



Manual balancing

USV-I / USV-M

Description

USV valves are designed for manual hydronic balancing of heating and cooling systems.

USV-I (red knob) is used together with USV-M to limit the flow in heating or cooling installation or can work separately as manual balancing valves for flow limitation. If certain pipe sectors do not require a control of differential pressure, USV-I and USV-M can be used as shut-off and measuring valve.

USV-M (blue knob) valve can be upgraded into an automatic USV-PV balancing valve. USV-M is designed for installation in the return pipe.

Upgrading from manual to automatic balancing is done by mounting PV-controller to an USV-M valve.

System does not need to be depressurized during the upgrade and the k_V -values does not change. USV-PV maintains constant differential pressure across a riser.

Due to its special design USV-PV has a firm connection between diaphragm housing and valve cone. Diaphragm controller thus acts only against the force of reference spring.

Features & benefits

- Pressure released cone
- Adapted membrane for every valve dimension which provides constant quality of performances for all sizes

Applications



USV-PV / I



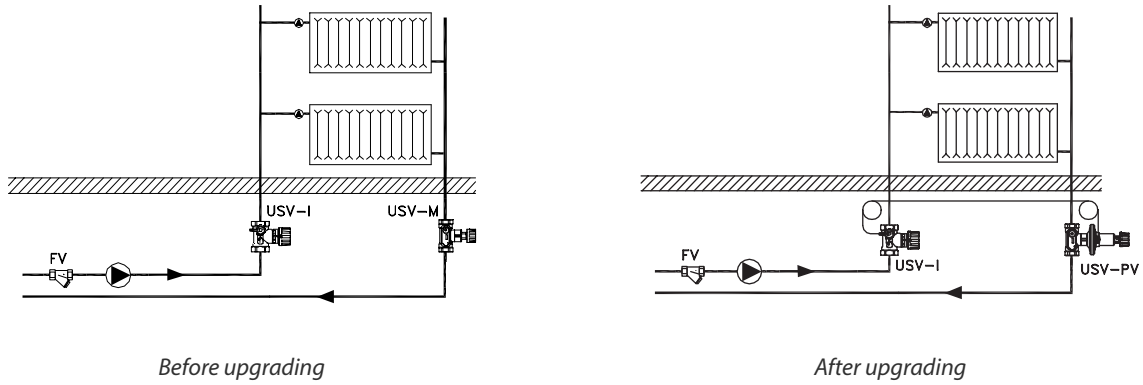
Upgrading of PV-controller from USV-M to USV-PV

USV-PV (blue knob) is designed to maintain a constant set differential pressure across a riser. Eventual operating noise caused by high differential pressure induced by changes in the system can be avoided by upgrading the manual valve to the differential pressure controller.

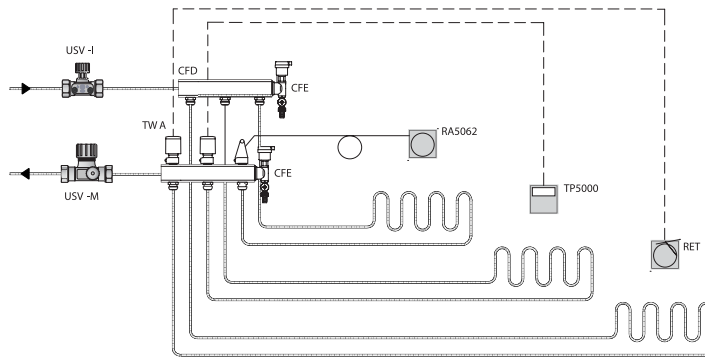
USV-PV can be set to control the differential pressure between 0,05 bar to 0,25 bar (5 kPa to 25 kPa). The PV controller is factory pre-set to 0,1 bar (10 kPa). PV-controller upgrading set includes an impulse tube and a threaded connector for the drain connection of USV-I.

USV-M (PV) and USV-I are compact valves in which the operating elements and connections are placed within an arc of 90°, so that in spite of small valve dimensions, access for installation and operation is optimal. Insulation caps for temperature up to 80 °C or 120 °C are available as accessory.

USV-M and USV-I are supplied in a set-pack with internal or external thread. If an external thread is chosen, a threaded or welded plug can be supplied as an accessory.

