

Ballorex Dynamic



Description

The Ballorex Dynamic valve is a combined pressure independent flow limiter and control valve which maintains a constant flow independently of pressure changes in heating or cooling systems.

Installed with an actuator the Ballorex Dynamic combines an automatic flow limiter and a two-way control valve. Having full control authority the valve reacts instantly and adjusts the flow according to the Building Management System (BMS) or room thermostat signal.

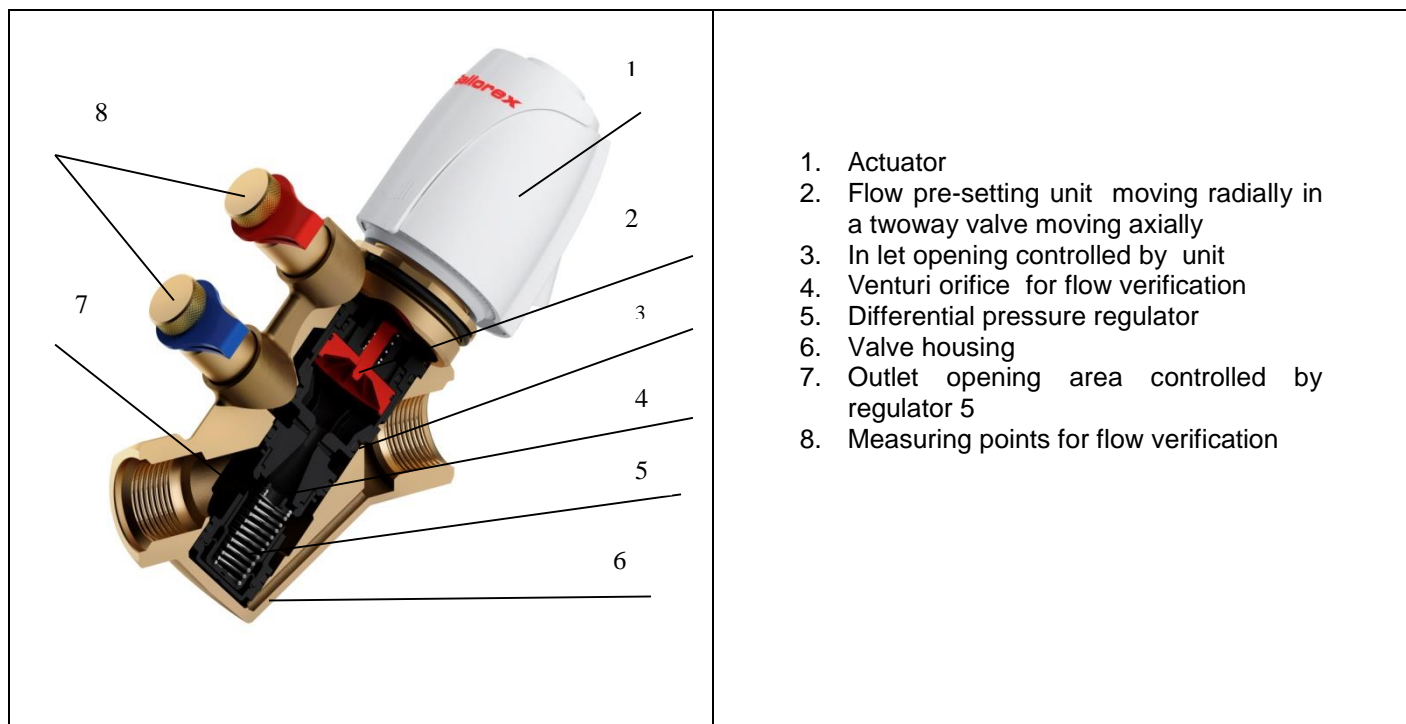
Versions

Dimensions	DN15, DN20, DN25 DN32, DN40, DN50
Flow	L (Low), S (Standard), H (High)

Benefits

- Automatic balancing
- Direct flow measuring of actual flow by the use of built-in Venturi nozzle
- Easy system error detection by actual flow verification
- Always 100% valve authority for perfect flow control as full stroke is independent of pre-setting
- Installation in any position and directly onto bends, reducers and flexible pipes
- No overflows and no unnecessary energy consumption
- Better thermal comfort
- High flow control accuracy with only $\pm 7\%$ tolerance
- Commissioning not needed
- Easy valve selection
- Colour coded cartridges for easy identification
- Easy system flushing due to removable cartridge
- Low installation cost due to the two in one motorized valve and automatic flow limiter construction
- Precise pump tuning for improved energy saving when verifying flow via measuring points
- System extension or repair possible without

Conception



Materials

Valve housing	DR Brass CW602N
Cartridge	PPS
Sealings	O-rings EPDM
O-ring	Reinforced EPDM

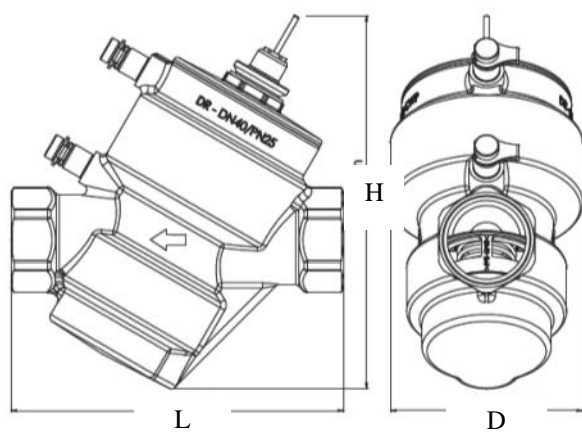
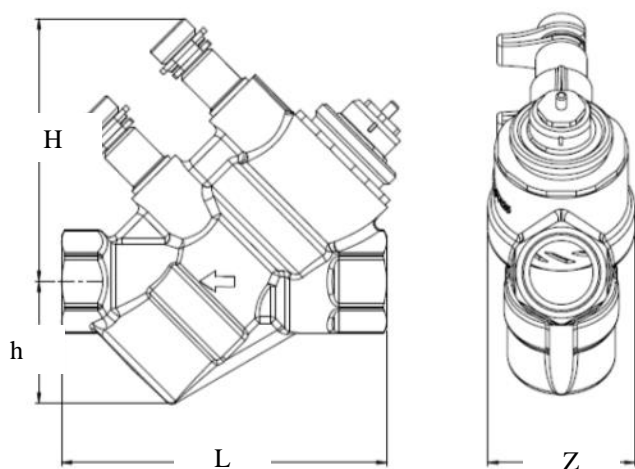
Specifications

Max. temperature	120°C
Min. temperature	-20°C
Max. pressure	25 bar
Operating pressure	30-400 kPa
Marking on valve	DN, PN, flow direction, DR
Connection	Female thread ISO 7/1 parallel

00274_2015-09_ENG



Dimensions

DN	G	Z (mm)	H (mm)	h (mm)	L (mm)
15	1/2"	44	76	35	95
20	3/4"	55	83	49	120
25	1"	71	81	56	125
32	1"1/4	82	87	72	154




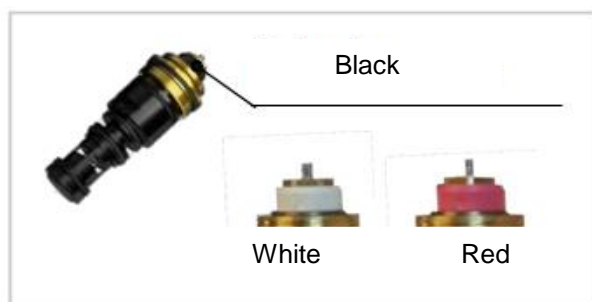
DN	G	D (mm)	H (mm)	L (mm)
40	1"1/2	109.5	212	189.5
50	2"	110.5	210	195

Product line

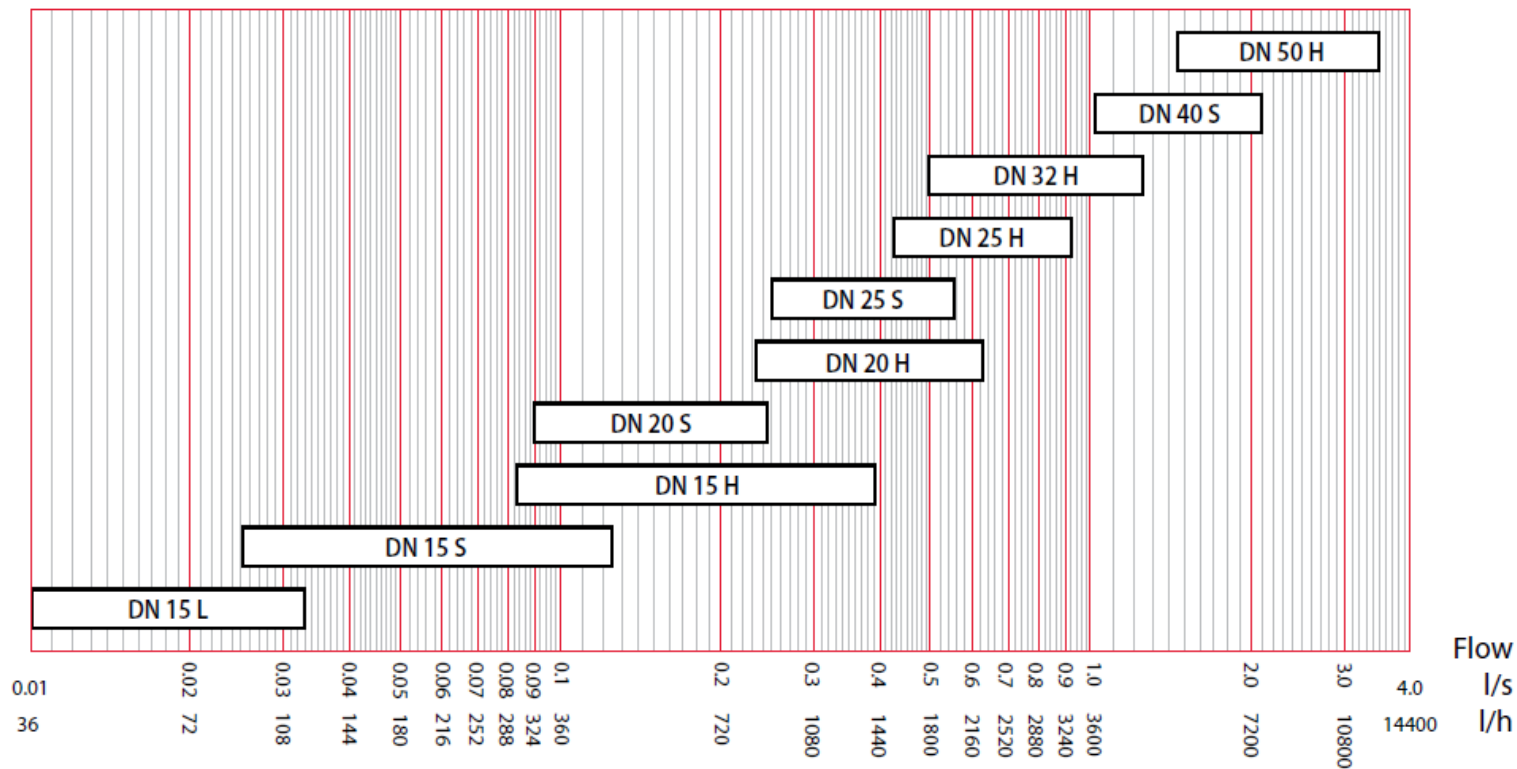
Illustration	DN	G	Size	Flow m ³ /h	Venturi Kv	Mini ΔP	Code
	15	1/2"	L - Low flow	0.036 - 0.118	0.23	30 kPa	4360000L-000001
			S - Standard flow	0.090 - 0.450	0.78	30 kPa	4360000S-000001
			H - High flow	0.3 - 1.4	2.5	30 kPa	4360000H-000001
	20	3/4"	S - Standard flow	0.320 - 0.882	1.9	30 kPa	4460000S-000001
			H - High flow	0.835 - 2.221	4.7	30 kPa	4460000H-000001
	25	1"	S - Standard flow	0.865-2.340	5.05	30 kPa	4560000S-000001
			H - High flow	1.750-3.3330	8.25	30 kPa	4560000H-000001
	32	1"1/4	H - High flow	1.910-4.4400	8.35	30 kPa	4660000H-000001
	40	1"1/2	S - Standard flow	3.920-7.880	17.5	30 kPa	4760000S-000001
	50	2"	H - High flow	5.650-12.600	29.5	30 kPa	4860000H-000001

Cartridge

Illustration	DN	G	Size	Flow m ³ /h	Color code	Code
	15	1/2"	L - Low flow	0.036 - 0.118	White	436000LL-000001
			S - Standard flow	0.090 - 0.450	Red	436000SS-000001
			H - High flow	0.3 - 1.4	Black	436000HH-000001
	20	3/4"	S - Standard flow	0.320 - 0.882	White	446000SS-000001
			H - High flow	0.835 - 2.221	Black	446000HH-000001
	25	1"	S - Standard flow	0.865-2.340	White	456000SS-000001
			H - High flow	1.750-3.3330	Black	456000HH-000001
	32	1"1/4	H - High flow	1.910-4.4400	Black	466000HH-000001
	40	1"1/2	S - Standard flow	3.920-7.880	White	476000SS-000001
	50	2"	H - High flow	5.650-12.600	Black	486000HH-000001



