Mixing valves

610 – 6370 series

01353/20 EN

Function

The mixing valves regulate the central heating system by mixing the boiler outlet water with the return water from the system in order to obtain the desired flow temperature to the user.
They can be motorized and combined with climatic regulators to send the hot water to the user according to the actual thermal load required.

Reference documentation

- Instruction sheet H0006621 Mixing valves
- Instruction sheet 18057 OPTIMISER® digital climate regulator
- Instruction sheet Digital regulator with synoptic diagram

Product range

610 Series Three-way sector mixing valve, threaded ______ sizes DN 15 (Rp 1/2”) – DN 50 (Rp 2”) F
Code 637042 Actuator for mixing valves ______ 230 V electric supply, three-point control signal
Code 637044 Actuator for mixing valves ______ 24 V electric supply, 0–10 V control signal

Technical specifications

Materials

Body:	brass EN 12165 CW617N
Control stem and rotor:	brass EN 12165 CW617N
Knob:	PA6-GF30
Position indicator:	aluminium
Seals:	EPDM, FKM

Performance

Medium:	water, glycol solutions
Max. percentage of glycol:	50 %
Maximum working pressure:	10 bar
Maximum differential pressure:	1 bar (mixing)
	2 bar (diverting)
Working temperature range:	5–110 °C
Leakage (Δp=1 bar):	≤ 0.5 % Kvs
Connections:	Rp 1/2”–Rp 2” (EN 10226-1)

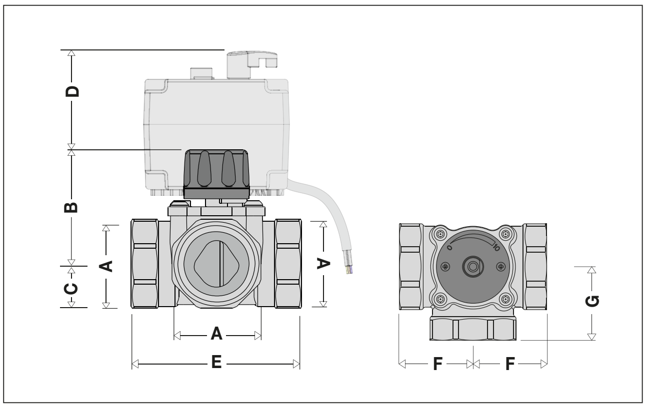
Actuators

Electric supply:	230 V – 50 Hz (code 637042)
	24 V (AC)/(DC) (code 637044)
Control signal:	3-point (code 637042)
	0–10 V, 0(4)–20 mA, 0–5 V, 5–10 V (code 637044)
Feedback signal:	0–10 V (code 637044)
Power consumption:	3 VA (code 637042)
	2 W (code 637044)
Protection class:	IP 44
Operating time (90°):	150 s (code 637042)
	75 s (code 637044)
Maximum torque:	5 N·m
Supply cable length:	1,5 m
Cable type:	H03V2V2-F 3x0,75 mm² (code 637042)
	FRR12 4x0,5 mm² (code 637044)
Ambient temperature range:	0–55 °C
Maximum ambient relative humidity:	80 %

Hydraulic characteristics

Ø	Rp 1/2”	Rp 3/4”	Rp 1”	Rp 1 1/4”	Rp 1 1/2”	Rp 2”
Kv (m³/h)	4	6,3	10	15	25	40

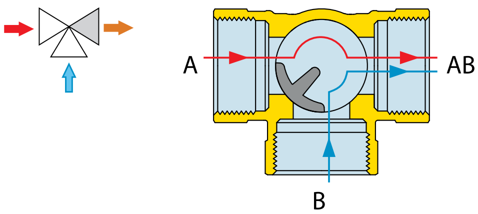
Dimensions

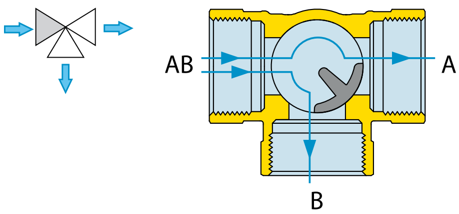


Code	A	B	C	D	E	F	G	Mass with actuator (kg)
610400	Rp 1/2"	61	17.5	72	72	36	36	0.9
610500	Rp 3/4"	61	18.5	72	72	36	36	1.0
610600	Rp 1"	61	20.5	72	82	41	41	1.1
610700	Rp 1 1/4"	64	24.5	72	94	47	47	1.4
610800	Rp 1 1/2"	71	29.5	72	106	53	53	2.0
610900	Rp 2"	73	35.0	72	120	60	60	2.7

Operating principle

610 series valves contain sector obturators, and can have different configurations, depending on the flow directions between the three ports.
If the valve has two inlets and one outlet, it is called a **mixing valve**.
In this configuration, the obturator position various the inlet flows from ports "A" and "B", which are combined into a single outlet flow through the common "AB" port.
This makes it possible to regulate the percentage mix of the inlet flows, passing from a flow completely from port "A" to one completely from port "B". Therefore, the intermediate obturator positions determine the percentage mix of the inlet flows.
If, instead, the valve has one inlet and two outlets, it is called a **diverter valve**. In this operating mode, the flow from the common "AB" port is diverted to the "A" or "B" ports. Therefore, the intermediate obturator positions determine a precise division ratio between the two outlet ports.





Construction details

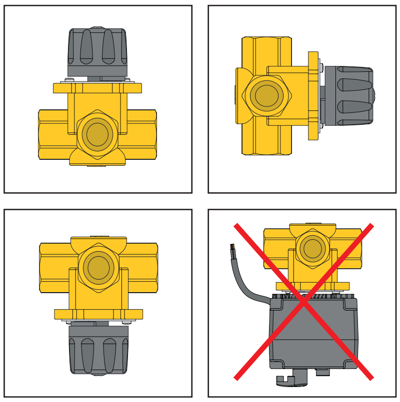
Use at high temperature
The body material, internal components and EPDM seals make it possible to use Caleffi 610 series mixing valves in heating systems with temperatures up to 110 °C.

Possibility of motorization
Caleffi 610 series mixing valves are supplied with manual knobs, but can be motorised using actuators code 637042 and 637044.

