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PRESSURE INDEPENDENT CONTROL VALVE

PUTTING YOU IN CONTROL

Ballorex Dynamic

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INVESTORS IN PEOPLE

BS 8537

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Association of Plumbing and Heating Contractors

The Bathroom Manufacturers Association

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Heating and Ventilating Contractors Association

The Brass Page for specifiers, designers, engineers and manufacturers

British Plumbing Employers Council

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The Copper Development Association

Scottish and Northern Ireland Plumbing Employers Federation

Builders Merchants Federation

Institute of Plumbing

The UK District Energy Association

The Chartered Institution of Building Services Engineers

Ballorex Dynamic

1. INTRODUCTION

At Pegler Yorkshire we are constantly striving to develop system solutions that meet the changing needs of installers, contractors and specifiers alike. The Pegler Yorkshire range of commissioning valves comprises a number of products for a broad spectrum of applications across the commercial sector.

Pegler Yorkshire valves provide one of the most comprehensive ranges of products on the market today. Users of Pegler Yorkshire valves can be confident that they are purchasing an established product range with a proven reputation for quality and reliability.

Pressure Independent Control Valve (PICV)
DN 15 - 50
1/2 - 2"

1.1 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.

Without actuator the Ballorex Dynamic works as an automatic flow limiter. In this way the valve ensures the design flow in terminal units. The Ballorex Dynamic valve also prevents overflows in the systems at any time.

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.

1.2 BENEFITS

- Automatic balancing
- Direct flow measuring of actual flow by the use of built-in Venturi measuring device ±3%
- 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 ±7% tolerance
- 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 altering the flow in the already operating terminal units
- Single unit housing, not susceptible to pipes tension, eliminates risk of water leakage from the valve

1.3 DESIGN BENEFITS

The Ballorex Dynamic valve consists of a pre-setting unit performing like a manual balancing valve, a two-way motorized valve, a thermoelectric or electromechanical actuator, a differential pressure regulator, measuring points, a Venturi orifice and a valve housing.

1. Actuator
2. Flow pre-setting unit moving radially and a two way valve moving axially
3. Inlet opening controlled by unit 2
4. Venturi orifice for flow verification
5. Differential pressure regulator
6. Valve housing
7. Outlet opening area controlled by regulator 5

The internal valve components are designed as one cartridge unit. This enables removal of the complete cartridge for easy system flushing. After the cartridge is removed, a blind cap (also used as the flow pre-setting tool) is mounted to seal the housing when flushing.

Ballorex Dynamic with removable cartridge.

The pre-setting unit of the cartridge ensures the design flow and at the same time it incorporates a two-way valve, controlled by the actuator in reference to the BMS system or room thermostat signal.

The actuator has 100% control authority at full stroke.The pre-setting unit moves radially and is independent of the modulating two-way valve function provided by an axial movement of the valve stem.

1.4 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. 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. After connecting the Ballorex Balancing Computer BC2, or any other flowmeter, to the Ballorex Dynamic, the flow reading is provided for precise flow tuning.

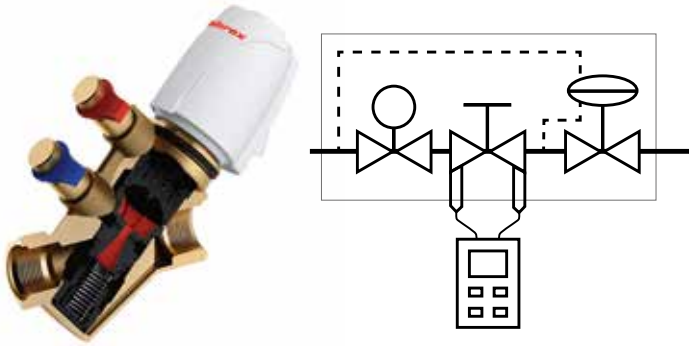
Ballorex Dynamic with pre-setting tool mounted.

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 re-- quired 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 device 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.

Flow measured across the Venturi nozzle integrated in the Ballorex Dynamic valve



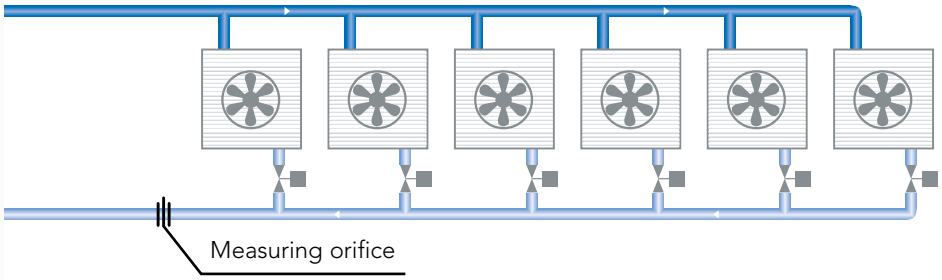
The internal valve parts are designed as one cartridge unit. This enables removal of the complete cartridge for easy system flushing. After the cartridge is removed, a blind cap (also used as the flow pre-setting tool) is mounted to seal the housing when flushing.

Flow verification across the Ballorex Dynamic valve during system commissioning.

1.5 ACTUAL FLOW VERSUS DIFFERENTIAL PRESSURE VERIFICATION

To verify if the valve maintains a constant flow two different methods can be used. The first method is based on actual flow measuring across the built-in Venturi device – as used in the Ballorex Dynamic. In the second method only the differential pressure is measured across the valve to verify if the integrated differential pressure regulator operates within its working range – flow reading is not available.

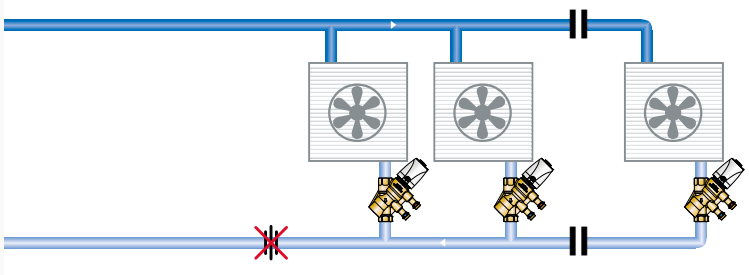
The direct reading of the actual flow has proved to be advantageous compared to the differential pressure measuring across the valve. The main reason is that the actual flow distribution in all the terminal units can be verified, this is particularly useful during system commissioning if the correct flow distribution is not obtained and the problem is to be identified. This is not possible when using the method of differential pressure measuring across a valve and for this reason extra measuring orifices must be installed to check the actual flow.



A measuring orifice is required, if only differential pressure across the valve can be measured in order to verify if the valves in a branch ensure the design flow.

When measuring the differential pressure only, the problem can be that debris in the system water can get stuck in the valve causing a wrong differential pressure reading. The flowmeter will in this instance show that the differential pressure required for dynamic flow control is obtained, but in reality the flow is not ensured as the valve is clogged.

As the Ballorex Dynamic valve has a direct read-out of the actual flow, it will show during commissioning if debris is blocking the cartridge. In this case the cartridge is to be removed, cleaned and reinserted after which the flow verification is repeated. This does not have any impact on the remaining valves as the Ballorex Dynamic is pressure independent.



No measuring orifice is required in branches when using Ballorex Dynamic valves.

No installation of measuring orifices is with the Ballorex Dynamic valve needed as the flow can be verified directly across the valve.

1.6 MOUNTING

The arrow on the Ballorex Dynamic housing indicates the flow direction to be respected. If the valve is to be used as an automatic flow limiter, without an actuator, it can be orientated 360° around the pipe axis.

Both the Ballorex Dynamic valves DN 15 - 25 and the Ballorex thermoelectric actuator can be installed in any position required. In case of the Ballorex Dynamic valves DN 32 - 50 with the electro-mechanical actuator any position is allowed except for the one with Ballorex actuator positioned underneath the Ballorex Dynamic valve.

The Ballorex Dynamic can be mounted directly onto bends and flexible pipes, etc - no straight piping is required.

System flushing should be carried out with the cartridge removed in the Ballorex Dynamic housing. To enable flushing the valve is sealed with the pre-setting cap, provided along with the valve. Maximum pressure during system flushing is 16 bar and the maximum temperature allowed is 25°C. When the system flushing is completed, the pre-setting cap is removed from the valve housing using a 10 mm Allen key and the cartridge can be mounted.

The cartridge is inserted and tightened carefully using a 37 mm key. No tool should be used on the small plastic nut on the top of the cartridge!

A rough pre-setting of the flow is done using the presetting cap with a setting scale of 0-100% of the cartridge flow range. 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.

To isolate the system flow a Ballorex shut-off cap is mounted onto the Ballorex Dynamic DN 15 - 32 valves. Since the valve offers leakage class IV some leakage shall be expected. The Ballorex shut-off cap may be tightened by hand only. Tools are not allowed for this purpose.