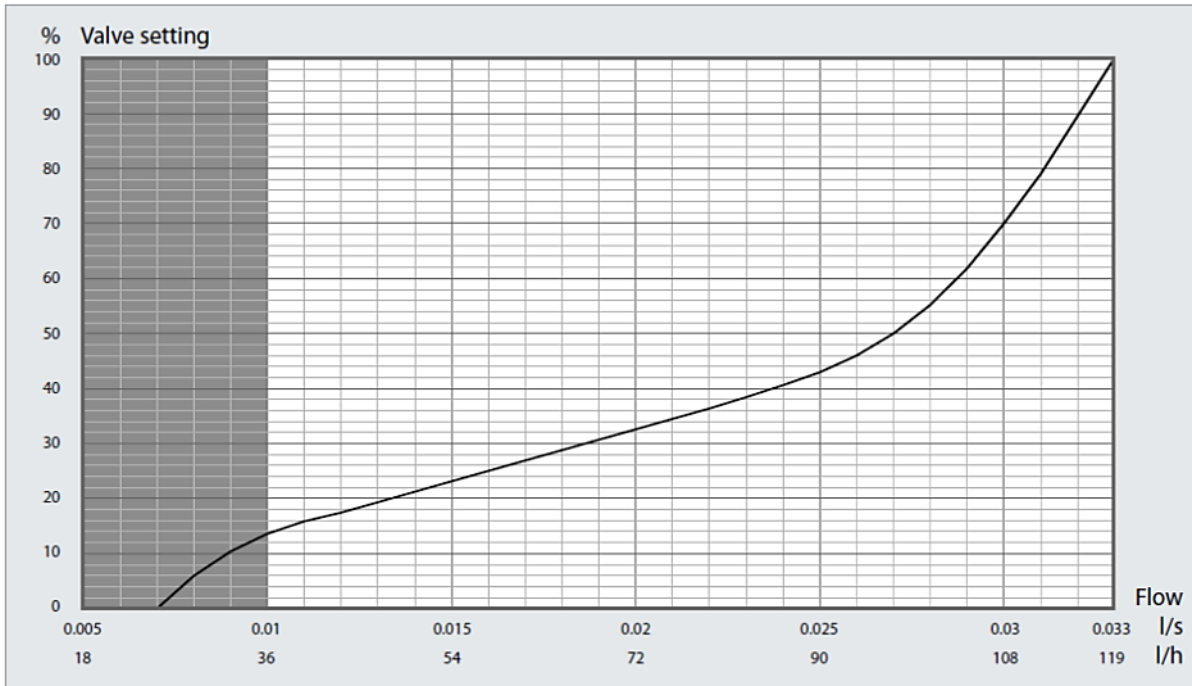
Quick selection chart



DN 15L female/female-Flow diagram

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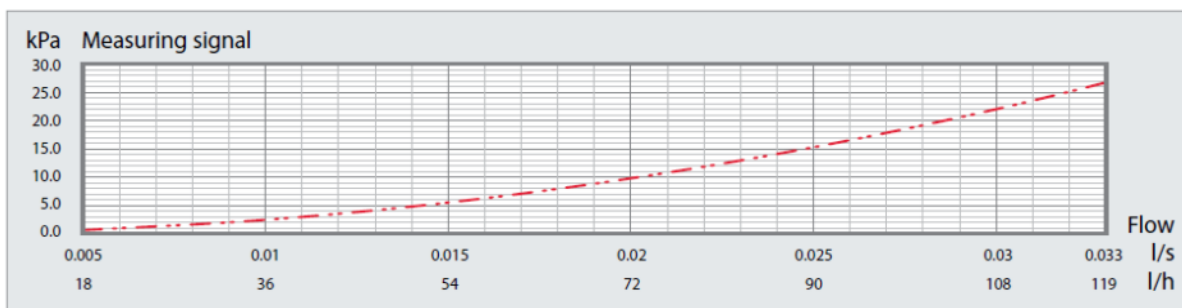
The black line in the below graph specifies the Ballorex Dynamic setting at a given flow. This flow is kept constant at a differential pressure range between 30-400 kPa across the Ballorex Dynamic.



The fixed Kvm value of the built-in Venturi nozzle in the Ballorex Dynamic valve is used for direct flow verification. By connecting a flowmeter to the measuring points of the Ballorex Dynamic and entering the Kvm value into the flowmeter, the actual flow through the Ballorex Dynamic is shown on the flowmeter display. The pre-setting tool is then rotated until the required flow is reached.

A high measuring accuracy is achieved across the entire setting range, but a setting below 14% is not recommended. At a setting below 14% the pressure loss across the Venturi orifice will be below 3.0 kPa which is the minimum requirement for a $\pm 3\%$ flow measuring tolerance accuracy.

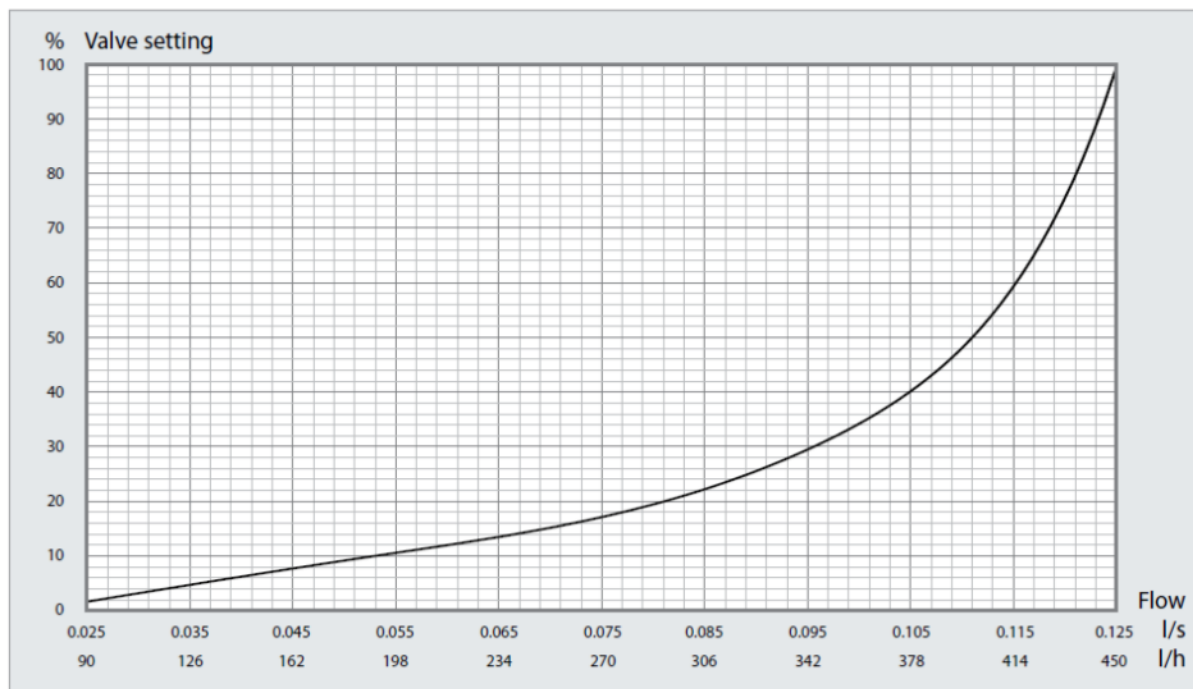
The red dotted line graph represents the measuring signal of a Ballorex Dynamic valve at a given flow. This graph is used during system commissioning



DN15 S

Black line

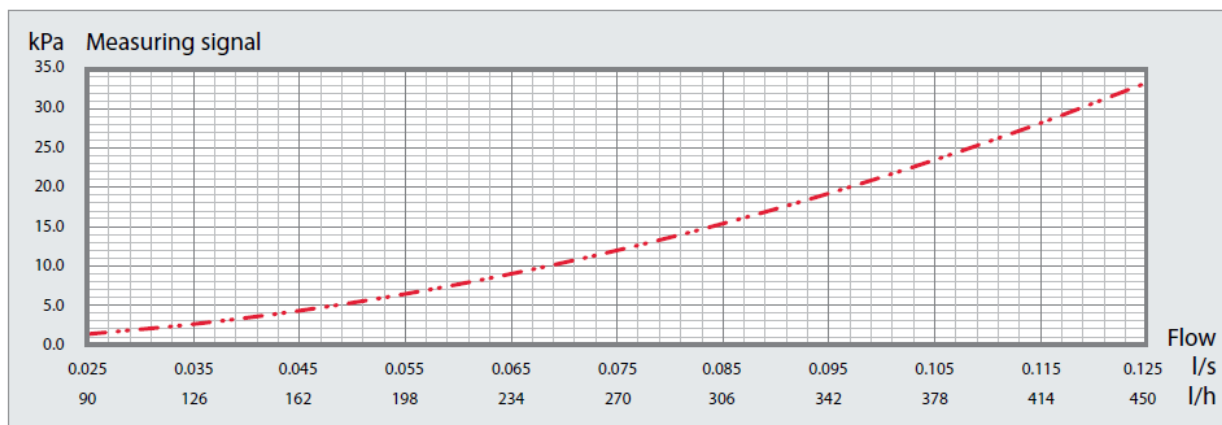
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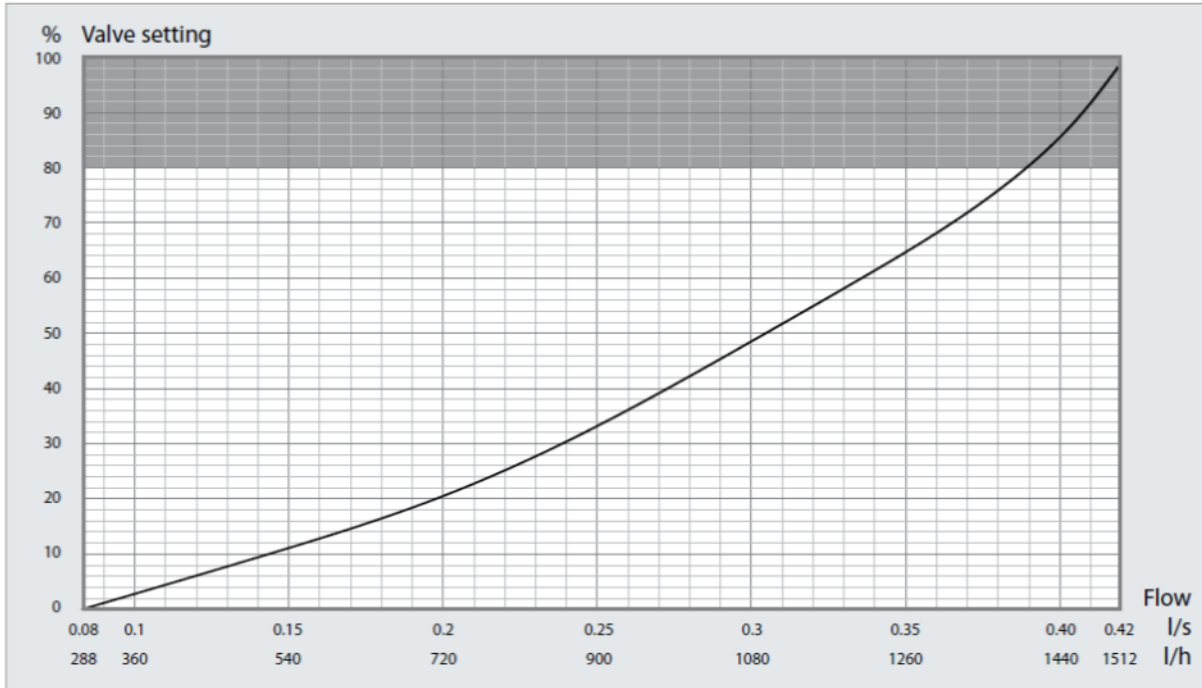
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DN15 H

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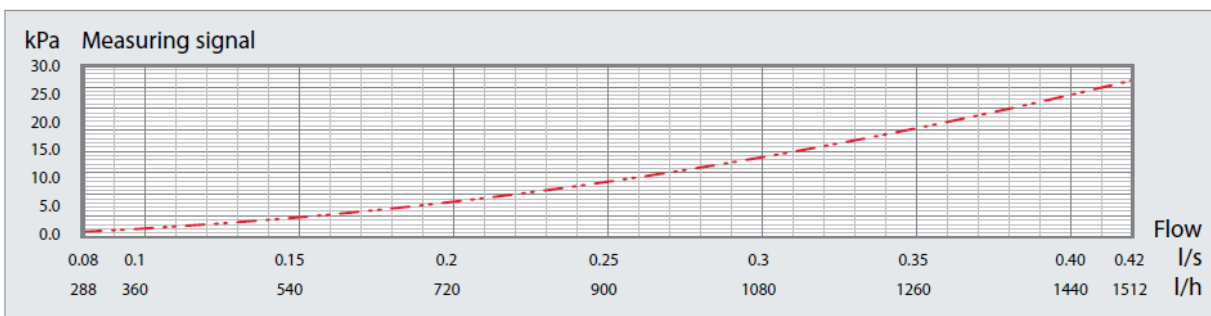
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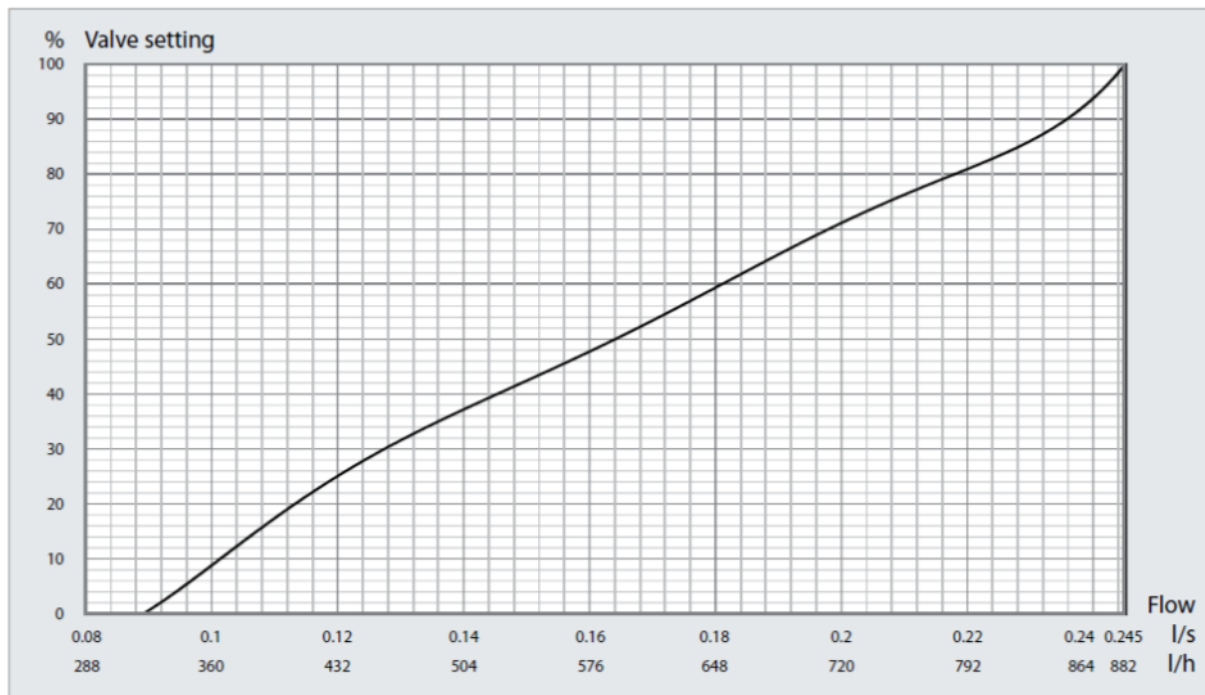
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DN20 S

