SAFETY

Safety - consult Blakeborough publication 'Safety' before starting any maintenance work.

The valve and actuator should be handled and installed with care. Consult publication 'Good Installation Practices' for details.

Before any maintenance work it is essential to ensure that the actuator is isolated and depressurised.

GENERAL

In the 'normal' position (with handwheel at neutral and no air pressure on the diaphragm) the stem of the direct acting actuator is held in a fully retracted position by means of the spring. An increase in air pressure in the upper diaphragm chamber thrusts the actuator stem assembly downwards and compresses the spring; decreasing the air pressure allows the spring to return the stem and diaphragm assembly back to its normal position.

- When mounted on pull-stem-to-open valves, the direct acting diaphragm actuator closes the valve upon increasing the air pressure in the upper diaphragm chamber.

- When mounted on push-stem-to-open valves, the direct acting diaphragm actuator opens the valve upon increasing the air pressure in the upper diaphragm chamber.

Raised metal pads on the yoke casting are provided for the mounting of accessories. All accessories should be removed before dismantling the actuator. Remove the actuator from the valve bonnet assembly as outlined in the basic instruction book covering the valve in use.

The side mounted handwheel provides a means for limiting actuator stem travel, thereby preventing either full valve opening or full valve closure during automatic operation. In order to limit the actuator stem extension turn the handwheel counterclockwise when the stem is at its highest position of travel. In order to limit the actuator stem retraction turn the handwheel clockwise when the stem is at its lowest position of travel. The valve can be manually positioned by means of the handwheel when instrument control is cut off either by air failure or intentional shut down.

ACTUATOR DISASSEMBLY

WARNING

Do not remove the diaphragm case screw nuts until the spring compression has been relieved.

To remove the diaphragm:

1. Set the handwheel to neutral position.

2. Remove the cover plate (25) from the spring barrel assembly (21) by removing four screws (13).

3. Relieve spring compression by inserting a tommy bar into the holes provided in the spring adjuster (11) and turn anti-clockwise.

4. Remove the diaphragm case screws and nuts (43 and 44), then lift off the upper diaphragm case (41). **CAUTION**: Do not remove the diaphragm case until the spring compression has been relieved.

5. Loosen the travel stop setscrews and discs (71 & 72) and remove the travel stop nut (70) from the actuator stem (20).

6. Unscrew and remove locknut (16).

7. Remove the diaphragm button (48), diaphragm (46), diaphragm plate (47) and travel stop collar (49).

8. Remove the upper grubscrews (40) and unscrew the lower diaphragm case (42) from the spring barrel (21).

9. Lift the stem (20) and the spring carrier (19) out of the spring barrel.

10. Remove the spring (29) from the spring barrel (21). Unscrew the upper travel stop nut (70) from the actuator stem.

11. Remove the lower grubscrew (40) and unscrew the spring barrel (21) from spring barrel baseplate (24).

12. Remove the spring seat (18), thrust bearing (37), washers (38) and unscrew the spring adjuster (11) from the spring adjuster screw (95).

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13. Remove the grubscrew (40) and unscrew the spring adjuster screw (95).

Disassembly of the jacking screw:

1. Using the handwheel turn the jackscrew (32) downward as far as it will go.

2. When the end of the jackscrew passes beyond the key (79) the jackscrew itself will rotate with the worm wheel (75). Complete the removal by turning the jackscrew out of the worm wheel by hand.

3. Remove the handwheel travel indicator screw and the indicator (81) from the jackscrew. This step is only necessary if the jackscrew or indicator is to be replaced.

4. Remove the bearing retainer screw and lockwasher (73 and 74) then unscrew and remove and remove the spring barrel base plate (24) from the yoke (31).

5. Remove the jackscrew key (79) from the spring barrel base plate (24).

6. Lift the spacer ring (78), with the two thrust bearings (76) and washers (77) (one washer above and one below the bearing) from the top of the worm wheel (75).