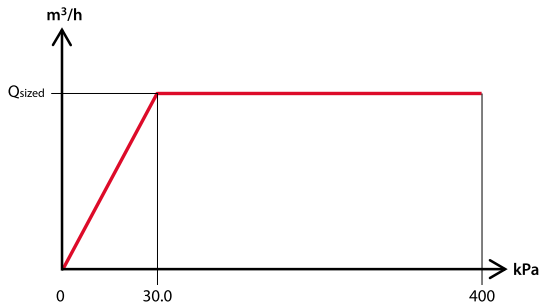
Maximum differential pressure across the Ballorex Dynamic valve must not exceed 400kPa neither during normal operation nor when the valve is in closed position.

Valve on pipe.

1.7 FLOWING CONTROL ACCURACY

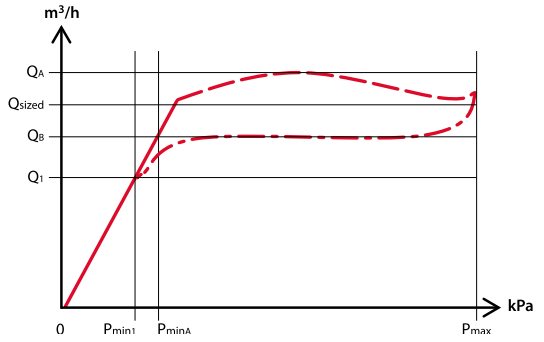
When set to a given flow, all valves based on the principle of dynamic balancing have a certain inaccuracy. Within the valve operating pressure range the real flow can deviate from the set design flow. In practise this means that the actual flow through the valve differs from what it was set to be because 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 ±7%. The differential pressure working range is defined in the below graph: from PminA to Pmax. The flow tolerance, the same as the deviation from the Qsized, is within QA - QB (±7%).



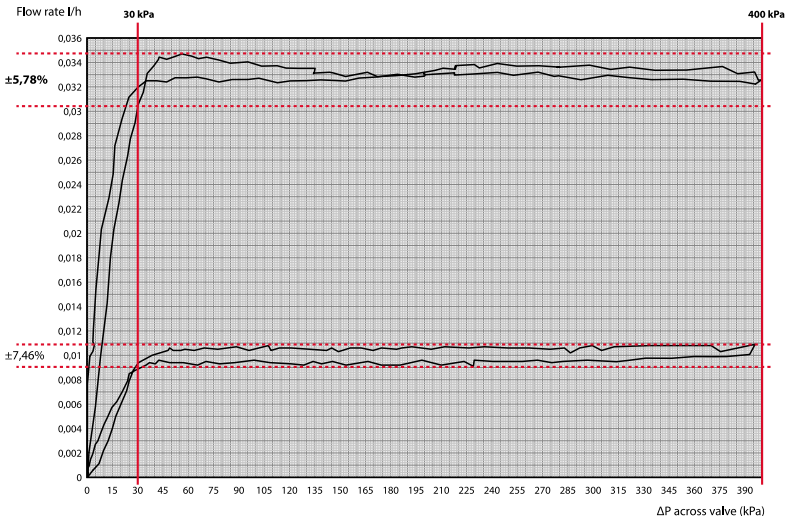
The Ballorex Dynamic minimum operating differential pressure in reference to the flow control accuracy.

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 PminA to Pmin1 would result in a desirable lower pump head, but the flow control accuracy would deteriorate accordingly: QA-QB < QA-Q1. 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.

1.8 ENERGY EFFICIENCY EXAMPLE

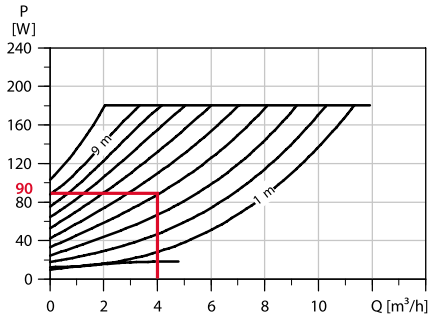
The below flow graph for the Ballorex Dynamic DN 15L indicates that the accuracy in the high flow end is within ±5.8% at a starting differential pressure of 30 kPa.



Ballorex Dynamic DN 15L flow control accuracy at different valve settings.

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.

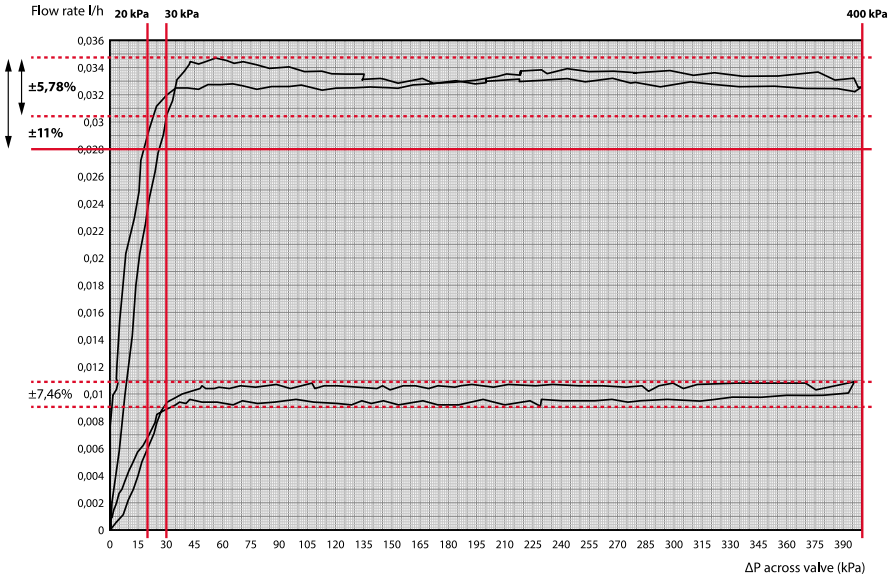
Pump characteristic



Pump power requirement

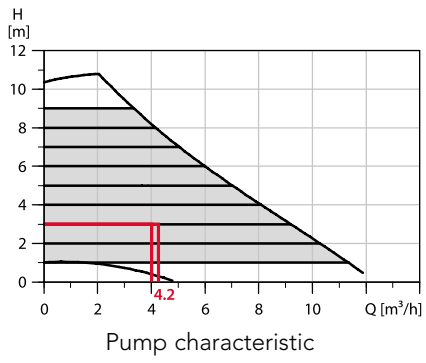
The Ballorex Dynamic valve operates at a starting differential pressure of 30 kPa. The pump power equals 90 W.

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 ±11%.

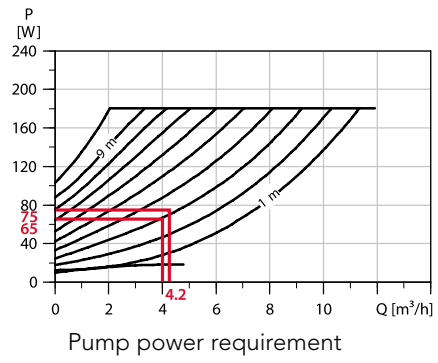


Ballorex Dynamic DN 15L flow control accuracy at a starting differential pressure of 20 kPa.

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 m3/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 10kPa higher head.



Pump characteristic



Pump power requirement

A pressure independent flow control valve at 20 kPa differential starting pressure. Flow control inaccuracy increases by ±5% but the pump power is reduced to 75 W. Flow will increase from 4.0 m3/h (93.3 kW) at a pump power of 65 W to 4.2 m3/h (98.0 kW) at a pump power of 75 W which results in an energy consumption increase in the controlled system of 4.7 kW.

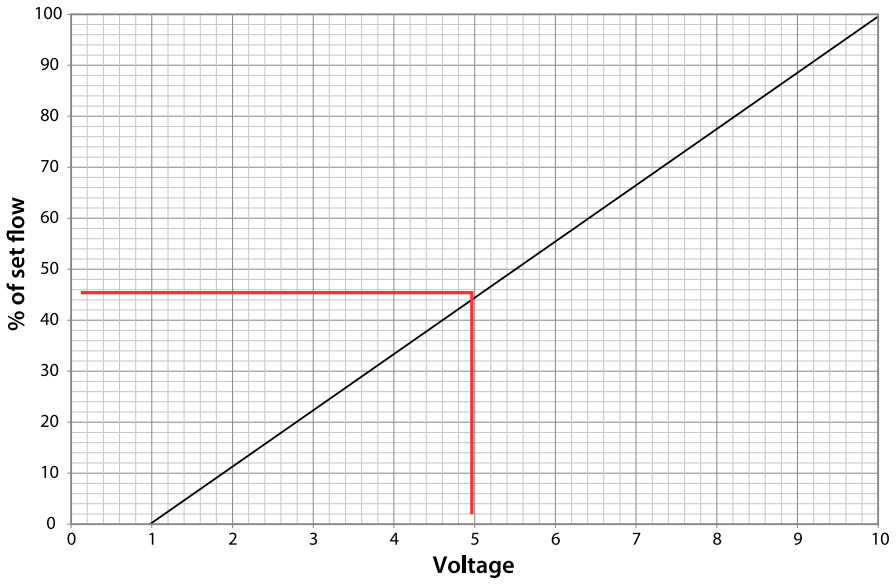
In this example the energy gain using a pump with lower pump head is 90 W - 75 W = 15 W. Compared to the accuracy loss caused by a possible overflow, the pump energy reduction is negligible. This shows that a simple pump head decrease due to a lower starting differential pressure requirement is not a 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.