Black line

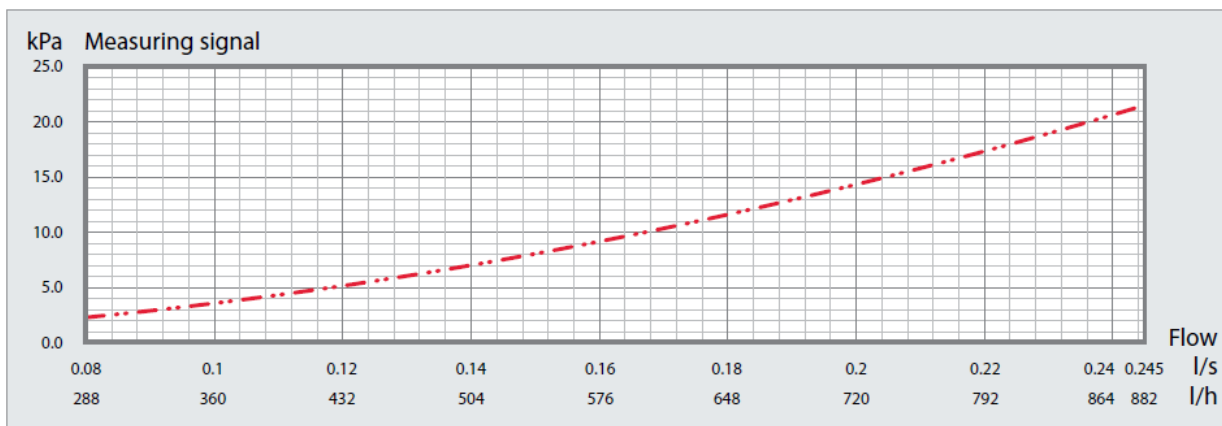
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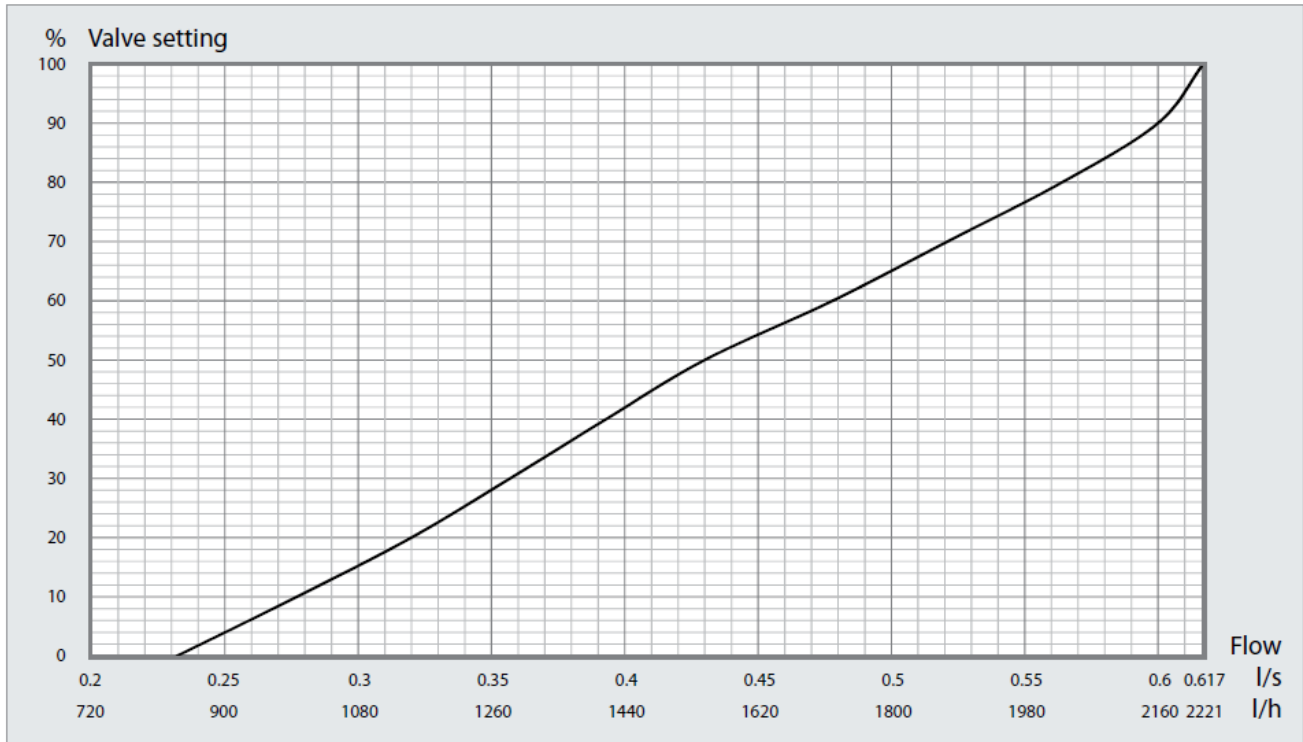
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DN20 H

Black line

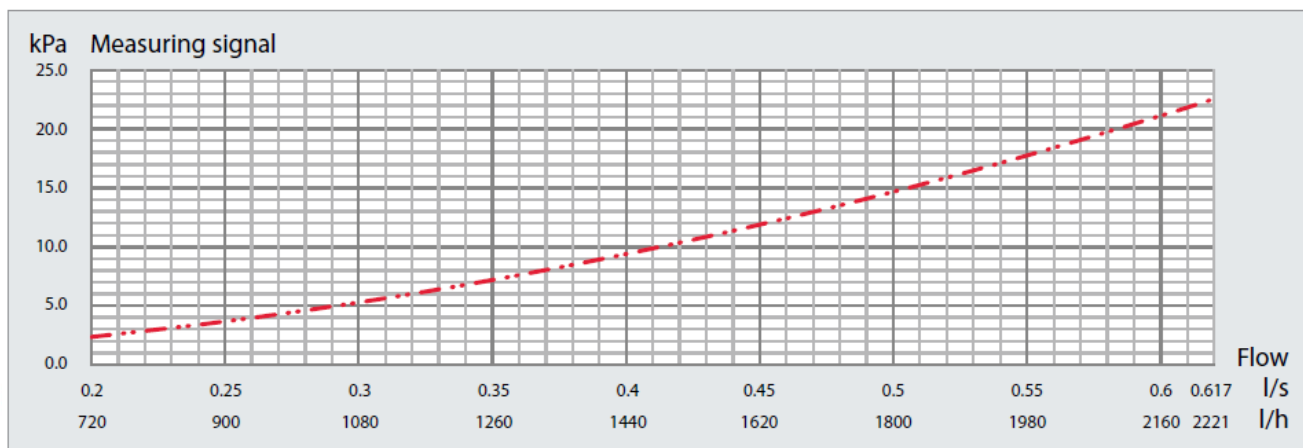
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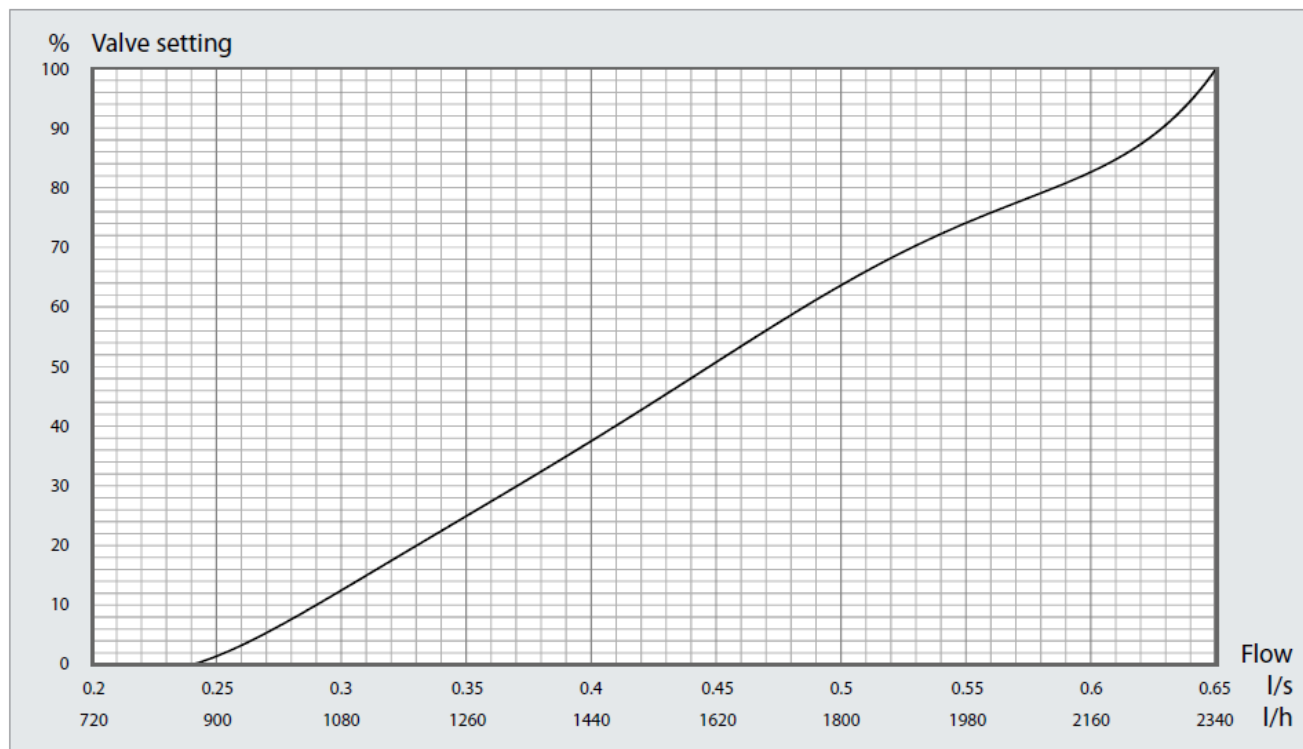
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DN25 S

