinder from the strut and withdraw the end plug. Remove the nut, the washer, the saddle washers and the bolt and withdraw the banjo plug.
- (8) Unscrew the bolts and remove the washers, the block and the strap from the upper end of the high pressure cylinder.
- (9) Unscrew the cap nut which secures the banjo link to the banjo post. Remove the bolts and shims and withdraw the banjo link from the spigot of the banjo.
- (10) Remove the screw and the release valve operating lever.
- (11) Remove the grub screws which locate the hand pump mounting bracket.
- (12) Unscrew the banjo posts and withdraw the high pressure cylinder assembly from the end fitting. Withdraw the hand pump mounting bracket, the pins and the travel stop from the cylinder; the pins are tapped No. 8 (0.164)—32—UNC—2B for extraction purposes.
- (13) Unscrew the bearing from the upper end of the cylinder and withdraw the piston rod assembly. Do not remove the ball end or the piston unnecessarily.
- (14) Unscrew the banjo bolt and remove the banjo from the base of the release valve bore. Remove the spring from the banjo bolt and the push rod and ball from the bore.
- (15) Unscrew the button housing and remove the button, the valve spindle, the spring, the guide, the washer and the valve seat from the bore.

- (16) Unscrew the plug to free the valve seat and piston valve at the upper end of the end fitting.
- (17) Unscrew the ball end from the lower end of the fitting, and remove the stem, the spring, the washers and the shims. Note the number of washers and shims fitted.
- (18) If necessary, remove the remaining blanking plugs from the fitting.

Assembling

21. All sealing rings are to be lightly coated with Grease XG.315 (34B/9100519) before being assembled in the unit.

- (1) Ensure that the sealing ring is fitted to the valve seat of the pressure relief valve. Insert the piston valve into the seat and position the seat against the shoulder of the housing in the end fitting. Screw in the plug to retain the valve seat and wire-lock the plug to the housing.
- (2) Ensure that the sealing ring is fitted to the ball end and position a maximum of three shims, followed by a maximum of five washers over the spigot.

Note . . .

If the number of shims and washers removed during dismantling is known, this number should be fitted on assembly. Position the spring over the spigot and insert the stem through the spring into the spigot bore.

- (3) Screw the ball end into the end fitting and ensure that the head of the stem seats over the domed head of the piston valve.
- (4) Ensure that the sealing rings are fitted on the button housing, the guide, and in the bore for the release valve assembly. Insert the button into the housing and follow with the valve spindle, the spring and the guide.
- (5) Position the seat and the washer in the release valve bore of the end fitting. Screw the button housing assembly into the bore and lock the housing by peening metal into the slot.
- (6) Position the spring and the push rod stem in the base of the banjo bolt. Fit a bonded

seal, the banjo and a second bonded seal over the bolt. Position the ball against the seat, insert the head of the push rod into the bore and screw the banjo bolt into the end fitting. Do not tighten the bolt at this stage. Ensure that a sealing ring is fitted to the spigot of the banjo.

- (7) Ensure that the sealing rings are fitted to the travel stop. Insert the stop, with the external ring leading, into the base of the high pressure cylinder, align the four smaller holes and insert the four pins.
- (8) Slide the barrel of the hand pump mounting bracket on the lower end of the high pressure cylinder with the mounting plate leading.
- (9) Insert the lower end of the high pressure cylinder into the end fitting and align the diametrically opposed holes of the cylinder and travel stop with the tapped bosses of the fitting.
- (10) Fit a sealing ring and a bonded seal on each post and screw the posts into the end fitting to locate the high pressure cylinder.
- (11) Fit a bonded seal on either side of the banjo link. Secure the link over the relevant banjo post with the cap nut and engage the elbow of the link over the spigot of the banjo at the lower end of the release valve bore. The banjo must be correctly aligned to receive the link elbow after which the banjo bolt must be tightened. Position the two packs of shims (a maximum of six in each pack) between the link elbow and banjo and screw in the bolts. Lock the bolt heads, the cap nut and the banjo bolt with wire.
- (12) Align the locating holes in the barrel of the hand pump mounting bracket with those in the end fitting, positioning the mounting plate on the same side of the strut as the banjo link. Screw in the grub screws to locate the barrel and lock each screw by peening in two diametrically opposite positions.
- (13) Ensure that the sealing ring and the phosphor bronze piston ring are fitted to the piston head. If a new phosphor bronze

ring is fitted it must 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 radius between 0.005 and 0.015 in. Insert the piston rod into the high pressure cylinder.