7. Unscrew the handwheel stem nut (86) from the gearbox. Rotate the handwheel slowly to disengauge the worm (83) from the worm wheel (75). Withdraw the handwheel stem assembly (90) (with worm and outer thrust bearing (84) attached) from the gearbox as a unit. If the inner thrust bearing and races (84 and 85) do not come out with the stem, remove them from the housing.

8. Remove the worm wheel (75) and the lower thrust bearing with races (76 and 77) from the housing.

Handwheel stem disassembly:

To save time in reassembling, do not disassemble this unit unless it is necessary to repair or replace parts. If disassembly is necessary proceed as outlined below:

1. Slide the worm (83) and the inner thrust bearing with its washers off the handwheel stem (90).

2. Remove the handwheel stem nut (92) and the washer (93), then remove the handwheel (91) and split ring (89).

3. Slide the stem nut assembly (86) and the thrust bearing and washers of the stem.

4. Check the wiper ring and bushes in the stem nut assembly for wear and replace if necessary.

ASSEMBLY

Assembling the handwheel stem unit:

1. Make up a bearing unit (84) between two washers (85) and slip the unit onto the stem (90).

2. Slide the handwheel stem nut (86) (bush end first) onto the stem (90).

3. Fit a split ring (89) and slip the handwheel (91) onto the stem. Secure the handwheel with washer and nut (92 and 93).

4. Slide the worm (83) onto the stem (90).

5. Make up a bearing unit (thrust bearing) (84) between two washers (85) and slip the unit onto the stem against the worm.

6. The handwheel stem unit is now ready for insertion into the bearing housing.

Assembling the jacking screw mechanism:

1. Clean the gear box and all parts thoroughly.

2. Make up a bearing unit, consisting of a bearing (76) between two washers (77), and place it on the shoulder at the bottom of the gear box.

3. Place the worm wheel (75) in the housing so that it rests on the bearing washer.

4. Insert the handwheel stem (90) assembly into the gearbox. Rotate the handwheel to mesh the worm and worm wheel.

5. Screw in the handwheel stem nut (86) to secure the stem assembly.

6. Make up another thrust bearing unit (see step 2) and place this unit squarely on top of the

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worm gear. Place spacer ring (78) on top of the bearing unit.

7. Screw the spring barrel baseplate (24) into the top of the gearbox, then with the screw holes in the baseplate and yoke aligned install the screw and washer (73 and 74).

8. Turn the jack screw (32) (by hand) into the gear box until the upper end of the screw is 6mm above the top face of the spacer ring (78).

9. Rotate the stem to line up the jack screw keyways with the internal slot in the baseplate (24) then insert the keys (79).

10. Place the spring adjuster screw (95) into the baseplate temporarily to hold the key in place.

11. Replace the handwheel travel indicator (81) on the lower end of the jackscrew.

Replacing the spring:

1. Screw the spring adjuster (11), thrust bearing (37) and washers (38) onto the spring adjuster screw (95).

2. Place the spring seat (18) over the bearing and washers followed by the spring (29).

3. Place the spring carrier (19) onto the stem (20) and screw the upper travel stop nut (70) onto the stem and secure in place with grubscrew and disc (71 and 72).

4. Lower the stem (20) and spring carrier (19) into the jacking screw, until the carrier sits on the spring (29).

5. Place the spring barrel (21) onto the spring barrel baseplate (24) and secure in place with grubscrews (40).

Diaphragm assembly:

1. Screw the lower diaphragm case (42) onto the spring barrel (21) and secure with grubscrews (40).

2. Place the travel stop collar (49) and diaphragm plate (47) on the end of the stem.
3. Examine the diaphragm (46) checking for signs of wear or porosity. Replace if necessary.

4. Dust the diaphragm (46) with talcum powder to prevent abrasion; place the diaphragm over the actuator stem to rest on the diaphragm plate so that the shape of the diaphragm will cause it to drape over the edge of the plate.

5. Place the diaphragm button (48) (rounded edge downwards) over the actuator stem then secure the assembly together with the actuator stem nut (16).