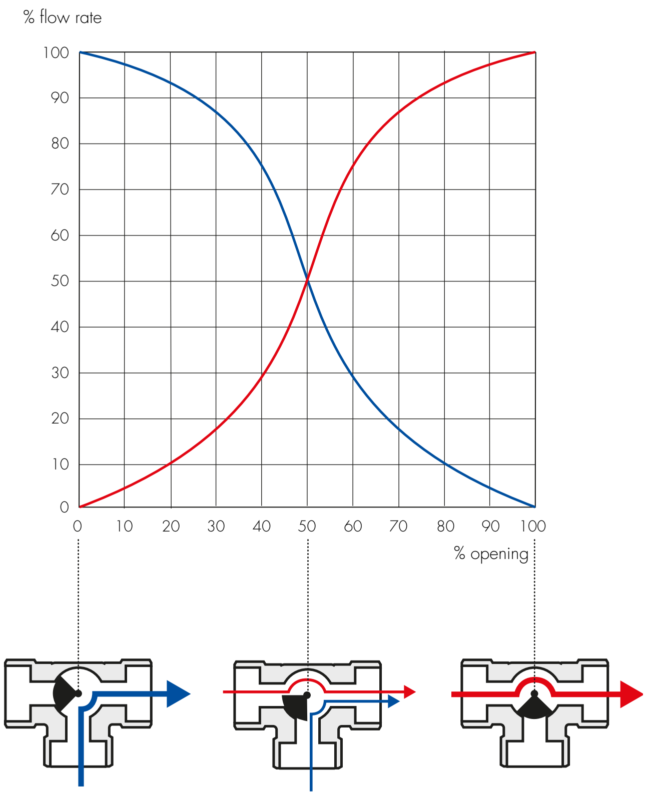
Low actuation torque
610 series mixing valves are designed to reduce internal friction between the valve body and regulation device. This means that only a small actuation torque is needed to turn the internal sector. As a result, the actuators have low power consumption.

Installation

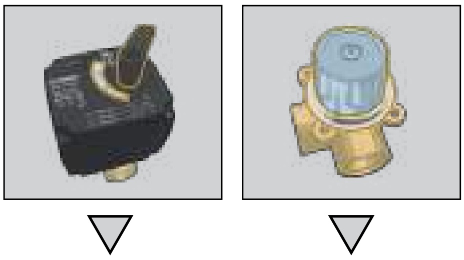
610 series mixing valves with no actuator fitted can be installed in any position.
If there is an actuator, it must not be installed with its stem pointing downwards.



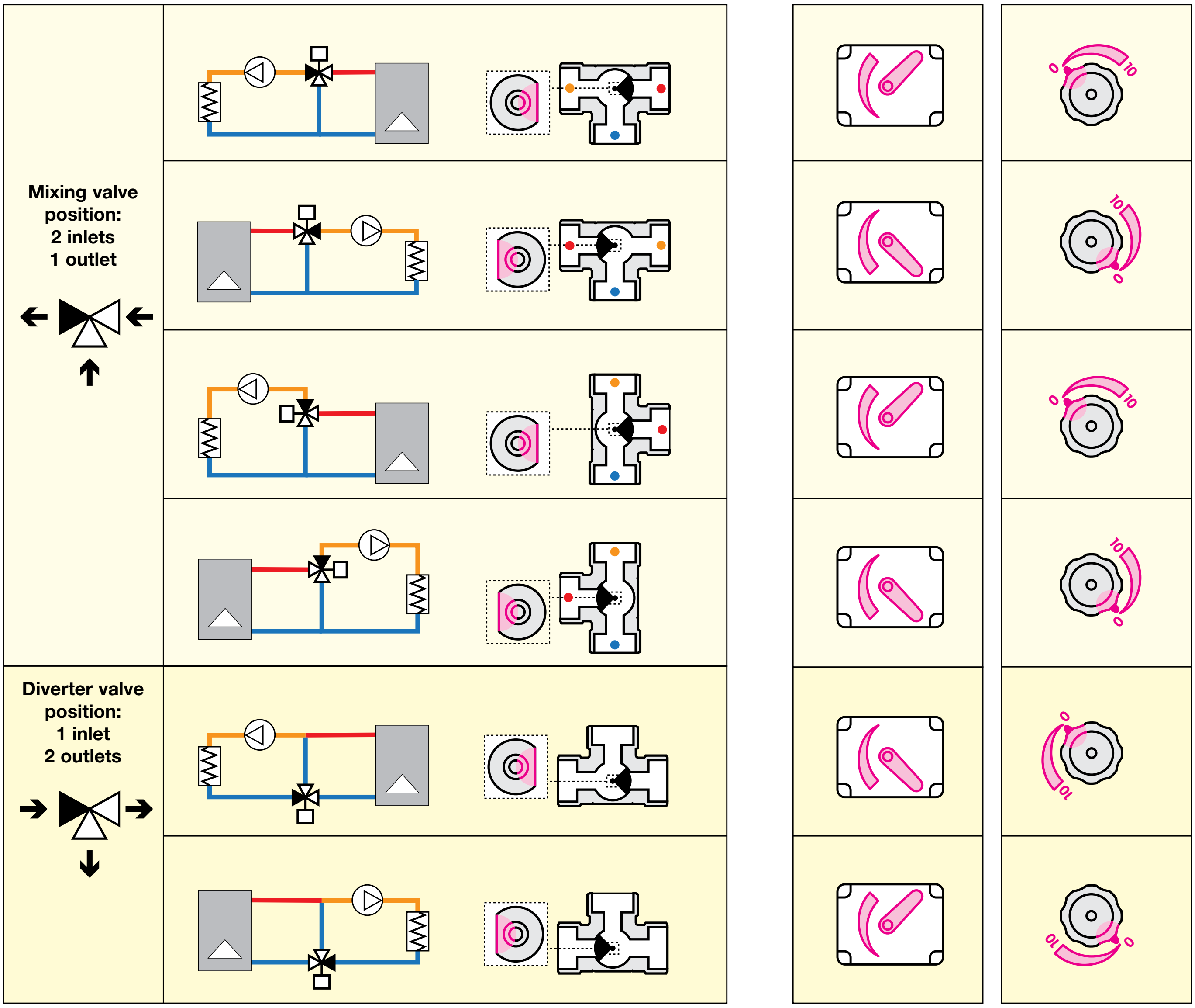
Regulating characteristics



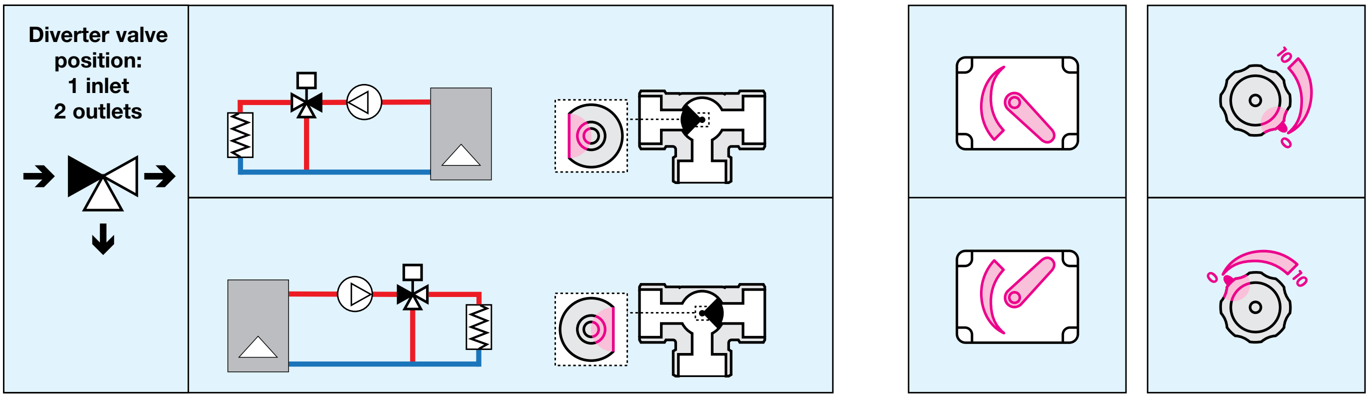
Configurations



MIXING CIRCUIT (temperature control)

