

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 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 (16) 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 (9 and 10), then lift off the upper diaphragm case (1). **CAUTION:** Do not remove the diaphragm case until the spring compression has been relieved.
5. Loosen the travel stop setscrews and discs (62 & 19) and remove the travel stop nut (3) from the actuator stem (20).
6. Lift off the diaphragm assembly withdrawing the attached actuator stem (20). Remove the upper travel stop (30).
7. Unscrew the actuator stem nut (17) and remove the diaphragm button (18), diaphragm (15) and diaphragm plate (8) from the actuator stem (20).

Spring barrel and actuator stem removal:

1. Remove the spring (29) then grasp the upper end of the spring adjusting screw (32) and withdraw it from the case (21).
2. Remove the spring seat (5) and thrust bearing parts (33 & 38) from the spring adjusting screw (32), then unscrew and remove the spring adjuster (11).
3. Remove the cover plate (63) then unscrew the clamp nut (41) from the bearing retainer (42) and lift the spring barrel case assembly (21) off the yoke (31).
4. Using the handwheel turn the jackscrew (36) downward as far as it will go.

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- When the end of the jackscrew passes beyond the key (43) the jackscrew itself will rotate with the worm wheel (46). Complete the removal by turning the jackscrew out of the worm wheel by hand.
- Remove the handwheel travel indicator screw and the indicator (49 and 61) from the jackscrew. This step is only necessary if the jackscrew or indicator is to be replaced.
- Remove the bearing retainer screw and lockwasher (44 and 45) then unscrew and remove and remove the bearing retainer (42) from the yoke (31).
- Remove the jackscrew key (43) from the bearing retainer (42).
- Lift the needle bearing (47) with the two bearing races (48) (one race above and one below the needles) from the top of the worm wheel (46).
- Unscrew the handwheel stem nut (55) from the gearbox. Rotate the handwheel slowly to disengage the worm (52) from the worm wheel (46). Withdraw the handwheel stem assembly (56) (with worm and outer thrust bearing (54) attached) from the gearbox as a unit. If the inner thrust bearing and races (53 and 54) do not come out with the stem, remove them from the housing.
- Remove the worm wheel (46) and the lower thrust bearing with races (47 and 48) 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:

- Slide the worm (52) and the inner thrust bearing with its races off the handwheel stem and remove the woodruff key (57).
- Slide the handwheel stem nut (55) and the outer thrust bearing races (53 and 54) off the stem.
- Remove the handwheel nut (60) and washer (59) then remove the handwheel (58) and the second woodruff key (57).

ASSEMBLY*Assembling the handwheel stem unit:*

- Place the handwheel woodruff key (57) on the stem (56) then slip the handwheel (58) and indicator plate (58A) onto the stem and key. Secure the handwheel with lockwasher and nut (59 and 60).
- Slide the handwheel stem nut (55) (flange end first) onto the stem (56).
- Make up a bearing unit (thrust bearing) (54) between two races (53) and slip the unit onto the stem against the handwheel stem nut.
- Position the second woodruff key (57) on the stem then slide the worm (52) onto the stem and key.
- Make up another thrust bearing unit as in step 3 above, then slip this unit onto the stem against the end of the worm.
- The handwheel stem unit is now ready for insertion into the bearing housing as directed below.

Assembling the jacking screw mechanism:

- Clean the gear box and all parts thoroughly.
- Make up a bearing unit, consisting of a bearing (47) between two races (48), and place it on the shoulder at the bottom of the gear box.
- Place the worm wheel (46) in the housing so that it rests on the bearing race.
- Insert the handwheel stem (56) assembly into the gearbox. Rotate the handwheel to mesh the worm and worm wheel.
- Screw in the handwheel stem nut (55) to secure the stem assembly.
- Make up another thrust bearing unit (see step 2) and place this unit squarely on top of the worm gear.
- Screw the bearing retainer (42) into the top of the gearbox, then with the screw holes in the housing and retainer aligned install the

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bearing retainer screw and lockwasher (44 and 45).

8. Turn the jack screw (36) (by hand) into the gear box until the upper end of the screw is 6mm above the top race of the upper thrust bearing.
9. Rotate the stem to line up the jack screw keyway with the internal slot in the bearing retainer (42) then insert the key (43).
10. Place the spring adjuster (32) into the bearing retainer temporarily to hold the key in place.
11. Rotate the handwheel to bring the jackscrew approximately even with the top of the bearing retainer (42) then remove the spring adjuster (32).
12. Replace the handwheel travel indicator (61) on the lower end of the jack screw.