1.9 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 -25
Electromechanical on/off 230/24 V and modulating 0-10 V actuators for sizes DN 32 -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.



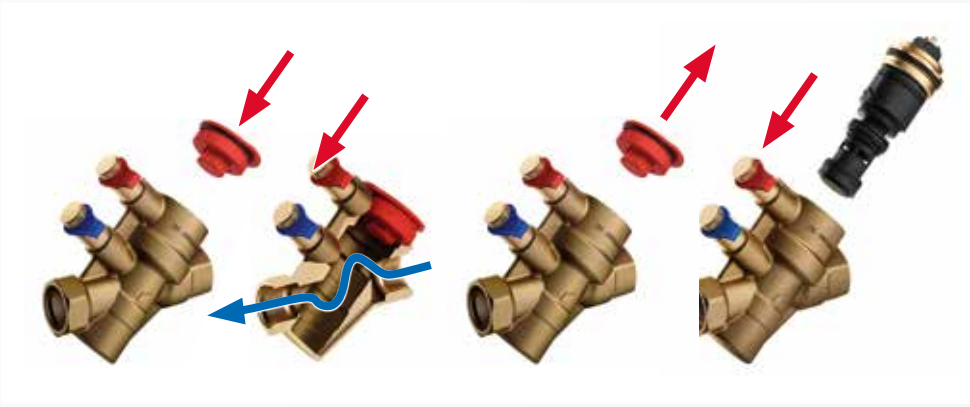
A Ballorex Dynamic DN 50H is set to provide a flow rate of 10000 l/h. To find the flow at an actuator position of 5 V, the graph shows that 45% of the pre-set flow will pass through the valve:
10000 l/h x 45% = 4500 l/h.

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.

1.10 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.



Flushing of Ballorex Dynamic.

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.

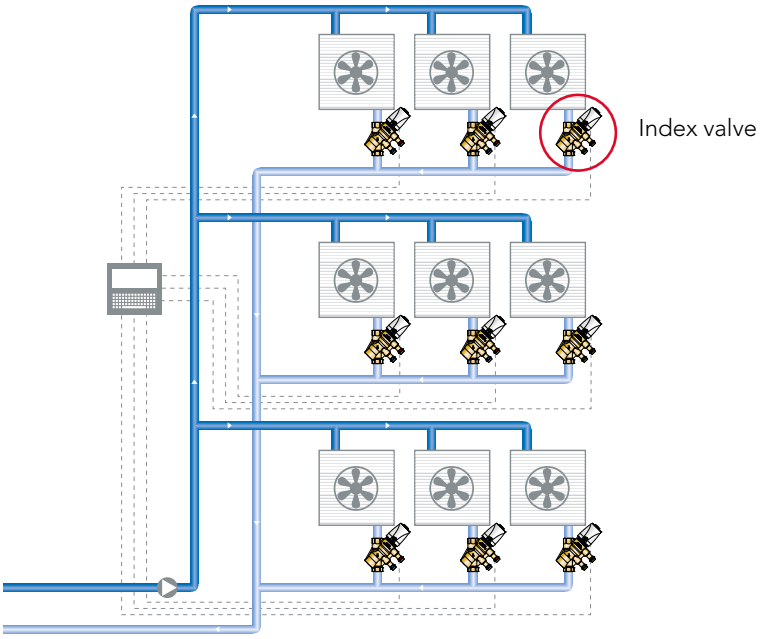
1.11 DYNAMIC SHUT-OFF CAP

A shut-off cap for Ballorex Dynamic DN 15 - 32 is available 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. Index

1.12 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.

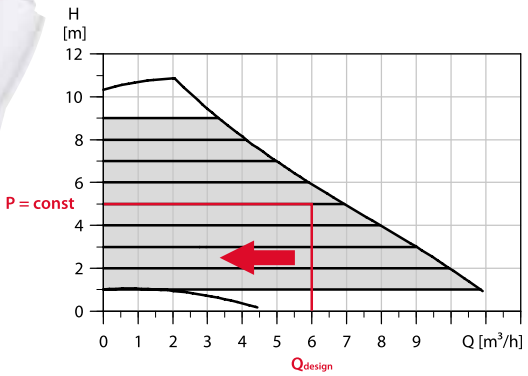


Indication of the index valve in a system of fan-coils balanced by Ballorex Dynamic valves.

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.

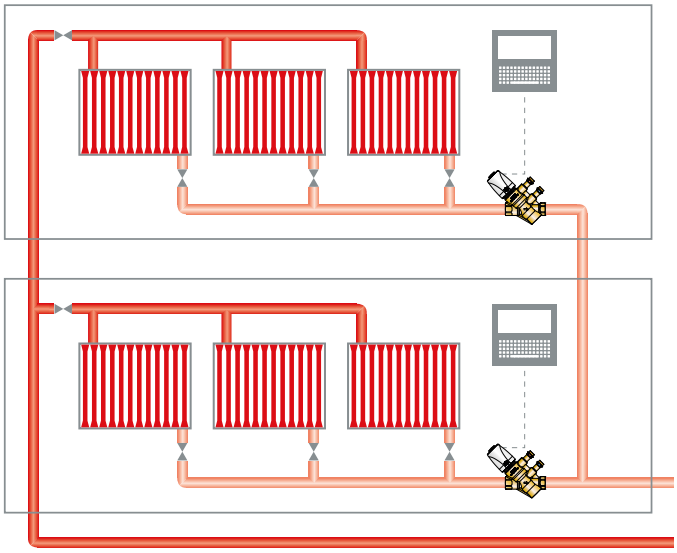
INTRODUCTION



Variable speed pumps installed in a system of Ballorex Dynamic valves operated in constant pressure mode. When flow decreases below the design value the differential pressure still remains on the same level ensuring the required conditions for Ballorex Dynamic valves to operate with 100% authority.

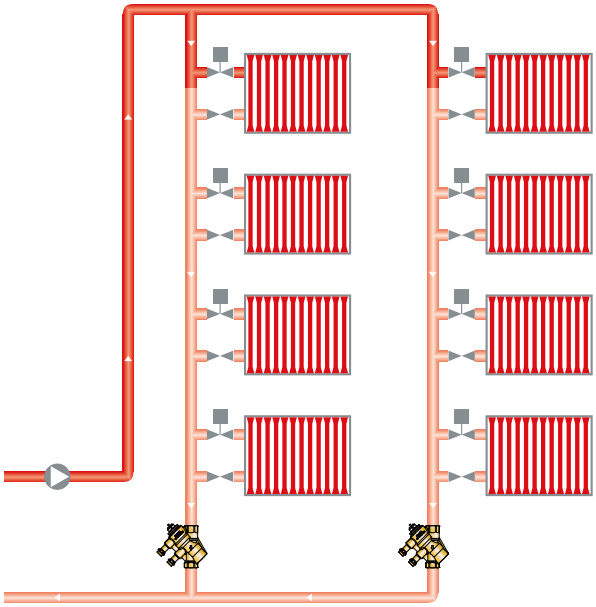
When using a variable speed pump it is recommended to operate it in a constant differential pressure mode. This will ensure that the flow will be adjusted according to the current load demand and that the constant pressure level will provide the required condition for the differential pressure regulator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

