

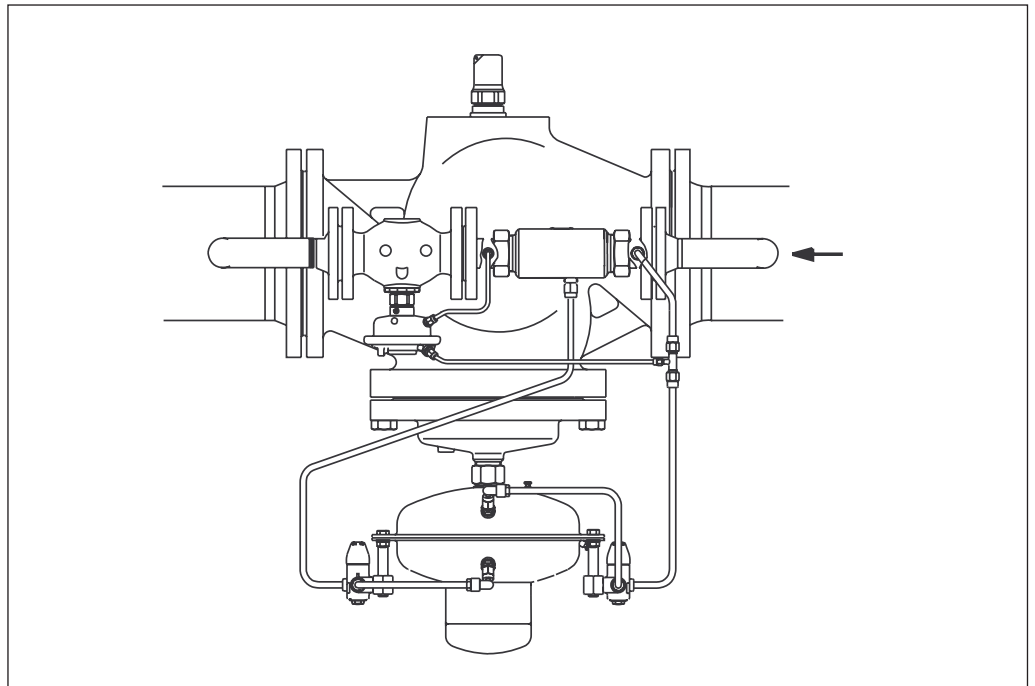
## Instructions

# Pilot-controlled PCVQ

DN 100 - DN 250

PN 16 / PN 25

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## 1 Safety Notes



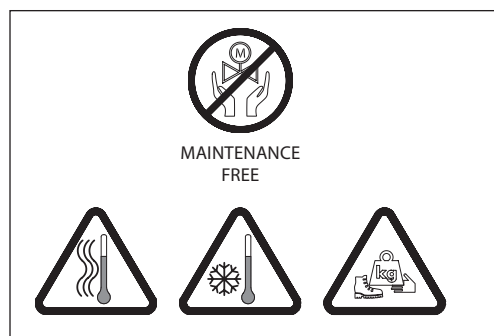
**Prior to assembly and commissioning to avoid injury of persons and damages of the devices, it is absolutely necessary to carefully read and observe these instructions.**

Necessary assembly, start-up, and maintenance work must be performed only by qualified, trained and authorized personnel.

Prior to assembly and maintenance work on the controller, the system must be:

- depressurized,
- cooled down,
- emptied and
- cleaned.

Please comply with the instructions of the system manufacturer or system operator.



## 2 Definition of Application

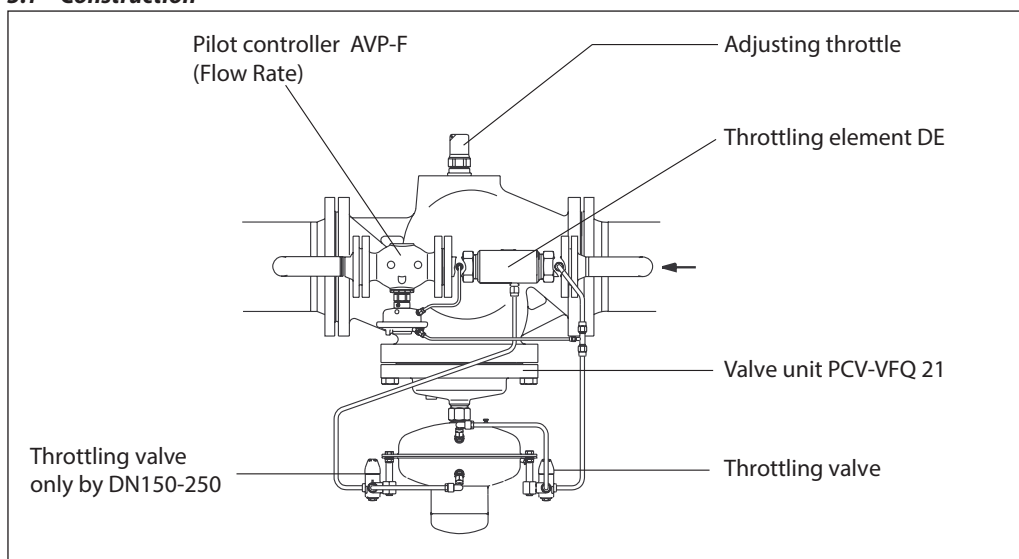
The controller is used for flow rate limitation of water for heating, district heating and cooling systems.

The admissible medium temperatures depend on the design and comprise 5 to 150 °C, 5 to 200 °C.

The technical data on the rating plates determine the use.

### 3 Description

#### 3.1 Construction



#### 3.2 Mode of Operation

The control unit consists of the PCV-VFQ21 valve unit, installed in the main pipe and AVP-F installed as pilot controllers in the bypass. In the bypass line, a throttle element is installed in front of the pilot controller.

The controller keeps the differential pressure across the main valve flow restrictor on a constant level and restricts the flow rate to the adjusted setpoints.

The valve and the pilot valves are pressure-balanced.

The setpoint for the flow rate limitation is adjusted at the adjusting throttle of the valve unit.

The valve unit in the main pipe is opening on rising pressure. The pilot controller in the bypass line is closing on rising pressure.

#### Flow Rate Limitation

If the flow rate reaches the adjusted setpoint, the differential pressure increases at the adjusting throttle. This differential pressure acts on the actuator AVP-F via the impulse tubes and the valve AVP-F closes. Consequently, the valve of the valve unit is throttled, too, and the flow rate is restricted.

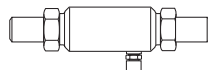
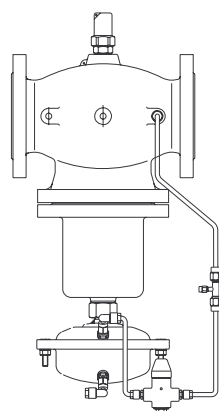
### 4 Technical Data

Technical data, see rating plates and the PCV data sheet.

