

Blakeborough Control Valves**Installation, Operation & Maintenance Manual****A40A Direct Acting Diaphragm Actuator (300 in²)****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 (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 pushes 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.

ACTUATOR DISASSEMBLY

To remove the diaphragm and actuator stem:

1. Remove the cover plate (25) from the spring barrel assembly (21) by removing four screws (13).
2. Relieve spring compression by inserting a tommy bar into the holes provided in the spring adjuster (11) and turn anti-clockwise.

3. Remove the diaphragm case screws and nuts (43 and 44), then lift off the upper diaphragm case (41).
4. Loosen the grub screw (71) and unscrew the travel stop nut (70) from the actuator stem (20).
5. Lift off the diaphragm assembly withdrawing the attached actuator stem (20). Remove the upper travel stop (49).
6. Unscrew the actuator stem nut (16) and remove the diaphragm button (48), diaphragm (46) and diaphragm plate (47) from the actuator stem (20).

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

To complete the actuator disassembly:

1. Remove the upper grub screw (40) and unscrew the lower diaphragm case assembly (42) from the spring barrel (21).
2. Remove the lower diaphragm case (42).
3. Lift out the spring carrier (19) and remove the spring (29).
4. Unscrew the lower grub screw (40) and remove the spring barrel (21) by unscrewing it from the spring barrel base (24).
5. Remove the spring seat (18) and thrust bearing parts (37 & 38) from the spring adjuster (11).
6. Unscrew the spring adjuster (11) from the adjuster screw assembly (32).
7. Remove the spring adjuster screw nut (15) to free the yoke (31) from the spring barrel base (24).
8. Remove cap screws (3) and lift the base (24) from the yoke (31).

ACTUATOR ASSEMBLY

Replacing the spring:

1. Examine the bushing in the spring adjuster screw (32) and replace if necessary.

Blakeborough Control Valves**Installation, Operation & Maintenance Manual****A40A Direct Acting Diaphragm Actuator (300 in²)**

2. Fit the spring barrel base (24) onto the yoke (31) and secure with cap screws (3).
3. Screw the spring adjuster screw (32) into the bridge of the spring barrel assembly (21) so that about 20mm of the screw (bushed end) protrudes below the spring at the bottom of the yoke.
4. Lock the spring adjuster screw (32) in position with the spring adjuster screw nut (15).
5. Screw the spring adjuster (11) (flat side down) on to the spring adjuster screw (32) so that it is opposite the lower end of the cover slot.
6. Place a thrust washer (38) at the bottom of the recess in the face of the spring adjuster (11).
7. Place the needle thrust bearing (37) followed by the upper thrust washer (38) in position and slip the spring seat (18) into place on top of the upper thrust washer.
8. Screw the spring barrel (21) onto the spring barrel base (24) and using the grub screw (40) lock in position.
9. Lower the spring (29) into the spring barrel (21) to rest on the spring seat (18).
10. Fit the spring carrier (19) on top of the spring.
11. Screw the lower diaphragm case (42) into the spring barrel (21) and secure with grub screw (40).
4. Place the diaphragm button (48) (rounded edge downwards) over the actuator stem then secure the assembly together with the actuator stem nut (16).
5. Invert the actuator stem assembly and slide the upper travel stop (49) over the stem.
6. Holding the travel stop (49) on the stem, lower the actuator stem into the spring adjuster screw (32).
7. Line up the holes in the diaphragm with the screw holes in the lower diaphragm case.
8. Place the upper diaphragm case assembly (41) 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 (43). Add nuts (44) and tighten up evenly and secure to obtain a good seal.