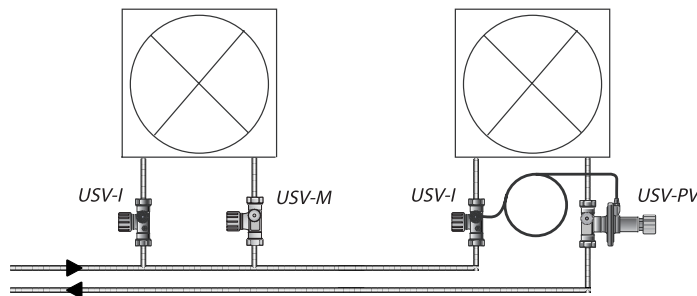


Upgradable USV valves are to be used for manual as well as automatic balancing of heating systems. If system has to be fitted with differential pressure controller, USV can be upgraded with PV controller.



USV in floor heating systems

Upgradable control valves are to be used for manual balancing of a floor system manifold.



USV in cooling systems

Upgradable USV control valves are to be used for manual or automatic hydronic balancing of cooling devices i.e. as fan coils or chilled ceilings.

Ordering

Product code numbers

USV set-pack (containing one USV-M and one USV-I)

| DN | k_{vs} (m ³ /h) | Int. thread ISO 7/1 | Code No. | Ext. thread ISO 228/1 | Code No. |
|-----|------------------------------|---------------------|-----------------|-----------------------|-----------------|
| 15 | 1.6 | Rp ½ | 003Z2141 | G ¾ A | 003Z2146 |
| 20 | 2.5 | Rp ¾ | 003Z2142 | G 1 A | 003Z2147 |
| 25 | 4.0 | Rp 1 | 003Z2143 | G 1¼ A | 003Z2148 |
| 32 | 6.3 | Rp 1¼ | 003Z2144 | G 1½ A | 003Z2149 |
| 40 | 10 | Rp 1½ | 003Z2145 | G 1¾ A | 003Z2150 |
| 50* | 16 | Rp 2 | 003Z2155 | G 2¼ A | 003Z2160 |

* DN 50 is not upgradable

PV controller for upgrading USV-M valve

| DN | Comments | Code No. |
|----|--|-----------------|
| 15 | Include: impulse tube 1.5 m and threaded connector | 003Z2156 |
| 20 | | 003Z2157 |
| 25 | | 003Z2158 |
| 32 | | 003Z2159 |
| 40 | | |

It is not necessary to depressurize the system in order to upgrade into differential pressure controller. K_v value does not change.

USV-M valve







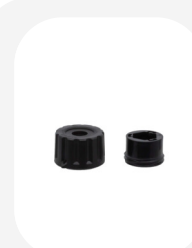
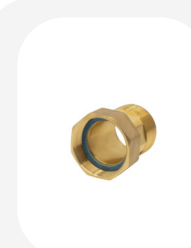




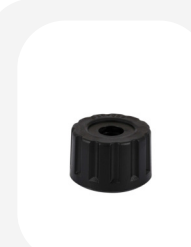

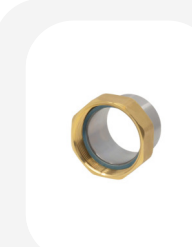
| DN | k_{vs} (m ³ /h) | Int. thread ISO 7/1 | Code No. | Ext. thread ISO 228/1 | Code No. |
|-----|------------------------------|---------------------|-----------------|-----------------------|-----------------|
| 15 | 1.6 | Rp ½ | 003Z2121 | G ¾ A | 003Z2126 |
| 20 | 2.5 | Rp ¾ | 003Z2122 | G 1 A | 003Z2127 |
| 25 | 4.0 | Rp 1 | 003Z2123 | G 1¼ A | 003Z2128 |
| 32 | 6.3 | Rp 1¼ | 003Z2124 | G 1½ A | 003Z2129 |
| 40 | 10 | Rp 1½ | 003Z2125 | G 1¾ A | 003Z2130 |
| 50* | 16 | Rp 2 | 003Z2153 | G 2½ A | 003Z2154 |

* DN 50 is not upgradable

USV-I valve

| DN | k_{vs} (m ³ /h) | Int. thread ISO 7/1 | Code No. | Ext. thread ISO 228/1 | Code No. |
|----|------------------------------|---------------------|-----------------|-----------------------|-----------------|
| 15 | 1.6 | Rp ½ | 003Z2131 | G ¾ A | 003Z2136 |
| 20 | 2.5 | Rp ¾ | 003Z2132 | G 1 A | 003Z2137 |
| 25 | 4 | Rp 1 | 003Z2133 | G 1¼ A | 003Z2138 |
| 32 | 6.3 | Rp 1¼ | 003Z2134 | G 1½ A | 003Z2139 |
| 40 | 10 | Rp 1½ | 003Z2135 | G 1¾ A | 003Z2140 |
| 50 | 16 | Rp 2 | 003Z2151 | G 2¼ A | 003Z2152 |

