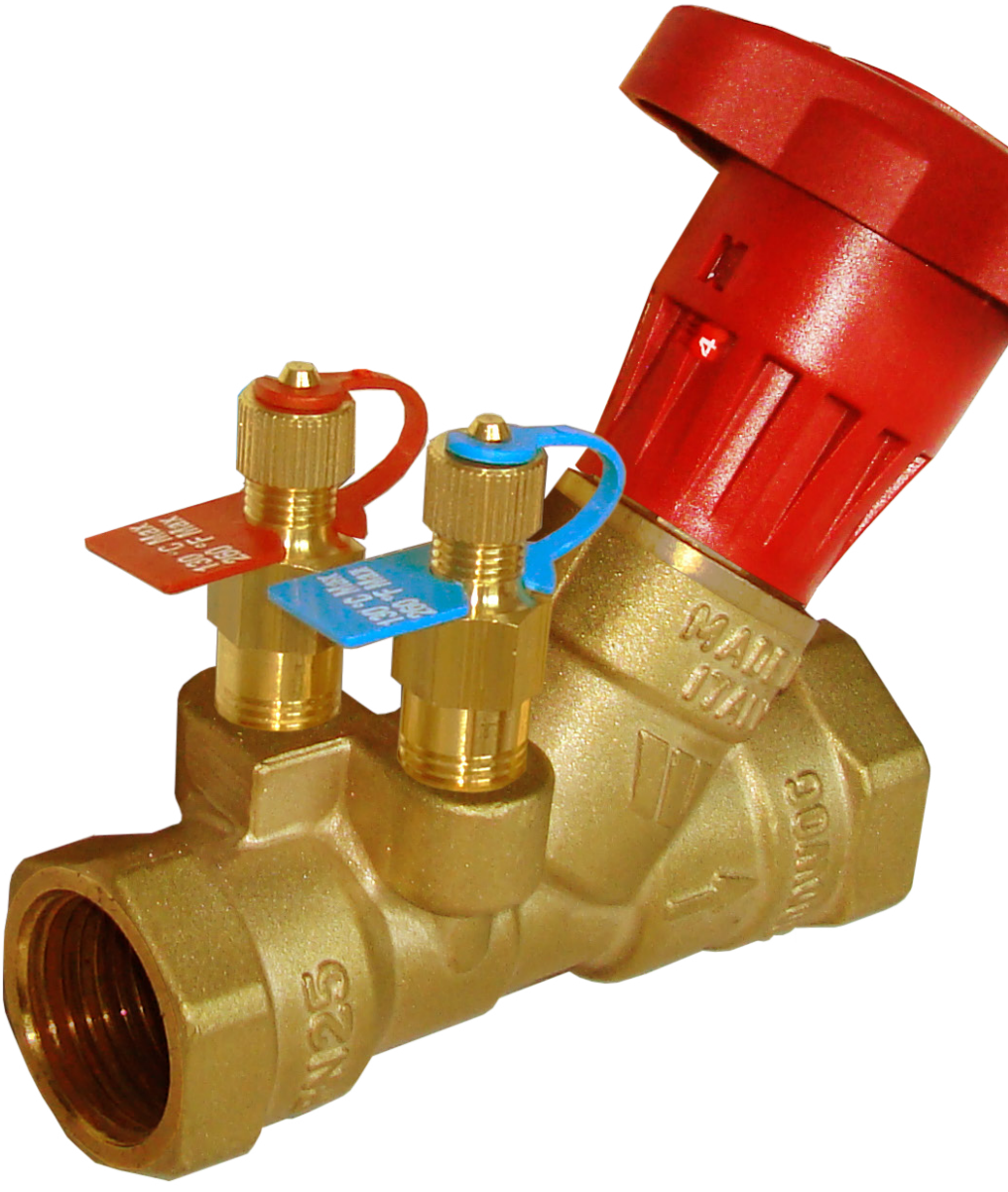
FO-BV Series

Fixed-orifice balancing and control valves

Technical Data Sheet



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Description

FO-BV Series fixed-orifice threaded valves are designed for flow control and monitoring in climate control and domestic hot or cold water distribution systems. By connecting a BVT-SET Series measuring instrument or differential pressure gauge to the connections on the valve body in the vicinity of the Venturi insert, these valves can be used as a diagnostic tool for monitoring system performance (flow rate, pressure).