Black line

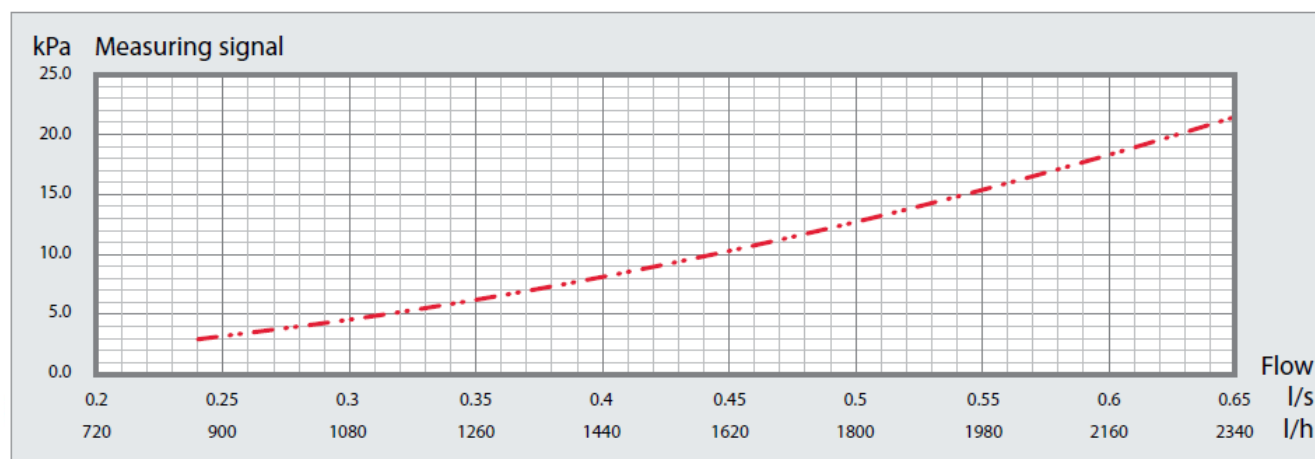
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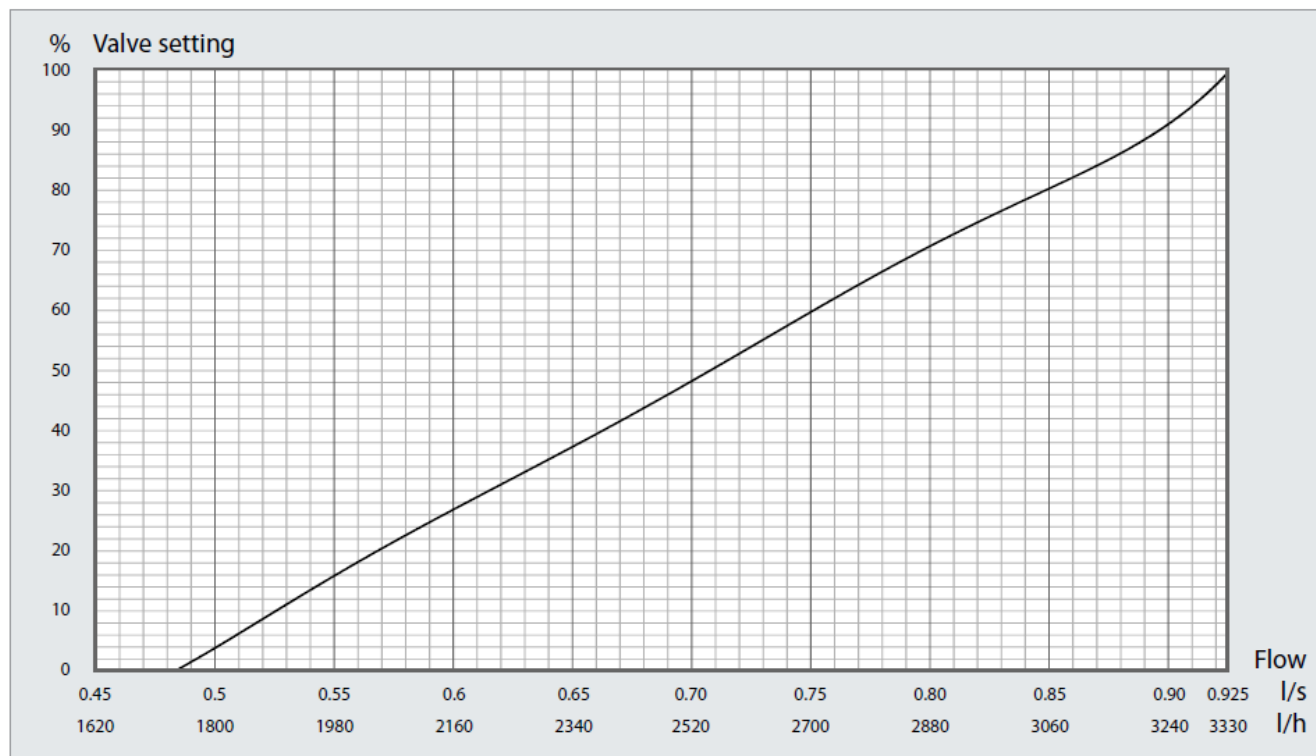
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DN25 H

Black line

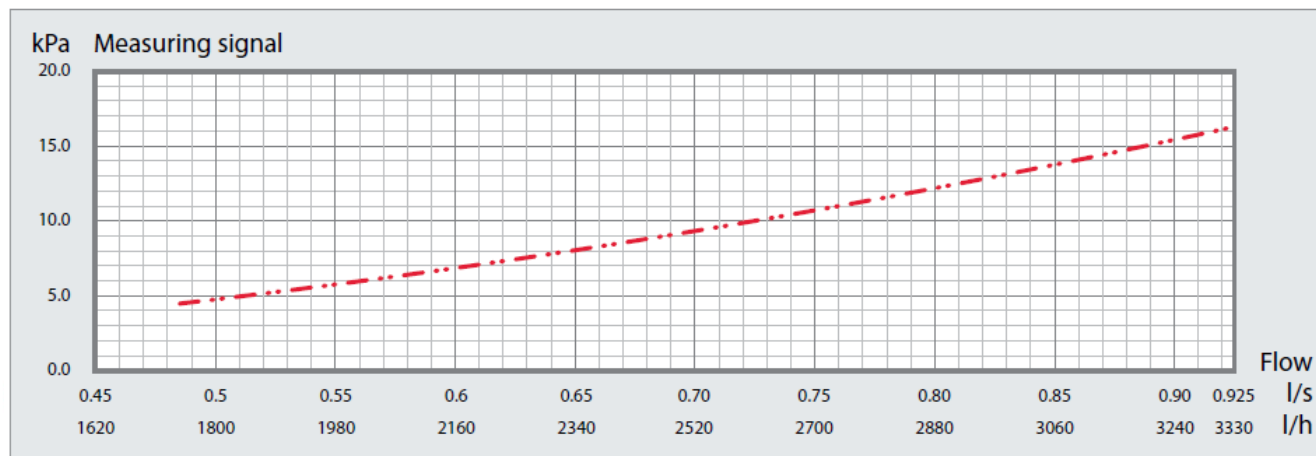
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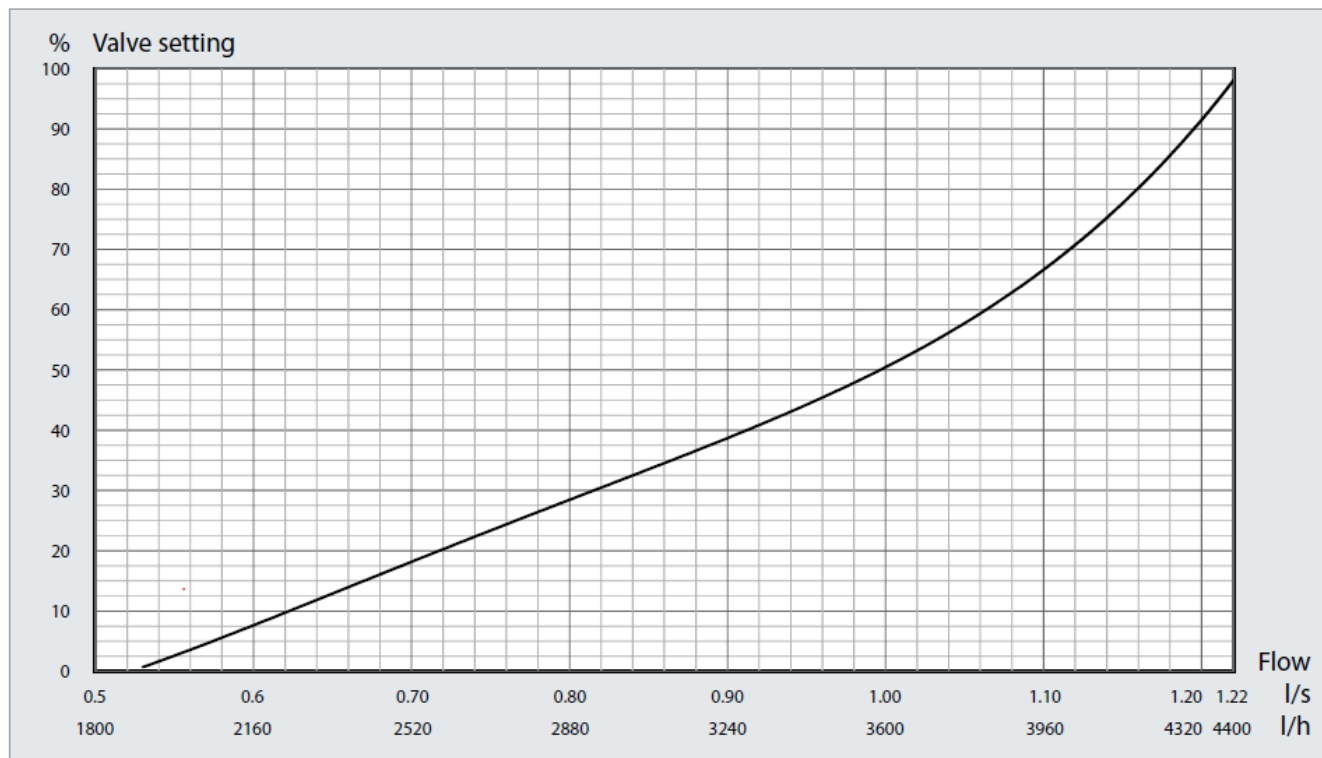
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DN32 H

Black line

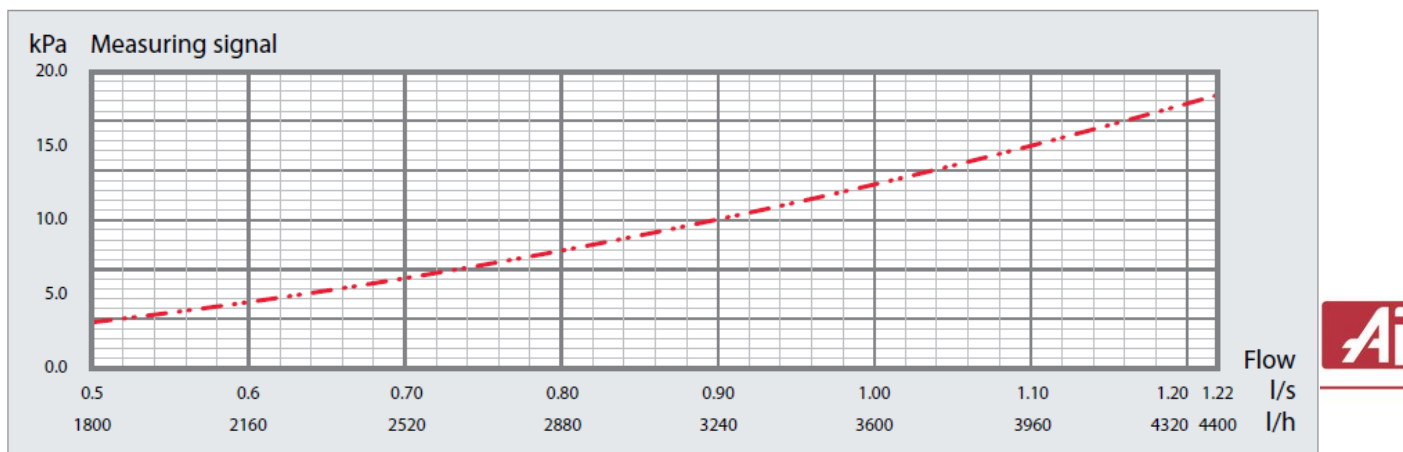
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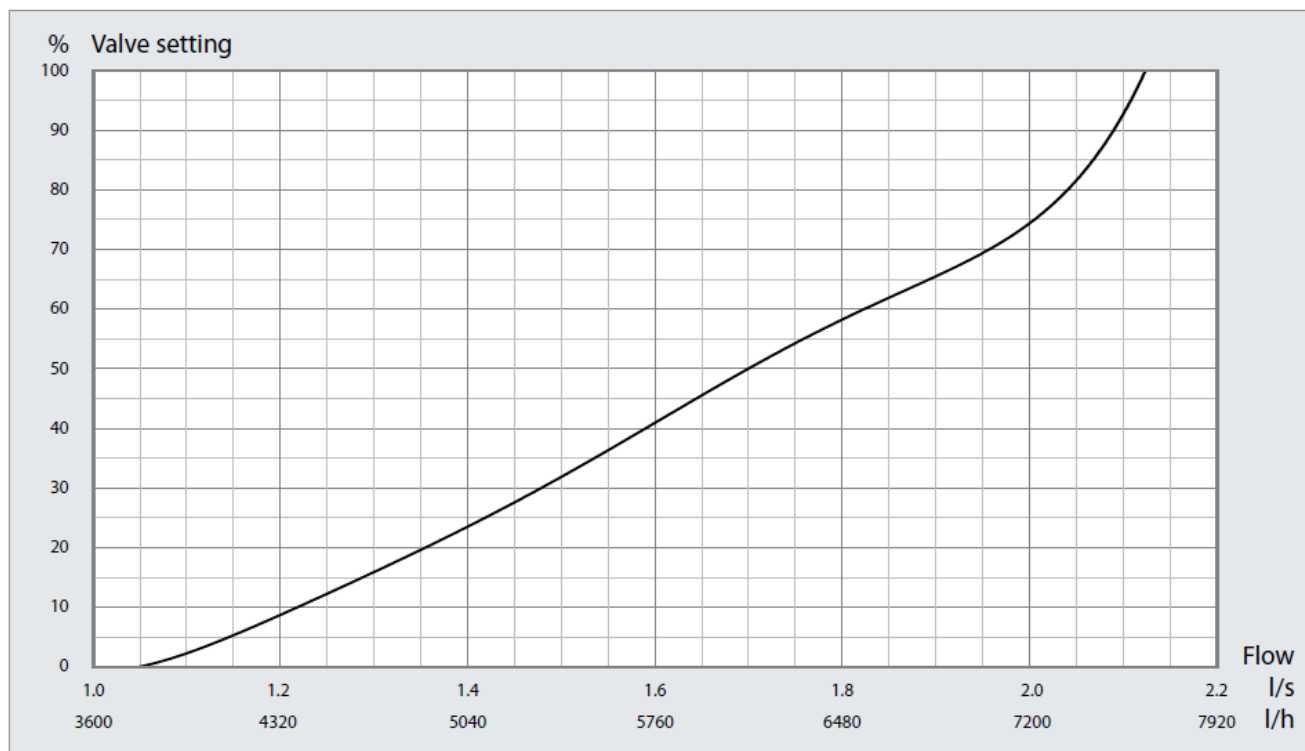
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DN40 S

