

Blakeborough Control Valves**Installation, Operation & Maintenance Manual****A41A Reverse 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 reverse acting actuator is held in a fully extended position by means of the spring. An increase in air pressure in the lower diaphragm chamber thrusts the actuator stem assembly upwards 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 reverse acting diaphragm actuator opens the valve upon increasing the air pressure in the lower diaphragm chamber.
- When mounted on push-stem-to-open valves, the reverse acting diaphragm actuator closes the valve upon increasing the air pressure in the lower 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 instructions 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).
2. Remove spring compression by inserting a rod or screwdriver into the holes 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). **CAUTION:** Do not remove the diaphragm case until the spring compression has been relieved.
4. Unscrew the actuator stem nut (16) and remove the washer (48A), diaphragm plate (47), diaphragm (46) and diaphragm button (48) from the actuator stem (20).

Complete actuator disassembly:

1. Lift the travel stop (49) over the actuator stem (20).
2. Remove the stem connector assembly (27).
3. Unscrew grubscrew (71) & unscrew the travel stop nut (70) from the actuator stem (20).
4. Remove the cap screws (3) and the bearing housing (52). The yoke (31) should now pull away from the spring barrel. Check the bushing for wear.
5. Remove the grubscrew (40) and unscrew the spring barrel base (24).
6. Remove the upper grubscrew (40) and unscrew the spring barrel from the lower diaphragm case (42).
7. Unscrew the locknut (53) and lift off the spring carrier (19), spring (29), split ring (54), stem (20), spring seat (18), thrust washers (38) and thrust bearings (37). Check the bearings and washers for wear.
8. Unscrew the spring adjuster (11) from the adjuster screw housing assembly (51).
9. Unscrew the spring adjuster housing assembly (51). Check the 'O' ring (34), seal (23) and bush for wear.

ASSEMBLY

Assembly of the actuator:

1. Place the 'O' ring (34) into the lower diaphragm case (42). Place 'O' ring (23) into the spring adjuster housing (51).
2. Screw the spring adjuster housing (51) into the lower diaphragm case (42). Slide the stem through the adjuster (51). Carefully turn the

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- assembly over and stand on the lower diaphragm case flange.
- Screw the spring adjuster (11) onto the spring adjuster housing (51).
 - Fit the thrust washers (38), thrust bearings (37), spring seat (18) and spring (29) over the stem (20).
 - Fit the spring carrier (19) over the stem (20). Lift the stem (20) if necessary to the upper position using an M12 eyebolt. Fit the split ring (54). Remove the eyebolt and secure the spring carrier (19) with the locknut (53).
 - Screw the spring barrel base (24) to the spring barrel (21) using two of the M16 tapped holes in the spring barrel base (24) and lift the assembly over the stem (20). Secure with the grubscrew (40).
 - Fit the yoke (31) and secure with capscrews (3).
 - Screw housing (52) into the spring barrel base (24) through the yoke (31).
 - Screw the travel stop nut (70) onto the stem (20).
 - Tension the spring (29) by turning the spring adjuster (11) clockwise using a suitable rod or screwdriver in the holes provided.
 - Carefully turn the actuator over and stand on the yoke.
 - Place the diaphragm plate (47) over the actuator stem (20). Drop the washer (48A) over the stem to rest on the diaphragm plate (47), then lock the assembly together with the actuator stem nut (16).
 - Line up the holes in the diaphragm with the holes in the lower diaphragm case. Note: to facilitate assembly, the spring adjuster (11) can be turned upward or downward (to reposition the spring) so that the diaphragm rests smoothly onto the case screw flange.
 - Place the upper diaphragm case assembly (41) over the diaphragm, aligning the case screw holes with those in the diaphragm case.
 - Insert the diaphragm case screws (44). Add nuts (43) and tighten evenly and secure to obtain a good seal.

Assembly of the diaphragm:

- Examine the diaphragm (46) checking for signs of wear or porosity. Replace if necessary.
- Slide the travel stop collar (49) over the stem (20).
- Slide the diaphragm button (48), rounded edge upwards, over the actuator stem (20) to rest on the shouldered area of the stem.
- Dust the diaphragm (46) with talcum powder to prevent abrasion; place the diaphragm over the actuator stem to rest on the diaphragm button (48) with the concave side uppermost on the button.
 - Connect an air gauge and a 0 to 4 bar (0 to 60 PSI) regulator to an air line