FO-BV

Fixed-orifice balancing and control valve with threaded connections for heating, cooling and domestic water systems.
Shut-off function, pre-setting function with 40 positions visible on the handwheel, and flow rate and differential pressure measuring function.
DZR (CW602N) brass valve body, PTFE gasket.
Accuracy KVs ± 3% (tested to BS 7350).
Fluid temperature from -10÷20°C(temperatures below 0°C or above 100°C only for water with anti-freeze and anti-boil added to it).
Max. pressure 25 bar up to 110°C (20 bar at 120°C).
Female threaded connections: ISO 228/1 for 1/2" and 3/4"; EN 10226/1 RP from 1" to 2".

Type	Part No.	DN	Kvs	Kvs tp	Flow rate [l/min]	Weight (kg)
FO-BV	FO-BV015	15	1.92	2.80	3.7-8.9	0.55
FO-BV	FO-BV020	20	3.67	5.33	8.3-19.5	0.62
FO-BV	FO-BV025	25	6.24	9.72	15.5-36.2	0.75
FO-BV	FO-BV032	32	12.54	20.25	32.4-75.0	1.19
FO-BV	FO-BV040	40	19.59	30.23	48.6-112.8	1.45
FO-BV	FO-BV050	50	29.72	55.07	91.2-210.6	2.06

Kvs = volumetric flow coefficient of valve
Kvs tp = volumetric flow coefficient at the test points

The key feature of **FO-BV Series** fixed-orifice balancing valves is their measurement accuracy. This derives from the Venturi insert, which ensures a maximum deviation of just ± 3% between rated and measured Kvs.

Technical features	
Maximum pressure	25 bar for -10°C < T < 110°C 20 bar for T = 110°C-120°C
Fluid operating temperature	-10÷20°C
FF threaded connections	ISO 228/1 for 1/2" and 3/4" EN 10226/1 RP from 1" to 2"
Kv accuracy	± 3%

Materials	
Body	DZR-CW602N brass
Venturi insert	DZR-CW602N brass
Disc	DZR-CW602N brass
Stem	DZR-CW602N brass
Disc seal	PTFE
Stem seal	EPDM
Handwheel	PA6 + 30% fibreglass and POM

Application

All distribution networks, even the simplest, are made up of different branches, whose flow rates need to be defined at the design stage and must then correspond to the values calculated in the course of operation.

In an unbalanced system (Fig.1), the flow rate to the circuits nearest the pump is too high, while the flow rate to the circuits furthest from the pump is too low. The resulting temperature differences between different rooms not only detract from comfort but also increase energy consumption. The use of thermostatic or control valves in this situation can cause noise.

The installation and correct setting of **FO-BV Series** balancing and control valves (Fig.2) on boiler room manifolds, at the bottom of risers and upstream of heat production and exchange units or zones ensures correct flow distribution, thus offering immediate benefits in terms of comfort and energy saving, as well as optimising the efficiency of the control system.

FO-BV Series valves also act as shut-off valves. **FO-BV Series** valves are particularly recommended for use in heating, cooling and domestic water distribution systems.

