Installation, Operation, Maintenance Instructions

Pneumatic Diaphragm On-Off Actuators

Series 3, Type: P6

Index
1 Using Kämmer valves and actuators correctly.
2 Unpacking
3 Installation
4 Quick check
5 Maintenance
6 Remove and install actuator
7 Disassemble actuator
8 Assemble actuator
9 Reverse actuator action
10 Troubleshooting chart

1 USING KÄMMER VALVES AND ACTUATORS CORRECTLY
1.1 General
The following instructions are designed to assist in unpacking, installing and performing maintenance as required on Kämmer products. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating or performing any maintenance.

DANGER: In most cases Kämmer valves and actuators are designed for specific applications (e.g. with regard to medium, pressure, temperature). For this reason they should not be used in other applications without first contacting the manufacturer.

1.2 Terms concerning safety
The safety terms DANGER, WARNING, CAUTION and NOTE are used in these instructions to highlight particular dangers and/or to provide additional information on aspects that may not be readily apparent.

DANGER: indicates that death, severe personal injury and/or substantial property damage will occur if proper precautions are not taken.

WARNING: indicates that death, severe personal injury and/or substantial property damage can occur if proper precautions are not taken.

CAUTION: indicates that minor personal injury and/or property damage can occur if proper precautions are not taken.

NOTE: indicates and provides additional technical information, which may not be very obvious even to qualified personnel.

Compliance with other, not particularly emphasised notes, with regard to transport, assembly, operation and maintenance and with regard to technical documentation (e.g. in the operating instruction, product documentation or on the product itself) is essential, in order to avoid faults, which in themselves might directly or indirectly cause severe personal injury or property damage.

1.3 Protective clothing
Kämmer products are often used in problematic applications (e.g. extremely high pressures, dangerous, toxic or corrosive mediums). In particular valves with bellows seals point to such applications. When performing service, inspection or repair operations always ensure, that the valve and actuator are depressurised and that the valve has been cleaned and is free from harmful substances. In such cases pay particular attention to personal protection (protective clothing, gloves, glasses etc.).

1.4 Qualified personnel
Qualified personnel are people who, on account of their training, experience and instruction and their knowledge of relevant standards, specifications, accident prevention regulations and operating conditions, have been authorised by those responsible for the safety of the plant to perform the necessary work and who can recognise and avoid possible dangers.

1.5 Installation
DANGER: Before installation check the order-no., serial-no. and/or the tag-no. to ensure that the valve/actuator is correct for the intended application.

Do not insulate extensions that are provided for hot or cold services.

Pipelines must be correctly aligned to ensure that the valve is not fitted under tension.
1.6 **Spare parts**
Use only Kämmer original spare parts. Kämmer cannot accept responsibility for any damages that occur from using spare parts or fastening materials from other manufacturers. If Kämmer products (especially sealing materials) have been on store for longer periods check these for corrosion or deterioration before using these products. Fire protection for Kämmer products must be provided by the end user.

1.7 **Service / repair**
To avoid possible injury to personnel or damage to products, safety terms must be strictly adhered to. Modifying this product, substituting nonfactory parts, or using maintenance procedures other than outlined in this instruction could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties. Between actuator and valve there are moving parts. To avoid injury Flowserve provides pinch-point-protection in the form of cover plates, especially where side-mounted positioners are fitted. If these plates are removed for inspection, service or repair special attention is required. After completing work the cover plates must be refitted.

Apart from the operating instructions and the obligatory accident prevention directives valid in the country of use, all recognised regulations for safety and good engineering practices must be followed.

**WARNING:** Before products are returned to Kämmer for repair or service Kämmer must be provided with a certificate which confirms that the product has been decontaminated and is clean. Kämmer will not accept deliveries if a certificate has not been provided (a form can be obtained from Kämmer).

1.8 **Storage**
In most cases Kämmer Products are manufactured from stainless steel. Products not manufactured from stainless steel are provided with an epoxy resin coating. This means that Kämmer products are well protected from corrosion. Nevertheless, Kämmer products must be stored adequately in a clean, dry environment. Plastic caps are fitted to protect the flange faces and to prevent the ingress of foreign materials. These caps should not be removed until the valve is actually mounted into the system.

1.9 **Valve and actuator variations**
These instructions cannot claim to cover all details of all possible product variations, nor in particular can they provide information for every possible example of installation, operation or maintenance. This means that the instructions normally include only the directions to be followed by qualified personal where the product is being used for is defined purpose. If there are any uncertainties in this respect particularly in the event of missing product-related information, clarification must be obtained via the appropriate FLOWSERVE sales office.