Diaphragm assembly:

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

1. Examine the diaphragm (46) checking for signs of wear or porosity. Replace if necessary.
2. Slide the diaphragm plate (47) over the actuator stem (20) to rest on the shoulder of the stem.
3. 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. Determine the valve travel from the nameplate, add 1.5mm (1/16") and call this dimension 'D'.
2. Apply about 2 bar (30 PSI) air pressure to the actuator chamber above the diaphragm in order to extend the stem as far as it will go. Ensure that stem travel has been stopped by the upper stop (49) by turning the spring adjuster (11) downwards to relieve any spring compression.
3. Screw the travel stop nut (70) onto the actuator stem (20) and position the nut so that its top surface is below the end of the spring adjuster screw (32) by a distance equal to 'D' (see step 1). Tighten the travel stop nut (70) securely with grub screws (71 and 72).
4. Exhaust all air pressure from the chamber above the diaphragm.
5. 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

ADJUSTMENTS

Blakeborough Control Valves

Installation, Operation & Maintenance Manual

A40A Direct Acting Diaphragm Actuator (300 in²)

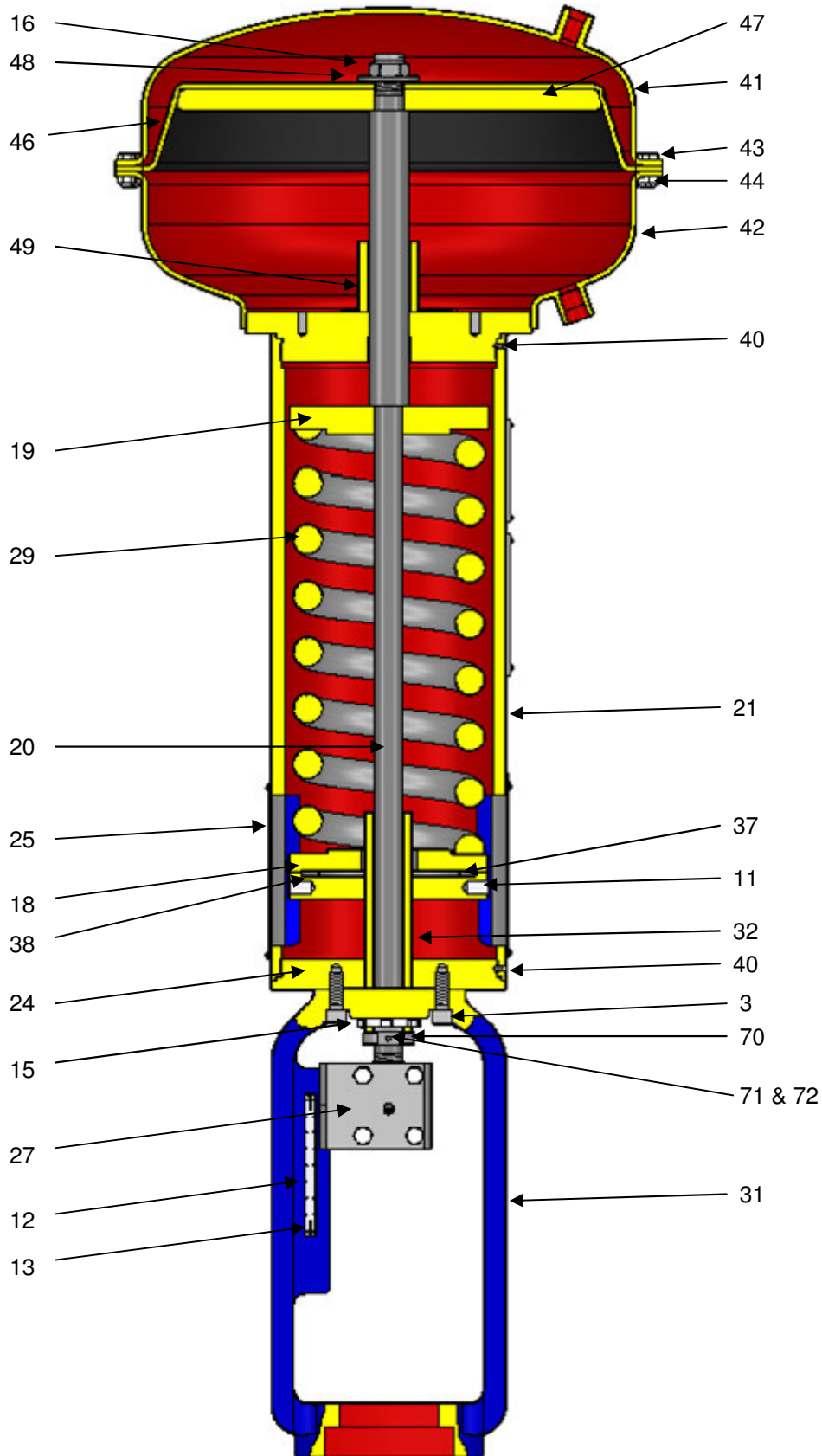
extended when air pressure reaches the upper range value.