## 5 Scope of Delivery

### DN 100, DN 125

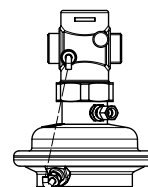
Assembly kit valve unit PCV-VFQ 21



Throttling element

Pilot controller DN 25

AVP-F



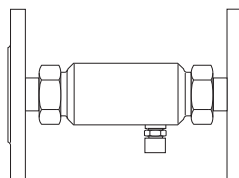
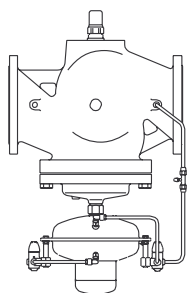
Cu pipe  $\varnothing 6 \times 1 \times 1500$  mm



Cu pipe  $\varnothing 10 \times 1 \times 3000$  mm

### DN 150, DN 250

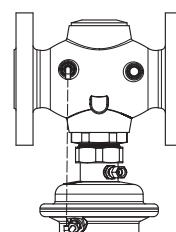
Assembly kit valve unit PCV-VFQ 21



Throttling element

Pilot controller DN 40

AVP-F



Cu pipe  $\varnothing 6 \times 1 \times 1500$  mm



Cu pipe  $\varnothing 10 \times 1 \times 3000$  mm

## 6 Assembly

### 6.1 Prior to Assembly:



CAUTION!

**Depressurized system before any assembly work !**

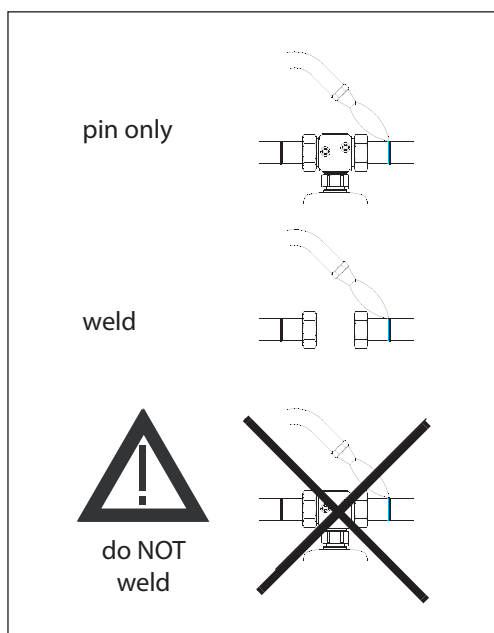
- Clean pipeline system.
- Install strainer in front of the controller.
- Install shut-off units in front of and behind the controller.

### 6.2 Installation Position, Installation Place

- Installation is only permitted in horizontal pipelines with the actuators hanging in a downward position.
- The controller may be installed in the supply as well as in the return line.

### 6.3 When installing:

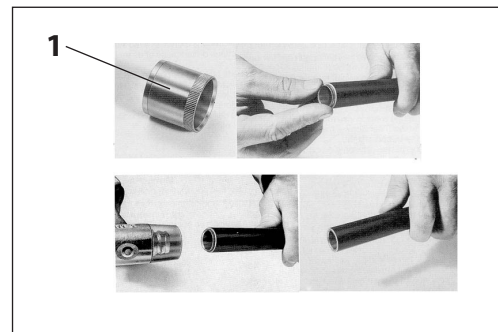
- Observe direction of flow.
- Design with welded ends:



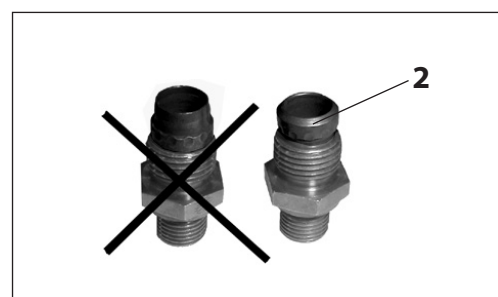
- Loads on the valve body and the throttle element by the pipes are not permitted.

### 6.4 Impulse Tube Installation

See installation scheme, section 6.6.  
For CU pipes  $\varnothing 10 \times 1$ , insert sockets 1 on both sides.



Care for correct position of the cutting rings 2.



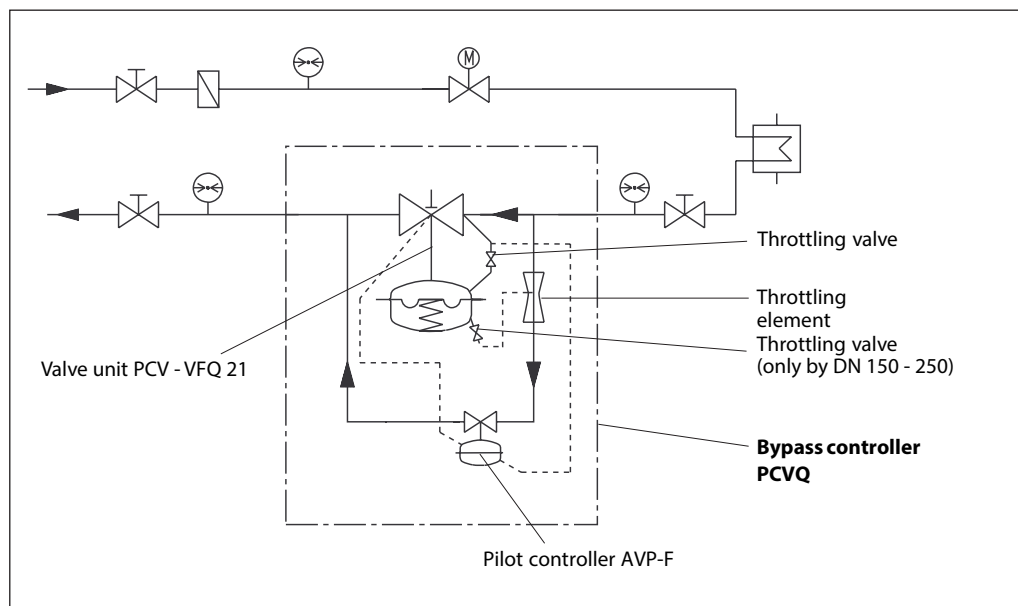
### 6.5 Insulation

The diaphragm actuators must not be insulated when insulating system parts.