2. APPLICATIONS



Application 1 - Central heating system

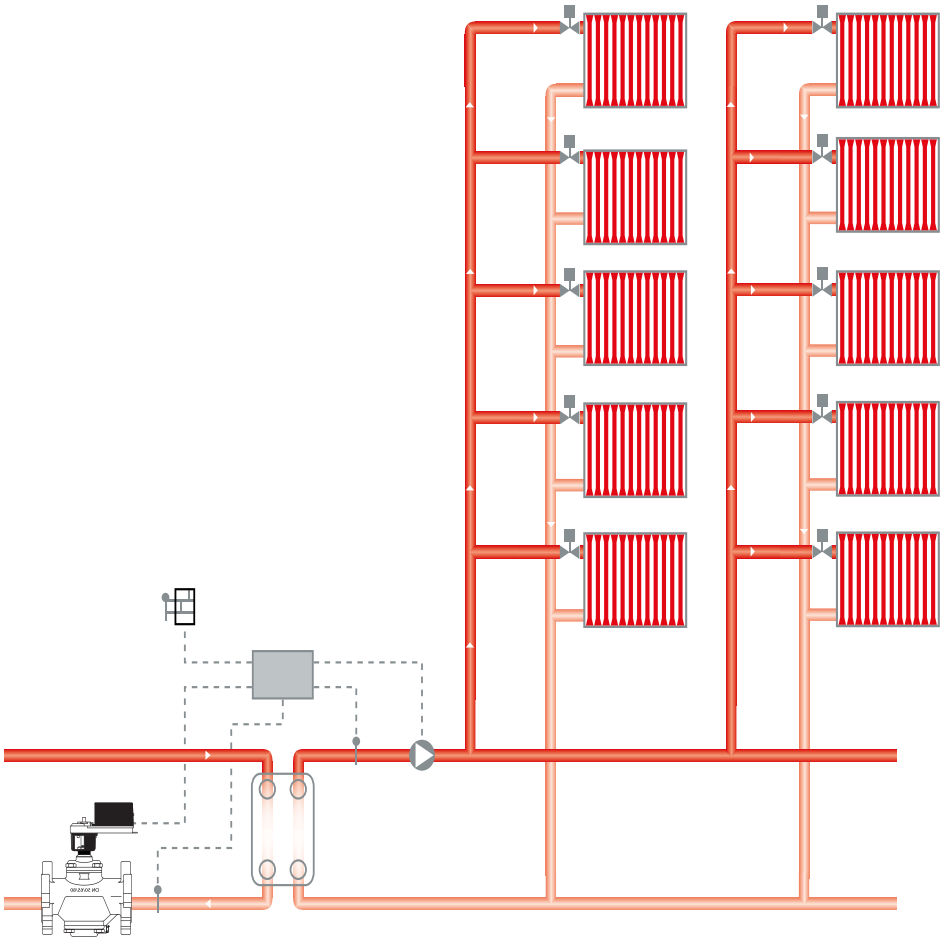
The Ballorex Dynamic can be installed in a branch of a central heating system with radiators or other terminal units. The Ballorex Dynamic will in this way ensure that pressure fluctuations from the remaining part of the system will not affect the controlled branch, keeping the flow constant. The actuator controlling the two-way valve of Ballorex Dynamic is connected to a thermostat or BMS system. By opening or closing the two-way valve in reference to the room temperature, the Ballorex Dynamic will ensure the required thermal indoor comfort.



Application 2 - One-pipe heating system

The Ballorex Dynamic is in a one-pipe heating system installed without an actuator. The Ballorex Dynamic will then operate as an automatic flow limiter ensuring the required water distribution in all the branches and risers.

APPLICATIONS

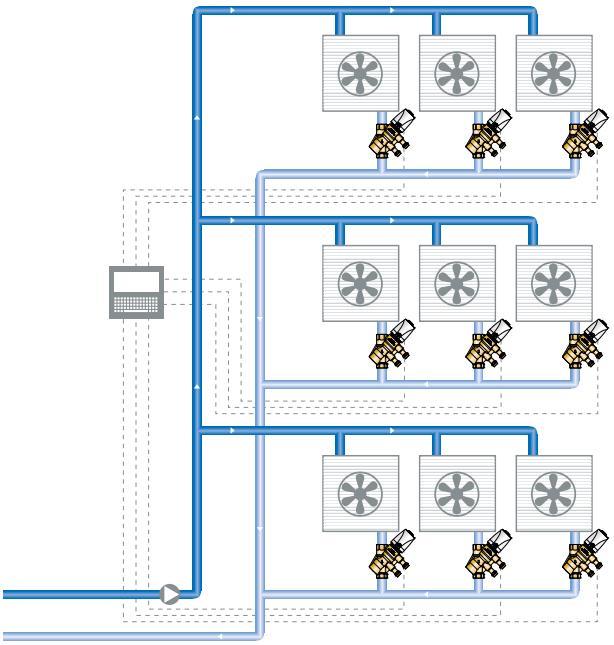


Application 3 - District heating system - heat exchange station.

The Ballorex Dynamic valves are used to control flow in heat exchange stations in heating and cooling systems.

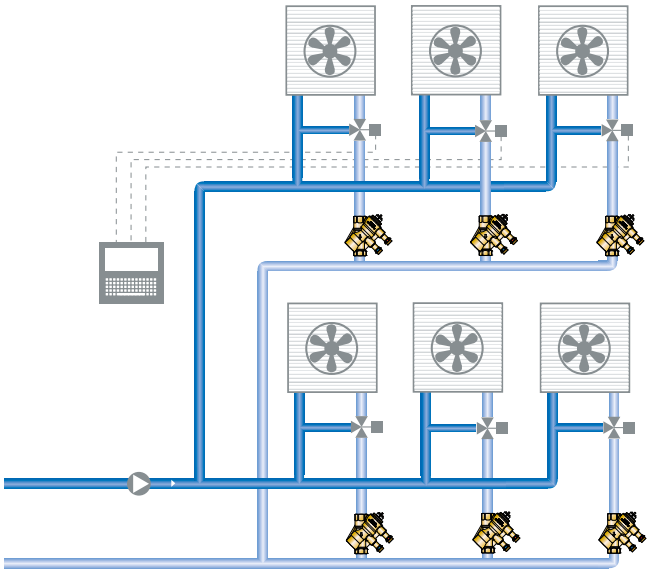
The maximum flow limitation is done by the DIP switch setting which is required to ensure the hydronic balance in sizing conditions.

The required temperature of water in the secondary side of the system is achieved by controlling flow on Ballorex Dynamic. The control unit or a BMS system provides a signal changing the position of the two-way valve in Ballorex Dynamic and thus assuring the required flow in reference to the outdoor air temperature. Each time a new flow is provided, the integrated in Ballorex Dynamic differential pressure regulator makes it is kept constant regardless of pressure fluctuations in the system.



Application 4 - Fan coil system with variable flow.

The Ballorex Dynamic will provide hydronic balance in variable flow systems and ensure sufficient flow at all load conditions in terminal units. The Ballorex actuator controlling the two-way valve inside the Ballorex Dynamic is connected to a room thermostat or a BMS system. By opening or closing the two-way valve in reference to the room temperature, the Ballorex Dynamic will ensure the required thermal indoor comfort.



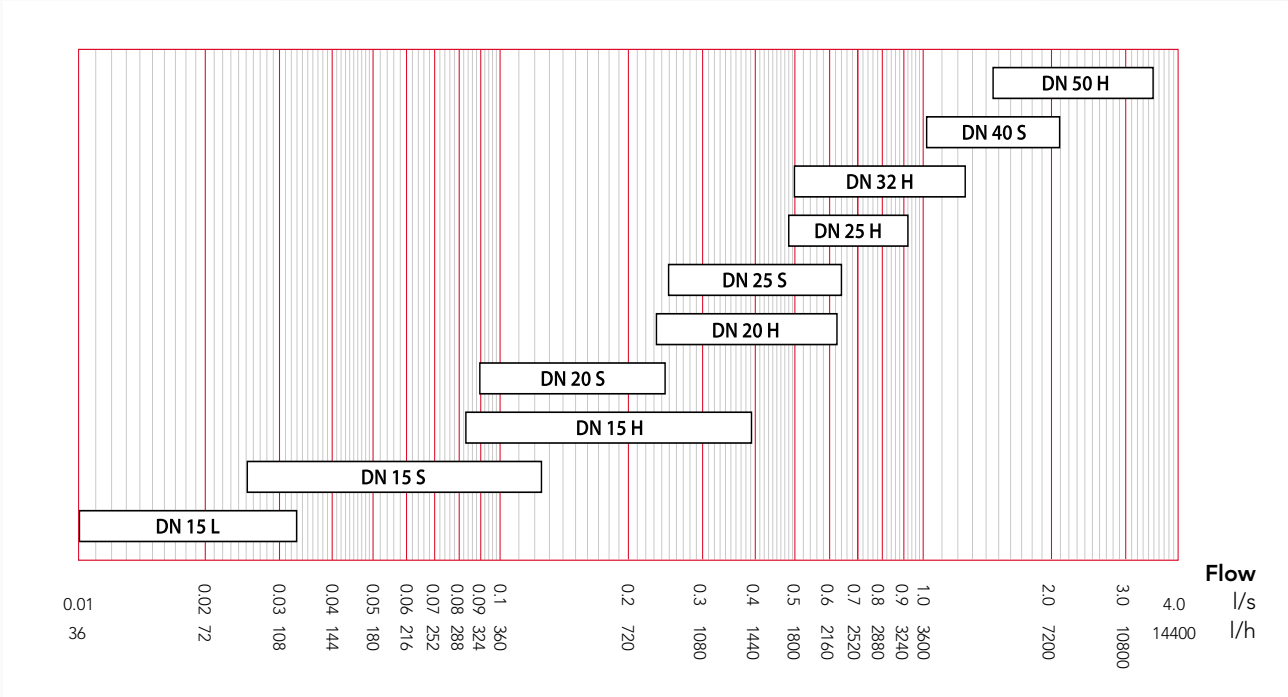
Application 5 - Fan coil system with constant flow.