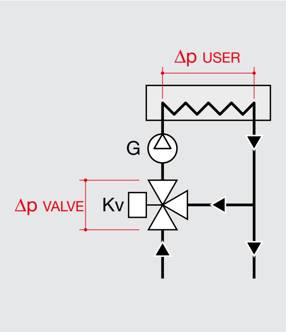


DIVERTING CIRCUIT (flow rate control)



Mixing circuit sizing

Typical diagram



In a mixing circuit, the portion upstream from the three-way valve is usually a zone with negligible Δp (and there is normally a hydraulic separator). Therefore the main pressure drop is due to the three-way valve, giving it regulating authority. For this reason, the three-way valve can be dimensioned by considering an acceptable pressure drop for the user circuit pump, which indicatively may be from 5 % to 15 % of the pressure drop in the user circuit:

$$\Delta p_{VALVE} \cong 0{,}05–0{,}15 \cdot \Delta p_{USER}$$

Expressing the valve pressure drop as a function of the flow rate G and flow coefficient Kv gives the valve sizing relationship:

$$Kv = 0{,}25–0{,}45 \;\; G/\sqrt{100 \cdot \Delta p_{USER}}$$

where: *G = flow rate, l/h*
Δp_{USER} *= pressure drop of all components in the circuit, excluding the valve, kPa*
Kv = valve flow coefficient, m^3/h

Alternatively, the sizing criteria described above can be represented graphically on specific diagrams: each coloured band corresponds to a choice of valve with hydraulic characteristics that are optimal for the design data.

Example

Size a three-way valve for a mixing circuit in a radiant panel system with the following characteristics:

- *Design flow rate: G = 2.000 l/h*
- *User pressure drop: Δp_{USER} = 23 kPa*

Analytical method:

Determine the flow coefficient Kv of the mixing valve:

$$Kv_{MIN} = 0{,}25 \cdot 2000/\sqrt{100 \cdot 23} = 10{,}4 \; m^3/h$$

$$Kv_{MAX} = 0{,}45 \cdot 2000/\sqrt{100 \cdot 23} = 18{,}8 \; m^3/h$$

Therefore the valve is chosen to be 1 1/4" with a coefficient Kv of 15 m^3/h

Ø	Rp 1/2"	Rp 3/4"	Rp 1"	Rp 1 1/4"	Rp 1 1/2"	Rp 2"
Kv (m^3/h)	4	6,3	10	15	25	40

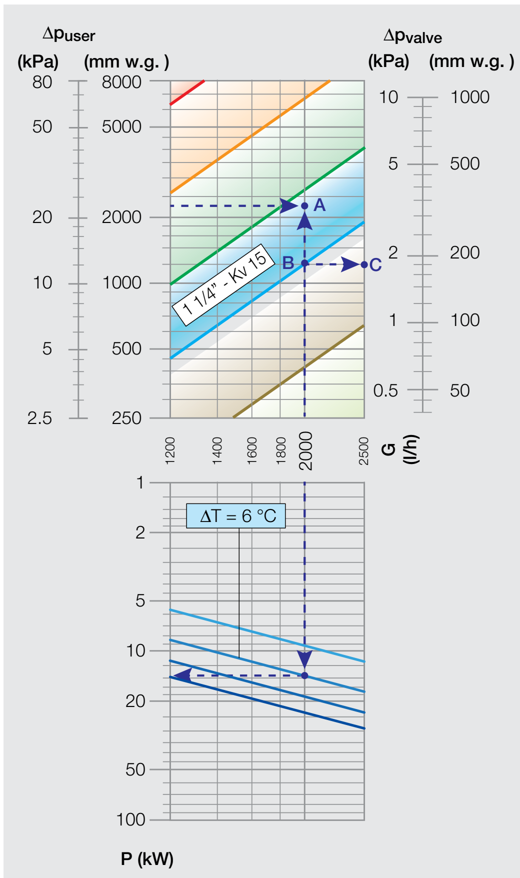
The valve pressure drop is:

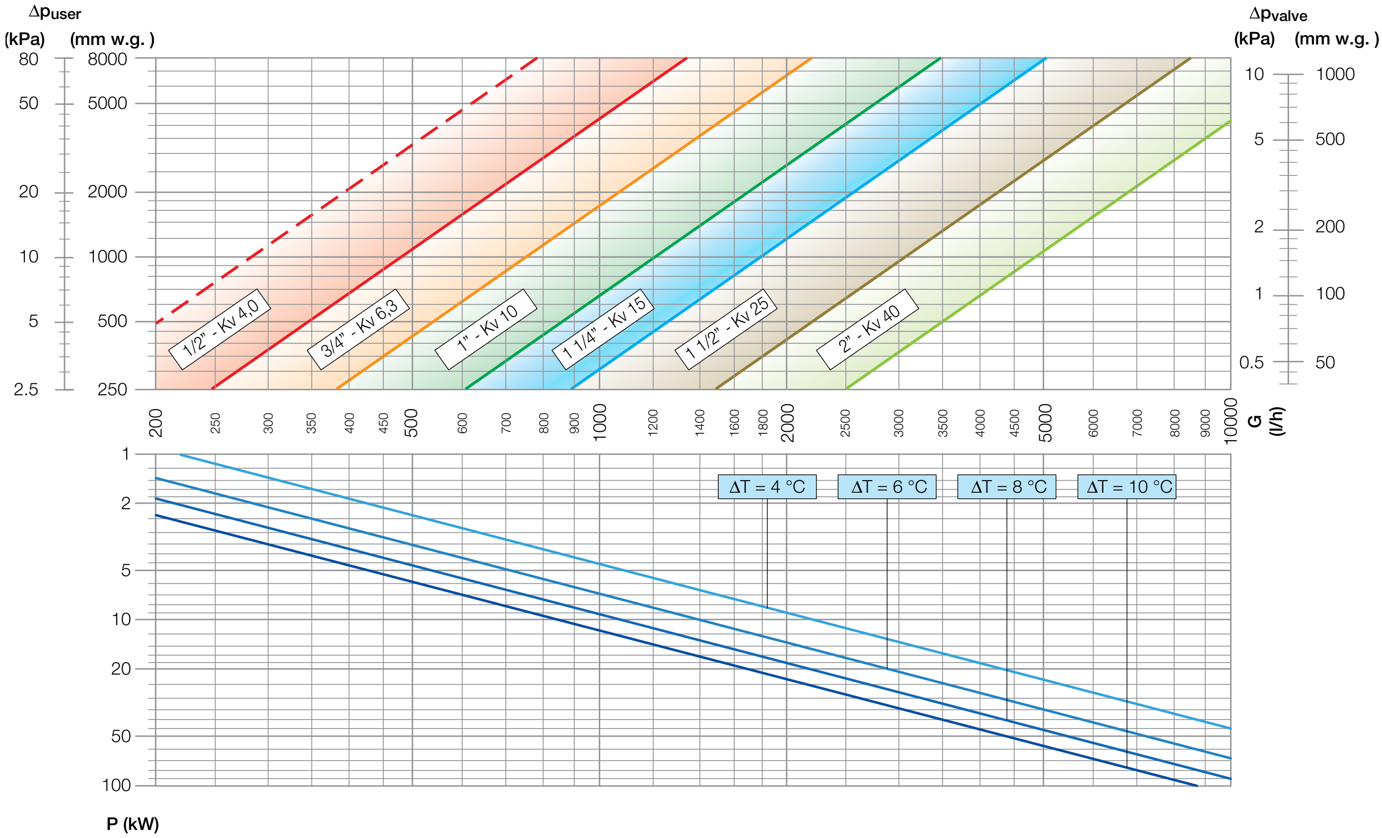
$$\Delta p_{VALVE} = (0{,}01 \cdot G/Kv)^2 = (0{,}01 \cdot 2000/15)^2 = 1{,}8 \; kPa$$