Black line

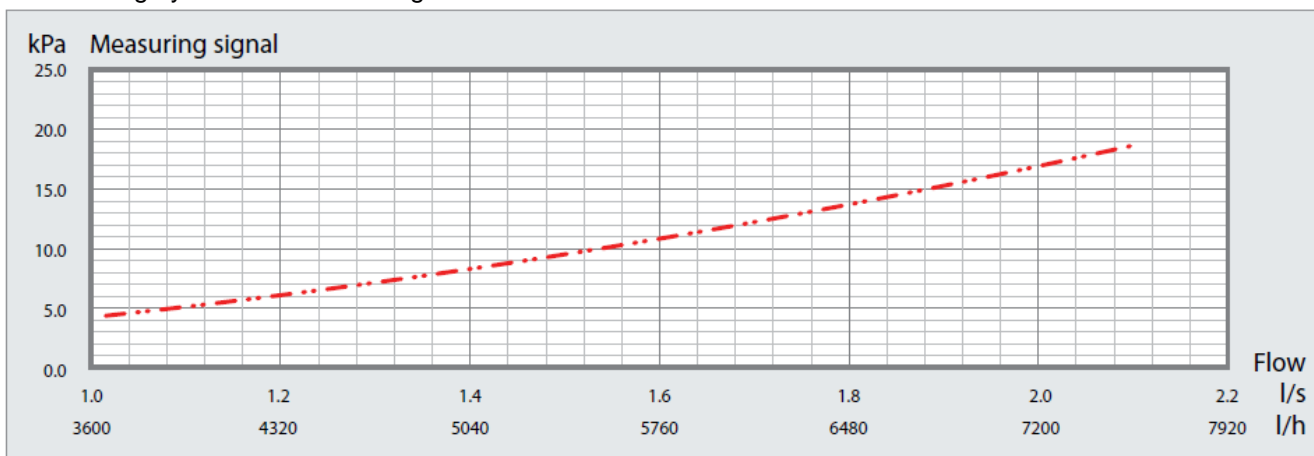
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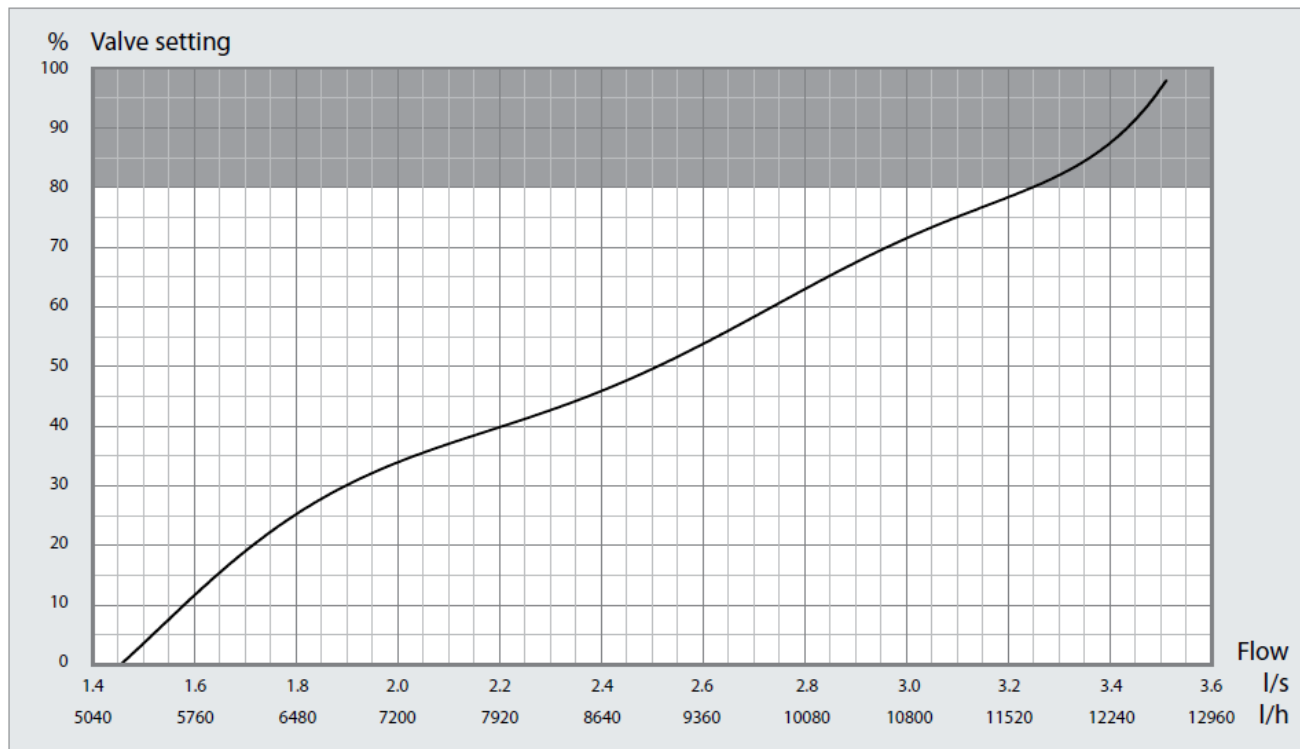
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DN50 H

Black line

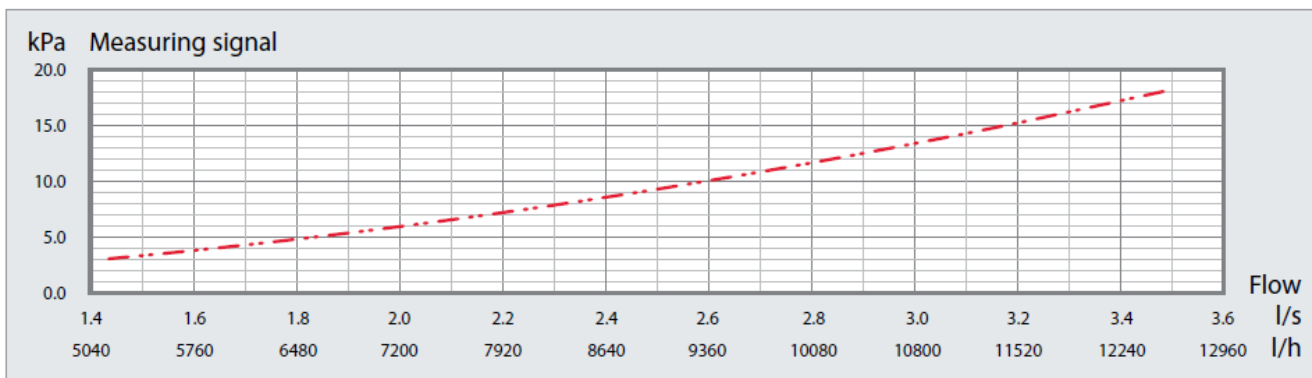
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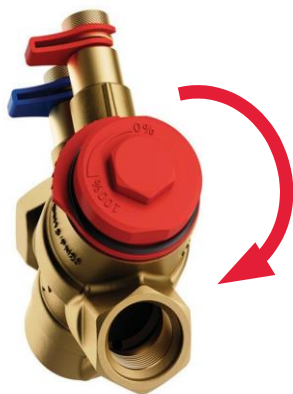
L/s													
Model	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Code	Mini	Maxi
DN15L	0,010	0,014	0,019	0,024	0,027	0,029	0,030	0,031	0,032	0,033	4360000L-000001	0,010	0,033
DN15S	0,048	0,081	0,096	0,105	0,111	0,115	0,118	0,121	0,123	0,125	4360000S-000001	0,048	0,125
DN15H	0,140	0,145	0,197	0,240	0,272	0,335	0,365	0,390	0,410	0,420	4360000H-000001	0,140	0,420
DN20S	0,102	0,114	0,128	0,146	0,164	0,182	0,198	0,218	0,236	0,245	4460000S-000001	0,102	0,245
DN20H	0,275	0,320	0,357	0,392	0,430	0,478	0,520	0,565	0,600	0,617	4460000H-000001	0,275	0,617
DN25S	0,290	0,330	0,370	0,410	0,448	0,485	0,528	0,585	0,628	0,650	4560000S-000001	0,290	0,650
DN25H	0,525	0,570	0,615	0,660	0,707	0,750	0,795	0,850	0,896	0,925	4560000H-000001	0,525	0,925
DN32H	0,620	0,710	0,810	0,910	1,000	1,060	1,118	1,120	1,190	1,220	4660000H-000001	0,620	1,220
DN40S	1,220	1,350	1,475	1,585	1,700	1,825	1,980	2,020	2,080	2,125	4760000S-000001	1,220	2,125
DN50H	1,575	1,525	1,900	2,200	2,500	2,725	2,950	3,225	3,430	3,525	4860000H-000001	1,575	3,525
m3/h													
Modèle	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Code	Mini	Maxi
DN15L	0,036	0,049	0,067	0,085	0,097	0,103	0,108	0,112	0,115	0,119	4360000L-000001	0,036	0,119
DN15S	0,173	0,292	0,346	0,378	0,400	0,414	0,425	0,436	0,443	0,450	4360000S-000001	0,173	0,450
DN15H	0,504	0,522	0,709	0,864	0,979	1,206	1,314	1,404	1,476	1,512	4360000H-000001	0,504	1,512
DN20S	0,367	0,410	0,461	0,526	0,590	0,655	0,713	0,785	0,850	0,882	4460000S-000001	0,367	0,882
DN20H	0,990	1,152	1,285	1,411	1,548	1,721	1,872	2,034	2,160	2,221	4460000H-000001	0,990	2,221
DN25S	1,044	1,188	1,332	1,476	1,613	1,746	1,901	2,106	2,261	2,340	4560000S-000001	1,044	2,340
DN25H	1,890	2,052	2,214	2,376	2,545	2,700	2,862	3,060	3,226	3,330	4560000H-000001	1,890	3,330
DN32H	2,232	2,556	2,916	3,276	3,600	3,816	4,025	4,032	4,284	4,392	4660000H-000001	2,232	4,392
DN40S	4,392	4,860	5,310	5,706	6,120	6,570	7,128	7,272	7,488	7,650	4760000S-000001	4,392	7,650
DN50H	5,670	5,490	6,840	7,920	9,000	9,810	10,620	11,610	12,348	12,690	4860000H-000001	5,670	12,690

Flow setting

Before setting the design flow on the Ballorex Dynamic, the pump must be set at maximum capacity and all service valves in the system must be in fully open position. The differential pressure across the Ballorex Dynamic must at all times not exceed 400 kPa.

The design flow is easily adjusted with the enclosed pre-setting tool. After connecting the Ballorex Balancing Computer BC2, or any other flowmeter, to the Ballorex Dynamic, the flow reading is provided for precise flow tuning.

The pre-setting tool is mounted on top of the valve covering the valve stem. The scale on the pre-setting tool is read against the marking on the brass housing of the valve.



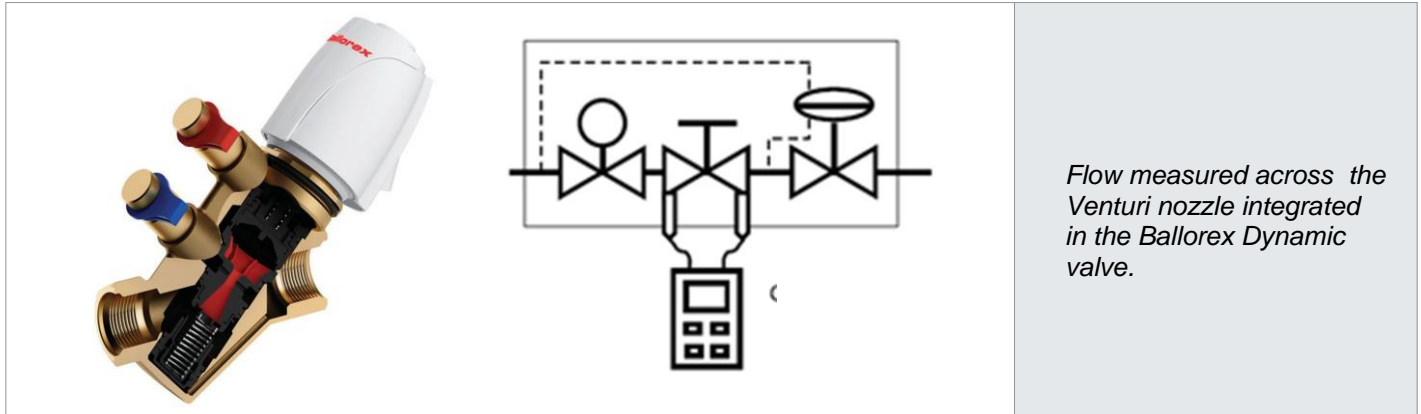
Ballorex Dynamic with pre-setting tool mounted.

The flow is set by turning the pre-setting tool from 0-90°. Each marking on the scale indicates a step of 10%. When the required flow is set and the starting differential pressure is provided, the flow is kept constant by the Ballorex Dynamic valve.



*Ballorex Dynamic at:
A - 100% pre-set flow
B - 50% pre-set flow*

A unique feature of the Ballorex Dynamic valve is the integrated Venturi nozzle which enables direct flow measurement. This provides an exact flow setting of the valve and makes verification of the actual flow rate possible at any time for correct documentation. System troubleshooting thereby also becomes considerably easier which saves time.



To verify the flow a flowmeter is connected to the measuring points of the Ballorex Dynamic. The fixed Kvm value of the integrated Venturi nozzle is then typed into the flowmeter to directly display the actual flow at an accuracy tolerance of $\pm 3\%$. When the required flow is set, the balance in the system is provided. The flow is kept constant by the Ballorex Dynamic valve regardless of pressure fluctuations.