The Ballorex Dynamic will provide hydronic balance in a constant flow system equipped with three-way motorized valves and ensure sufficient flow at all load conditions in a fan coil or other terminal unit. The Ballorex Dynamic is in this application without an actuator as the room temperature control is ensured by the operation of a three-way motorized valve. The three-way motorized valve is connected to a thermostat or a BMS system. By opening or closing the three-way valve in reference to the room temperature, the required thermal indoor comfort is achieved.

3. PRODUCT FINDER

3.1 PRODUCT FINDER

902 DN 15 - DN 50

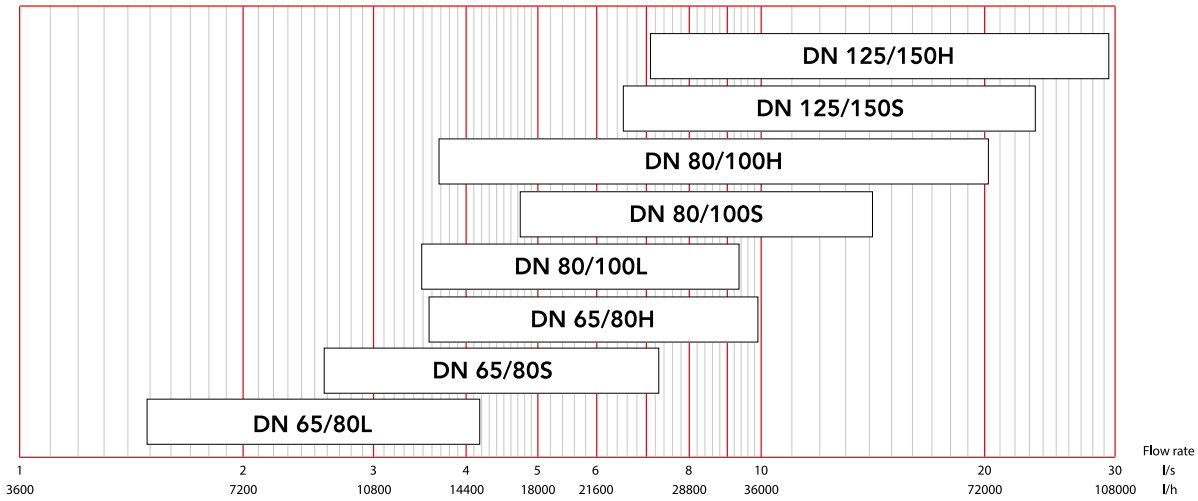


Ballorex Dynamic Flow range				
l/s	l/h	Dimension	Colour code	Valve Threaded
0.01-0.033	36-118	DN 15L	White	15230
0.025-0.125	90-450	DN 15S	Red	15231
0.083-0.39	300-1400	DN 15H	Black	15232
0.089-0.245	320-882	DN 20S	White	15240
0.232-0.617	835-2221	DN 20H	Black	15241
0.240-0.650	865-2340	DN 25S	White	15221
0.485-0.925	1750-3330	DN 25H	Black	15222
0.530-1.220	1910-4400	DN 32H	Black	15223
1.02-2.10	3670-7560	DN 40S	White	15224
1.44-3.50	5180-12600	DN 50H	Black	15225

Also available: Press, Press Union, Push Fit Connection.

3.1 PRODUCT FINDER

902XS DN 65 - DN 125



Ballorex Dynamic Flow range			
l/s	l/h	Dimension	Valve Threaded
1.48-4.16	5310-15000	DN 65/80L	14989
2.57-7.15	9240-25700	DN 65/80S	14992
3.55-9.88	12800-35600	DN 65/80H	14993
3.49-9.38	12600-33800	DN 80/100L	14994
4.73-14.2	17000-51000	DN 80/100S	14995
3.68-20.2	13300-72700	DN 80/100H	14996
6.48-23.3	23300-83800	DN 125/1505	14997
7.10-29.5	25600-106000	DN 125/150H	14998

Ballorex Dynamic

4. COMMISSIONING PRODUCTS

902S Dynamic Commissioning Valve

Ballorex Venturi DZR Dynamic valve excluding actuator.
ISO 7/1 Parallel threads

PSU902S Dynamic Commissioning Valve

Ballorex Venturi DZR Dynamic Valve - excluding actuator. XPress union end x XPress end for copper/carbon steel/stainless steel tube. Direct flow measuring.

PS902S Dynamic Commissioning Valve

Ballorex Venturi DZR Dynamic Valve - excluding actuator. XPress ends for copper/carbon steel/stainless steel tube. Direct flow measuring.

902XS Dynamic Commissioning Valve

902XS Ballorex Dynamic, sizes upto DN 65 - DN 125, suitable for District Heating Systems.

PT902S Dynamic Commissioning Valve

Ballorex DZR Dynamic valve - no actuator. Tectite ends for copper/carbon steel/stainless steel tube.

XTU902S Dynamic Commissioning Valve

Ballorex DZR Dynamic Valve - no actuator. XPress union end x Tectite push end for copper/carbon steel/stainless steel tube. Direct flow measuring.

XT902S Dynamic Commissioning Valve

Ballorex DZR Dynamic Valve - no actuator. XPress press end x Tectite push end for copper/carbon steel/stainless steel tube. Direct flow measuring.

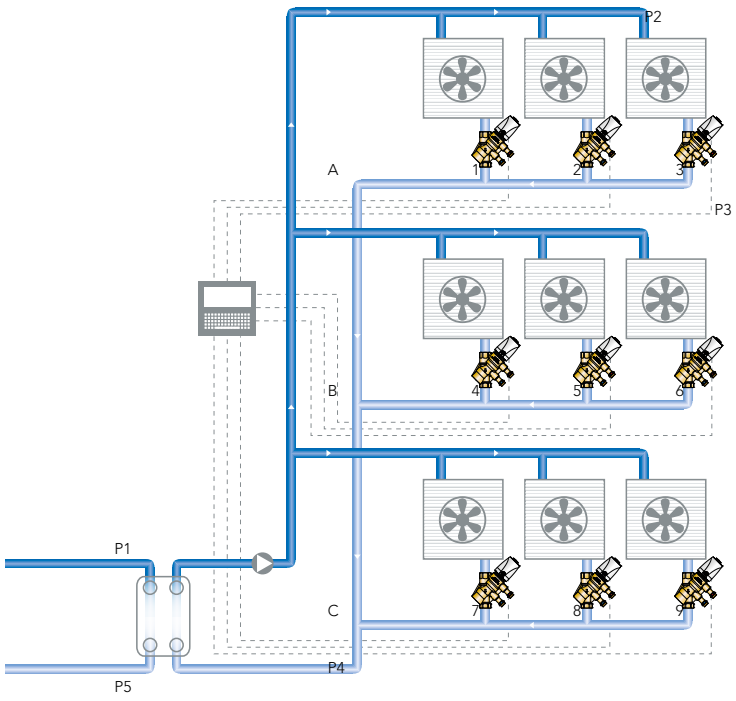
Dynamic Actuators

A range of on/off and modulating mechanisms suiting the Dynamic Valve.

5. SIZING EXAMPLES

5.1 BALLOREX DYNAMIC SYSTEM SIZING

Ballorex Dynamic valves are in the following example installed in a system of fan coil units. The valves will provide the required flow to the terminal units to control the indoor temperature.



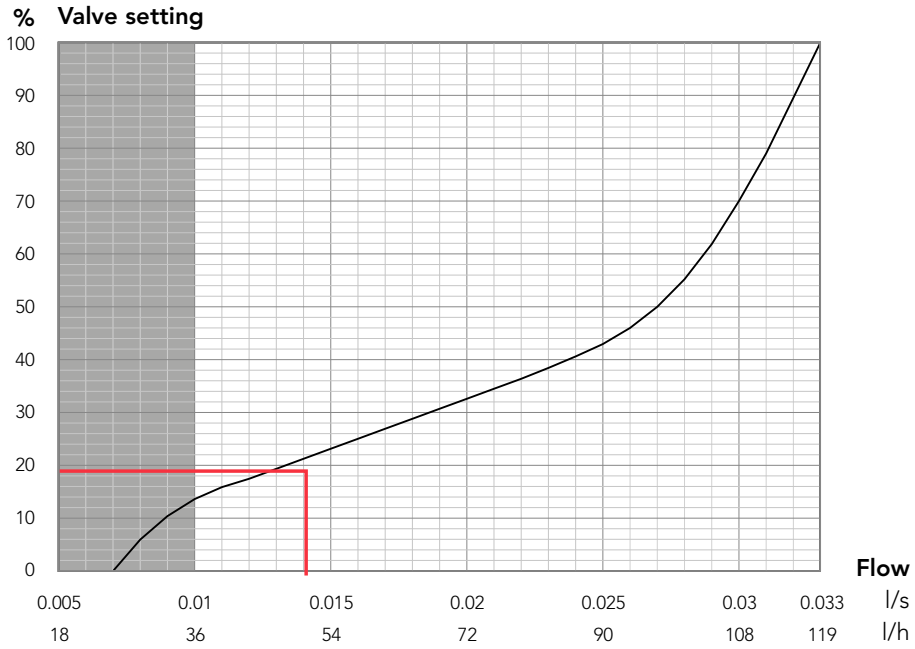
Fan coil cooling system balanced by a Ballorex Dynamic valve on each terminal unit.