- (14) Ensure that the wiper ring is fitted to the bearing and pack the internal groove with Grease XG.277 (34B/9100514). Temporarily screw the bearing into the cylinder over the piston rod.
- (15) Ensure that the sealing rings are fitted to the end plug and the banjo plug. Insert these plugs into the upper and lower ends of the low pressure cylinder respectively, leading with the sealing rings. Secure the banjo plug with the saddle washers, the bolt, the washer and the nut.
- (16) With bonded seals positioned on each side of the banjo, secure the banjo plug of the low pressure cylinder to the relevant boss of the end fitting by screwing in the banjo bolt.
- (17) Ensure that the piston rod bearing is screwed in to butt against the high pressure cylinder, then slacken off the bearing, if necessary until the block can be positioned between the bearing and the low pressure cylinder with the flat of the block mating with one of the flats on the bearing. Fit the strap round the bearing and ensure that the holes in the strap coincide with those in the block and the low pressure cylinder. When the correct position of the components is achieved, measure the gap between the bearing and the face of the high pressure cylinder, then unscrew the bearing and fit shims to take up the slack. Re-position the parts and fit the washers and bolts to secure the strap to the block. Insert the bolt to secure the ends of the strap and locate the end plug in the low pressure cylinder.

Note . . .

The ring of the filler plug anchor chain must be threaded on to the bolt between the walls of the end plug. Lock the bolt heads with wire.

- (18) Secure the suction pipe banjo, between bonded seals, on the banjo post by screwing on the cap nut.
- (19) Fit a bonded seal on the reducing adapter and screw the adapter into the inlet port of the hand pump.
- (20) Attach the hand pump to the mounting bracket with the washers and bolts. Lock the heads of the bolts with wire.
- (21) Connect the suction pipe to the reducing adapter of the hand pump. Wire-lock the union nut and the adapter.
- (22) Secure the banjo of the delivery pipe, between bonded seals, to the hand pump outlet port by screwing in the banjo bolt. Wire-lock the head of the bolt.
- (23) Fit the sealing plug, the bonded seals and the blanking plugs to the tappings of the end fitting and wire-lock all plugs.
- (24) Attach the base plate to the ball end of the end fitting by inserting the pin and the split pins.
- (25) Secure the lever over the button of the release valve with the pivot screw. Wire-lock the head of the screw.
- (26) Fit a bonded seal to the stack pipe and screw the pipe into the end plug at the upper end of the low pressure cylinder.
- (27) Ensure that the filler plug is attached to the chain and screw the plug into the stack pipe.
- (28) Ensure that the pip-pin is attached by its chain to the ball end at the outer end of the piston rod.

Filling and testing

22. (1) Remove the banjo bolt at the

delivery port of the hand pump and screw in the test adapter ST.460001.273 to retain the banjo of the delivery pipe between the existing bonded seals. Connect a pressure gauge equipped with a bleeder screw to the test adapter.

- (2) With the unit standing upright and the piston rod in the fully closed position, remove the filler plug from the low pressure cylinder and fill the cylinder with oil O.M.15 (34B/9100572) until fluid can be seen in the stack pipe. Do not fit the filler plug at this stage.
- (3) Operate the hand pump to move the piston rod to the fully extended position and ensure that the pressure gauge connection is bled free of air. Continue to operate the hand pump until the pressure relief valve blows off. This should occur between 2,218 and 2,242 lb/in². It may be necessary to remove the ball plug and adjust the thickness of washers or shims to obtain the correct blow-off pressure.
- (4) Operate the hand pump to cause the relief valve to blow-off and reseal twenty times. Leakage is not permissible.
- (5) Depress the release valve lever and move the piston rod manually to the closed position. Remove the pressure gauge and the test adapter and re-fit the banjo bolt. Top up the low pressure cylinder with fluid if necessary. Operate the hand pump to move the piston rod to the fully extended position, then screw in and tighten the filler plug.
- (6) Depress the release valve lever and manually close the piston rod. Release the external load and the unit should partially extend. Repeat this test three times.
- (7) Using the hand pump, move the piston rod to the fully extended position and leave the unit in this condition.

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