- 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.

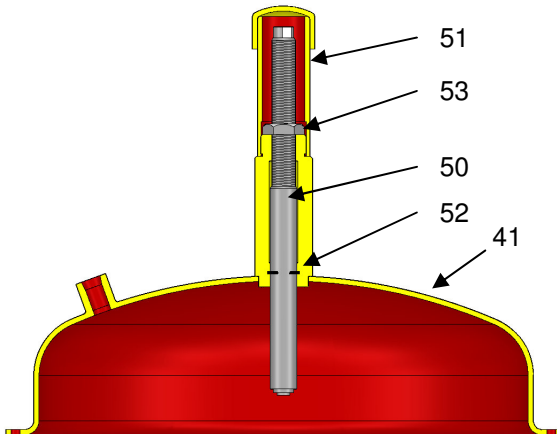
6. Replace the dust cover (25) and the actuator is ready for mounting on the valve body (see valve instruction book).

ACTUATOR PARTS LIST	
3	Capscrews
11	Spring Adjuster
12	Travel Indicator Scale
13	Fixing Screws
15	Spring Adjuster Screw Nut
16	Actuator Stem Nut
18	Spring Seat
19	Spring Carrier
20	Actuator Stem
21	Spring Barrel
24	Spring Barrel Base
25	Covers
27	Stem Connector Assembly
29	Spring
31	Yoke
32	Spring Adjuster Screw
37	Thrust Bearings
38	Thrust Washers
40	Grubscrews
41	Upper Diaphragm Case
42	Lower Diaphragm Case
43	Case Screws
44	Case Screw Nuts
46*	Diaphragm
47	Diaphragm Plate
48	Diaphragm Button
49	Travel Stop Collar
71	Grubscrews
72	Disc
*	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 cover (51) from the diaphragm case assembly (41).
2. Unscrew and remove the locknut (53) from the handwheel stem (50).
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 handjack stem (50) can now be unscrewed from the handjack body. Care should be taken not to damage the 'O' ring seal (52) when withdrawing the screwed portion of the stem.
5. Remove 'O' ring (52) and replace.

Assembly

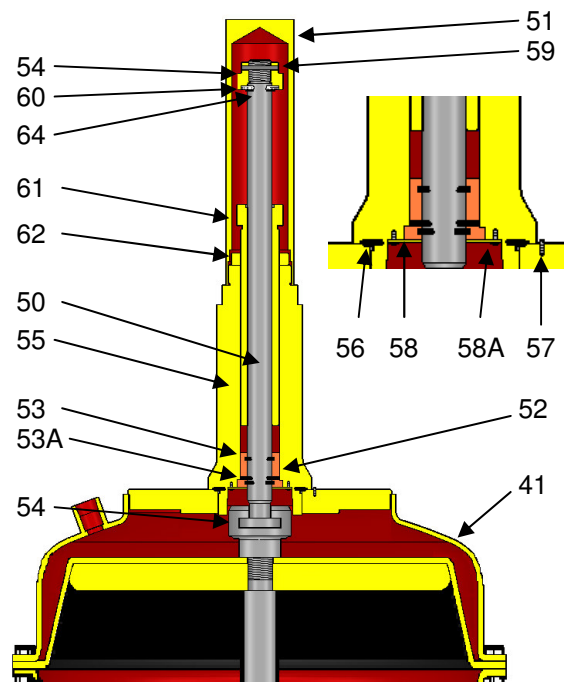
1. Lightly coat 'O' ring (52) with a smear of silicone grease and replace in the handjack body.
2. Screw the stem (50) into the handjack body being careful not to damage 'O' ring (52).