Replacing the spring:

1. Place the spring barrel case (21) in position on top of the yoke (31) and rotate the barrel so that the dust cover slot (16) is in vertical alignment with the bearing retainer screw (44).
2. Install the clamp nut (41) and secure the barrel to the yoke, then replace the cover (16).
3. Screw the spring adjuster (11) (flat side down) on to the spring adjuster screw (32) until it is approximately 6mm from the lower end of the threads.
4. Place a thrust washer (33) at the bottom of the recess in the face of the spring adjuster (11).
5. Place the needle thrust bearing (38) followed by the upper thrust washer (33) in position and slip the spring seat (5) (large spigot down) into place on top of the upper thrust washer.
6. Carefully install the spring adjuster screw (32) (unit assembled as above) into the bearing retainer (42).
7. Place the upper travel stop (30) inside the spring adjuster screw to rest on top of the jackscrew (36).
8. Insert the spring (29) into the barrel to rest on the spring seat (5).

Diaphragm assembly:

The diaphragm and actuator stem assembly will enter the spring barrel as a unit.

1. Examine the diaphragm (15) checking for signs of wear or porosity. Replace if necessary.
2. Slide the diaphragm plate (8) over the actuator stem (20) to rest on the chamfered area of the stem.
3. Dust the diaphragm (15) 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.
4. Place the diaphragm button (18) (rounded edge downwards) over the actuator stem then secure the assembly together with the actuator stem nut (17).
5. Invert the actuator stem assembly and slide the upper travel stop (30) over the stem.
6. Holding the travel stop (30) on the stem, lower the actuator stem into the spring adjuster screw (32), and finally guide the diaphragm plate boss into the spring.
7. Line up the holes in the diaphragm with the screw holes in the lower diaphragm case.
8. Place the upper diaphragm case assembly (1) over the diaphragm, aligning the case screw holes with those in the diaphragm case. Note: to facilitate assembly, the spring adjuster (11) can be turned in either direction.
9. Insert the diaphragm case screws (9). Add nuts (10) and tighten up evenly and secure to obtain a good seal.

ADJUSTMENTS*Establishing the handwheel neutral position and positioning the 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 (1) for use when

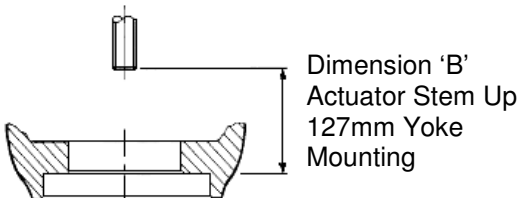
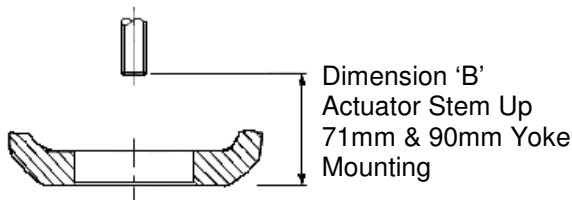
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positioning the travel stop nut (3) on the actuator stem (20).

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 (36) (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'.



| Yoke mtg dia | Travel | 'Y' | 'B' (see drg) |
|--------------|--------|-----|---------------|
| 71 | 38 | 242 | 165 |
| 90 | | 248 | 203 |
| | 57 | 248 | 203 |
| 127 | | 334 | 280 |
| 90 | 89 | 320 | 256 |
| 127 | | 380 | 312 |

5. If necessary, loosen the handwheel travel indicator scale holding screws then adjust the scale (37) so that the centre mark (neutral) is in line with the indicator (61) and check dimension 'B'.

Setting the diaphragm pressure range:

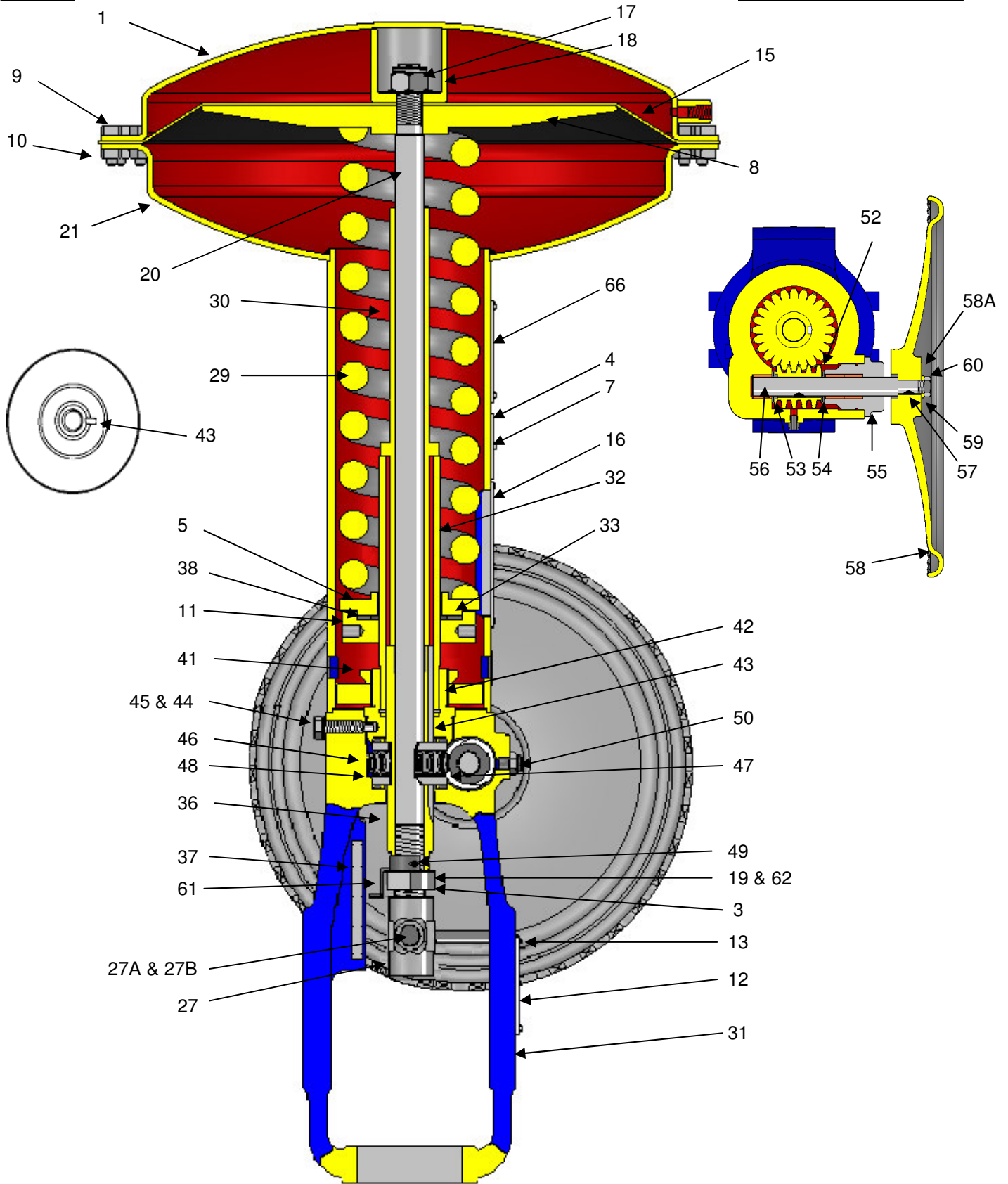
1. To set the diaphragm pressure range, the spring is compressed just enough to

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.
- 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 (16) and the actuator is ready for mounting on the valve body (see valve instruction book)

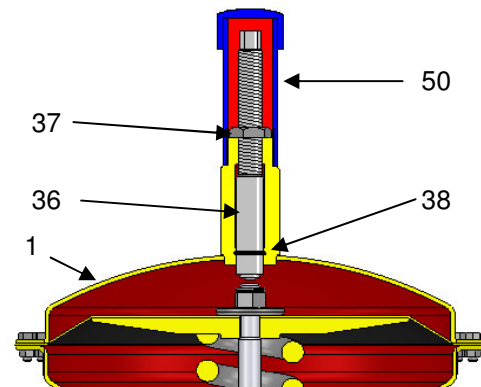


| ACTUATOR PARTS LIST | |
|---------------------|-------------------------------|
| 1 | Upper diaphragm case assembly |
| 3 | Travel stop nuts |
| 4 | Nameplate |
| 5 | Spring seat |
| 7 | Nameplate screws |
| 8 | Diaphragm plate |
| 9 | Case screws |
| 10 | Case screw nuts |
| 11 | Spring adjuster |
| 12 | Travel indicator scale |
| 13 | Fixing screws |
| 15* | Diaphragm |
| 16 | Dust cover assembly |
| 17 | Actuator stem nut |
| 18 | Diaphragm button |
| 19 | Travel stop nut set screw |
| 20 | Actuator stem |
| 21 | Spring barrel case assembly |
| 27 | Stem connector |
| 27A | Stem connector screw |
| 27B | Stem connector screw nut |
| 29 | Spring |
| 30 | Upper travel stop collar |
| 31 | Yoke |
| 32 | Spring adjuster screw |
| 33 | Thrust bearing |
| 36 | Jack screw |
| 37 | Handwheel travel scale |
| 38 | Thrust washers |
| 41 | Clamp nut |
| 42 | Bearing retainer |
| 43 | Key (jacking screw) |
| 44 | Bearing retainer screw |
| 45 | Bearing retainer lock washer |
| 46 | Worm wheel |
| 47 | Bearing (worm gear) |
| 48 | Thrust race (worm gear) |
| 49 | Travel indicator screw |
| 50 | Lubricator |
| 52 | Worm |
| 53 | Thrust race |
| 54 | Thrust bearing |
| 55 | Handwheel stem nut assy |
| 56 | Handwheel stem |
| 57 | Keys (handwheel stem) |
| 58 | Handwheel |
| 58A | Indicator plate |
| 59 | Handwheel lock washers |
| 60 | Handwheel nut |
| 61 | Handwheel travel indicator |
| 62 | Set screw disc |
| 63 | Cover plate |
| 66 | Valve nameplate |