The fan coil flow specified for the sizing conditions is as follows:
Ballorex Dynamic No. 1: required flow 0.014 l/s (50 l/h)
Ballorex Dynamic No. 2: required flow 0.020 l/s (72 l/h)
Ballorex Dynamic No. 3: required flow 0.025 l/s (90 l/h)

Ballorex Dynamic No. 4: required flow 0.30 l/s (1080 l/h)
Ballorex Dynamic No. 5: required flow 0.35 l/s (1260 l/h)
Ballorex Dynamic No. 6: required flow 0.40 l/s (1440 l/h)

Ballorex Dynamic No. 7: required flow 0.50 l/s (1800 l/h)
Ballorex Dynamic No. 8: required flow 1.00 l/s (3600 l/h)
Ballorex Dynamic No. 9: required flow 1.10 l/s (3960 l/h)

For the No. 1 Ballorex Dynamic valve the required flow is within a Ballorex Dynamic DN 15L valve flow range. To find the DN 15L valve setting, a vertical line is drawn from the flow axis (0.014 l/s) to the black curve. Subsequent a horizontal line is drawn from the point of the intersection of the vertical line with the curve to the setting axis. The valve setting then reads 21% to obtain a flow of 0.014 l/s in the Ballorex Dynamic valve No. 1.



Flow diagram for Ballorex Dynamic DN 15L with a 21% required setting at 0.014 l/s.

The setting for the remaining Ballorex Dynamic valves is as follows:
Ballorex Dynamic No. 2: DN 15L - setting 33%
Ballorex Dynamic No. 3: DN 15L - setting 43%

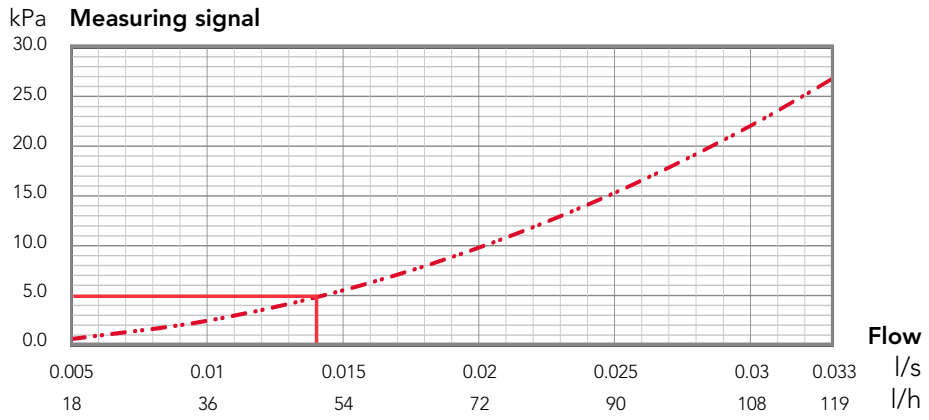
Ballorex Dynamic No. 4: DN 15H - setting 48%
Ballorex Dynamic No. 5: DN 15H - setting 65% or DN20H - setting 28%
Ballorex Dynamic No. 6: DN 20H - setting 42%

Ballorex Dynamic No. 7: DN 20H - setting 65% or DN25S - setting 64%
Ballorex Dynamic No. 8: DN 32H - setting 50%
Ballorex Dynamic No. 9: DN 32H - setting 67%

During system commissioning the flow can be adjusted by means of the setting tool or more precisely using a Ballorex flowmeter. When using any other flowmeter, the Kvm value must be typed into the flowmeter to receive the correct flow reading.

SIZING EXAMPLES

The pressure loss across the measuring points of the No. 1 Ballorex Dynamic valve at the flow of 0.014 l/s must be 5.0 kPa.



Measuring signal diagram for Ballorex Dynamic DN 15L. The pressure loss measured across Ballorex Dynamic DN 15L measuring points at a flow of 0.014 l/s is 5.0 kPa.

The same principle applies to the remaining valves in this example. In order to obtain the required flow the following pressure loss across the measuring points of the valves must be obtained:

Ballorex Dynamic No. 2 measuring signal: 9.0 kPa
Ballorex Dynamic No. 3 measuring signal: 15.0 kPa
Ballorex Dynamic No. 4 measuring signal: 19.0 kPa
Ballorex Dynamic No. 5 measuring signal: 25.5 kPa
Ballorex Dynamic No. 6 measuring signal: 9.5 kPa
Ballorex Dynamic No. 7 measuring signal: 14.5 kPa
Ballorex Dynamic No. 8 measuring signal: 18.5 kPa
Ballorex Dynamic No. 9 measuring signal: 22.5 kPa

Knowing that fan coil No. 3 is in the reference circuit, the pump head can be calculated. The pump pressure must be equal to the sum of pressure loss generated in the heat exchanger, pipes, service valves, strainers, fan coil, etc. In addition 30.0 kPa (ΔPb) required for the Ballorex Dynamic is to be added. If the pressure loss calculated along the circuit P1, P2, P3, P4, P5, P1 equals ΔPC = 35.0 kPa, the pump head ΔPh must be at least:
ΔPh = ΔPC + ΔPb = 35.0 + 30.0 kPa = 65.0 kPa. If a variable speed pump is used, it is to be operated in a constant differential pressure mode (65.0 kPa) to provide the Ballorex Dynamic valves with at least 30 kPa differential pressure at all times.

Balancing valves are not required in A, B and C branches. The Ballorex Dynamic valves installed at the terminal units will ensure the hydronic balance in the whole system.

5.2 GENERAL SPECIFICATIONS DN 15L-50H

1 Pressure independent flow control valve Ballorex Dynamic

1.1. The contractor must install the pressure independent control valves where indicated in drawings.

2. Function

2.1. The valve must be usable with/or without actuator, either as a dynamic flow limiter or a pressure independent control valve.

2.2. The positioning of valve housing with thermo-electric actuator must be possible in any direction (360°).

2.3. Flushing through valve with the cartridge removed from the housing must be possible.

2.4. Direct flow measuring must be possible at all times with an accuracy tolerance of within ±3%.

2.5. The pre-setting of the valve must have no effect on the valve authority.

2.5. Maximum flow setting must be externally adjustable.

2.6. The valve must have no requirement for straight up- or downstream piping.

3. Valve Body

3.1. The valve body must be made of hot stamped DR brass CW602N CuZn36Pb2As.

3.2. The pressure rating must be no less than PN25.

3.3. A flow arrow must be indicated on the valve body.

3.4. Flow pre-setting, actuator and the measuring points must be positioned on the same side of the housing.

3.5. Flow measuring through the measuring points must be possible in all valve directions (360°).

4. Flow regulation unit

4.1. The flow regulation unit must consist of glass-reinforced polyphenylene sulphide.

4.2. The flow regulation unit must be of cartridge type for easy accessibility, system flushing, replacement or maintenance.

4.3. The flow regulation unit must be easily identifiable and color-coded.

4.4. Flow measurement must be done across a cartridge comprising an integrated Venturi nozzle.

5. Actuator

5.1. The thermo-electric actuator must be rated IP54 (waterproof).

5.2. The electromechanical actuator must be rated IP40.

5.3. Actuator must be driven by 24 V or 230 V operating voltage.

5.4. Actuator must use full stroke providing full authority.

5.5. Actuator must have visible indication of stroke position.

6. ACTUATORS

6.1 THERMOELECTRIC ACTUATOR FOR DYNAMIC DN 15-25

Ballorex Dynamic valves are in the following example installed in a system of fan coil units. The valves will provide the required flow to the terminal units to control the indoor temperature.

ON/OFF and modulating actuator

Thermoelectric

Ballorex Dynamic DN 15 - 25 ½" - 1"

6.1.1 DESCRIPTION

A thermoelectric actuator is used to operate Ballorex Dynamic DN 15 -25 valves. The actuator is controlled by a room thermostat, with two-point output or pulse-width modulation, or a building management system (BMS). The actuator is provided as normally closed in the following versions:

- modulating 0-10 V DC signal, 24 V AC
- on/off 24 V AC/DC
- on/off 230 V

The actuator mechanism is made up of a PTC resistor – a heated wax element – and a compression spring. The wax element is heated by applying the operating voltage and thereby moving the integrated piston. The force generated by this movement is transferred to the piston to open or close the Ballorex Dynamic valve.