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 (53) onto the stem (50). Refit the cover (51).

PARTS LIST A40J HANDJACKS	
41	Diaphragm Case Assembly
50	Stem
51	Limit Stop Cover
52*	'O' Ring
53	Locknut
*	Recommend Spare Parts

TYPE A40K TOP MOUNTED LIMIT STOP

The handjack assembly when added to the upper diaphragm case is used to pull the actuator stem upwards or to limit the travel of the valve plug in the downward direction.



Disassembly

It is very important to relieve all spring compression before proceeding with dismantling. With the diaphragm case at atmospheric pressure proceed as follows:

Blakeborough Control Valves

Installation, Operation & Maintenance Manual

A40A Direct Acting Diaphragm Actuator (300 in²)

1. Remove cover (51).
2. Drive the stem nut pin (59) out of the stem nut (54) and unscrew the stem nut from the stem (50).
3. Lift the thrust bearings and washers (60) from the jacking screw (61).
4. Loosen the locknut (62) and revolve the stem (50) in a clockwise direction until the retaining ring (64) 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 (61) away from the rest of the actuator. Care should be take not to damage the 'O' ring (53) during this step.
6. It will now be possible to disengage and remove the stem (50) from the nut (63).
7. Remove the grub screw (57) and unscrew the handjack body (55) from the case (41). Check the 'O' ring (56).
8. Remove screws (58A) and the retaining plate (58). The 'O' ring housing (52) and 'O' rings (53) and (53A) should now be free to remove from the handjack body (55).
9. Fit the retaining ring (64) onto the stem (50). Replace the thrust bearings and washers (60).
10. The stem nut (54) is secured to the actuator stem with Loctite 241. Screw the stem nut (54) onto the stem (50) and replace the stem nut pin (59).
11. Position the limit stop to the correct position to limit the valve travel and re-fit the cover (51).
7. Insert the diaphragm case screws (43 and 44) and tighten evenly.
8. Screw the locknut (62) onto the jacking screw (61) and the screw the jacking screw (61) into the handjack body (55).

Assembly

1. Lightly coat 'O' rings (53 and 53A) with a smear of silicone grease. Fit the 'O' rings into the 'O' ring housing (52).
2. Locate the 'O' ring housing (52), taking care not to damage the 'O' rings, into the recess in the handjack body (55).
3. Fit the retaining plate (58) with screws (58A).
4. Smear 'O' ring (56) with a coat of silicone grease and locate on the handjack body (55). Screw the handjack body (55) into the upper diaphragm case (41) taking care not to damage 'O' ring (56).
5. Insert the handjack stem (50) through the handjack body being careful not to damage 'O' ring (53), and engage onto stem nut (54).
6. Place the upper diaphragm case assembly (41) over the diaphragm, aligning the case

PARTS LIST A40K HANDJACKS	
41	Upper diaphragm case
50	Stem
51	Limit stop cover
52	'O' ring housing
53	'O' rings
53A	'O' rings
54	Stem nut
55	Handjack body
56	'O' ring
57	Grubscrew
58	Retaining plate
58A	Screws
59	Stem nut pin
60	Thrust bearing & washer
61	Jacking screw
62	Locknut
63	Nut
64	Retaining Ring
*	Recommended spare parts