2 **UNPACKING**
2.1 Each delivery includes a packing slip. When unpacking, check all delivered valves and accessories using this packing slip.

2.2 Larger valves can be lifted using slings on the yoke rods or, if present, on the lugs provided for this purpose. If slings are used, attach them so that the outer tubing or attaching parts are not damaged.

**WARNING:** If slings are used, be aware that the centre of gravity of the valve may be above the lifting point. In this case, secure or support the valve against rotating, to prevent damage or personnel injury.

2.3 Report transport damage to the carrier immediately.

2.4 In case of discrepancies, contact your nearest FLOWSERVE sales office.

3 **INSTALLATION**
3.1 Clean tubing prior to installing.

3.2 If possible, install the valve in an upright position (actuator on top), to ease maintenance. An upright installation position is important with low-temperature applications, in order to keep the distance between the packing material and the medium as large as possible. The packing material then retains the ambient temperature as much as possible.

**NOTE:** Do not insulate extension bonnets that are provided for hot or cold services

3.3 Make sure that sufficient overhead clearance above the actuator is maintained, to allow for disassembly of plug from the valve body.

3.4 After installing, check direction of flow again. The direction of flow is shown by the arrow on the housing.

3.5 If the valve is to be welded into the line, make sure that the valve is shielded from excessive heat.

3.6 Connect supply pressure and signal lines. Control valves are supplied with a positioner. The end connections for supply pressure and signal are clearly marked. Series 4 actuators and positioners are suitable for max. 4.2 bar (60 psi) supply pressure. If the supply pressure exceeds the pressure specified on the nameplate, a pressure reducing station is required. If instrument air is not available, install an oil separator/air filter in the air inlet line. All connections must be leak free.

**WARNING:** Prevent other items of equipment from making mechanical contact with the actuator housing.

4 **QUICK CHECK**
Before operating, check the valve as follows:

4.1 Open and close the valve, and observe the movement of the actuator stem. The movement must be smooth and linear.

4.2 Check for maximum stroke through change of signal
(for pneumatic positioners, 0.2 - 1.0 bar or corresponding split-range values; for IP positioners, 4-20 or 0-20 mA).

4.3 Check all air connections for leaks.

4.4 Tighten packing nut (see table 1).

<table>
<thead>
<tr>
<th>Thread</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M20 x 1,5</td>
<td>1 3</td>
</tr>
<tr>
<td>M30 x 1,5</td>
<td>6 15</td>
</tr>
<tr>
<td>M38 x 1,5</td>
<td>15 35</td>
</tr>
<tr>
<td>M45 x 1,5</td>
<td>17 40</td>
</tr>
</tbody>
</table>

Table 1

4.5 Check fail-safe position. To do this, close supply pressure and observe whether the valve opens or closes as defined.

4.6 After use at fluctuating temperatures, re-tighten all bolt connections and check for leaks.

5 MAINTENANCE

Check valves for correct functioning at regular intervals (at least once every 6 months) as follows. This check can be made when installed and in many cases without interrupting production. If internal defects are suspected, see section „Disassembly and Assembly of Valve“.

5.1 Examine gaskets for leaks and if necessary re-tighten bolts (see Fig. 1).

5.2 Check bellows gasket and test connection - if present - for external leaks.

5.3 Check valve for damage caused by corrosive residues or corrosive vapours.

5.4 Clean valve/actuator and repaint as necessary.

5.5 Check gland nut for correct torque (see table 1).

**NOTE:** An excessively tightened gland nut can cause excessive packing wear and can hinder the free movement of the plug stem.

5.6 If possible, open and close valve and check for maximum stroke and smooth movement of the plug stem. Irregular movement of the plug stem may indicate internal defects.

**WARNING:** Keep hands, hair, clothing, etc. away from all moving parts. Failure to do so can lead to serious injury.

5.7 Check all accessories for firm seating.

5.8 If possible, close supply pressure and check the fail-safe position.

5.9 Check stem boot for wear.

5.10 Check actuator for leaks. To do this, spray housing, air connections and plug stem guide with leak spray and check for any bubble formation.

5.11 Clean plug stem.

5.12 Check air filter, if present, and if necessary replace insert.

**Note:** For further information regarding service and maintenance please contact your nearest FLOWSERVE office.

**DANGER:** On actuators with aluminium cases the actuator springs must be renewed with original spare parts every 10 years or after 50,000 operating hours which ever occurs first.
Fig. 1: On-Off actuator, Air-to-Open
6.1 REMOVE ACTUATOR FROM VALVE BODY
(refer to Figs. 1 + 2)

6.1.1 Shut off the air supply.
WARNING: Depressurise the line to atmospheric pressure and drain all fluids from the valve before working on the actuator. Failure to do so can cause serious injury.