Fig. 1

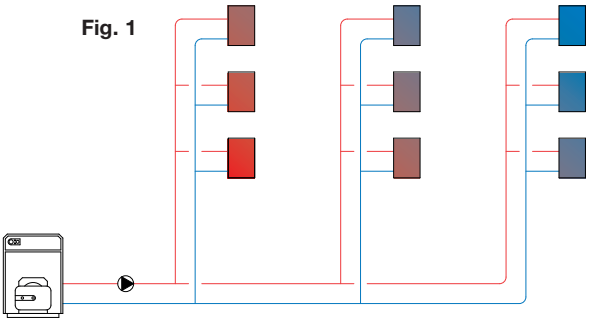
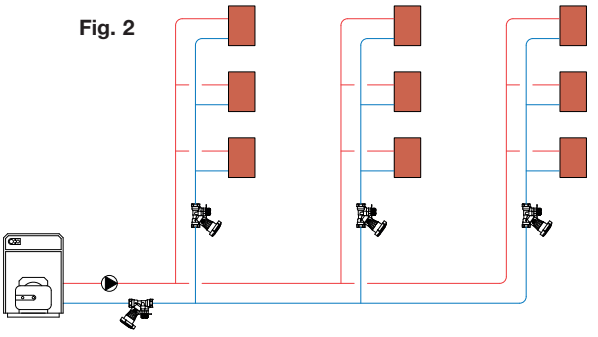


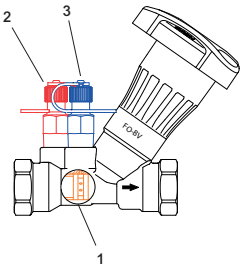
Fig. 2



Operation

FO-BV Series fixed-orifice balancing valves (Fig.1) are based on the measuring principle that makes use of the Venturi effect. They are equipped with a calibrated-orifice insert of known Kvs (1) connected to the high pressure (2) and low pressure (3) test points. By measuring the differential pressure ΔP (in bar) at the two test points, it is therefore possible to calculate the fluid flow rate Q (in m³/h) using the formula:

$$Q = Kvs \cdot \sqrt{\Delta p}$$

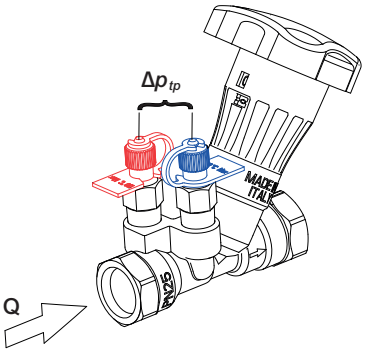


Measurement of flow rates

The easiest way to measure pressures and flow rates is to connect a **BVT-SET Series** measuring instrument and read the values shown on the digital display. Alternatively, you can measure the pressure at the test points and then use the formula or flow curve shown below. Kvs tp is the volumetric flow coefficient at the test points corresponding to the Kvs of the Venturi insert:

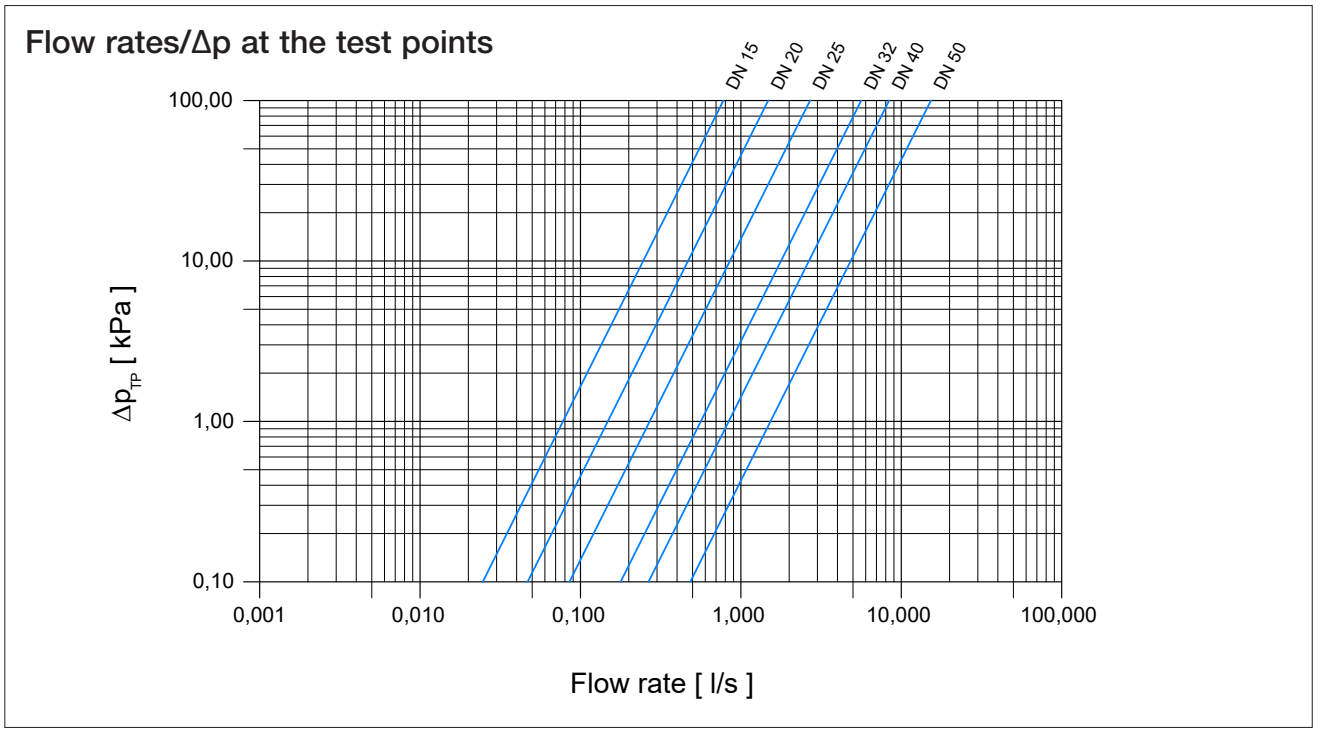
$$Q = \frac{Kvs_{tp} \cdot \sqrt{\Delta p_{tp}}}{36} \quad [\,l/s]$$

DN	Ksv tp
15	2.80
20	5.33
25	9.72
32	20.25
40	30.23
50	55.07



The minimum flow rate that can be measured for each DN can be calculated as the minimum Δp that can be measured at the test points by the differential pressure gauge.

Chart



Sizing

Where the pressure drop (Δp) to be balanced and the design flow are known, use the flow curve or formula shown below:

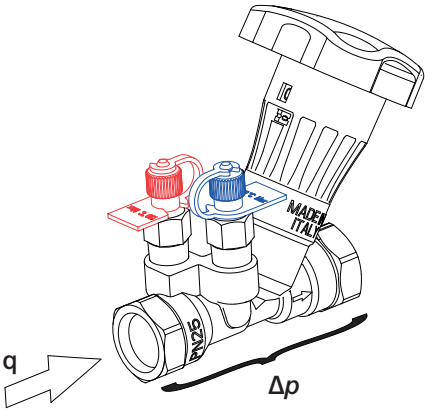
$$Kv = \frac{q}{\sqrt{\Delta p}}$$

where:
Kv = volumetric flow coefficient
q = flow rate in m^3/h
Δp = pressure drop to be balanced in bar

The following can be determined from the above:

$$Kv = 0.01 \times \frac{q}{\sqrt{\Delta p}}$$ if q is expressed in l/h and Δp in kPa

$$Kv = 36 \times \frac{q}{\sqrt{\Delta p}}$$ if q is expressed in l/s and Δp in kPa