Accessories code numbers

| | | | | |
|--|---|--|--|--|
|  <p>003L8153</p> <p>Impulse tube with O-rings, 5 m</p> <p>Impulse tube with O-rings, 5 m</p> |  <p>003Z0109</p> <p>Impulse tube adapter</p> <p>Impulse tube adapter</p> |  <p>003L8139</p> <p>EPP insulation cap ASV / USV DN 40</p> <p>EPP insulation cap ASV / USV DN 40</p> |  <p>003L8167</p> <p>Insulation cap USV DN 25</p> <p>Insulation cap USV DN 25</p> |  <p>003L8155</p> <p>Shut-off knob for ASV-I DN 15 (black)</p> <p>Shut-off knob for ASV-I DN 15 (black)</p> |
|  <p>003L8172</p> <p>EPP insulation cap ASV / USV DN 25</p> <p>EPP insulation cap ASV / USV DN 25</p> |  <p>003L8157</p> <p>Shut-off knob for ASV-I DN 25 (black)</p> <p>Shut-off knob for ASV-I DN 25 (black)</p> |  <p>065F6060</p> <p>Tailpiece with External thread DN 40</p> <p>Tailpiece with External thread DN 40</p> |  <p>003L8170</p> <p>EPP insulation cap ASV / USV DN 15</p> <p>EPP insulation cap ASV / USV DN 15</p> |  <p>003L8164</p> <p>Insulation cap USV DN 50</p> <p>Insulation cap USV DN 50</p> |
|  <p>003L8158</p> <p>Shut-off knob for ASV-I DN 32 - 50 (black)</p> <p>Shut-off knob for ASV-I DN 32 - 50 (black)</p> |  <p>003L8166</p> <p>Insulation cap USV DN 20</p> <p>Insulation cap USV DN 20</p> |  <p>003L8147</p> <p>Shut-off knob for ASV-M DN20 (black)</p> <p>Shut-off knob for ASV-M DN20 (black)</p> |  <p>003L8165</p> <p>Insulation cap USV DN 15</p> <p>Insulation cap USV DN 15</p> |  <p>065F6080</p> <p>Tailpiece for welding DN 40</p> <p>Tailpiece for welding DN 40</p> |



003L8169

Insulation cap USV DN 40

Insulation cap USV DN 40



003L8171

EPP insulation cap ASV / USV DN 20

EPP insulation cap ASV / USV DN 20



003L8141

Drain connection G 3/4 A

Drain connection G 3/4 A



003L8149

Shut-off knob for ASV-M DN32-50 (black)

Shut-off knob for ASV-M DN32-50 (black)



003L8173

EPP insulation cap ASV / USV DN 32

EPP insulation cap ASV / USV DN 32



003L8146

Shut-off knob for ASV-M DN15 (black)

Shut-off knob for ASV-M DN15 (black)



003L8156

Shut-off knob for ASV-I DN 20 (black)

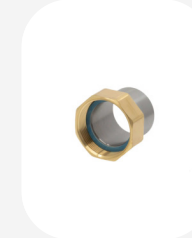
Shut-off knob for ASV-I DN 20 (black)



003L8138

EPP insulation cap ASV / USV DN 50

EPP insulation cap ASV / USV DN 50



003L8163

Tailpiece for welding set DN 50

Tailpiece for welding set DN 50



003L8148

Shut-off knob for ASV-M DN25 (black)

Shut-off knob for ASV-M DN25 (black)



003L8168

Insulation cap USV DN 32

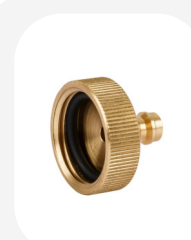
Insulation cap USV DN 32



003L8152

Impulse tube with O-rings, 1,5 m

Impulse tube with O-rings, 1,5 m



003L8143

Measuring connector for drain connection 3/4"

Measuring connector for drain connection 3/4"