6.1.2 Remove the coupling (21) from the actuator stem (24):
Loosen clamping screws (50) and expand the clamping gap as required, apply air to the actuator to move the actuator stem around 5% from it’s end position. Screw out the slotted nut (51) and drive the actuator stem out of the coupling (by applying more air on “Air-to-Open” or by venting air on “Air-to-Close”). Remove ring (52), split ring (53) and slotted nut (51).

6.1.3 Attach a crane to the eye bolt (42) to support the actuator and remove the nuts (20) from the yoke rods (15). Vent the actuator.

6.1.4 Loosen the coupling locknut and unscrew the coupling (21) from the plug stem.

6.2 CONNECT ACTUATOR TO VALVE BODY
(refer to Figs. 1 + 2)

6.2.1 Screw the coupling (21) onto the plug stem until the stem touches the thrust washer (54).

6.2.2 Mount the actuator onto the valve and secure the yoke rods (15) to the yoke plate (18) using the nuts (20) and lockwashers (19). Connect an air supply to the actuator using a valve that can regulate the air to aerate and vent the actuator.

6.2.3 Fit the slotted nut (51), ring (52) and split rings to the actuator stem (on ‘Air-to-Open’ versions retract the stem by applying air).

6.2.4 Carefully enter the actuator stem into the coupling and screw the slotted nut (51) into the coupling.

6.2.5 Screw the coupling anticlockwise onto the actuator stem to achieve a pretension of 2 to 4 mm ensuring that the NAMUR studs (17) are correctly positioned.

CAUTION: Ensure that the plug assembly is not rotated with the plug seated. This may cause irreparable damage to the seating faces.

6.2.6 Tighten coupling locknut, slotted nut (51) and clamping screws (50).

6.2.7 As required reconnect all tubing.

7 DISASSEMBLE ACTUATOR
(see Fig. 1)

7.1 Disassemble body
7.1.1 Unscrew the 8/10 screws (38), crisscross, and in equal measures until the actuator spring(s) (43) are fully decompressed and the plate (34) is loose.

7.1.2 Remove plate (34), spring(s) (43) and spring guide (31).

7.1.3 Loosen and remove the 24 flange screws/nuts (26/23).

7.1.4 Reattach the plate (34) to the spring housing (25). With suitable lifting equipment attached to the eyebolt (42) remove the spring housing (25).

7.1.5 Remove the actuator stem (24) complete with diaphragm: lifting equipment can be used if an eyebolt is fitted to the top of the actuator stem.

7.2 Disassemble diaphragm
7.2.1 Clamp the actuator stem below the diaphragm in a vice (protect the stem against surface damage).

7.2.2 Loosen the lock螺丝 (29) and screw the nut (30) clockwise onto the sleeve (28) (secure the sleeve from rotating with a wrench across the flats on the lower portion of the sleeve), until the split ring (6) can be removed.

7.2.3 Remove sleeve (28), diaphragm plate (3), diaphragm (4), plate (5) and split ring (6).

7.3 Disassemble actuator stem seal and guide
7.3.1 Diaphragm housing (12)
7.3.1.1 Remove ring (7) and press the calked ring (8) out to the top.

7.3.1.2 Remove the seal kit consisting of backup rings (9) and O-ring (10).

7.3.1.3 Remove wiper ring (16) and bushing (11).

7.3.2 Guide bushing (33)
2.3.2.1 Remove wiper ring (16) and bushing (11).
Fig. 1: On-Off actuator, Air-to-Open

1 Pre-tension plate
2 Grooved pin, Ø 5 x 25
3 Diaphragm plate
4 Diaphragm
5 Plate
6 Split ring
7 Ring
8 Ring
9 Back-up ring
10 O-Ring
11 Bushing
12 Diaphragm housing
13 Yoke plate, top
14 Slotted nut
15 Yoke rod
16 Wiper ring
17 Screw, NAMUR
18 Yoke plate, lower
19 Spring washer, M16
20 Nut, M16
21 Coupling, kpl.
22 Travel indicator, assy.
23 Nut, M12
24 Actuator stem
25 Spring housing
26 Screw, M12 x 50
27 Vent plug
28 Sleeve
29 Screw, M5 x 10
30 Nut
31 Spring guide
32 Grooved pin, Ø 6 x 16
33 Guide bushing
34 Plate
35 Washer
36 Screw, M6 x 10
37 Snap ring
38 screw
39 Cap
40 Grooved pin, Ø 5 x 25
41 Threaded insert
42 Eyebolt
43 Spring
8 ASSEMBLE THE ACTUATOR
(see Figs. 1 + 2)

8.1 Assemble diaphragm housing
8.1.1 Fit bushing (11) and wiper ring (16) to diaphragm housing.
8.1.2 Enter backup ring (9), O-ring (10) and backup ring (9) from the other side.
8.1.3 Fit the ring (8) and catch in three positions.