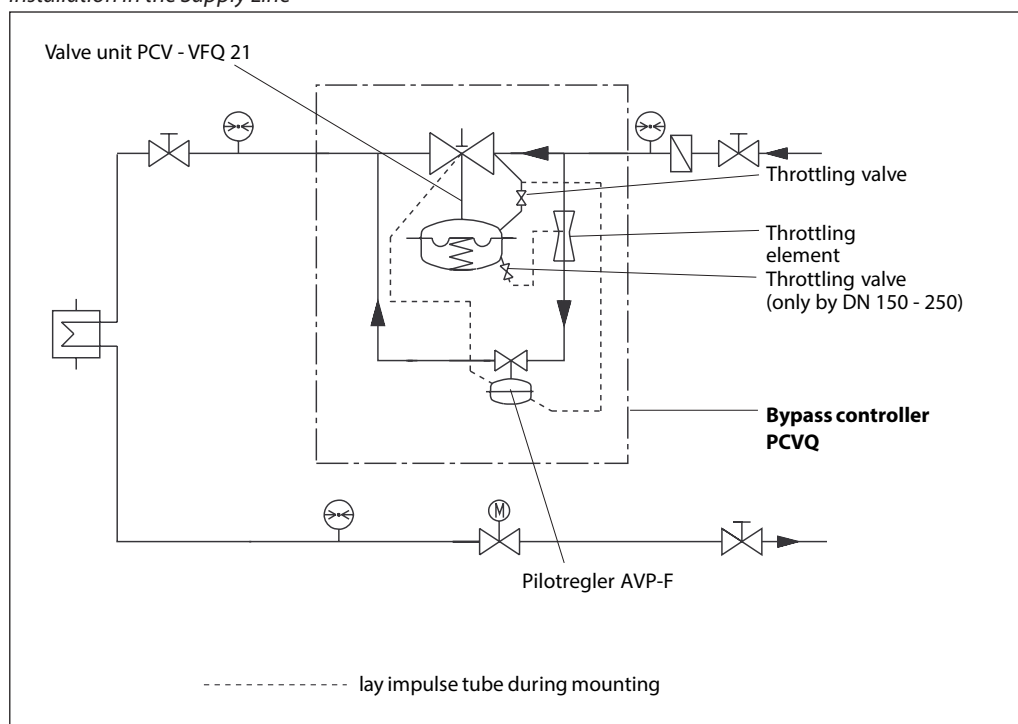
6 Assembly

6.6 Installation Scheme

Installation in the Return Line



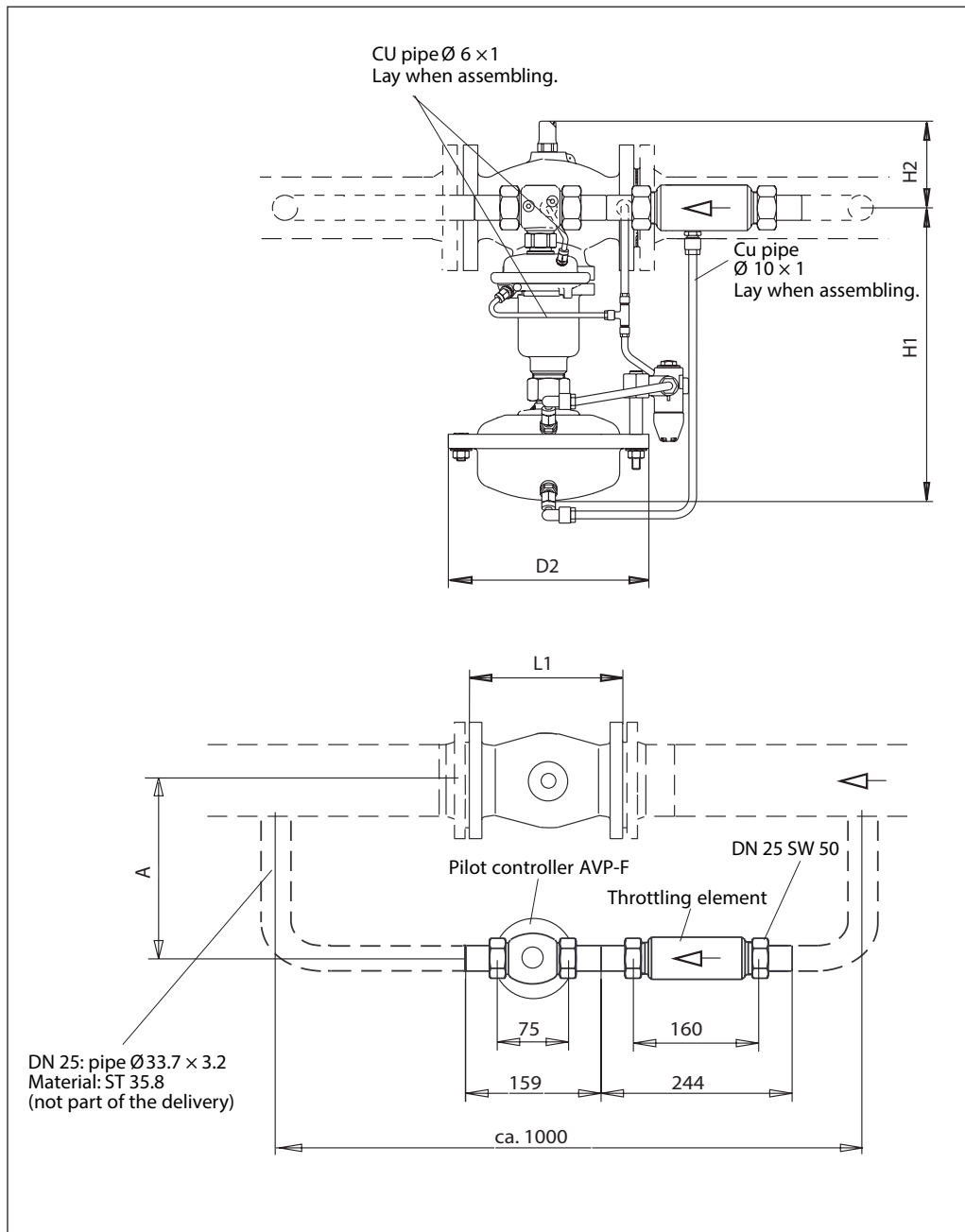
Installation in the Supply Line



6 Assembly

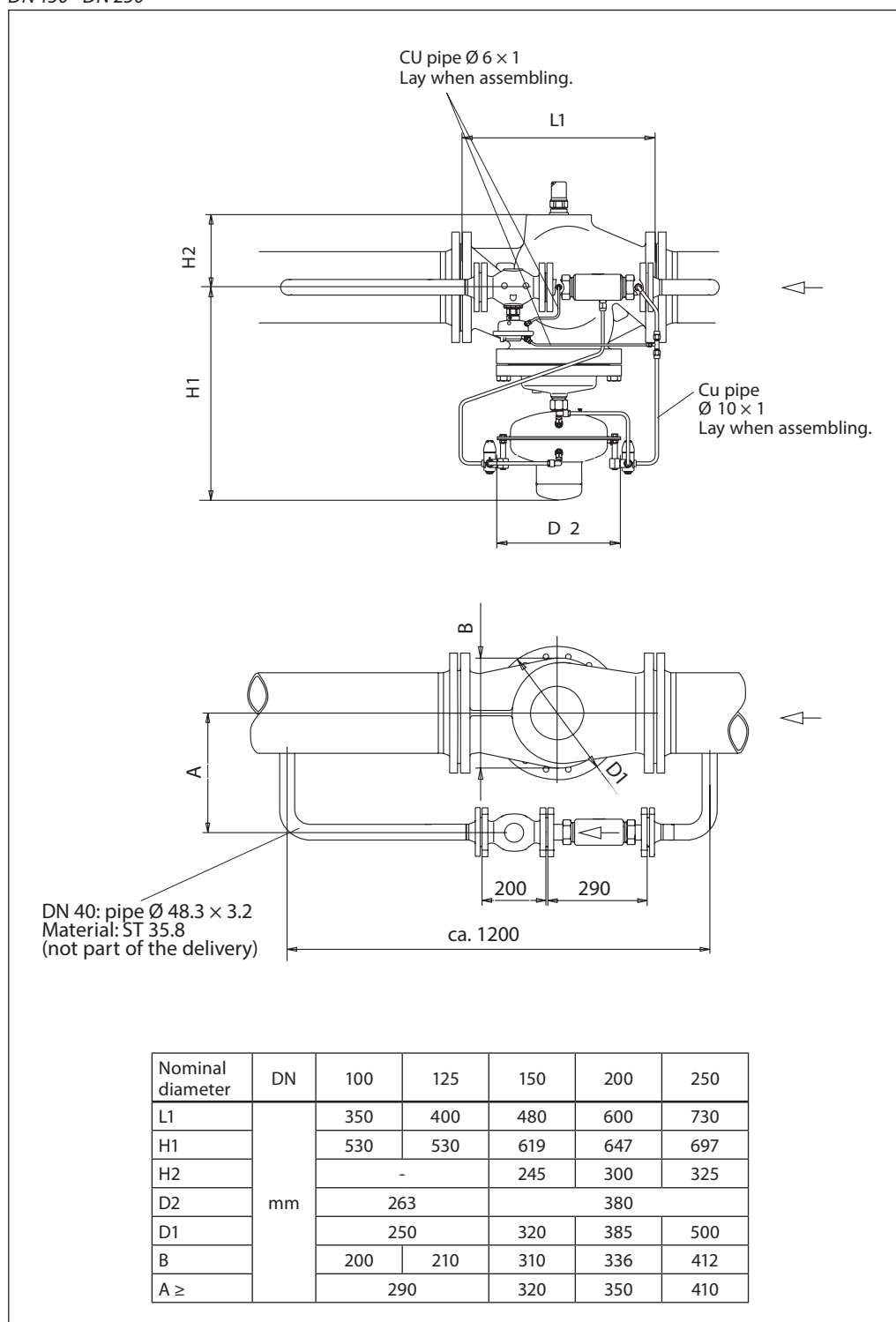
6.7 Assembly Drawings, Dimensions

DN 100 - DN 125



6 Assembly (continuous)

DN 150 - DN 250

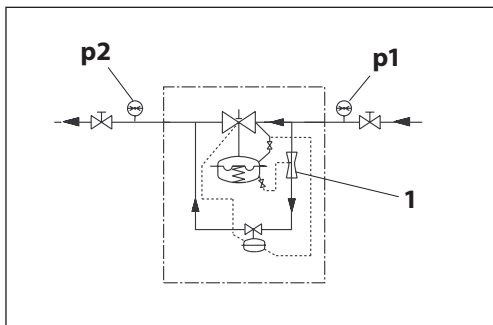




## 7 Start-up

### 7.1 Required Static Pressure

The static pressure **p1** in front of the controller must not fall below 1.5 bar (excess pressure). Non-observance may lead to cavitation and damages in the throttling element **1**.



### 7.3 Filling the System

#### Note:

The controller **4** is closed when no pressure is applied and only opens with a defined flow in the bypass.

The pilot controller **5** is closing on rising pressure.



**To avoid too high pressure differences on the controller, observe the following sequence when starting-up!**

This procedure guarantees that there is no overturn of the diaphragm in the valve and the actuators.