6. Put the upper diaphragm case (41) in place and insert a case screw to maintain alignment.

7. Insert the diaphragm case screws (43). Add nuts (44) and tighten up evenly and secure to obtain a good seal.

Positioning the upper travel stop nut:

1. Screw the upper travel stop nut (70) up the actuator stem (20).

2. The upper travel stop nut should be positioned on the actuator stem in accordance with dimension 'X' given in Table 1. Determine the bonnet mount hole by measuring the actuator being serviced, then refer to the nameplate for the actuator stroke and determine dimension 'X' to be used.

Table 1

Yoke Mtg Diameter (mm)	Travel (mm)	'B'	'X'	'Y'
90.5	57	216	436	285
	89	258	458	317
127	57	314	421	368
	89	341	459	400
	127	384	677	438
	152	409	702	463
	178	435	729	489

3. After the position of the upper travel stop has been determined on the actuator stem, unscrew the stop and apply 'Loctite 241' to the actuator threads where the upper travel will finally be positioned.

4. Finally position the upper travel stop on the actuator stem to dimension 'X'

5. Install the set screw discs into the set screw holes in the travel stop nut (70), then install

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and tighten the set screws to secure the stop nut at its correct setting.

ADJUSTMENTS

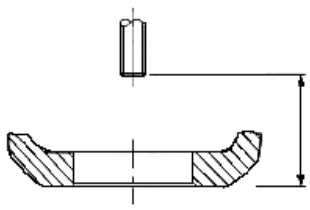
Establishing the handwheel neutral position and positioning the lower travel stop nut:

1. Connect an air supply line (with regulator and a 0 to 60 PSI gauge) to the air connection in the diaphragm case (41) for use when positioning the travel stop nut (70) on the actuator stem (20).

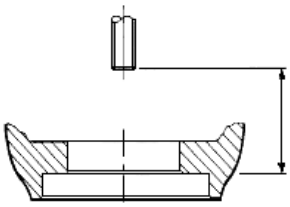
2. Dimension 'Y' listed below is provided for setting the jack screw (handwheel) in neutral position. The bonnet mount hole size in the bottom of the yoke for the specific actuator being serviced determines the measurement used (see table below).

3. Place a straightedge across the lower machined surface of the bore hole inside the bottom of the yoke (31).

4. Position the jack screw (32) (by handwheel) so that a vertical measurement from the contacting surface of the straightedge to the end of the jack screw is in accordance with dimension 'Y'.



Dimension 'B'
Actuator Stem Up
90mm Yoke
Mounting



Dimension 'B'
Actuator Stem Up
127mm Yoke
Mounting

5. If necessary, loosen the handwheel travel indicator scale holding screws then adjust the scale so that the centre mark (neutral) is in line with the indicator (81) and check dimension 'B'.

6. With the handwheel in NEUTRAL, position the lower travel stop nut (70) on the actuator stem as follows:

   a. Determine the valve travel from the nameplate and add 1.5mm and call this dimension 'D'.

   b. Apply about 2 bar air pressure to the chamber above the diaphragm in order to extend the stem as far as it will go.

   c. Ensure the stem travel has been stopped by the upper stop (70) by turning the spring adjuster (11) downward to relieve and spring compression.

   d. Screw the travel stop nut (70) onto the stem (20) and position the nut so that its top surface is below the end of the jackscrew (32) by a distance equal to 'D'. Tighten the travel stop nut setscrews securely.

   e. Exhaust all air pressure from the chamber above the diaphragm.

Setting the diaphragm pressure range:

1. To set the diaphragm pressure range, the spring is compressed just enough to counterbalance the downward thrust of the diaphragm when air pressure in the upper chamber is at the preload pressure. Once the starting point has been established, the spring design ensures that the stem will be fully extended when air pressure reaches the upper range value.

   a. Connect an air gauge and a 0 to 4 bar (0 to 60 PSI) regulator to an air line leading to the chamber above the diaphragm.

   b. Turn the spring adjuster (11) upward until there is a positive indication of spring compression.

   c. Determine the lower value of the diaphragm pressure range from the nameplate.

   d. Gradually increase the air pressure to the upper diaphragm chamber and determine at what pressure the stem starts to move downwards.