8.2 Assemble guide bushing (33)
8.2.1 Fit bushing (11) and wiper ring (16).

8.3 Assemble diaphragm
8.3.1 Clamp the actuator stem in a vice (protect the stem against surface damage).
8.3.2 Fit the split rings (6) in the groove in the actuator stem and place the plate (5) on top.
8.3.3 Fit the diaphragm (4) on top of the plate (5) ensuring that the inner bead sits correctly in the groove machined into the plate (5).
8.3.4 Place the O-ring (10) over the actuator stem until it sits in the plate (5).
8.3.5 Place the diaphragm plate (3) over the actuator stem (24) onto the diaphragm (4).
8.3.6 Place the sleeve (28) over the actuator stem. Screw the nut (30) onto the sleeve (28) until the split ring (6) can be fitted into the groove in the actuator stem. Rotate the nut (30) anticlockwise to clamp the diaphragm and torque the nut to the value shown in table 1. Tighten the locking screw (29).

8.4 Assemble actuator
8.4.1 Place the ring (7) in the centre of the diaphragm housing (12).
8.4.2 Fit the actuator stem assembly to the diaphragm housing (12) ensuring that the outer bead of the diaphragm sits correctly.
8.4.3 Replace spring housing (25) and secure with 24 screws/nuts (26/23) (torque values see table 1).
8.4.4 Replace spring guide (31) (if used). Replace spring(s) (43) ensuring they are situated correctly within the rollpins (2).
8.4.5 Place the plate (34), complete with cap (39) and guide bushing (33), onto the springs and tighten the 8/10 screws (38), crisscross, and in equal measures until the plate contacts the spring housing (torque values see table 1).

WARNING: NEW SCREWS (38) must be used EVERY time. Grease the screws before fitting.

9. REVERSE ACTUATOR ACTION

9.1 Remove cap (39), threaded insert (41) and eyebolt (42) and refit to the reverse side.

<table>
<thead>
<tr>
<th>Fastener</th>
<th>Pos.</th>
<th>Torque value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange screws/nuts</td>
<td>26, 23</td>
<td>60 Nm</td>
</tr>
<tr>
<td>Screws</td>
<td>38</td>
<td>22 Nm max.*</td>
</tr>
<tr>
<td>Nut</td>
<td>30</td>
<td>190 Nm</td>
</tr>
</tbody>
</table>

Table 1: Torque values

* Torque value for strongest spring set
# Troubleshooting chart

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem pulsates</td>
<td>1. Unstable air supply</td>
<td>2. Adjust air supply</td>
</tr>
<tr>
<td></td>
<td>2. Vent or passage blocked</td>
<td>3. Clean vent or passage</td>
</tr>
<tr>
<td>Actuator slow</td>
<td>1. Air supply too low</td>
<td>1. Adjust air supply</td>
</tr>
<tr>
<td></td>
<td>2. Diaphram case leaks air</td>
<td>2. Seal diaphram case</td>
</tr>
<tr>
<td></td>
<td>3. Spring case vent blocked</td>
<td>3. Renew vent</td>
</tr>
<tr>
<td>Actuator will not return to end</td>
<td>1. Air supply too low</td>
<td>1. Adjust air supply</td>
</tr>
<tr>
<td>position</td>
<td>2. Broken actuator spring</td>
<td>2. Renew all actuator springs</td>
</tr>
<tr>
<td></td>
<td>3. Actuator movement blocked</td>
<td>3. Dissassemble actuator and check</td>
</tr>
<tr>
<td>Actuator will not return to the</td>
<td>1. Actuator not vented</td>
<td>1. Vent actuator</td>
</tr>
<tr>
<td>failsafe position</td>
<td>2. Broken actuator spring</td>
<td>2. Renew all actuator springs</td>
</tr>
<tr>
<td></td>
<td>3. Actuator movement blocked</td>
<td>3. Dissassemble actuator and check</td>
</tr>
</tbody>
</table>

All data subject to change without notice

©04.2002 Flowserve Corporation. Flowserve and Kammer are trademarks of Flowserve Corporation