### 7.2 Leak and Pressure Tests

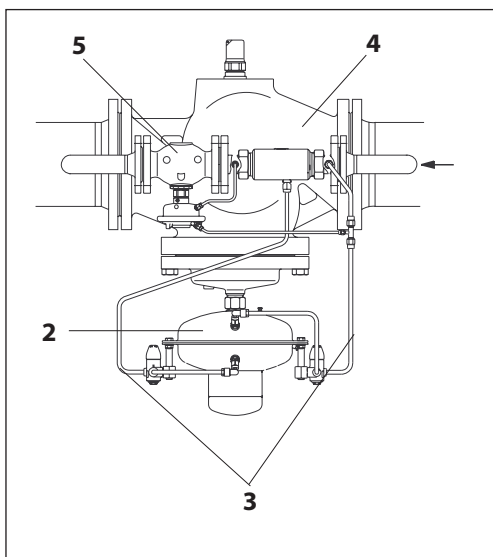


**To avoid too high pressures at the diaphragm actuators, the following should be observed prior to any pressure tests:**

#### Actuator of valve unit:

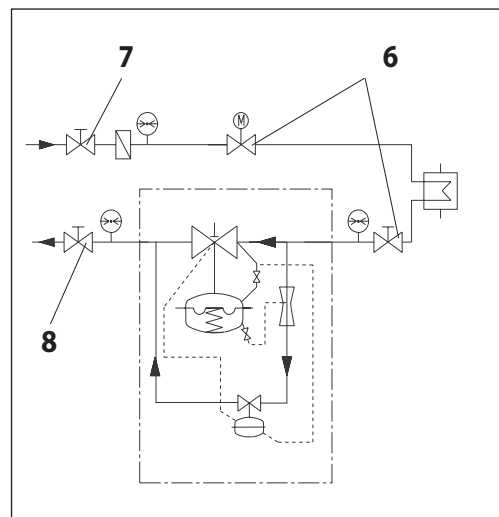
The admissible operating excess pressure in the actuator **2** is 25 bar <sup>1)</sup>. For higher pressures, you must:

- Remove the impulse tubes **3** at the actuator and close the connections with a stopper.
- Prior to any leak or pressure test, the instructions in section 7.3 must be complied with.



<sup>1)</sup> Pre-condition: Same pressure on both sides of the diaphragm. If the pressure load is one-sided, the (+)diaphragm chamber may have an excess pressure of 1 bar in comparison to the (-) diaphragm chamber.

1. Open units **6** of the system.
2. Slowly open shut-off units in the supply flow **7** and the return flow **8**.



### 7.4 Start-up

During starting-up the filled system, open the units in the same sequence as described in section 7.3.