ADJUSTMENTS

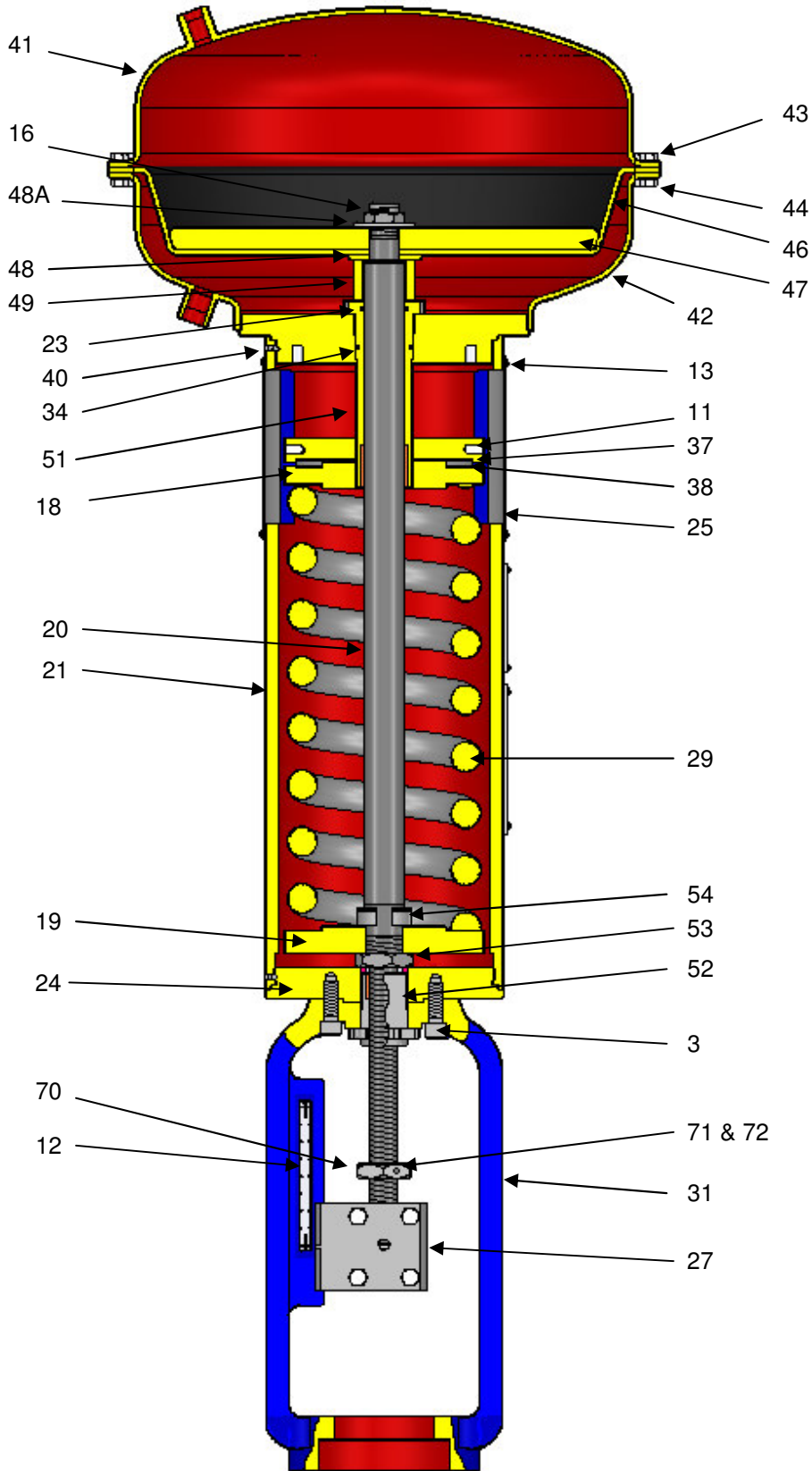
- Determine the valve travel from the nameplate, add 1.5mm, and call this dimension 'D'.
- Turn the spring adjuster (11) upward to apply spring force to the stem and ensure that the diaphragm button (48) is against the upper travel stop (49).
- Position the travel stop nuts (70) on the actuator stem (20) so that the upper nut surface is below the end of the bearing housing (52) by a distance equal to 'D' (see step 1 above). Tighten the grubscrew and disc (71 and 72) to lock the travel stop nut securely in position.
- Apply about 2 bar (30 PSI) air pressure to the actuator chamber below the diaphragm in order to retract the stem as far as it will go. Check the travel.
- To set the diaphragm pressure range, the spring is compressed just enough to counterbalance the upward thrust of the diaphragm when air pressure in the lower chamber is at the preload pressure. Once the starting point has been established, the spring design ensures that the stem will be fully retracted when air pressure reaches the upper range value.
 - 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) 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 lower diaphragm chamber and determine at what pressure the stem starts to move upwards.
- 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.
- f. Replace the dust cover (25)