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e. Adjust the spring compression by moving the spring adjuster (11) and again increase the air pressure gradually. Repeat this testing and adjusting procedure until the actuator stem just starts to move as the increasing air pressure passes the lower value of the pressure range. The diaphragm pressure range has now been established.

Note: Spring design limits the amount of possible 'jackup' compression. Too much initial compression leaves insufficient spring deflection for full actuator stroke.

2. Replace the dust cover (25) and the actuator is ready for mounting on the valve body (see valve instruction book)

ACTUATOR PARTS LIST	
11	Spring Adjuster
14	Bush
16	Locknut
18	Spring seat
19	Spring Carrier
20	Actuator Stem
21	Spring Barrel
24	Spring Barrel Baseplate
25	Covers
27	Stem connector
28	Nameplate Screws
29	Spring
31	Yoke
32	Jacking Screw
37	Thrust Bearing
38	Thrust Washers
40	Grubscrew
41	Upper Diaphragm Case
42	Lower Diaphragm Case
43	Diaphragm Case Screws
44	Diaphragm Case Nuts
45	Diaphragm Case Washers
46*	Diaphragm
47	Diaphragm Plate
48	Diaphragm Button
49	Travel Stop Collar
70	Travel Stop Nut
71	Grub Screw
72	Disc
73	Locking Screw
74	Washer
75	Worm Wheel
76	Thrust Bearing
77	Thrust Washer
78	Spacer Ring
79	Keys
81	Travel Indicator
82	Lubricator
83	Worm
84	Thrust Bearing
85	Thrust Washers
86	Stem Nut Assembly
88	Bush
89	Split Ring
90	Handwheel stem
91	Handwheel
92	Locknut
93	Washer
94	Indicator Plate
95	Spring Adjuster Screw
*	Recommended spare parts

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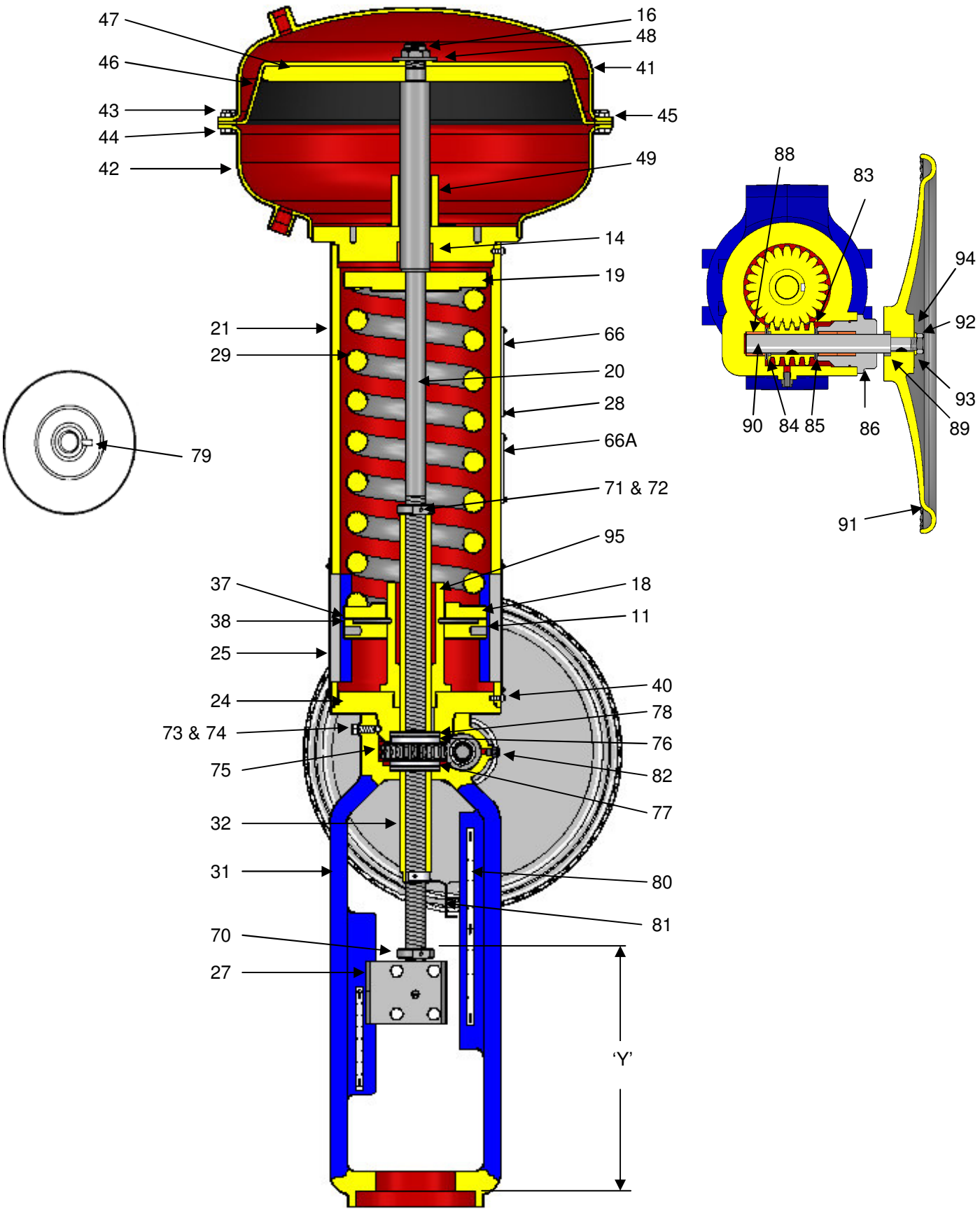