HANDWHEEL position	Kv (m³/h Δp =1 bar) DN15	DN20	DN25	DN32	DN40	DN50
0.5	0.41	0.41	1.47	2.56	2.72	5.36
0.7	0.41	0.47	1.73	2.92	3.12	6.54
1.0	0.53	0.58	2.09	3.42	3.69	8.35
1.3	0.62	0.70	2.44	3.88	4.29	10.54
1.5	0.70	0.78	2.70	4.18	4.82	12.37
1.7	0.78	0.86	3.01	4.54	5.71	14.39
2.0	0.86	0.97	3.57	5.42	7.78	17.45
2.3	0.95	1.08	4.18	6.76	10.45	20.20
2.5	1.02	1.20	4.57	7.92	12.29	21.73
2.7	1.14	1.40	4.87	9.05	14.13	23.06
3.0	1.38	1.94	5.27	10.56	16.34	24.84
3.3	1.63	2.54	5.61	11.58	17.88	26.44
3.5	1.76	2.93	5.74	12.06	18.63	27.44
3.7	1.83	3.24	5.88	12.40	19.17	28.42
4.0	1.89	3.51	6.14	12.54	19.59	29.72
4.4	1.92	3.67	6.24	-	-	-

You can use the flow curve to calculate the setpoint position, provided that two of the following three variables are known: flow rate, pressure drop to be balanced and valve Kv.

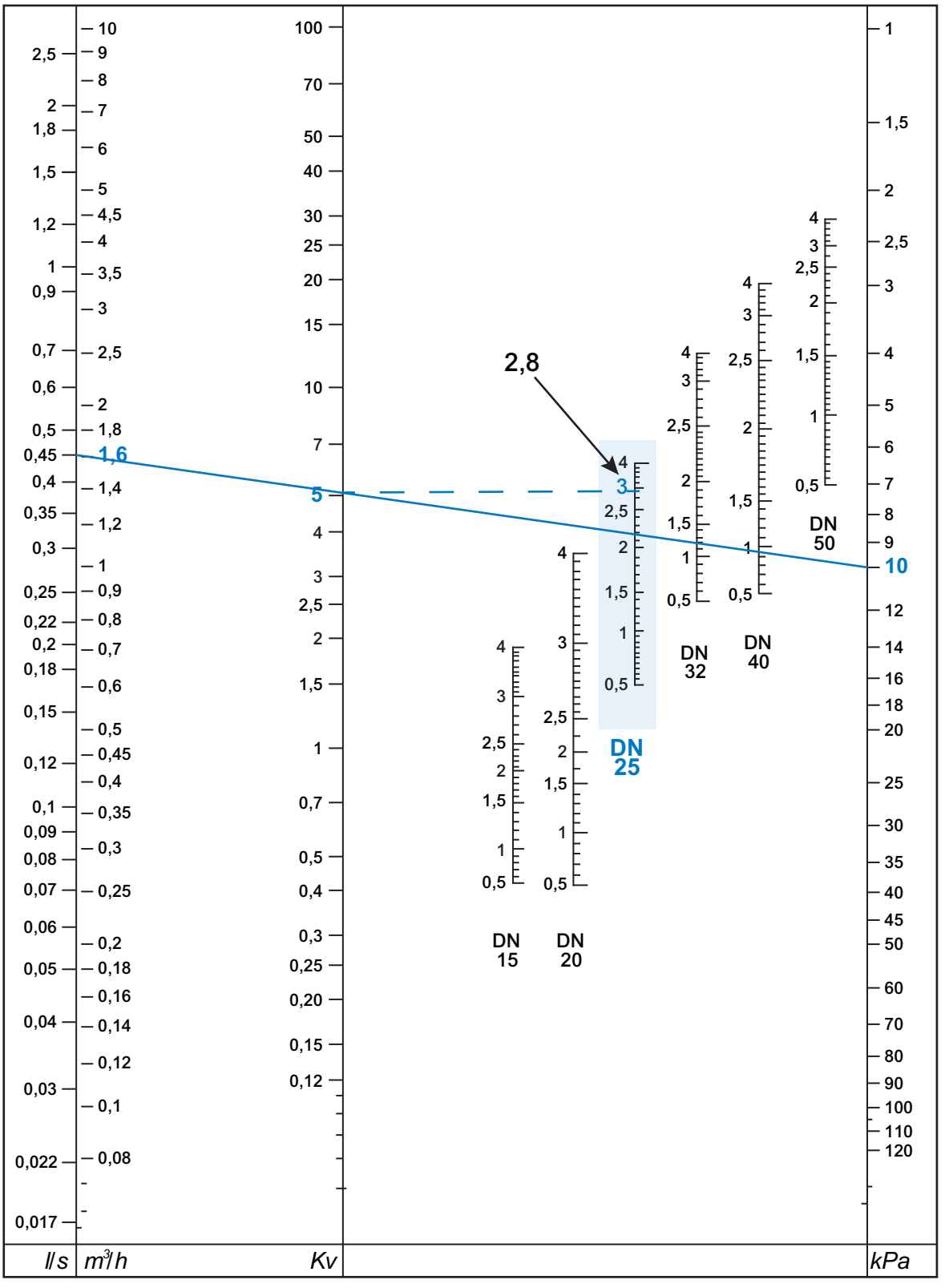
Worked example of how to use the flow curve