### 7.5 Putting out of operation

When putting the system out of operation, first close the shut-off units in the supply flow and then those of the return flow.

## 7 Start-up

### 7.6 Flow Rate Adjustment

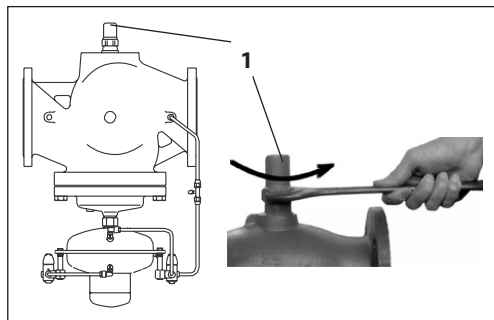
The setting of the setpoint for the flow rate limitation is made by means of flow adjusting curves (see section 7.7) or a heat meter (see page 33).

#### Adjustment by means of flow adjusting curves

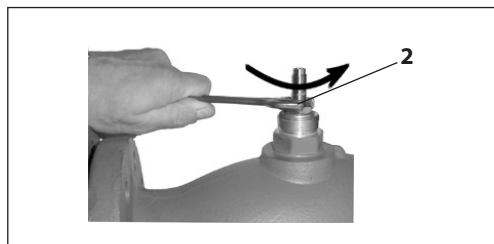
Adjustment is to be made at a shut-down system.

#### Procedure

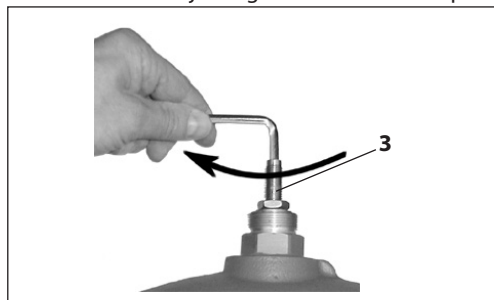
1. Unscrew cover 1.



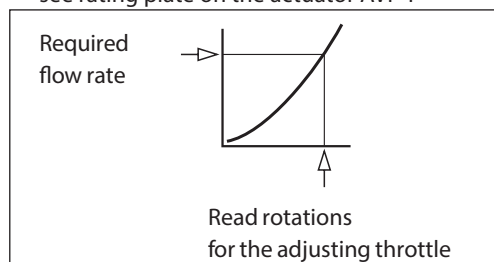
2. Loosen the counter nut 2.



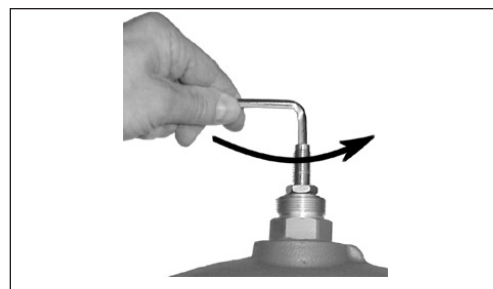
2. Screw in the adjusting throttle 3 to its stop.



3. Choose diagram, (see section 7.7, Flow Adjusting Curves)  
Observe effective pressure  $\Delta p_b$ : 0.2 or 0.5 bar  
see rating plate on the actuator AVP-F



4. Turn the adjusting throttle by this number of rotations to the left.



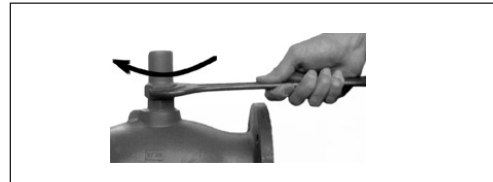
5. The adjusted flow rate can be verified by means of a flow rate measuring device.  
Perhaps you need to re-adjust the flow rate.

Care for an adequate differential pressure in the system.

6. Tighten the counter nut without changing the position of the adjusting throttle.



7. Re-screw the cap nut 1.



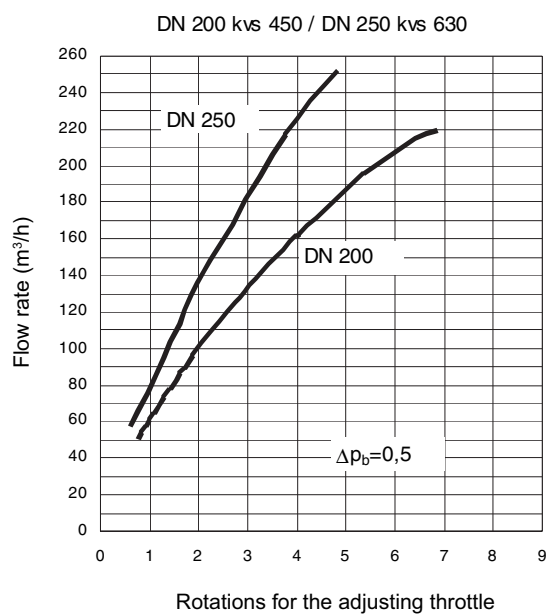
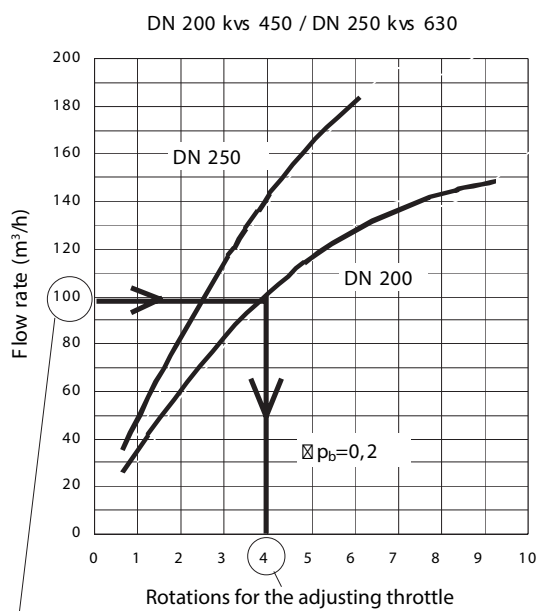
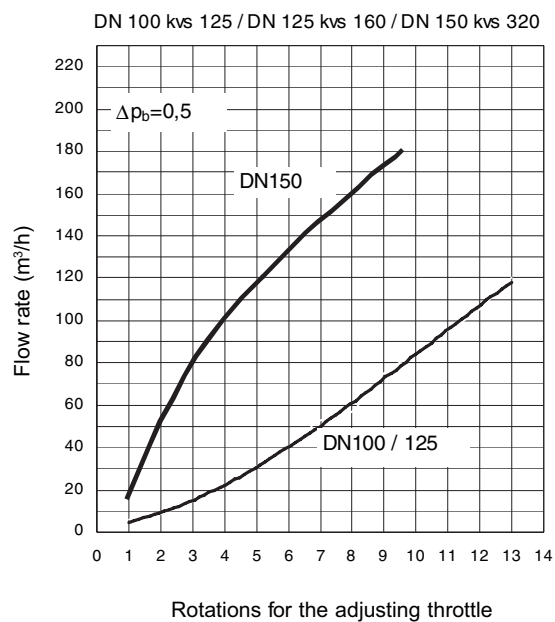
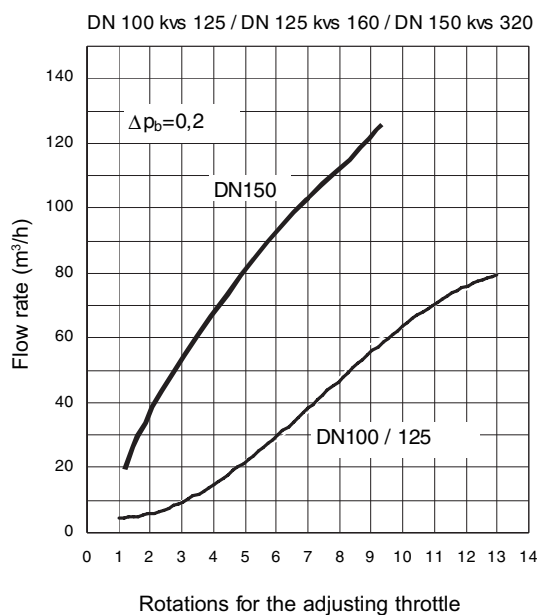
8. The cap nut can be sealed.