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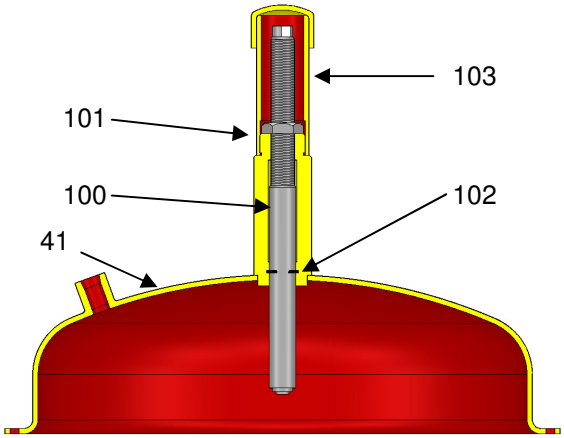
TYPE A40J TOP MOUNTED LIMIT STOP

The A40J limitstop assembly when added to the upper diaphragm case is used to limit the travel of



the valve plug in the upwards direction.

Disassembly

It is very important to remove the spring compression before preceeding with dismantling. Refer to disassembly instructions above. With the diaphragm case at atmospheric pressure:

1. Unscrew the plastic cover (103) from the diaphragm case assembly (41).

2. Unscrew and remove the locknut (101) from the stem (100).

3. Remove all the diaphragm case screws and nuts (43 and 44) and lift the upper diaphragm case (41) away from the actuator.

4. The stem (100) can now be unscrewed from the handjack body. Care should be taken not to damage the 'O' ring seal (102) when withdrawing the screwed portion of the stem.