Graphical method:

Alternatively, the graphs to the side can be used.
Intersecting the flow rate G with the pressure drop Δp_{USER} gives point A, which is within the band for the 1 ¼" valve. The valve pressure drop can be obtained by starting from point B (where the flow rate G intersects the curve for the chosen valve) and reading the corresponding value at point C on the relative axis.

It is also possible to obtain the exchanged power from the graph below the chosen graph. In the example, assuming a temperature difference of 6 °C, we can estimate a power of 13,9 kW based on the design flow rate of 2000 l/h.

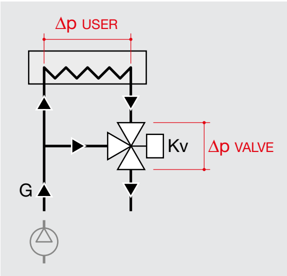




Δp user
(kPa) (mm w.g.)
Δp valve
(kPa) (mm w.g.)
1/2" - Kv 4,0
3/4" - Kv 6,3
1" - Kv 10
1 1/4" - Kv 15
1 1/2" - Kv 25
2" - Kv 40
G (l/h)
ΔT = 4 °C
ΔT = 6 °C
ΔT = 8 °C
ΔT = 10 °C
P (kW)

Diverting circuit sizing

Typical diagram



In these two types of circuit, the two- or three-way diverter valve regulates the flow rate passing through the user circuit. In such cases, it is important to have good authority by dimensioning the regulating valve to ensure that the pressure drop is not too low compared to that of the user circuit. Recommended values for rapid sizing can be chosen considering:

$$\Delta p_{VALVE} \cong 0{,}5 \div 1{,}0 \cdot \Delta p_{USER}$$

Expressing the valve pressure drop as a function of the flow rate G and flow coefficient Kv gives the valve sizing relationship:

$$Kv = 0{,}10 \div 0{,}15 \ \ G/\sqrt{100 \cdot \Delta p_{USER}}$$

where: *G = flow rate, l/h*
Δp_{USER} = pressure drop of all components in the circuit, excluding the valve, kPa.
Kv = valve flow coefficient, m^3/h

Alternatively, the sizing criteria described above can be represented graphically on specific diagrams: each coloured band corresponds to a choice of valve with hydraulic characteristics that are optimal for the design data.

Example

Size a three-way valve to control the power of a heat exchanger with the following characteristics:

- *User heating capacity: P = 50 kW*
- *User temperature difference: ΔT = 10 °C*
- *User pressure drop: Δp_{USER} = 30 kPa*

Analytical method:

Determine the nominal flow rate from the power and temperature difference:
G = P · 860/ΔT = 50 · 860/10 = 4300 l/h

Determine the flow coefficient Kv of the diverter valve:

$$Kv_{MIN} = 0{,}10 \cdot 4300/\sqrt{100 \cdot 30} = 7{,}9 \ m^3/h$$

$$Kv_{MAX} = 0{,}15 \cdot 4300/\sqrt{100 \cdot 30} = 11{,}8 \ m^3/h$$

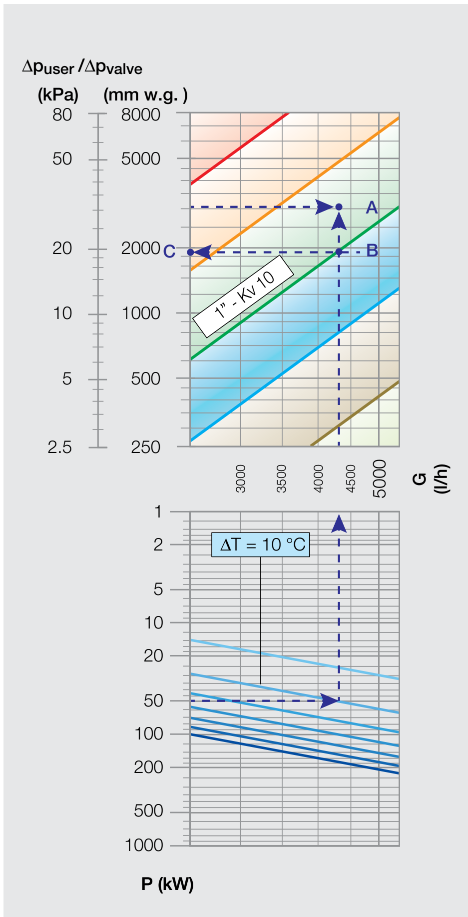
Therefore the valve is chosen to be 1" with a coefficient Kv of 10 m^3/h.