The flow rate adjustment is completed.  
Now, adjust the differential pressure, see section 7.8.

## 7 Start-up

### 7.7 Flow Adjusting Curves



Example  
Ventil DN 200

required flow rate  
limitation: 100 m³/h

necessary  
rotations of the  
adjusting throttle: 4

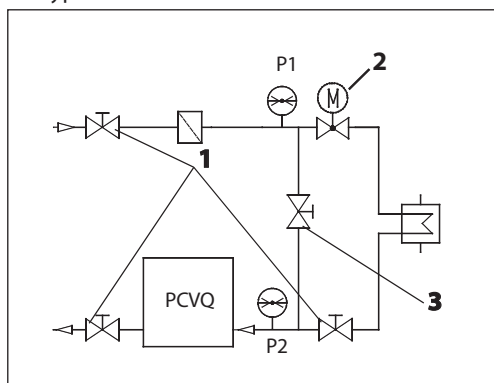
## 7 Start-up

### Adjustment by means of a flow rate measuring device:

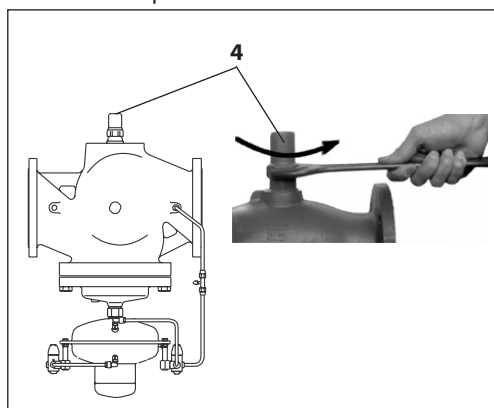
#### Procedure

1. Prior to the adjustment of the flow rate, start the system in accordance with the instructions given in section 7.4.
2. The shut-off units **1** and the control units **2** must be completely opened so that the flow rate is not restricted by a unit.

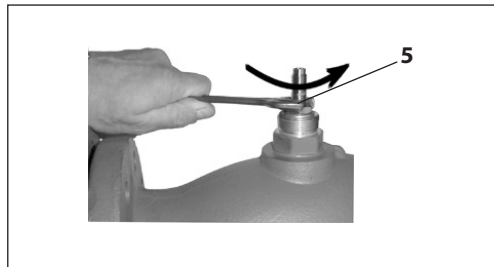
The adjustment can also be carried out via a bypass **3**.



3. Unscrew cap nut **4**.

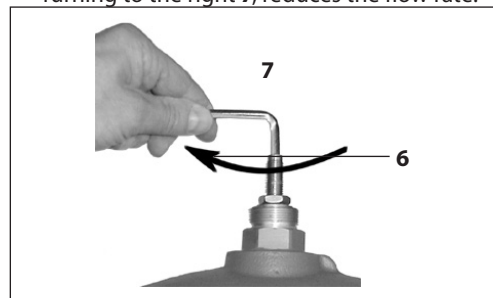


4. Loosen the counter nut **5**.

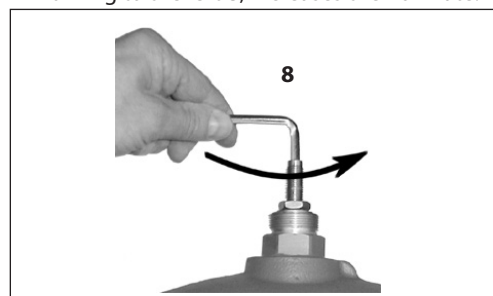


5. Adjust the flow rate limitation by turning the adjusting throttle **6**:

Turning to the right **7**, reduces the flow rate.



Turning to the left **8**, increases the flow rate.

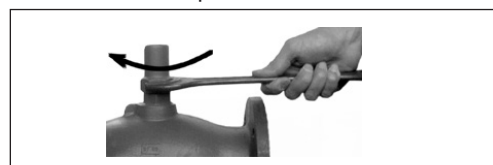


6. Observe the flow rate indicator.

7. After having completed the adjustment, tighten the counter nut without changing the position of the adjusting throttle.



8. Re-screw the cap nut.



9. The cap nut can be sealed.

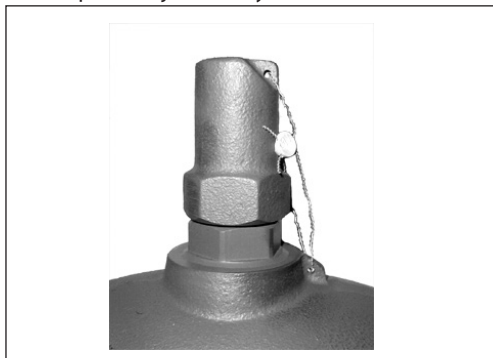


The flow rate adjustment is completed.

## 7 Start-up

### 7.8 Sealing

The setpoint adjuster may be sealed.



### 7.10 Function Test

#### Flow rate

The adjusted flow rate must not be exceeded if the system is completely open.