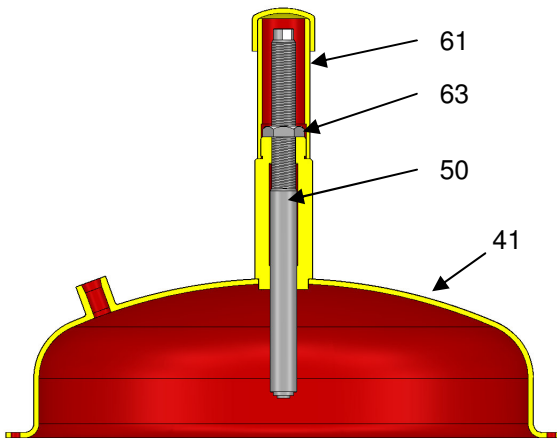
Note: Spring design limits the amount of possible 'jackup' compression. Too much initial compression leaves insufficient spring deflection for full actuator stroke.

ACTUATOR PARTS LIST	
3	Capscrews
11	Spring Adjuster
12	Travel Indicator Scale
13	Fixing Screws
16	Actuator Stem Nut
18	Spring Seat
19	Spring Carrier
20	Actuator Stem
21	Spring Barrel
23*	Seal
24	Spring Barrel Base
25	Covers
27	Stem Connector Assembly
29	Spring
31	Yoke
34*	'O' Rings
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
48A	Washer
49	Travel Stop Collar
51	Adjuster Housing
53	Locknut
54	Split Ring
70	Travel Stop Nut
71	Grubscrews
72	Disc
*	Recommended Spares for Actuator



TYPE A41J TOP MOUNTED LIMIT STOP

The A41J 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 (61) from the diaphragm case assembly (41).
2. Unscrew and remove the locknut (63) 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.

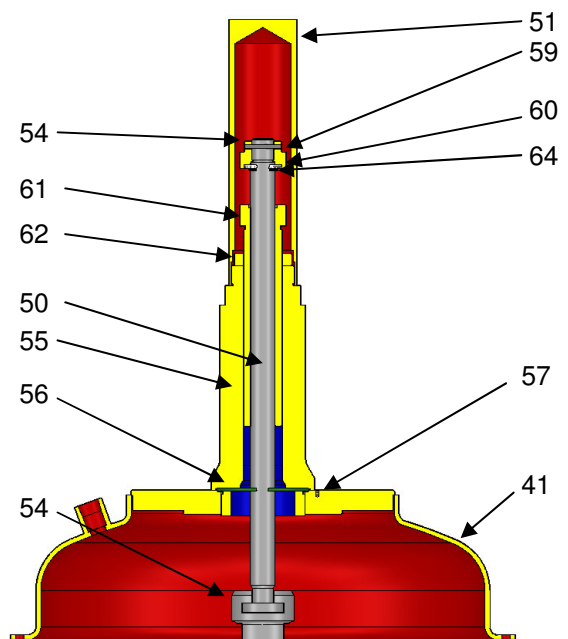
Assembly

1. Screw the stem (50) into the handjack body.
2. Place the upper diaphragm case assembly (41) over the diaphragm, aligning the case holes with those in the diaphragm.
3. Insert the diaphragm case screws (43 and 44) and tighten evenly.
4. Screw locknut (63) onto the stem (50). Refit the cover (61).

PARTS LIST A40J HANDJACKS	
41	Diaphragm Case Assembly
50	Stem
61	Limit Stop Cover
63	Locknut
*	Recommend Spare Parts

TYPE A41K TOP MOUNTED LIMIT STOP

The A41K limit stop assembly when added to the upper diaphragm case is used 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:

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

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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.
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).
8. Remove the 'O' ring (56).

Assembly

1. 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).
2. Insert the handjack stem (50) through the handjack.
3. 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.
4. Insert the diaphragm case screws (43 and 44) and tighten evenly.
5. Screw the locknut (62) onto the jacking screw (61) and screw the jacking screw (61) into the handjack body (55).
6. Fit the retaining ring (64) onto the stem (50). Replace the thrust bearings and washers (60).
7. 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).
8. Position the limit stop to the correct position to limit the valve travel and re-fit the cover (51).

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