Product details

General data

Technical data

| | |
|--|-------------------|
| Max. working pressure | 16 bar |
| Test pressure | 25 bar |
| Max. differential pressure across the valve (USV-M/PV) | 0.8 bar (80 kPa) |
| Max. differential pressure across the valve (USV-I) | 1.5 bar (150 kPa) |
| Flow temperature | -20 to 120 °C |

Sizing

Required:

- A. Correct valve size USV-M / I
- B. Correct USV-I presetting

Given:

1. Required max. flow in the riser

$$Q = 0,80 \text{ [m}^3\text{/h]}$$

2. Pressure drop across riser

$$\Delta p_s = 15 \text{ [kPa]}$$

3. Available pump pressure

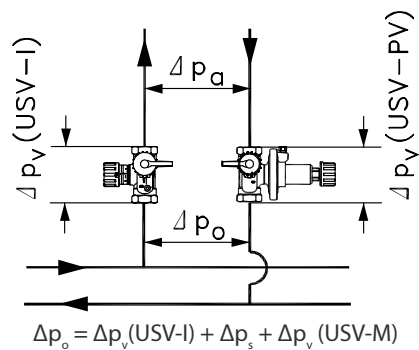
$$\Delta p_o = 45 \text{ [kPa]}$$

Solution:

- A) Correct valve size :

Pipe size and low pressure drop (fully opened valve) can be criterions for valve selection. The example selects USV-M 20 valve. Pressure drop is read from sizing diagram by taking a horizontal line from DN 20 valve with presetting 3,2 (fully opened valve) to intersect k_v -axis at 2,5 [m³/h].

A straight line connecting this point and $Q = 0,80 \text{ [m}^3\text{/h]}$ intersects the differential pressure bar at $\Delta p_v \text{ (USV-M)} = 10 \text{ [kPa]}$.



- B) Correct valve size and presetting of USV-I:

The differential pressure across USV-I can be calculated as follows:

$$\Delta p_v \text{ (USV-I)} = \Delta p_o - \Delta p_s - \Delta p_v \text{ (USV-M)}$$

$$\Delta p_v = 45 \text{ [kPa]} - 15 \text{ [kPa]} - 10 \text{ [kPa]} = 20 \text{ [kPa]}$$

The example selects USV-I 20. Presetting is read from the sizing diagram by taking a straight line from max. flow

$Q = 0,80 \text{ [m}^3\text{/h]}$ to the differential pressure $\Delta p_v \text{ (USV-I)} = 20 \text{ [kPa]}$ and to the intersection with k_v -axis at $k_v = 1,8 \text{ [m}^3\text{/h]}$.

Draw a horizontal line from this point to the adjustment curve of the chosen valve (DN 20). Starting from closed valve, the presetting of 1,6 turns is required.

USV-PV

Required:

Diff. pressure setting of USV-PV

Given:

1. Required max. flow in the riser

$$Q = 0,80 \text{ [m}^3\text{/h]}$$

2. Pressure drop across riser

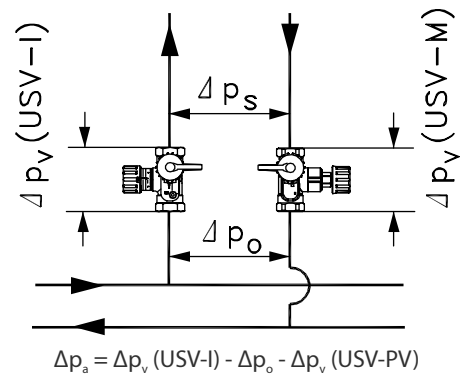
$$\Delta p_s = 15 \text{ [kPa]}$$

3. Available pump pressure

$$\Delta p_o = 45 \text{ [kPa]}$$

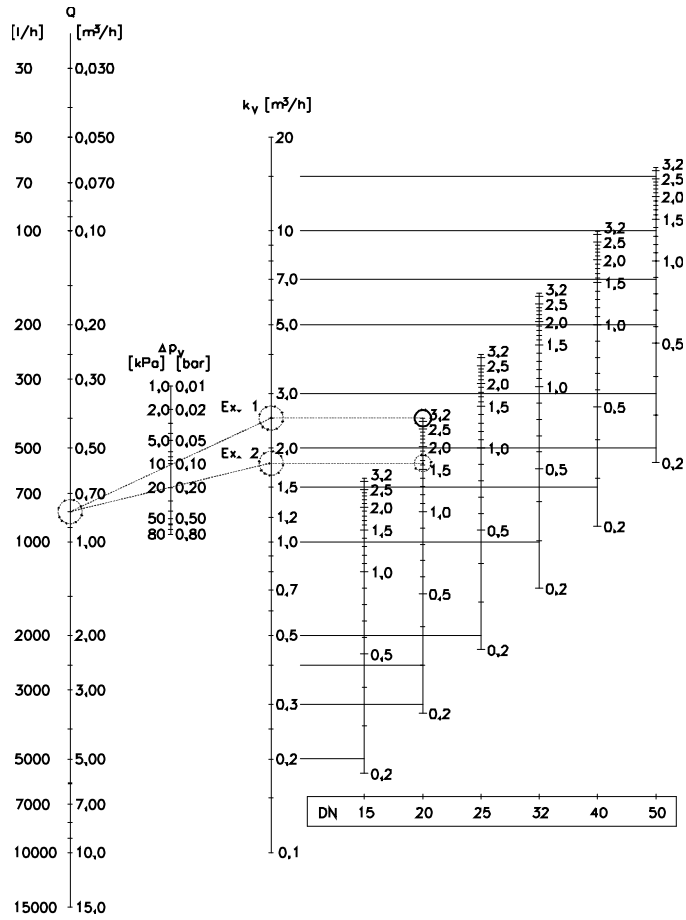
Solution:

USV-M is upgraded to USV-PV by mounting the PV controller to the USV-M valve and connecting it to the USV-I by the means of impulse tube. USV-PV maintains constant differential pressure Δp_a (pressure drop across riser - see fig.). USV-PV is to be set at $\Delta p_a = 15 \text{ [kPa]}$.



k_v -values [m³/h] for various presettings:

| Size | Number of turns | | | | | | | |
|-------|-----------------|------|------|------|------|------|------|------|
| | 0.20 | 0.60 | 1.00 | 1.40 | 1.80 | 2.20 | 2.70 | 3.20 |
| DN 15 | 0.2 | 0.5 | 0.8 | 1.1 | 1.2 | 1.4 | 1.6 | 1.6 |
| DN 20 | 0.3 | 0.8 | 1.3 | 1.6 | 1.9 | 2.1 | 2.4 | 2.5 |
| DN 25 | 0.4 | 1.3 | 1.9 | 2.6 | 3.1 | 3.4 | 3.7 | 4.0 |
| DN 32 | 0.7 | 2.0 | 3.1 | 4.1 | 4.9 | 5.4 | 5.9 | 6.3 |
| DN 40 | 1.1 | 3.1 | 4.9 | 6.4 | 7.6 | 8.5 | 9.1 | 10.0 |
| DN 50 | 1.7 | 4.9 | 7.6 | 10.0 | 11.9 | 13.3 | 14.4 | 16.0 |



A straight line connecting the bars of flow, differential pressure and k_v value shows the relationship between these three variables.

$$k_v = \frac{10 \times Q}{\sqrt{\Delta p}}$$


Q [m³/h]

Δp [kPa]

A horizontal line from the intersection with the k_v bar shows the presetting value for each valve size.

Design

- 1. Shut-off knob
- 2. Shut-off spindle
- 3. Setting spindle
- 4. Scale disc
- 5. O-rings
- 6. Valve cone
- 7. Valve body

| DN |  |
|----|---|
| 15 | 2,5 |
| 20 | 3 |
| 25 | 4 |
| 32 | 5 |
| 40 | 5 |

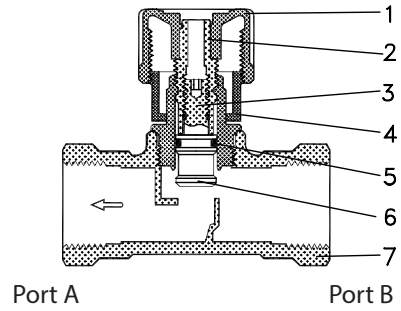


Fig. USV-I

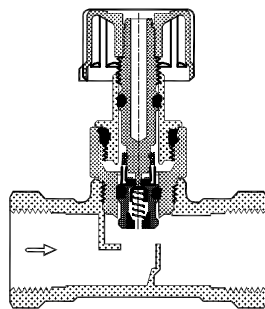
USV-I incorporates a double cone (3,6) able to give maximum stroke limitation, thus achieving flow limitation. It also incorporates shut off function. ASV-I is equipped with the plugs for the flow measurement and a connection for the USV-P/PV impulse tube.