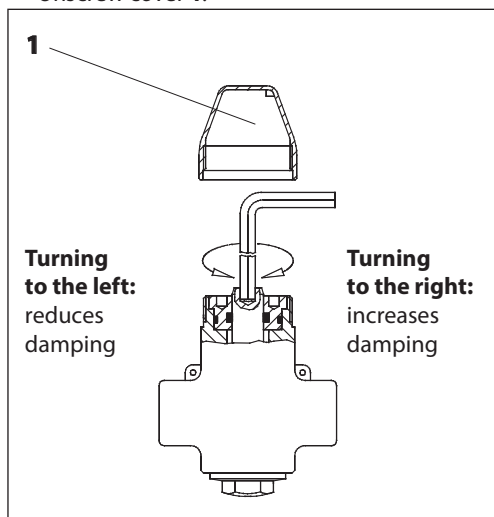
If the setting is exceeded in either direction, check the adjustment as described in section 7.5.

### 7.9 Adjustment of the Throttle Valves

Number of throttle valves:

DN 100, 125: 1 ×  
DN 150-250 : 2 ×

- Unscrew cover 1.



- **Standard adjustment:**

Turn in the valve spindle by turning it to the right by means of a wrench SW5 to its stop.

Then unscrew valve spindle by turning it to the left by approx. 10 rotations.

- **Increase of damping**, e.g. necessary in case of pressure vibrations.

Screw in the valve spindle by turning it to the right.

- **Reduction of damping**, e.g. in case of a control that is too slug.

Unscrew the valve spindle by turning it to the left.

## 8 Trouble Shooting

Fault	Possible cause	Remedy
Controller does not hold the flow rate on a constant level	Throttle valve is open too widely.	Slightly close the throttle valve, see section 7.10.
	Air in the actuators	<ol style="list-style-type: none"> <li>1. Loosen impulse tube connections at the actuators by approx. 1 rotation.</li> <li>2. Deaerate, <b>Caution hot water !</b> (move impulse tube until medium penetrates).</li> <li>3. Tighten impulse tube connections.</li> </ol>
	Impulse tubes or impulse tube connections are dirty or damaged.	<ol style="list-style-type: none"> <li>1. Remove impulse tube.</li> <li>2. Clean impulse tubes and impulse tube connections and check for free passage.</li> </ol>
Flow rate is too low	Valve plug of the pilot valve AVP-F does not open: Valve seat or plug is dirty or damaged, trim is dirty.	<ol style="list-style-type: none"> <li>1. Remove impulse tube.</li> <li>2. Dismount actuator and trim. Procedure, see section 9.4.</li> <li>3. Clean seat and plug.</li> <li>4. If damaged, replace trim or valve.</li> </ol>
	Valve plug of the pilot valve VFQ 21 does not open: Valve seat or plug is dirty or damaged, trim is dirty.	<ol style="list-style-type: none"> <li>1. Remove impulse tube.</li> <li>2. Dismount actuator and trim 1 ). Procedure, see sections 9.1 and 9.2.</li> <li>3. Clean seat and plug.</li> <li>4. If damaged, replace trim or valve.</li> </ol>
	Rolling diaphragm in the actuator of the valve unit is defective, i.e. valve VFQ 21 does not open.	<ol style="list-style-type: none"> <li>1. Remove impulse tube.</li> <li>2. Loosen union nut SW 46 and remove actuator, see also section 9.1.</li> <li>3. Replace actuator.</li> </ol>

<sup>1)</sup> The trim can be replaced by qualified personnel up to DN 125.

From DN 150 replacement should be carried out by the Danfoss service personnel.

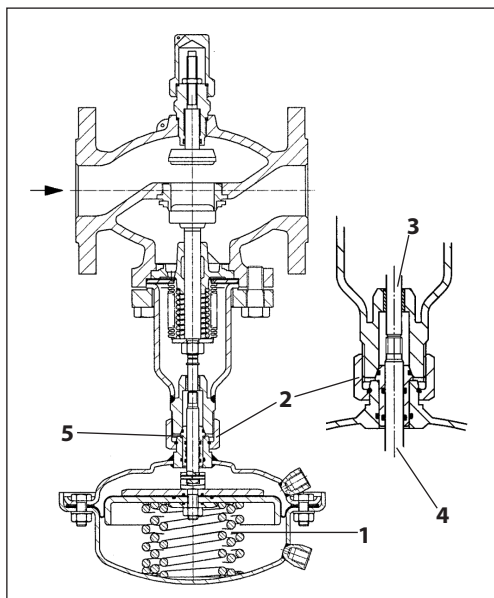
## 9 Replacement of Valve, Actuator, Trims

### 9.1 Dismounting and Mounting Actuator and Valve

#### Note:

The springs **1** in the actuator are pre-stressed. Therefore, the actuator must be pushed upwards to be dismounted. You need a second person to do this.

Valve unit DN 100–125

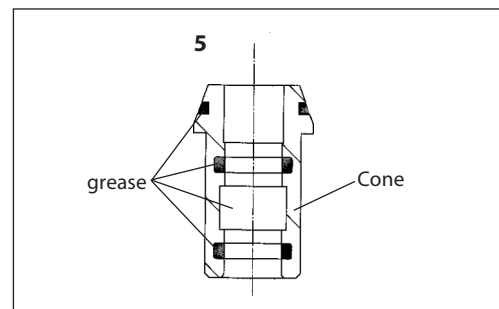


Valve stem **3** and the stem of the actuator **4** are not screwed to each other.

#### Dismounting

1. Dismount impulse tubes.
2. Support actuator below or by a second person as the springs **1** are pre-stressed.
3. Loosen union nut **2**.
4. Remove actuator.

Prior to assembly check cone **5**!



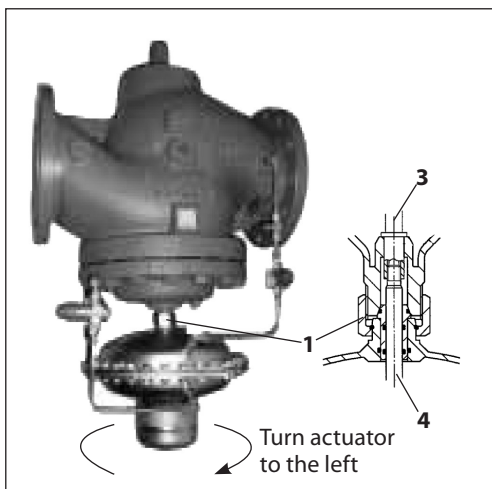
1. Clean cone prior to mounting.
2. Check O rings for damages, in case of damages, replace cone (see Spare Parts).
3. Grease cone with high-performance fitting component: BARRIERTA L55/3 HV (see Spare Parts).

#### Mounting

1. Place actuator at the valve and push upwards.
2. Screw on union nut **2**.
3. Align actuator, observe position of impulse tube connections.
4. Tighten union nut **1**, max. torque 100 Nm.