6.1.2 BENEFITS

- Small dimensions
- First-open function
- Maintenance free
- Function display
- Noiseless
- Low power consumption
- 360° installation position
- Long expected service life
- Protection class IP54element is heated by applying the operating voltage and thereby moving the integrated piston. The force generated by this movement is transferred to the piston to open or close the Ballorex Dynamic valve.

6.1.3 DESIGN

The thermoelectric actuator can be used with Ballorex Dynamic DN 15-25. The installation of the actuator is done by mounting the adaptor onto the valve. The actuator is then clicked onto the adaptor.

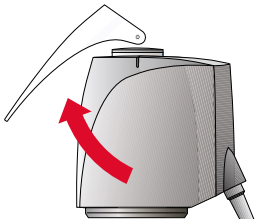
1 - Function display
2 - Visor protection against unauthorized access
3 - Actuator housing
4 - Wax element

The actuator is delivered in open position before electricity is applied for a first-open function. This enables the operation of the heating or cooling system during the construction phase before electrical wiring is completed. During the later electrical start-up, the first-open function is unlocked by applying the operating voltage for more than 6 minutes. The actuator will thereafter be completely operable.

The first-open function of the actuator is not designed for system filling or flushing. It is recommended to remove the cartridge from the valve housing before system flushing. To fill the system the actuator must be removed.

The actuator function display element moves up or down as the built-in wax element contracts or expands in response to the applied voltage.

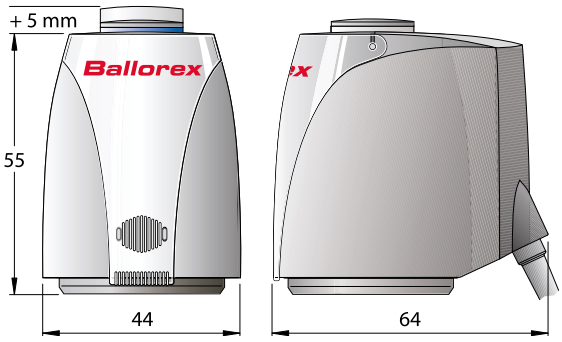
The function display is designed for verification of the valve position. As the built-in wax element expands or contracts, the function display element moves up or down. The function display element is not to be depressed at any time as this might cause damage to the actuator.



Actuator access protection.

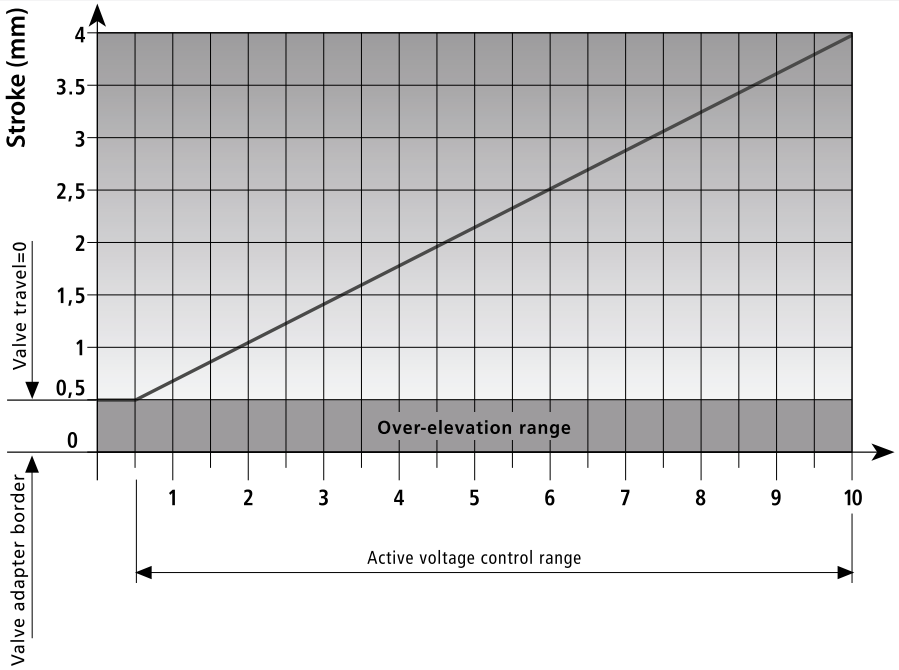
The actuator is protected against unauthorized access simply by removing the visor.

6.1.4 MODULATING ACTUATOR 24 V

Dimensions	Specifications	
	**Operating voltage**	24 V AC, 50-60 Hz
	Base position	Normally closed
	Operating power	2 W
	Average actuation delay	30 s/mm
	Control voltage	0-10 V DC
	Actuator travel	4 mm
	Actuating force	100 N ±5%
	Ambient temperature	0 to +60°C
	Protection class	IP54
	CE conformity	EN 60730
	Connecting cable	White/1 m/30 g

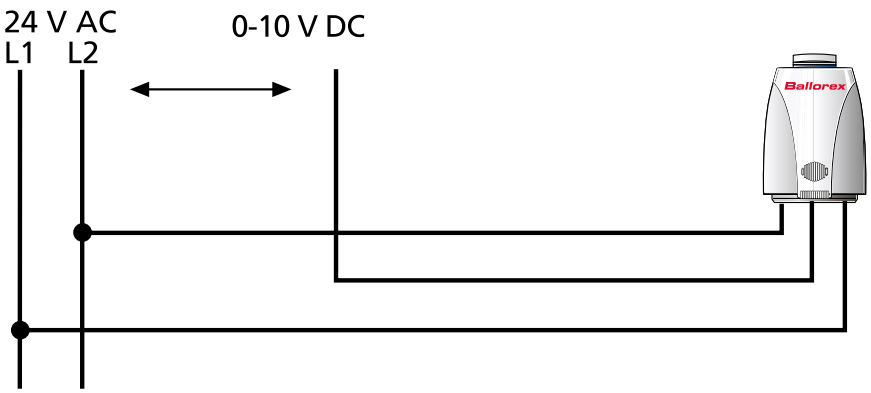
Actuator	Article	Description
	15281	902 Modulating actuator (AE01) Modulating actuator - 24 V AC operating voltage

The modulating thermo-electric actuator will open or close Ballorex Dynamic DN 15-25 valves in direct proportion to the applied control voltage. The control is powerless and is achieved by use of a 0-10 V DC signal which is provided either by a room thermostat or by a building management system (BMS). When a control voltage is applied, the actuator opens the valve proportionally to the detected actuator travel.



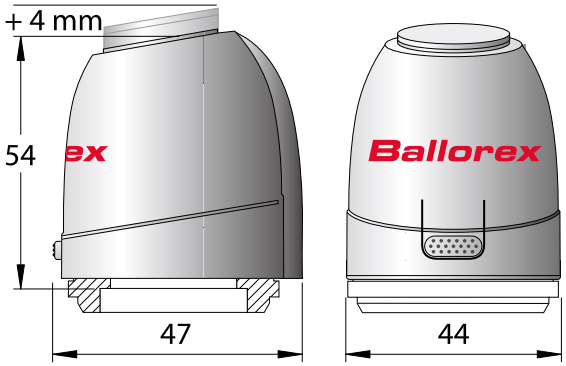
Stroke in reference to the 0-10 V control signal.

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.



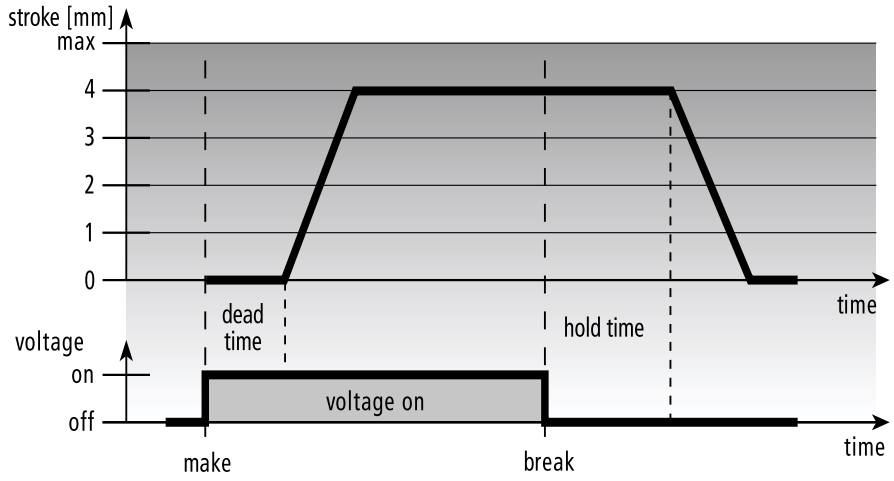
Connection of the actuator.