5. Remove 'O' ring (102) and replace.

Assembly

1. Lightly coat 'O' ring (102) with a smear of silicone grease and replace in the handjack body.

2. Screw the stem (100) into the handjack body being careful not to damage 'O' ring (102).

3. Place the upper diaphragm case assembly (41) over the diaphragm, aligning the case holes with those in the diaphragm.

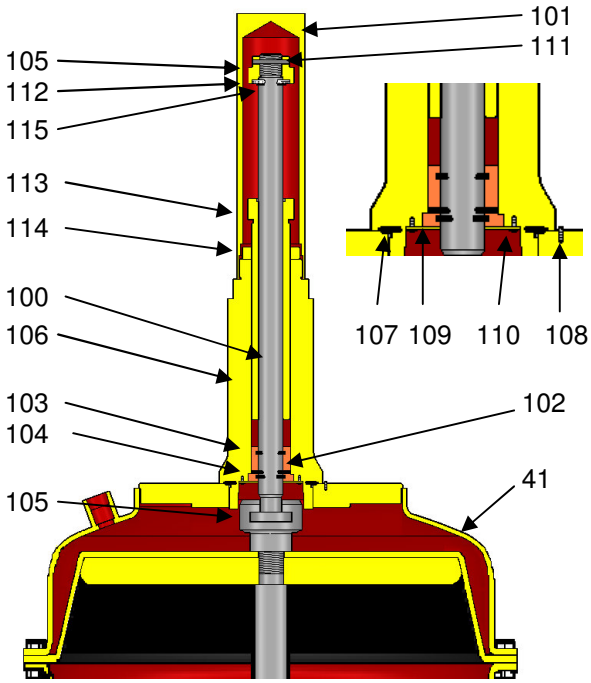
4. Insert the diaphragm case screws (43 and 44) and tighten evenly.

5. Screw locknut (101) onto the stem (100). Refit the plastic cover (103).

PARTS LIST A40J HANDJACKS	
41	Diaphragm Case Assembly
100	Stem
101	Locknut
102*	'O' Ring
103	Limit Stop Cover
*	Recommend Spare Parts

TYPE A40K TOP MOUNTED LIMITSTOP

The A40K limitstop assembly when added to the upper diaphragm case is used to limit the travel of the valve plug in the downward direction.



Disassembly

With the diaphragm case at atmospheric pressure proceed as follows:

1. Remove cover (101).

2. Drive the stem nut pin (111) out of the stem nut (105) and unscrew the stem nut from the stem (100).

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3. Lift the thrust bearings and washers (112) from the jacking screw (113).

4. Loosen the locknut (114) and revolve the stem (100) in a clockwise direction until the retaining ring (115) is accessible. Remove the retaining ring.

5. Remove all the diaphragm case screws and nuts (43 and 44) and lift the upper diaphragm case (41) along with the jacking screw (113) away from the rest of the actuator. Care should be take not to damage the 'O' ring (103) during this step.

6. It will now be possible to disengauge and remove the stem (100) from the nut (105).

7. Remove the grub screw (108) and unscrew the handjack body (106) from the case (41). Check the 'O' ring (107).

8. Remove screws (110) and the retaining plate (109). The 'O' ring housing (102) and 'O' rings (103) and (104) should now be free to remove from the handjack body (106).

Assembly

1. Lightly coat 'O' rings (103 and 104) with a smear of silicone grease. Fit the 'O' rings into the 'O' ring housing (102).

2. Locate the 'O' ring housing (102), taking care not to damage the 'O' rings, into the recess in the handjack body (106).

3. Fit the retaining plate (109) with screws (110).

4. Smear 'O' ring (107) with a coat of silicone grease and locate on the handjack body (106). Screw the handjack body (106) into the upper diaphragm case (41) taking care not to damage 'O' ring (107).

5. Insert the handjack stem (100) through the handjack body being careful not to damage 'O' ring (103), and engauge onto stem nut (105).

6. Place the upper diaphragm case assembly (41) over the diaphragm, aligning the case holes with those in the diaphragm. Turn the spring adjuster if necessary.

7. Insert the diaphragm case screws (43 and 44) and tighten evenly.

8. Screw the locknut (114) onto the jacking screw (113) and the screw the jacking screw (113) into the handjack body (106).

9. Fit the retaining ring (115) onto the stem (100). Replace the thrust bearings and washers (112).

10. The stem nut (105) is secured to the actuator stem with Loctite 241. Screw the stem nut (105) onto the stem (100) and replace the stem nut pin (111).

11. Position the limit stop to the correct position to limit the valve travel and re-fit the cover (101).

PARTS LIST A40K HANDJACKS	
41	Upper diaphragm case
100	Stem
101	Limit stop cover
102*	'O' ring housing
103*	'O' rings
104*	'O' rings
105	Stem nut
106	Handjack body
107*	'O' ring
108	Grubscrew
109	Retaining plate
110	Screws
111	Stem nut pin
112	Thrust bearing & washer
113	Jacking screw
114	Locknut
115	Retaining Ring
*	Recommended spare parts

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