* Recommended spare parts

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 proceeding with dismantling. Refer to disassembly instructions above. With the diaphragm case at atmospheric pressure:

1. Unscrew the plastic cover (50) from the diaphragm case assembly (1).
2. Unscrew and remove the locknut (37) from the handwheel stem (36).
3. Remove all the diaphragm case screws and nuts (9 and 10) and lift the upper diaphragm case (1) away from the actuator.
4. The handjack stem (36) can now be unscrewed from the handjack body. Care should be taken not to damage the 'O' ring seal (38) when withdrawing the screwed portion of the stem.
5. Remove 'O' ring (38) and replace.

Assembly

1. Lightly coat 'O' ring (38) with a smear of silicone grease and replace in the handjack body.
2. Screw the stem (36) into the handjack body being careful not to damage 'O' ring (38).

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3. Place the upper diaphragm case assembly (1) over the diaphragm, aligning the case holes with those in the diaphragm.
4. Insert the diaphragm case screws (9 and 10) and tighten evenly.
5. Screw locknut (37) onto the stem (36). Refit the plastic cover (50).

4. Loosen the locknut (47) and revolve the stem in a clockwise direction until the retaining ring (43) is accessible. Remove the retaining ring.
5. Remove all the diaphragm case screws and nuts (9 and 10) and lift the upper diaphragm case (1) clear of the handwheel stem (36).
6. Disengage and remove the handwheel stem (36) from the nut (49).
7. Disengage the stem (36) from the nut (49) and remove 'O' ring (38) and replace.

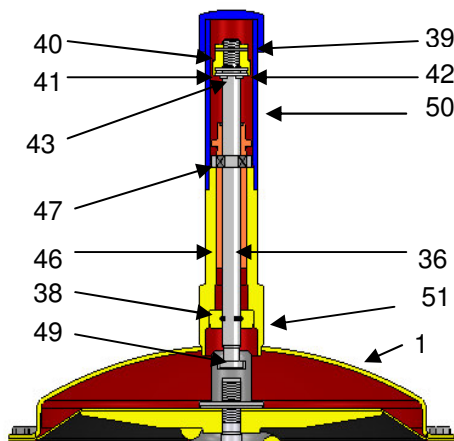
| PARTS LIST A41J HANDJACKS | |
|---------------------------|-------------------------|
| 1 | Diaphragm Case Assembly |
| 36 | Stem |
| 37 | Locknut |
| 38* | 'O' Ring |
| 50 | Limit Stop Cover |
| * | Recommend Spare Parts |

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. Unscrew the plastic cover (50) from the diaphragm case assembly (1).
2. Drive the stem nut pin (39) out of the stem nut (40) and unscrew the stem nut from the handwheel stem (36).
3. Lift the two thrust bearings (41 and 42) from the jack screw (46).

Assembly

1. Lightly coat 'O' ring (38) with a smear of silicone grease and replace in the handjack.
2. Insert the stem (36) through the handjack body and engage onto stem nut (49).
3. Place the upper diaphragm case assembly (1) over the diaphragm, aligning the case holes with those in the diaphragm.
4. Insert the diaphragm case screws (9 and 10) and tighten evenly.
5. Fit the retaining ring (43) onto the handjack stem (36). Replace the thrust bearings and washers (41 and 42).
6. The stem nut (40) is secured to the actuator stem with Loctite 241. Screw the stem nut (40) onto the stem (36) and replace the stem nut pin (39).
7. Refit the plastic cover (50).

| PARTS LIST A41K HANDJACKS | |
|---------------------------|-------------------------|
| 1 | Diaphragm case |
| 36 | Stem |
| 38 | 'O' Ring |
| 39 | Stem nut pin |
| 40 | Stem nut |
| 41 | Thrust washer |
| 42 | Thrust bearing |
| 43 | Circlip |
| 46 | Jacking screw |
| 47 | Lock nut |
| 49 | Nut |
| 50 | Limit stop cover |
| * | Recommended spare parts |