Use the following procedure to limit the flow: turn the valve knob (1) fully counter clockwise to open the valve. The mark on the knob will now be opposite »0« on the scale (4). Turn the valve knob (1) clockwise to the required setting (e.g. for setting 2,2 the knob must be rotated two full turns and then forward to »2« on the scale.

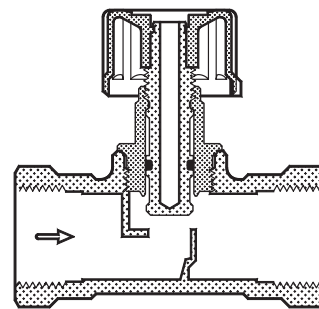
Hold the knob (1) to keep the setting (e.g. 2,2) and using a hexagon socket key turn the spindle (3) fully counter clockwise (until a stop can be felt). Turn the valve knob (1) fully counter clockwise so that the mark on the knob is opposite »0« on the scale (4). The valve is now open as many turns from the closed position (2,2) as indicated by the conversion from required flow. To annul the setting, turn the hexagon socket key fully clockwise (until a stop can be felt).

Remember, at the same time the knob must be held on its »0« setting.

USV-M



DN 15 - 40




DN 50

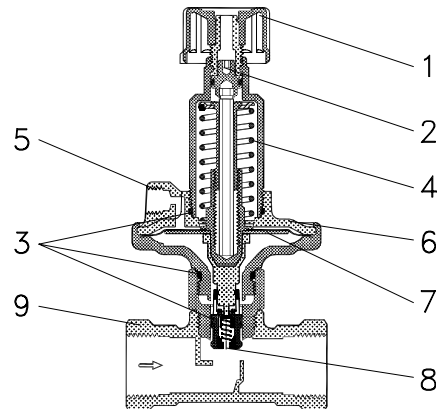
USV-M can be upgraded to USV-PV automatic balancing valve. The system does not need to be depressurized during the upgrade.

USV-M dimension DN 50 is not upgradable.

USV-PV valve

1. Shut-off knob
2. Differential pressure setting spindle
3. O-ring
4. Reference spring
5. Impulse tube connection
6. Diaphragm element
7. Control diaphragm
8. Pressure-relieved valve cone
9. Valve body

| DN |  |
|----|---|
| 15 | 2,5 |
| 20 | 3 |
| 25 | 4 |
| 32 | 5 |
| 40 | 5 |



| Turns (n) | bar |
|-----------|------|
| 0 | 0,25 |
| 1 | 0,24 |
| 2 | 0,23 |
| 3 | 0,22 |
| 4 | 0,21 |
| 5 | 0,2 |
| 6 | 0,19 |
| 7 | 0,18 |
| 8 | 0,17 |
| 9 | 0,16 |
| 10 | 0,15 |

| Turns (n) | bar |
|-----------|------|
| 11 | 0,14 |
| 12 | 0,13 |
| 13 | 0,12 |
| 14 | 0,11 |
| 15 * | 0,1 |
| 16 | 0,09 |
| 17 | 0,08 |
| 18 | 0,07 |
| 19 | 0,06 |
| 20 | 0,05 |

* Factory setting

USV-PV is designed to maintain a constant set differential pressure. Via an internal connection - trough the cone (8) and together with the reference spring (4), pressure in the return pipe acts on the underside of the control diaphragm (7) while via an impulse tube (5), pressure in the flow pipe acts on the top of the diaphragm. In this way the balancing valve maintains adjusted differential pressure in the riser.

USV-PV is factory-set on 0,1 bar (10 kPa). The differential pressure can be varied between 0,05 bar and 0,25 bar (5 kPa and 25 kPa).

Materials

Material of parts in contact with water

| | |
|---------------------------|-----------------|
| Valve body, spindle, etc. | Brass |
| Cone (USV-M/PV) | DZR Brass |
| Diaphragm and O-rings | EPDM |
| Spring | Stainless steel |



Pressure and temperature data

Measurement of flow and differential pressure

USV-I is fitted with a test plug and a drain connection and the pressure drop across valve can be measured with Danfoss measuring device PFM 3000 or other standard devices. Using the pressure drop characteristics of USV-I and differential pressure of the fully opened valve, actual flow can be obtained.