Ø	Rp 1/2"	Rp 3/4"	Rp 1"	Rp 1 1/4"	Rp 1 1/2"	Rp 2"
Kv (m^3/h)	4	6,3	10	15	25	40

The valve pressure drop is:
$\Delta p_{VALVE} = (0{,}01 \cdot G/Kv)^2 = (0{,}01 \cdot 4300/10)^2 = 18{,}5$ kPa

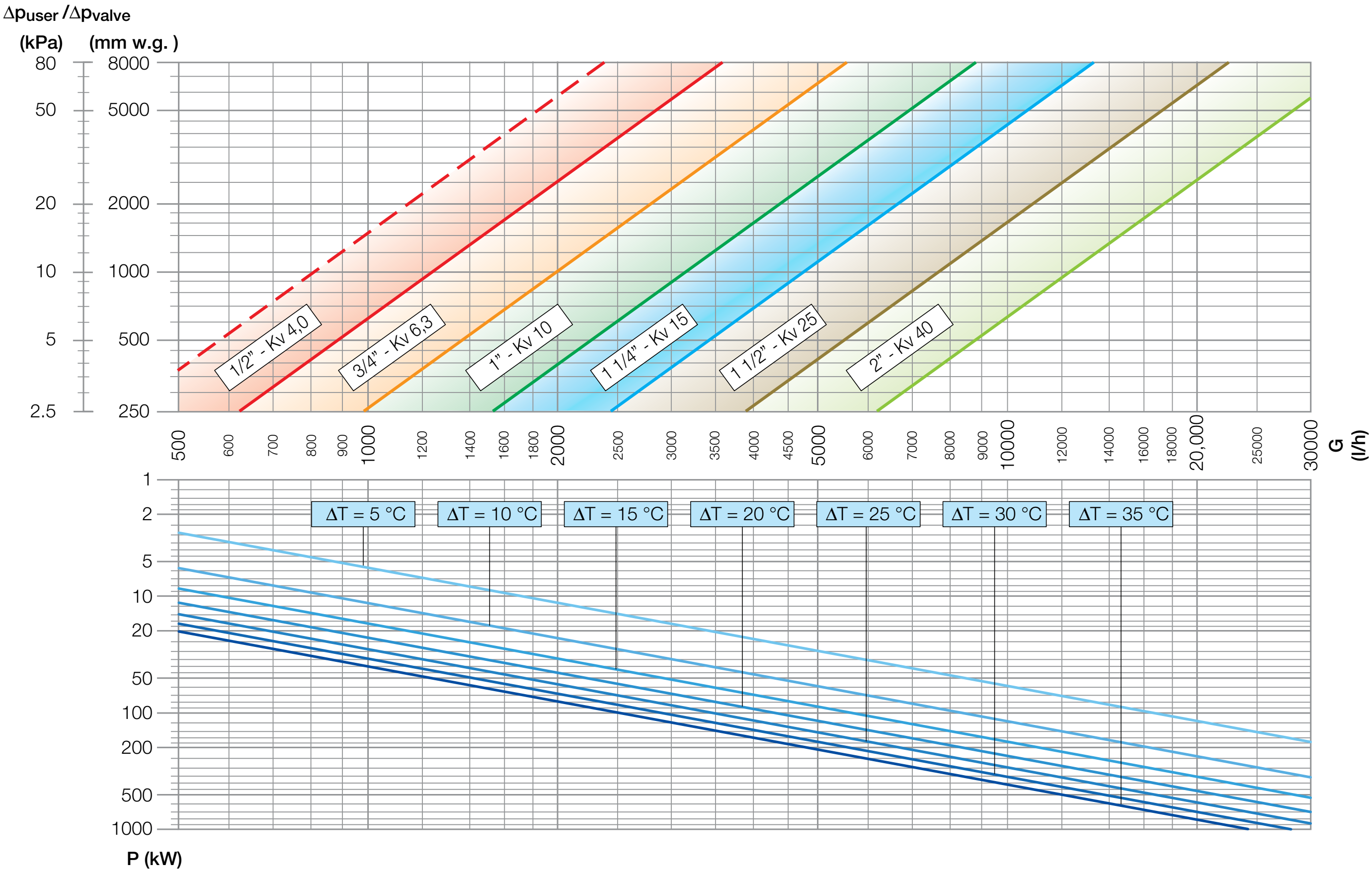
The authority can be calculated for the chosen diverter valve using the specific formula:
$a = \Delta p_{VALVE} / (\Delta p_{VALVE} + \Delta p_{USER})$

$a = 18{,}5/(18{,}5+30) = 0{,}38$



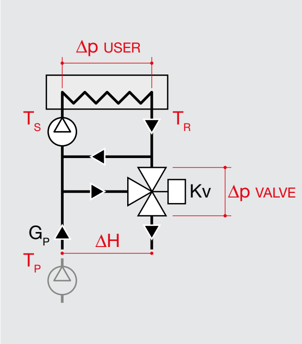
Graphical method:

The design flow rate can be obtained from the graph below the sizing graph by finding the 50 kW heating capacity point on the line that corresponds to a temperature difference of 10 °C. Then find point A that corresponds to the pressure drop Δp_{USER} within the band for the chosen 1" valve.
The valve pressure drop can be obtained from point B (where the flow rate G intersects the chosen valve) and reading the corresponding value at point C on the same axis.


Δpuser /Δpvalve
(kPa)
(mm w.g.)
80
50
20
10
5
2.5
8000
5000
2000
1000
500
250
1/2" - Kv 4,0
3/4" - Kv 6,3
1" - Kv 10
1 1/4" - Kv 15
1 1/2" - Kv 25
2" - Kv 40
500
600
700
800
900
1000
1200
1400
1600
1800
2000
2500
3000
3500
4000
4500
5000
6000
7000
8000
9000
10000
12000
14000
16000
18000
20,000
25000
30000
G
(l/h)
ΔT = 5 °C
ΔT = 10 °C
ΔT = 15 °C
ΔT = 20 °C
ΔT = 25 °C
ΔT = 30 °C
ΔT = 35 °C
1
2
5
10
20
50
100
200
500
1000
P (kW)

Injection circuit sizing

Typical diagram



In an injection circuit, the by-pass line separates the user circuit from the primary circuit in which the three-way valve is installed. Moreover, this circuit must always have an upstream pump in order to work. The correct authority value must be considered when dimensioning in order to ensure effective temperature regulation of the flow to the user circuit. The valve pressure drop must therefore not be too low compared to the available head ΔH upstream from the circuit. Recommended values for rapid sizing can be chosen considering:

$$\Delta p_{VALVE} \cong 0,5\text{–}1,0 \cdot \Delta H$$

Expressing the valve pressure drop as a function of the flow rate G_p and flow coefficient Kv_{VALVE} gives the valve sizing relationship:

$$Kv = 0,10\text{–}0,15 \;\; G_P / \sqrt{100 \cdot \Delta H}$$

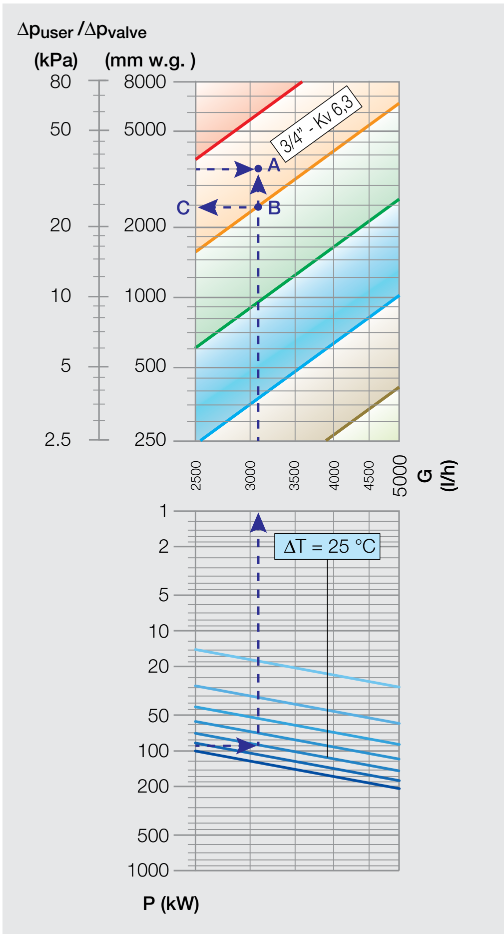
where: G_P = *flow rate in the primary circuit, l/h*
ΔH = *available head upstream from the circuit, kPa*
Kv = *valve flow coefficient, m^3/h*

Alternatively, the sizing criteria described above can be represented graphically on specific diagrams: each coloured band corresponds to a choice of valve with hydraulic characteristics that are optimal for the design data.