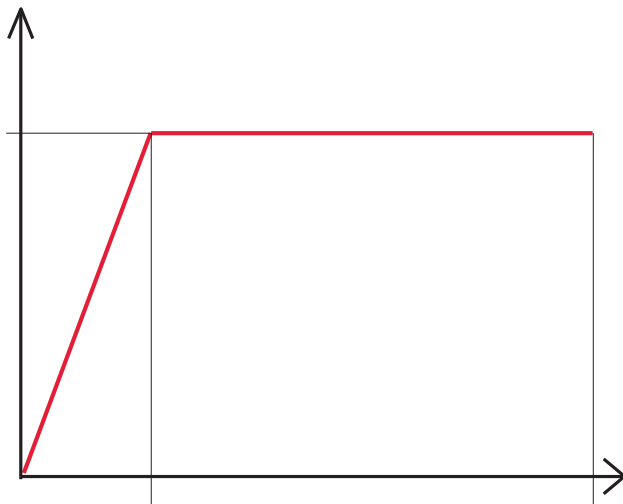
Ballorex Dynamic flow control accuracy

When set to a given flow, all valves based on the principle of dynamic balancing have a certain inaccuracy. Within the valve operating pressure range the real flow can deviate from the set design flow. In practise this means that the actual flow through the valve differs from what it was set to be because of pressure fluctuation in the system. This typically occurs from hysteresis and the desire to have a low starting pressure which is required for the differential pressure regulator in the valve to stabilize the flow.

The starting pressure of the index valve contributes to the total system pressure loss and therefore influences the pump dimensioning.

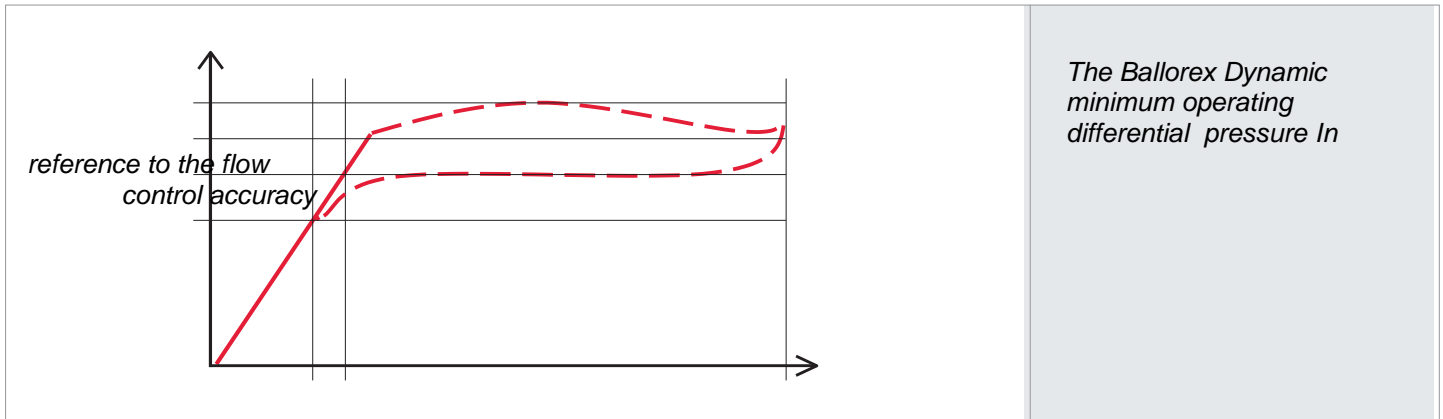
The built-in differential pressure regulator stabilizes the flow across the Ballorex Dynamic when the pressure loss across the valve is within 30 kPa to 400 kPa.

When the pressure loss decreases below 30 kPa, the Ballorex Dynamic operates with lower accuracy and at much lower differential pressure it enters into a static balancing zone.



The regulator ensuring constant differential pressure across the flow pre-setting unit and the two-way valve unit requires a pressure loss of minimum 30 kPa and maximum 400 kPa across the complete valve to operate properly. Within this pressure loss range the valve will maintain a constant flow (Qsized).

The required starting differential pressure of 30 kPa across the Ballorex Dynamic ensures a high flow control accuracy of at least $\pm 7\%$. The differential pressure working range is defined in the below graph: from P_{minA} to P_{max} . The flow tolerance, the same as the deviation from the Q_{sized} , is within $Q_a - Q_b$ ($\pm 7\%$).

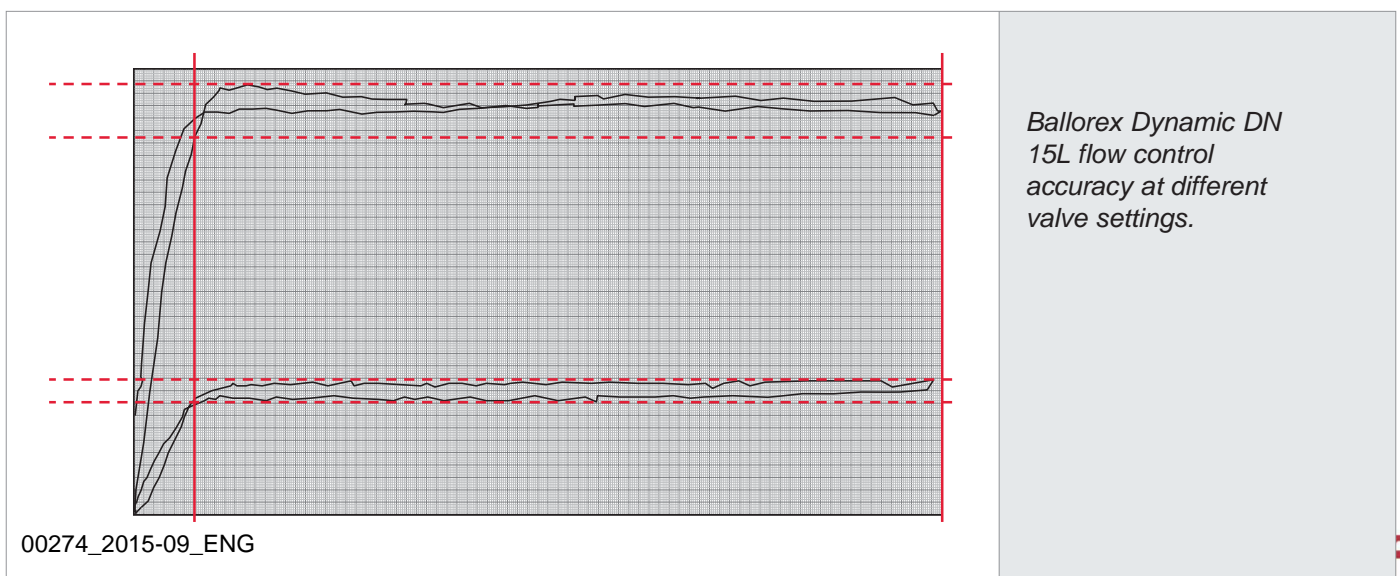


Common for pressure independent control valves is that a decrease in the differential pressure affects the accuracy of the valve.

The starting differential pressure specified for the Ballorex Dynamic has for the above reason been carefully selected as 30 kPa. Decreasing this value from P_{minA} to P_{min1} would result in a desirable lower pump head, but the flow control accuracy would deteriorate accordingly: $Q_a - Q_b < Q_a - Q_1$. The high flow control accuracy will therefore achieve a better system energy efficiency compared to a pressure independent flow control valve with a low starting differential pressure.

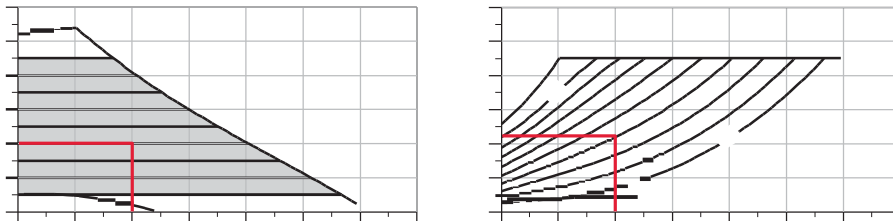
Ballorex Dynamic energy efficiency example

The below flow graph for the Ballorex Dynamic DN 15L indicates that the accuracy in the high flow end is within $\pm 5.8\%$ at a starting differential pressure of 30 kPa.



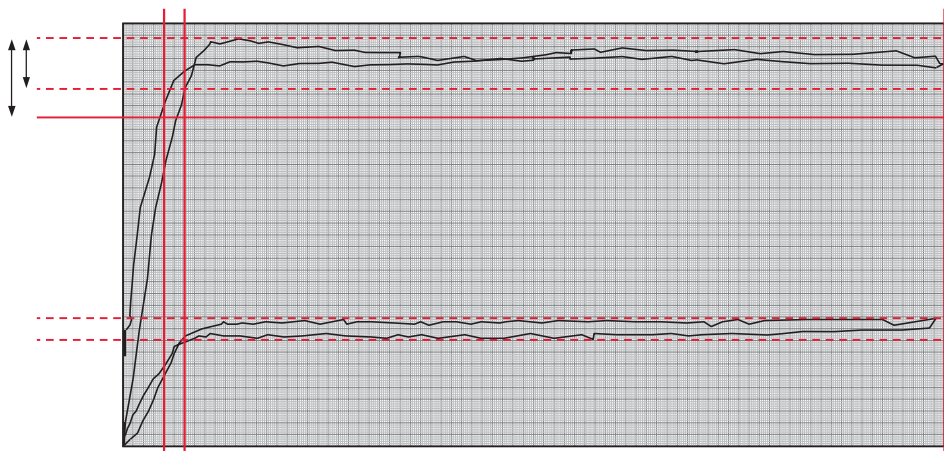
In this example a Ballorex Dynamic DN 15L valve is installed in a heating system consisting of 35 terminal units. The supply and return water temperature difference is 20°C, the total required flow is 4.0 m³/h and the required pump head is 40 kPa, of which 30 kPa is required for the Ballorex Dynamic DN 15L valve. The total system capacity is

93.3 kW and the pump requires 90 W power supply.



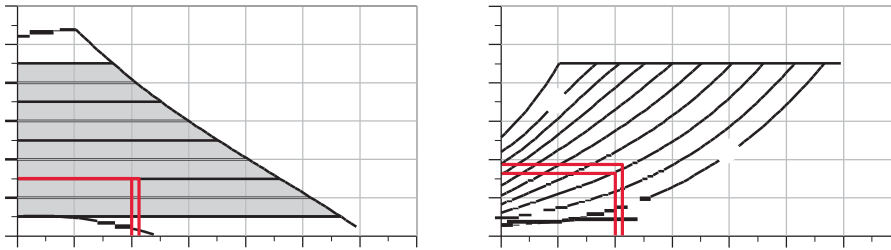
The Ballorex Dynamic valve operates at a starting differential pressure of 30 kPa. The pump power equals 90 W

If the starting differential pressure is decreased by 10 kPa to 20 kPa the flow control accuracy will at the same time decrease to around $\pm 11\%$.



Ballorex Dynamic DN 15L flow control accuracy at a starting differential pressure of 20 kPa.

The decreased flow control accuracy can cause the total flow in the system to increase by $11.0\% - 5.8\% = 5.2\%$ equal to approximately $0.2 \text{ m}^3/\text{h}$ more flow and a 4.7 kW higher energy consumption. The result is that the maximum overflow in this example may cause a much higher energy consumption than applying a pump with 10 kPa higher head.



A pressure independent flow control valve at 20 kPa differential starting pressure.

In this example the energy gain using a pump with lower pump head is $90 \text{ W} - 75 \text{ W} = 15 \text{ W}$. Compared to the accuracy loss caused by a possible overflow, the pump energy reduction is negligible. This shows that a simple pump head decrease due to a lower starting differential pressure requirement is not a key factor and cannot be used as an argument for supporting improved energy efficiency only.

The basis of the Ballorex Dynamic valve design is to provide a high flow control accuracy for improved energy efficiency. For this reason the whole Ballorex Dynamic range has been designed for a starting differential pressure of 30 kPa , instead of only 20 kPa which would compromise the valve performance.

The high flow control accuracy will compensate for the increased differential pressure requirement. Overflows are eliminated and improved system energy efficiency provided

Ballorex Dynamic Actuators

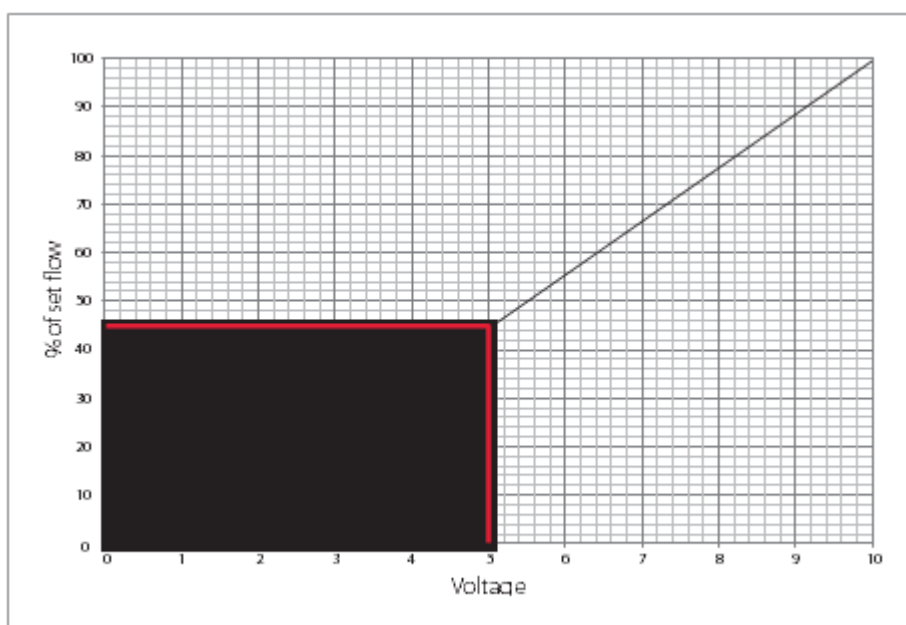
Two types of actuators are available for the Ballorex Dynamic valves:

Thermoelectric on/off 230/24 V and modulating 0-10 V actuators for sizes DN 15 - 32

Electromechanical on/off 230/24 V and modulating 0-10 V actuators for sizes DN 40 - 50

The diagram shows the typical modulating characteristics of Ballorex Dynamic. The data is based on the properties of a Ballorex Dynamic DN 50H.