Note: When measuring the pre-set flow all radiator valves must be set for the nominal flow. Differential pressure [Δp_v] measuring in the riserdes. Drain connection of the USV-I and USV-M is to be fitted with a measuring connector (Danfoss Code No. **003L8143**)

Pressure testing

Max. test pressure 25 bar

When pressure testing the system you must secure that both sides of the membrane have the same static pressure to prevent damage of the pressure controller. That means the impulse tube must be connected and any needle valves must be open.

If USV-PV is installed in combination with USV-I, both valves can be open or closed (both valves must be in the same position!).

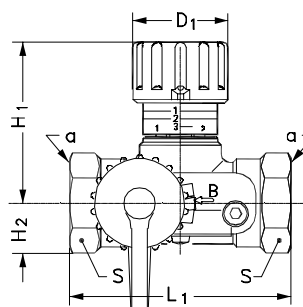
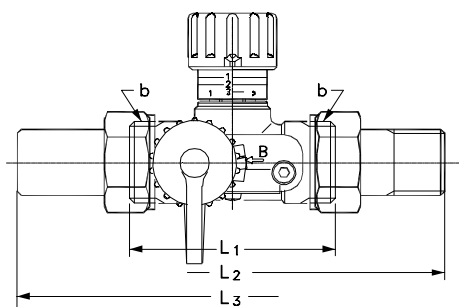
Dimensions

Ext. thread

Int. thread

With tailpiece welding

With tailpiece threaded



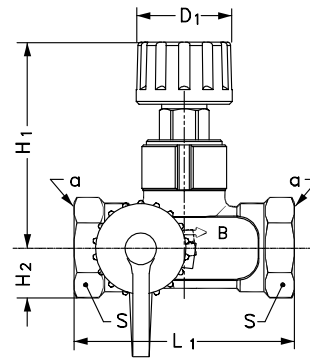
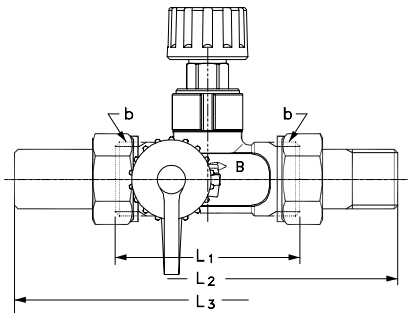
| Type | L ₁ [mm] | L ₂ [mm] | L ₃ [mm] | H ₁ [mm] | H ₂ [mm] | D ₁ [mm] | S [mm] | a ISO 7/1 | b ISO 228/1 | Weight [kg] |
|----------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------|-------------------|-------------|-------------|
| USV-I 15 | 65 | 131 | 139 | 48 | 15 | 28 | 27 | R _p ½ | G ¾ A | 0,31 |
| USV-I 20 | 75 | 147 | 159 | 60 | 18 | 35 | 32 | R _p ¾ | G 1 A | 0,4 |
| USV-I 25 | 85 | 169 | 169 | 75 | 23 | 45 | 41 | R _p 1 | G 1¼ A | 0,67 |
| USV-I 32 | 95 | 191 | 179 | 95 | 29 | 55 | 50 | R _p 1¼ | G 1½ A | 1,1 |
| USV-I 40 | 100 | 202 | 184 | 100 | 31 | 55 | 55 | R _p 1½ | G 1¾ A | 1,22 |
| USV-I 50 | 130 | 246 | 214 | 106 | 38 | 55 | 67 | R _p 2 | G 2½ A | 2 |

Ext. thread

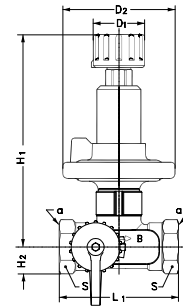
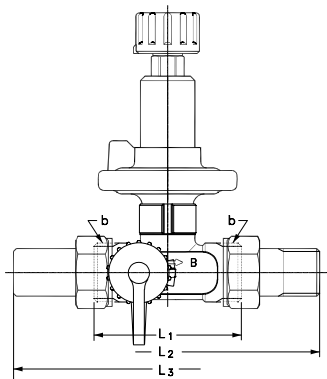
Int. thread