Example

Size a three-way valve to control the flow temperature for an injection circuit with the following characteristics:

- *Primary circuit flow temperature: T_P = 70 °C*
- *Secondary circuit flow temperature: T_S = 50 °C*
- *Heating capacity: P = 90 kW*
- *Available head: ΔH = 35 kPa*
- *Return temperature: T_R = 45 °C*



Analytical method:

Determine the temperature difference on the primary circuit:

$\Delta T = T_P - T_R = 70 - 45 = 25$ °C

Determine the flow rate in the primary circuit:

$G_P = P \cdot 860/\Delta T = 90 \cdot 860/25 = 3096$ l/h

Determine the flow coefficient Kv of the valve:

$$Kv_{MIN} = 0,10 \cdot 3096/\sqrt{100 \cdot 35} = 5,2 \; m^3/h$$

$$Kv_{MAX} = 0,15 \cdot 3096/\sqrt{100 \cdot 35} = 7,8 \; m^3/h$$

Therefore the valve is chosen to be 3/4" with a coefficient Kv of 6.3 m^3/h

Ø	Rp 1/2"	Rp 3/4"	Rp 1"	Rp 1 1/4"	Rp 1 1/2"	Rp 2"
Kv (m^3/h)	4	6,3	10	15	25	40

The valve pressure drop is:

$\Delta p_{VALVE} = (0,01 \cdot G/Kv)^2 = (0,01 \cdot 3096/6.3)^2 = 24,1$ kPa

The authority can be calculated for the chosen valve using the specific formula:

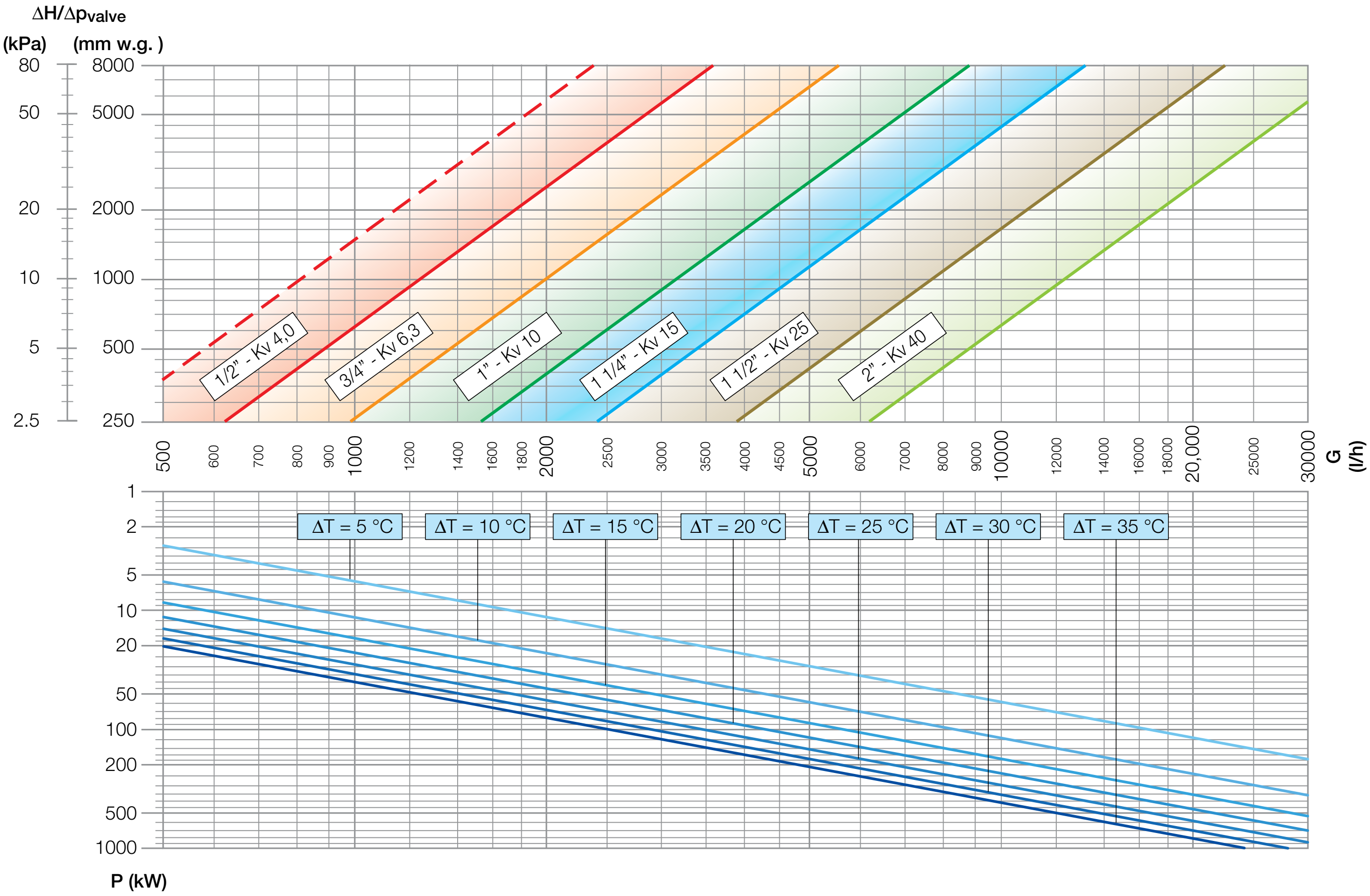
$a = \Delta p_{VALVE} / (\Delta p_{VALVE} + \Delta p_{USER})$

$a = 24,1 / (24,1 + 35) = 0,40$

Graphical method:

The design flow rate can be obtained from the graph below the dimensioning graph by finding the 90 kW heating capacity point on the line that corresponds to a temperature difference of 25 °C. Then find point A that corresponds to the pressure drop ΔH within the band for the chosen 3/4" valve.

The valve pressure drop can be obtained from point B (where the flow rate G_p intersects the chosen valve) and reading the corresponding value at point C on the same axis.