Calculate the setpoint to assign to a DN 25 valve with a flow rate of 1.6 m³/h and a pressure drop of 10 kPa.

Solution:

Draw a line between 1.6 m³/h and 10 kPa. The resulting Kv=5.

From this point, draw a horizontal line that meets the DN 25 column. Your line will meet this column at the point corresponding to 2.8 turns.



Setting

To set a valve, to 2.8 turns for example, and obtain a given pressure drop (calculated either analytically or from the flow curve), proceed as follows:

1. Fully close the valve (Fig. 1)
2. Open the valve by 2.8 turns (Fig. 2)
3. Fully tighten the internal stem using a 3 mm hex wrench
4. The valve is now set.

The setpoint is shown on a primary scale (full turn – against a red background) and a secondary scale (tenths of a turn - against a neutral background).
To check that the pre-setting value is correct, close the valve; the indicator should show 0.0.
Now open the valve fully; the indicator should show the setpoint, in this case 2.8 (Fig. 2).
For correct valve selection and pre-setting (pressure drop), consult the flow curve, which shows the pressure drop at various setpoints and flow rates for all valve sizes.
The valve reaches its fully open position after 4 turns (Fig. 3), so turning the handwheel further will not increase the flow rate.

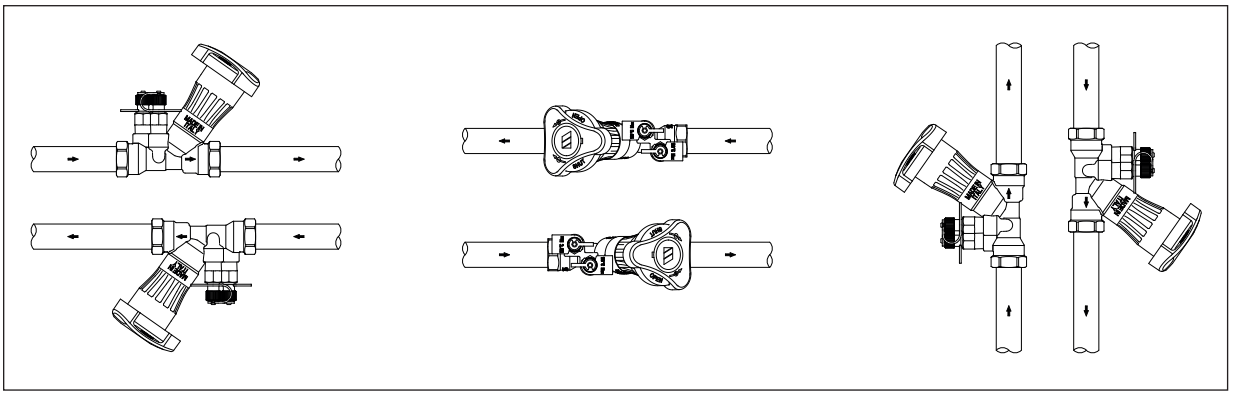
Fig. 1
Valve closed 0.0

Fig. 2
Valve open by 2.8 turns

Fig. 3
Valve fully open by 4.0 turns

Installation

The valve can be installed in any position in relation to the pipe, provided it complies with the direction of fluid flow shown by the arrow cast into the valve body.