## 9 Replacement of Valve, Actuator, Trims

Valve unit DN 150–250



Then, return the actuator by approx. 1 rotation (to the left)

3. Align actuator, observe position of the control lines connections.
4. Tighten union nut 1, **torque 100 Nm**.

The stem of the actuator **4** is screwed into the valve stem **3**.

### Dismounting

1. Dismount impulse tubes.
2. Completely loosen union nut **1**.

➡ The actuator hangs on the screwed-in stem **4**.



The actuator weights approx. 20 kg. In addition, an internal spring package is pre-stressed. Secure against dropping down before unscrewing.

3. Screw the stem of the actuators **4** out of the valve stem **3** by turning the actuator to the left.

### Mounting

1. Place actuator at the valve and push upward to press the spring package in the actuator together (second person necessary).
2. Carefully turn actuator to the right. By this, carefully screw in the stem of the actuator into the valve stem to its stop.



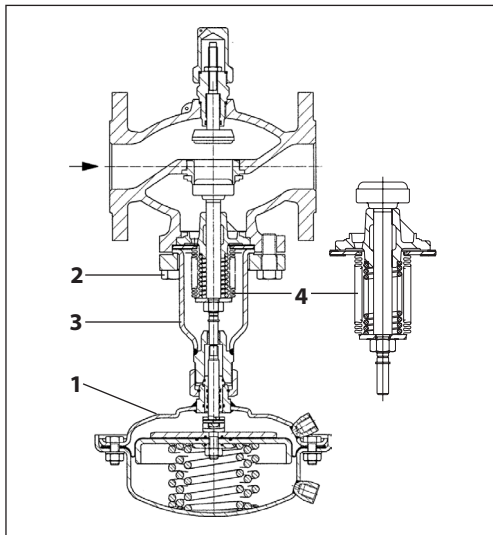
## 9 Replacement of Valve, Actuator, Trims

### 9.2 Replacement of Trim Valve VFQ 21

The trim can be replaced by qualified personnel up to DN 125. From DN 150 replacement should be carried out by the Danfoss service personnel.

#### Removing the trim:

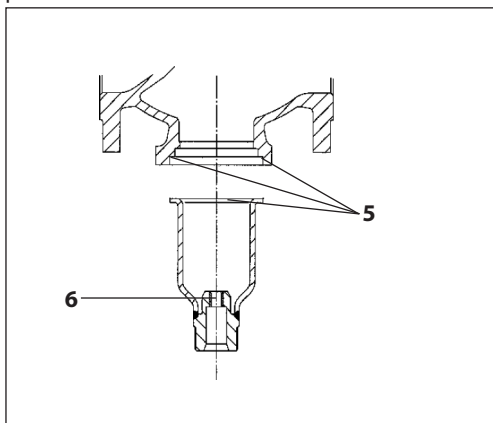
Valves DN 100–125



1. Dismount actuator **1**  
(see section 9.1).
2. Unscrew hexagon head cap screw **2**.
3. Remove bonnet **3**.
4. Take out trim **4**.

#### Prior to installation:

Clean sealing surfaces **5** and socket **6**, grease sealing surfaces with antiseize graphite petroleum.



#### Installing the trim:

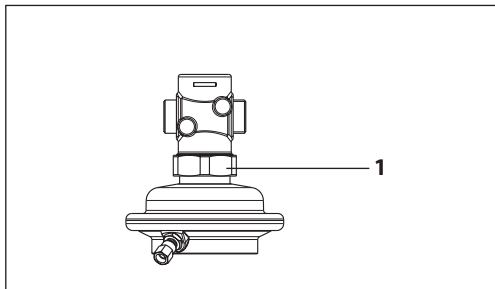
Mounting is carried out in reverse order.  
Torque hexagon head cap screws **2**:

DN	Torque	Wrench
100 - 125	180 Nm	SW 30

## 9 Replacement of Valve, Actuator, Trims

### 9.3 Dismounting, Mounting

Actuator AVP-F



#### Dismounting

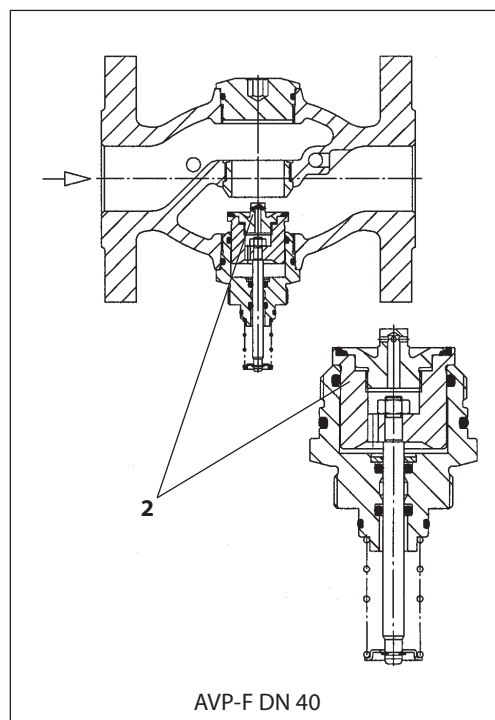
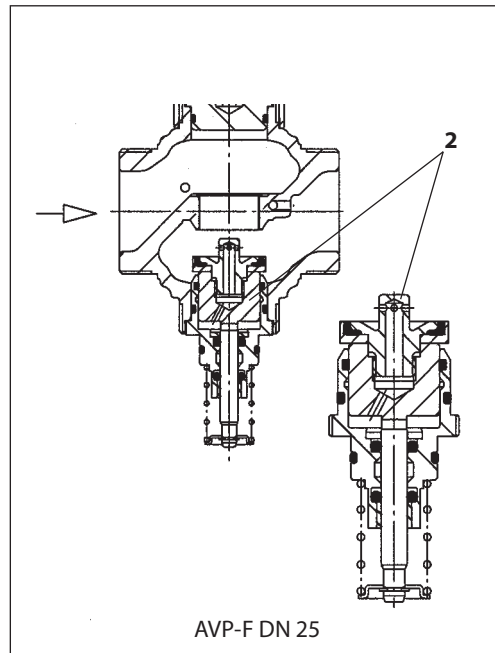
1. Dismount impulse tubes.
2. Loosen union nut **1**.
3. Remove actuator.

#### Mounting

1. Place actuator at the valve and align, observe position of the impulse tube connections.
2. Screw on union nut **1** and tighten, torque 100 Nm.

### 9.4 Replacement of Trim

Valve AVP-F



#### Dismounting

1. Unscrew actuator (see above).
2. Unscrew trim **2**.  
DN 25: with pipe tongs, wrap gum strips around the trim  
DN 40: with wrench SW 55
3. Pull out trim.

#### Mounting

Mounting is carried out in reverse order. Only tighten with low torque, sealing is made with O rings.





## Instructions

## Pilot-controlled PCVQ DN 100 - DN 250 (PN 16, PN 25)

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