ΔH/Δpvalve
(kPa)
(mm w.g.)
80
50
20
10
5
2.5
8000
5000
2000
1000
500
250
1/2" - Kv 4,0
3/4" - Kv 6,3
1" - Kv 10
1 1/4" - Kv 15
1 1/2" - Kv 25
2" - Kv 40
500
600
700
800
900
1000
1200
1400
1600
1800
2000
2500
3000
3500
4000
4500
5000
6000
7000
8000
9000
10000
12000
14000
16000
18000
20,000
25000
30000
G
(l/h)
ΔT = 5 °C
ΔT = 10 °C
ΔT = 15 °C
ΔT = 20 °C
ΔT = 25 °C
ΔT = 30 °C
ΔT = 35 °C
1
2
5
10
20
50
100
200
500
1000
P (kW)

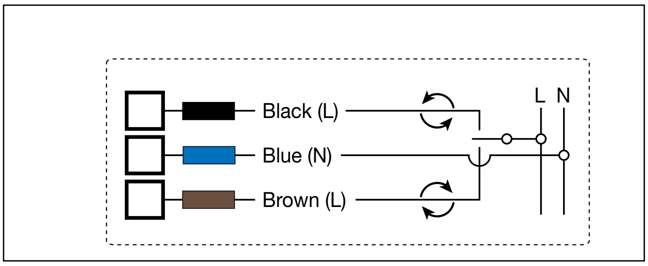
Actuator wiring diagrams

6370

tech. broch. 01353

Actuator for 610.00 code mixing valves from 1/2” to 2”.
Electric supply: **230 V** - 50 Hz.
Control signal: **Three-point**.
Power consumption: 6 VA.
Protection class: IP 44.
90° rotation.
Operating time: 150 s.
Ambient temperature range: 0–55 °C.
Storage temperature range: -10–70 °C.
Supply cable length: 1.5 m.

Code	Voltage V	Motor torque (N·m)
637042	230	5

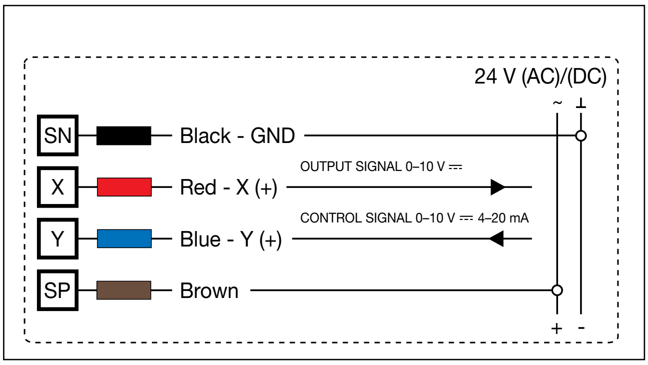


6370

tech. broch. 01353

Actuator for 610.00 code mixing valves from 1/2” to 2”.
Electric supply: **24 V**.
Control signal: **0–10 V**.
Power consumption: 6 VA.
Protection class: IP 44.
90° rotation.
Operating time: 75 s.
Ambient temperature range: 0–55 °C.
Storage temperature range: -10–70 °C.
Supply cable length: 1.5 m.

Code	Voltage V	Motor torque (N·m)
637044	24	5



Accessories

161

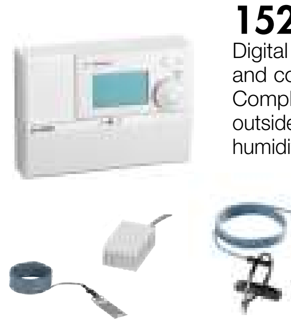
Digital regulator with functional synoptic diagram for heating and cooling complete with immersion flow probe and Ø 6 mm PT1000 return probe (pocket to be chosen according to the pipe).
Optional climatic probe.
Adjustment temperature range: 5–95 °C.
Electric supply: 230 V - 50/60 Hz.
Control signal: Three-point.
Protection class: IP 20 / EN 60529.
Probe cable length: 1.5 m.

Code
161010

1520

Digital climate regulator complete with flow contact probes and outside temperature probe.
Adjustment range: 20–90 °C.
Electric supply: 230 V - 50/60 Hz.
Control signal: Three-point.
Protection class: IP 40.