The diagram shows how much flow is allowed through the valve at the different control voltages.



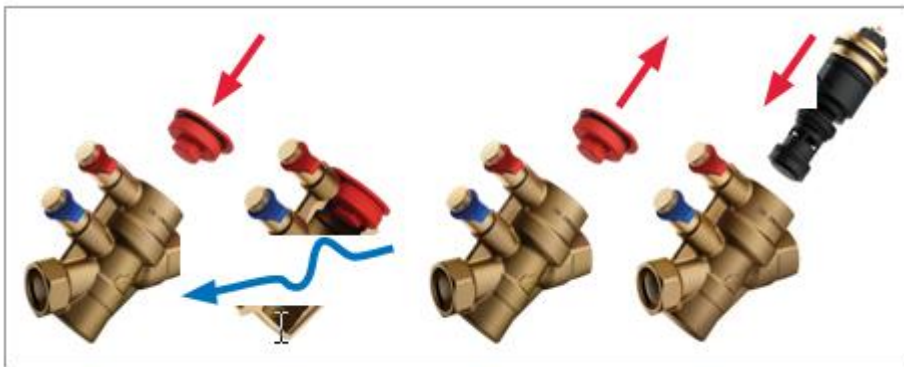
*A Ballorex Dynamic DN 50H is set to provide a flow rate of 10000 l/h. To find the flow at an actuator position of 5 V, the graph shows that 45% of the pre-set flow will pass through the valve:
 $10000 \text{ l/h} \times 45\% = 4500 \text{ l/h}$.*

The DN 50H valve with the actuator is in initially closed position at 0 V. The higher the voltage the more open the valve is.

The characteristic is linear.

Ballorex Dynamic system flushing

It is recommended to flush the system after the installation of Ballorex Dynamic valves. This is done by removing the Ballorex Dynamic cartridge and replacing it with the red pre-setting cap to seal off the valve when flushing is carried out. It is furthermore recommended that strainers are mounted in the system to protect terminal units and valves.



When the system flushing is completed, all filters and strainers have to be cleaned, the pre-setting cap is removed and the cartridge is inserted into the valve housing again and tightened carefully.

Ballorex Dynamic shut-off cap

A shut-off cap for Ballorex Dynamic DN 15 - 32 is provided to isolate the flow across the valve installed in an operating system. The shut-off cap is mounted on the Ballorex Dynamic valve in the place of the actuator. Hand tightening of the shut-off cap ensures flow isolation.

It is required that the differential pressure across an open as well as a closed Ballorex Dynamic valve may never exceed 400 kPa.

The valve leak class does not ensure 100% tightness, thus using it as a service valve is not recommended.

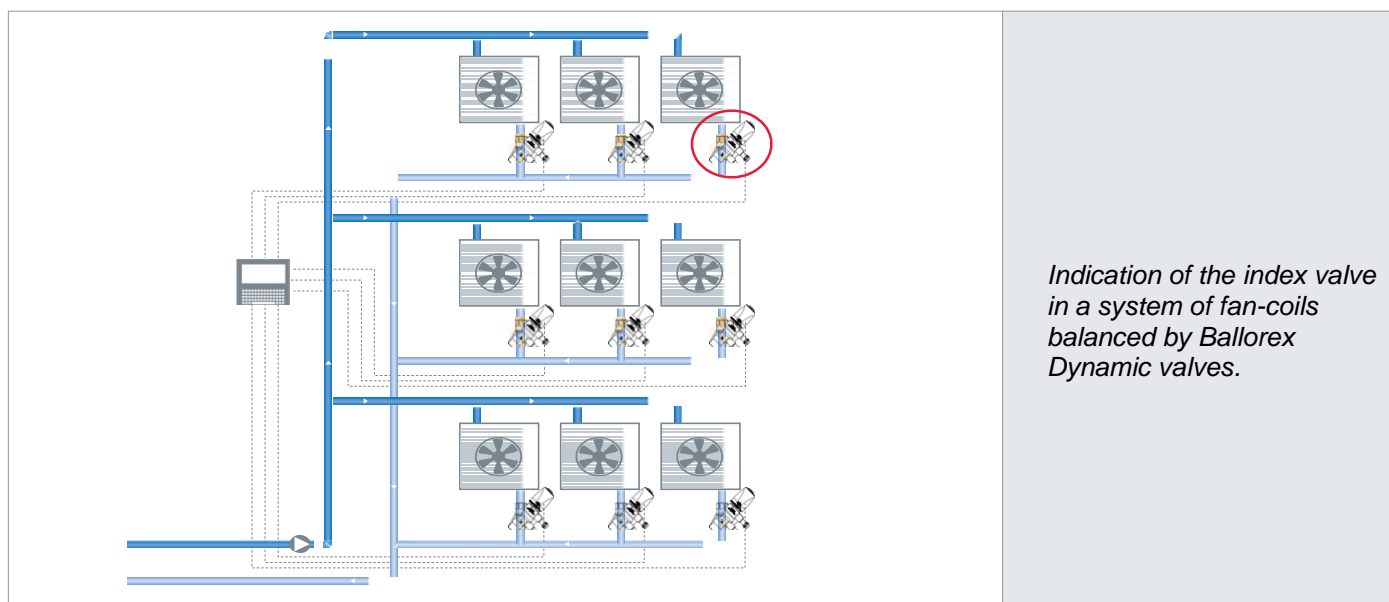


The shut-off cap is used for flow isolation across the Ballorex Dynamic valve provided that the differential pressure across the closed valve never exceeds 400 kPa

Ballorex Dynamic operation

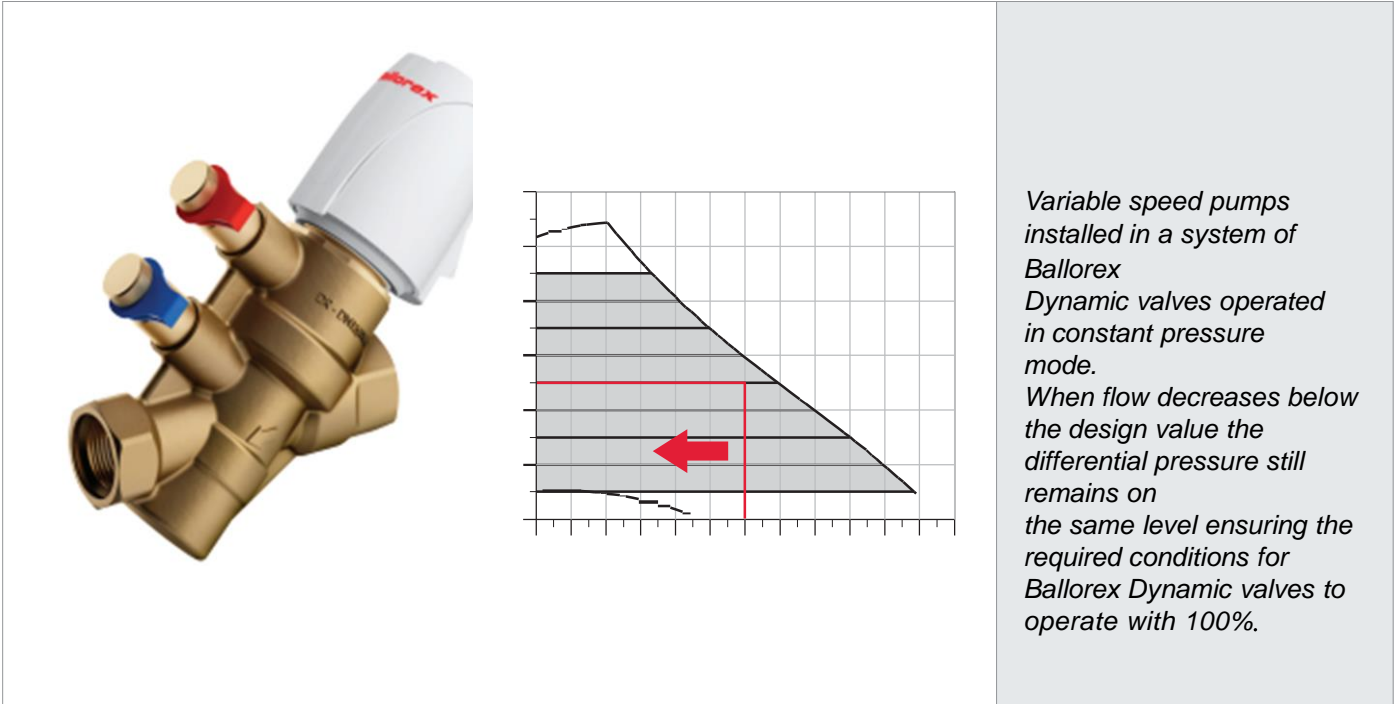
A balancing procedure is not required when using Ballorex Dynamic valves. The valves are simply set to the required flow rate and will compensate for pressure fluctuations in the system. The hydronic balance in the system is thereby ensured.

When all valves are set to the required flow rate, the pump head is minimized to avoid unnecessary energy consumption. The pump head is minimized to the optimal point where the pump delivers only as much pressure as the index valve needs to operate correctly.



The optimal pump setting is easily found in a system with Ballorex Dynamic valves. The pump is set to its maximum capacity during the pre-setting of the Ballorex Dynamic valves. After the setting of all valves is completed, a flow meter is connected to the index valve, which is the system valve with the least differential pressure available. Typically this would be the most remote valve from the pump.

The pump head is then reduced until the flow on the index valve starts to decrease dramatically. This point is the minimum pressure required. To be sure that sufficient pressure is available, the pump head is slightly increased again until the design flow rate of the index valve is displayed in the flowmeter again. Hydronic balance is established and the pump head kept at a minimum.

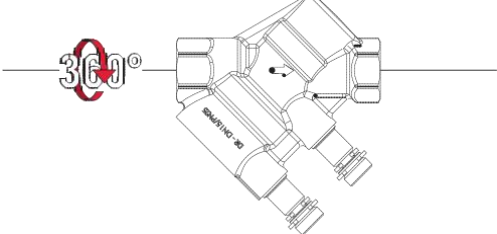
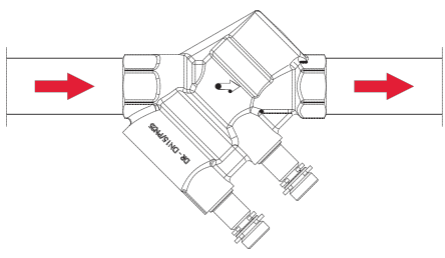
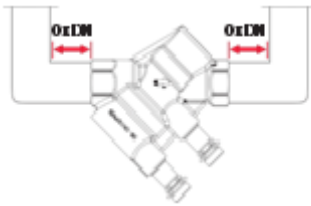
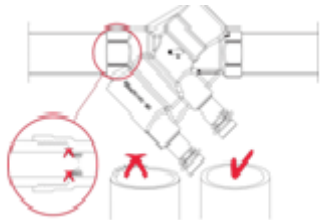


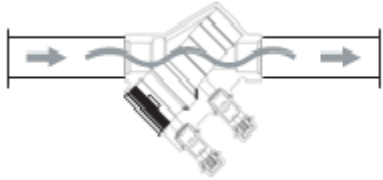
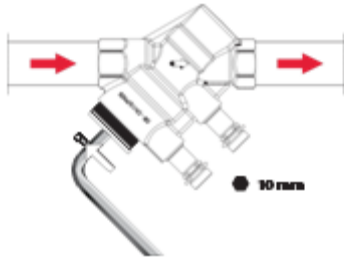
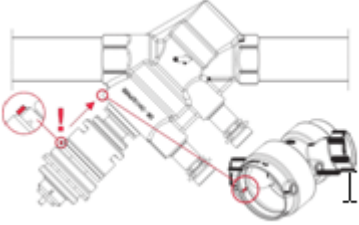
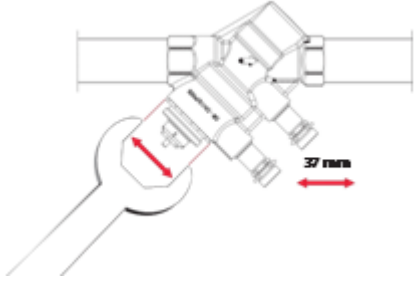
When using a variable speed pump it is recommended to operate it in a constant differential pressure mode. This will ensure that the flow will be adjusted according to the current load demand and that the constant pressure level will provide the required condition for the differential pressure regulator inside the Ballorex Dynamic valves to operate correctly.