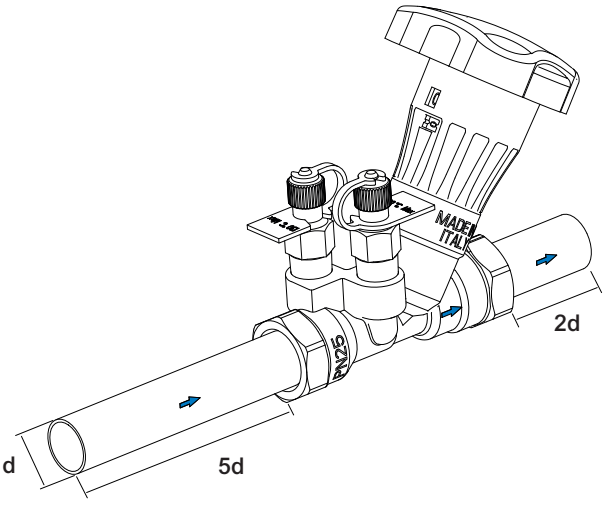


For more accurate readings, it is also advisable to:

- use valves with the same DN as the pipe on which they are to be installed;
- allow a straight run of pipe of at least 5 times the pipe diameter on the upstream side, and at least 2 times the pipe diameter on the downstream side;
- when installing the valve immediately downstream of a pump, double these distances (10d upstream and 4d downstream).

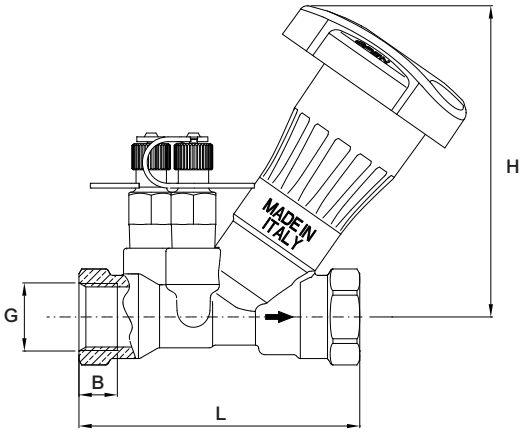
Important

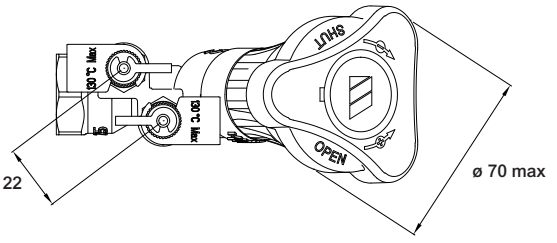
Install the balancing valves in such a way that the setpoint indicator is clearly visible and there is enough space to connect the **BVT-SET Series** measuring instrument to the test points.



Overall dimensions (mm)

FO-BV





DN	G	H	L	B
15	1/2”	98	87	17.5
20	3/4”	98	95.9	19.0
25	1”	98	100.0	22.5
32	1” 1/4	118.3	117.5	24.8
40	1” 1/2	120.4	120.7	24.8
50	2”	130.6	145.3	29.2

Specification text

FO-BV Series

Fixed-orifice balancing and control valve **FO-BV Series** – WATTS brand – with female threaded connections from DN15 to DN50 for heating, cooling and domestic water systems.

Shut-off function, pre-setting function with 40 positions on numerical indicator in the handwheel, and diagnosis using a computerised instrument (BVT-SET) on self-sealing pressure test points. Mechanical memory of the setpoint position. DZR (CW602N) brass valve body, PTFE seal. Nominal pressure 25 bar (up to 110°C), 20 bar (at 120°C). Operating temperature range: from -10÷120°C.

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