Code	
152001	with 1 channel
152002	with 2 channels
152003	with 3 channels



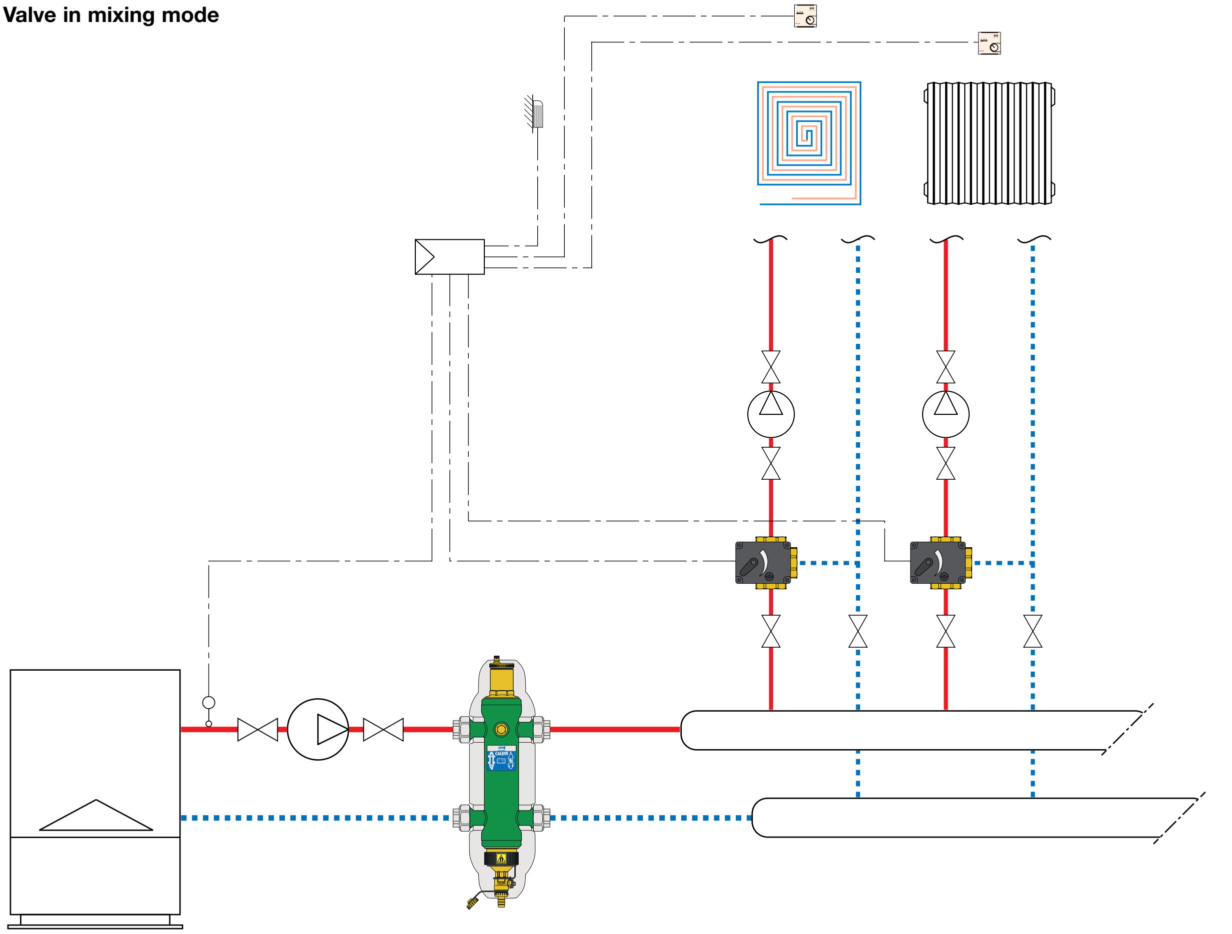
1520

Digital temperature controller for heating and cooling.
Complete with flow temperature probe, outside temperature probe and relative humidity limit probe.
Electric supply: 230 V - 50/60 Hz.
Control signal: Three-point.
Power consumption: 5.5 VA.
Protection class: IP 40.

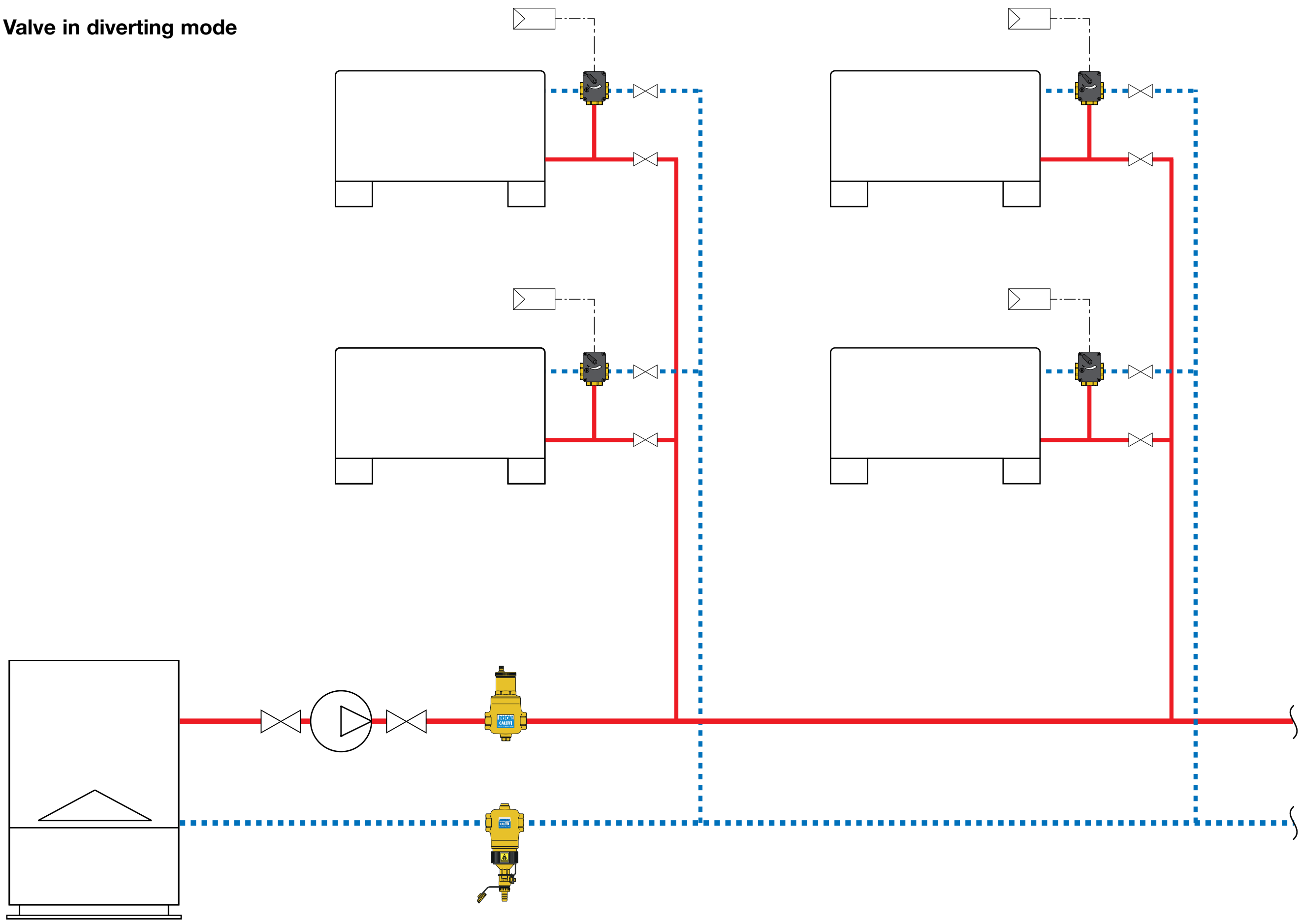
Code	
152021	1 channel

Application diagrams

Valve in mixing mode



Valve in diverting mode



SPECIFICATION SUMMARY

610 series

Three-way sector mixing valve with manual control. Threaded connections Rp 1/2” (Rp 1/2”–Rp 2”). Brass body. PA6-GF30 knob. EPDM, FKM seals. Medium: water, glycol solutions. Max. percentage of glycol 50 %. Working temperature range 5–110 °C. Maximum working pressure 10 bar. Maximum differential pressure 1 bar in mixing mode (2 bar in diverting mode). Seepage (Δp=1 bar): < 0,1 % Kvs. Can be motorized.

Code 637042

Actuator for 610.00 code mixing valves from 1/2” to 2”. Electric supply 230 V - 50 Hz. Control signal: Three-point. Power consumption 6 VA. Protection class IP 44. 90° rotation. Operating time 150 s. Maximum torque 5 N·m. Supply cable length 1,5 m. Ambient temperature range 0–55 °C. Maximum humidity: 80 %. Medium temperature range 5–110 °C.

Code 637044

Actuator for 610.00 code mixing valves from 1/2” to 2”. Electric supply 24 V (AC)/(DC). Control signal: 0–10 V, 0(4)–20 mA, 0–5 V, 5–10 V. Power consumption 6 VA. Protection class IP 44. 90° rotation. Operating time 75 s. Maximum torque 5 N·m. Supply cable length 1,5 m. Ambient temperature range 0–55 °C. Maximum humidity: 80 %. Medium temperature range 5–110 °C.

We reserve the right to make changes and improvements to our products and the related technical data in this publication, at any time and without prior notice.

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