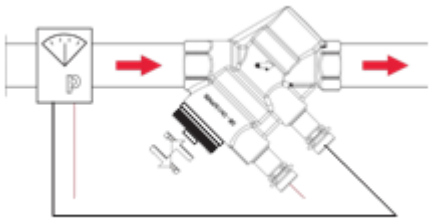
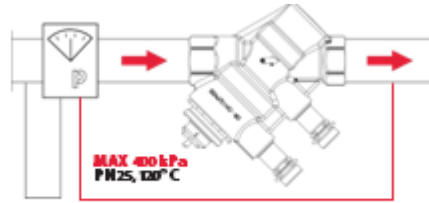
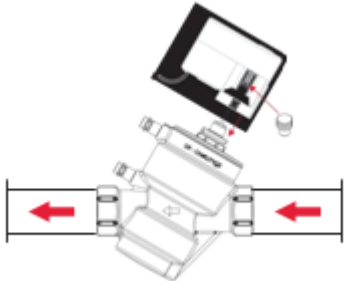
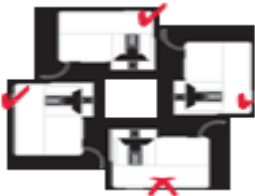
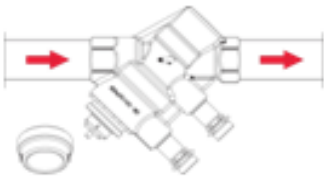


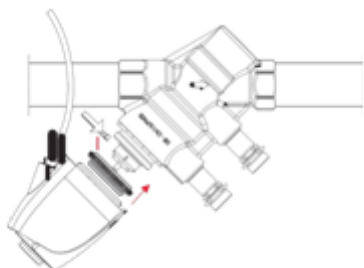
Installation

Mounting instructions DN 15 – 50

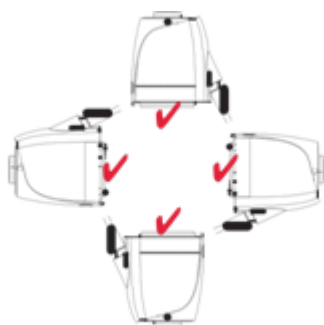
	<p>The arrow on the Ballorex Dynamic housing indicates the flow direction to be respected.</p>
	<p>The Ballorex Dynamic can be orientated 360° around the pipe axis.</p>
	<p>No straight piping is required the Ballorex Dynamic can be mounted directly onto bends and flexible pipes, etc.</p>
	<p>Deburring of pipe ends is to be performed to avoid system clogging. A loose hem is not to hang into the pipe.</p>

	<p>System flushing should be carried out before the cartridge is installed in the Ballorex Dynamic housing.</p> <p>To enable flushing the valve is sealed with the pre-setting cap.</p> <p>Maximum pressure during system flushing is 16 bar and the maximum temperature allowed is 25°C.</p>
	<p>When the system flushing is completed, the pre-setting cap is removed from the valve housing using a 10mm Allen key.</p>
	<p>A cartridge sized for the design flow is mounted in the Ballorex Dynamic housing.</p> <p>Note! The cartridge steering pin must slide into the valve housing groove</p>
	<p>The cartridge is tightened carefully using a 37 mm key.</p> <p>Note : No tool should be used on the small nut on the top of the cartridge.</p>

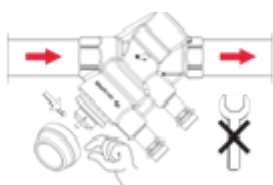
	<p>A rough pre-setting of the flow is done using the pre-setting cap with a setting scale of 0-100% of the cartridge flow range.</p> <p>For a precise flow setting the Ballorex Balancing Computer BC2 is connected to the Ballorex Dynamic. The pre-setting cap is then used to change the cartridge setting until the desired flow is displayed on the balancing computer</p>
	<p>Maximum differential pressure allowed across the Ballorex Dynamic is 400 kPa and the maximum allowed temperature is 120°C</p>
	<p>When using Ballorex Dynamic DN 40 - 50 as a control valve, an actuator must be mounted. The provided adaptor is slid onto the actuator spindle and the Ballorex actuator is then screwed onto Ballorex Dynamic</p>
	<p>Both the Ballorex Dynamic valves DN 40 - 50 and the Ballorex actuator can be mounted in any position except for the Ballorex actuator positioned underneath the Ballorex Dynamic valve</p>
	<p>To isolated the system flow a Ballorex shut-off cap is mounted onto the Ballorex Dynamic DN 15 - 32 valves</p>



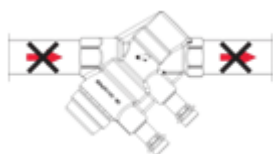
When using Ballorex Dynamic sizes DN 15 - 32 as a control valve, an actuator must be mounted. A connection ring is mounted onto the valve housing and the Ballorex actuator is then clicked on



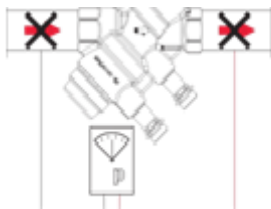
Both the Ballorex Dynamic valves DN 15 - 32 and the Ballorex actuator can be installed in any position required



The Ballorex shut-off cap is tightened by hand only. Tools are not allowed for this purpose



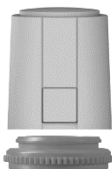


After tightening the Ballorex shut-off cap, flow across the Ballorex Dynamic valve will be blocked

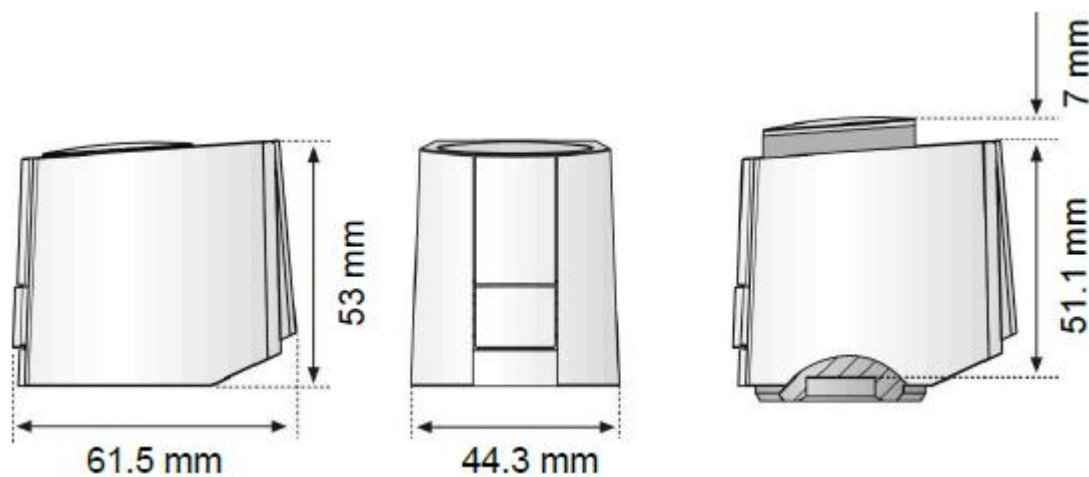


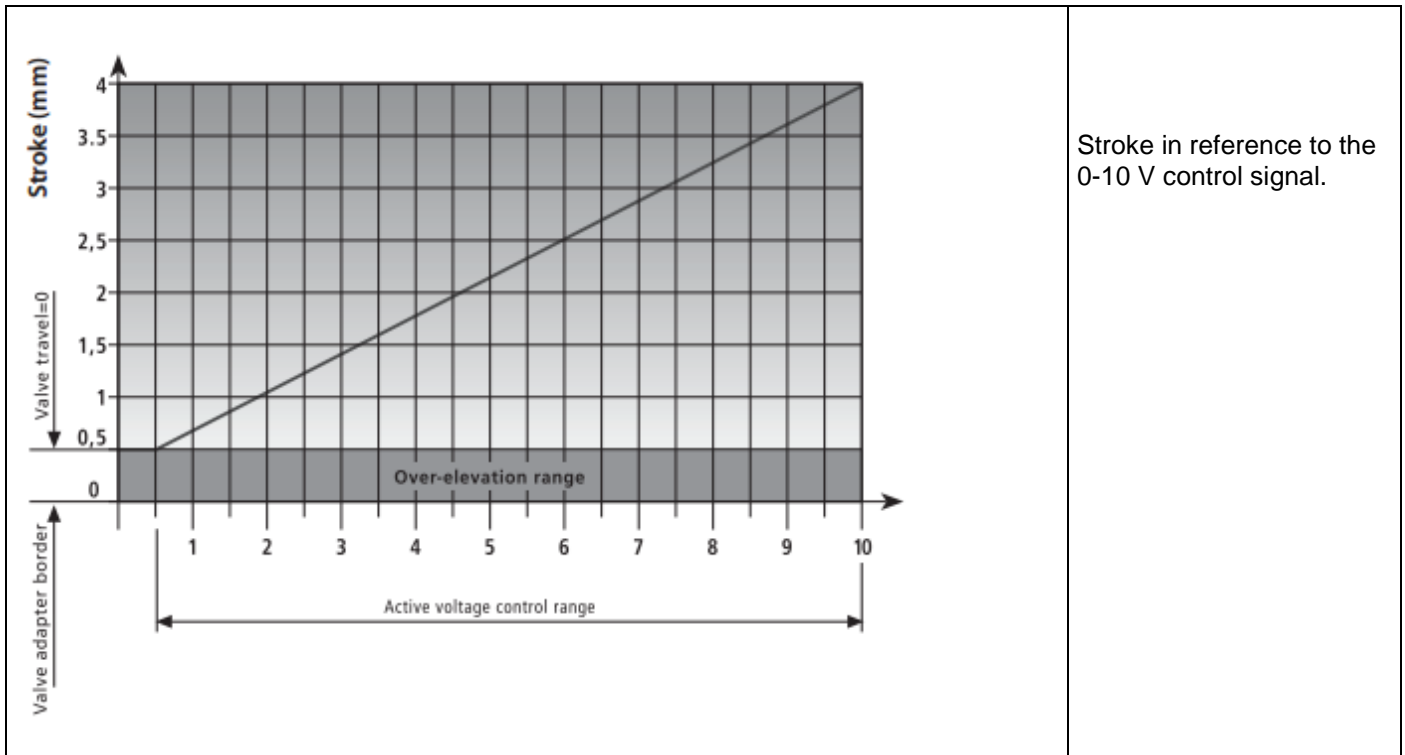
Maximum differential pressure across the Ballorex Dynamic valve must not exceed 400 kPa

Actuators

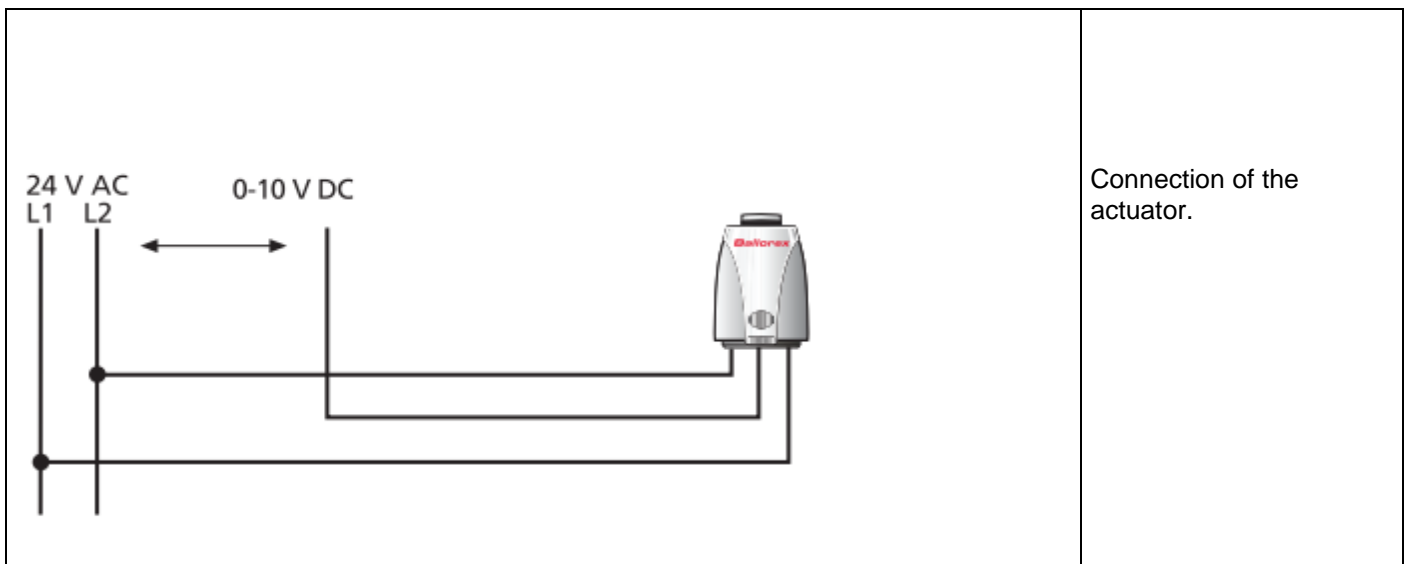
Figure	Illustration	Description					Code
		Size	NO / NF	Technology	V	Control	
ACTU ON/OFF		M30x1.5	NF (normally closed)	Electro-thermal	24V	ON/OFF	C430015001
		M30x1.5	NF (normally closed)	Electro-thermal	230V	ON/OFF	C430014001
ACTU MOD		M30x1.5	NF (normally closed)	Thermo-electronic	24V	0 - 10V	U620007001

Proportional actuators - 24V





The Ballorex Dynamic actuator normally remains closed. The valve is opened once by 0.5 mm and then closes again after applying the operating voltage of 24 V AC. This is done as a first-open function to unlock and to find the closing point of the valve. This ensures an optimum match with the valve.



Actuators ON/OFF - 230V or 24V