With tailpiece welding

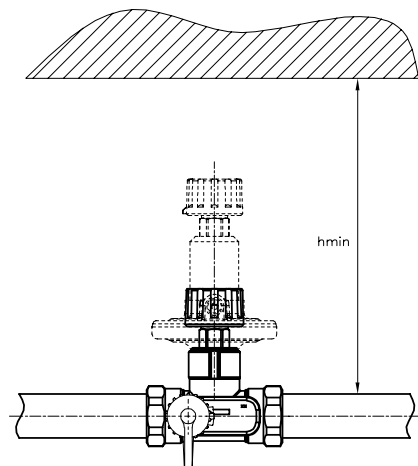
With tailpiece threaded



| Type | L ₁ [mm] | L ₂ [mm] | L ₃ [mm] | H ₁ [mm] | H ₂ [mm] | D ₁ [mm] | S [mm] | a ISO 7/1 | b ISO 228/1 | Weight [kg] |
|----------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------|-------------------|-------------|-------------|
| USV-M 15 | 65 | 131 | 139 | 61 | 15 | 28 | 27 | R _p ½ | G ¾ A | 0.28 |
| USV-M 20 | 75 | 147 | 159 | 76 | 18 | 35 | 32 | R _p ¾ | G 1 A | 0.4 |
| USV-M 25 | 85 | 169 | 169 | 96 | 23 | 45 | 41 | R _p 1 | G 1¼ A | 0.73 |
| USV-M 32 | 95 | 191 | 179 | 121 | 29 | 55 | 50 | R _p 1¼ | G 1½ A | 1.28 |
| USV-M 40 | 100 | 202 | 184 | 126 | 31 | 55 | 55 | R _p 1½ | G 1¾ A | 1.35 |
| USV-M 50 | 130 | 246 | 214 | 106 | 38 | 55 | 67 | R _p 2 | G 2½ A | 2 |



| Type | L ₁ [mm] | L ₂ [mm] | L ₃ [mm] | H ₁ [mm] | H ₂ [mm] | D ₁ [mm] | D ₂ [mm] | S [mm] | a ISO 7/1 | b ISO 228/1 | Weight [kg] |
|-----------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------|-------------------|-------------|-------------|
| USV-PV 15 | 65 | 131 | 139 | 115 | 15 | 28 | 61 | 27 | R _p ½ | G ¾ A | 0,55 |
| USV-PV 20 | 75 | 147 | 159 | 144 | 18 | 35 | 76 | 32 | R _p ¾ | G 1 A | 0,9 |
| USV-PV 25 | 85 | 169 | 169 | 184 | 23 | 45 | 98 | 41 | R _p 1 | G 1¼ A | 1,8 |
| USV-PV 32 | 95 | 191 | 179 | 230 | 29 | 55 | 122 | 50 | R _p 1¼ | G 1½ A | 3,35 |
| USV-PV 40 | 100 | 202 | 184 | 235 | 31 | 55 | 122 | 55 | R _p 1½ | G 1½ A | 3,45 |



| | h_{\min} |
|----------|------------|
| DN 15 | 150 |
| DN 20 | 200 |
| DN 25 | 250 |
| DN 32/40 | 320 |

Installation

USV-I must be installed in the flow pipe. USV-M must be installed in the returned pipe. The direction of the flow must follow the direction of the arrow on the valve body. USV-M and USV-I can be installed in any positions if installation instructions are being observed. It is recommended that a filter i.e. Danfoss Typ FV is installed in the supply pipe. After upgrading USV-M to USV-PV the impulse tube between USV-I and USV-PV must be flushed through before installation.

A 90° angle between service features (shut-off on the one side, measuring and draining on the other), allow upside down installation and easy measuring, shut-off and draining of the system.

Certificates, declarations and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

When you click on the link you will be directed to the latest version of the 'Declaration of Conformity'. Products developed and sold before this date of issue conform to the directives/standards in force at the time of their sale.

| Approval type | Title | Certification body | Approval topic |
|-----------------------------|---|-----------------------------|------------------------|
| Manufacturer's Declaration | Danfoss MD BF206986516781en-000401.01 | Danfoss | Pressure, PED, EU RoHS |
| UA Declaration | Danfoss UA 2023-01-23 MTC ASV RA FH RAX PL03 PL28 | Danfoss | Pressure, PED |
| Pressure Safety Certificate | LLC CDC EURO-TYSK UA.TR.089.1011.01-22 | LLC CDC EURO TYSK - Ukraine | Pressure, PED |
| Export Control Declaration | Butterfly, other valves, Manual balancing valves, one pipe solution valves and hot water balancing valves | Danfoss | |

Contact details

Online support

Danfoss offers a wide range of support along with our products, including digital information, software, mobile apps and expert guidance. See the possibilities below.



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