6.1.5 ON/OFF ACTUATOR 230 V AND 24 V

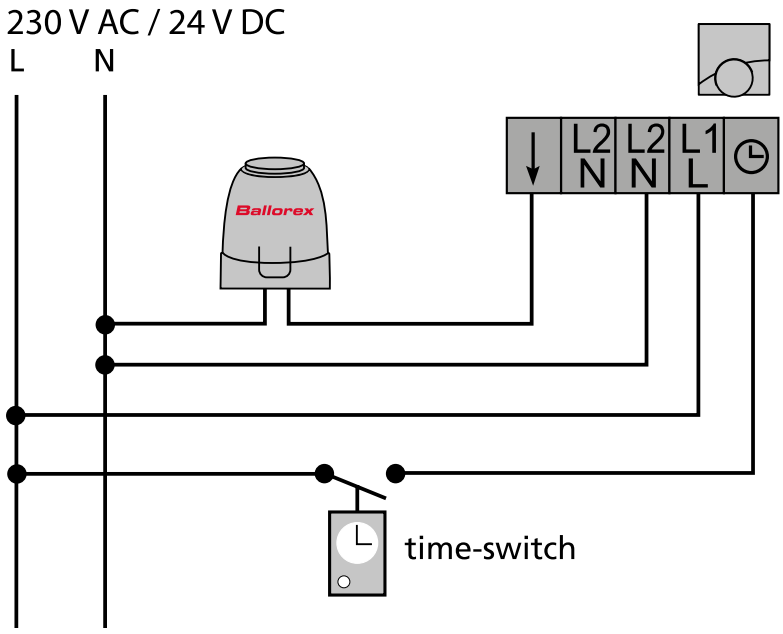
Dimensions	Specifications		
	**Operating voltage**	24 V AC/DC 50-60 Hz	24 V AC/DC 0-60 Hz
	Base position	Normally closed	Normally closed
	Operating power	1.8 W	1.8 W
	Closing and opening	approx. 3 min.	approx. 3 min.
	Actuating force	100 N ±5%	100 N ±5%
	Ambient temperature	0 to +60°C	0 to +60°C
	Protection class	IP54	IP54
	CE conformity	EN 60730	EN 60730
	Connecting cable	Grey/1 m	Grey/1 m

Actuator	Article	Description
	15280	902 Actuator ON/OFF actuator - 230 V operating voltage Normally closed
	15202	902 Actuator ON/OFF actuator - 24 V operating voltage
	15203	902 Actuator ON/OFF actuator - 24 V operating voltage

The Ballorex Dynamic DN 15-25 valves are opened steadily by the ram motion of the actuator upon switching on the operating voltage and after the expiry of the dead time. The wax element cools down after the operating voltage is cut, and the closing force of the compression spring will close the valve evenly.



Operation of the actuator.



Connection of the actuator.

6.2 ELECTROMECHANICAL ACTUATOR FOR DYNAMIC DN 40-50

ON/OFF and modulating actuator

Electro-mechanical

Ballorex Dynamic DN 40 - 50 1½ - 2"

6.2.1 DESCRIPTION

The electromechanical actuators for the Ballorex Dynamic DN 40 - 50 valves are available in three versions:

- AVUE - modulating controlled by 0-10 V DC signal 24 V AC
- AVUX - on/off 24 V AC
- AVUM - on/off 230 V AC

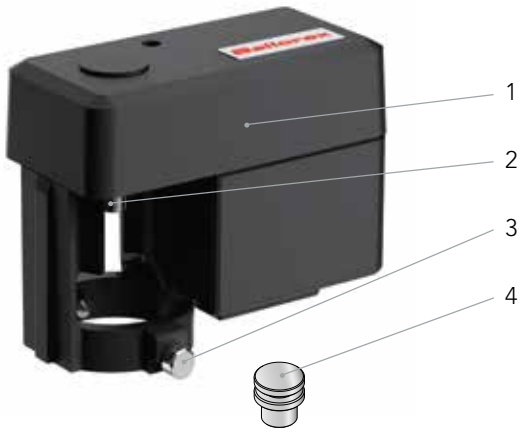
The AVUE actuator has a linear output drive for use in combination with any controller providing a 0-10 V direct current (DC) output signal to operate a Ballorex Dynamic DN 40 - 50 valve. The AVUX is a 24 V alternating current (AC) modulating linear actuator suitable for modulating a Ballorex Dynamic valve from any 24 V (AC), 3-point controller or device. The AVUM is a mains voltage (230 V AC) modulating linear actuator to be controlled from any controller or device having a 3-point mains switched output.

6.2.2 BENEFITS

- Accurate positioning
- Simple installation and commissioning (self-referencing/auto stroking)
- Direct coupling to valve
- Actuator fitting to the valve without the use of tools
- Built-in manual override supplied as standard (screwdriver operated for security)
- Neat compact design easing fitting at terminal units
- Fly lead simplifying wiring to the controller
- Approved to European EMC and safety standards
- Manual Override Reset facility (AVUE)
- 0-10 V DC control signal input (AVUE)
- 3-point modulating signal (AVUX & AVUM)

6.2.3 DESIGN

The electromechanical actuators for Ballorex Dynamic DN 40 - 50 valves operate by a screw jack principle using a reversible synchronous motor via a gear train and a magnetic clutch.

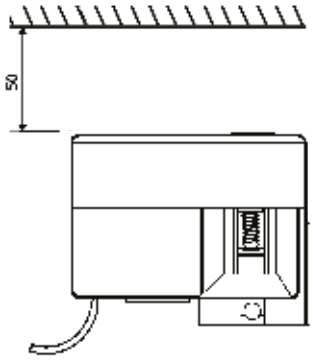


1 - Housing
2 - Claw coupling
3 - Captive fixing screws
4 - Adapter slid into the claw (2) (factory mounted on the valve stem)

6.2.4 INSTALLATION

The actuator cover is not to be removed when installing the actuator onto the Ballorex Dynamic DN 40 - 50 valves. It is required that the two captive fixing screws in the mounting frame are fully retracted prior to the installation.

The adapter, factory mounted on the valve, is then slid into the claw coupling. The actuator frame is lowered onto the valve until it is even with the valve clamping face. The two captive screws are then finally finger tightened (tools are not required). The claw coupling should already be in the optimum position, but if this is not the case, the manual override must be adjusted on the top of the unit (a small, flat-blade screwdriver will be required; turning the screw clockwise will drive the claw coupling down). The AVUE actuator has a reset button on the underside to be used when the manual override is operated at the unit powered-up. Minimum 50 mm space above the actuator is required.



Mounting space requirement is minimum 50 mm from the top of the actuator.

The colour-coded fly lead is connected to the controller, as shown in the appropriate connection diagram. Cable length and resistance limitations must be observed.

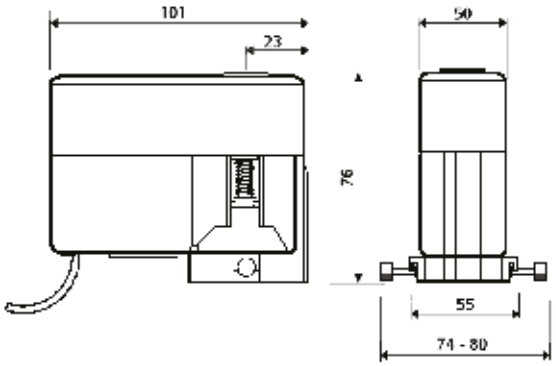
Wiring from actuator to controller	Max. length 1.5 mm cable unscreened	Max. resistance per conductor
AVUE 0-10 V DC signal	100 m	50Ω
AVUM - 230 V AV	100 m	10Ω

Wiring pre-cautions

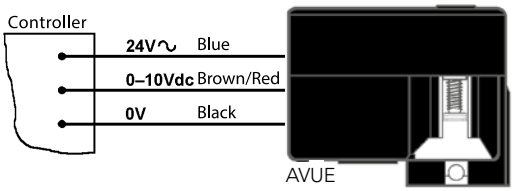
It must be ensured the cable is routed clear of valve and pipework.

Applying power to the actuator before its installation onto the valve is completed will change the pre-set position, and adjustment by the manual override will be required to fitt the actuator onto the valve.

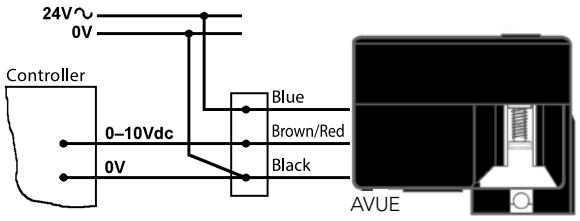
6.2.5 MODULATING ACTUATOR 24 V

Dimensions	Specifications	
	**Operating voltage**	24 V AC
	Operating power	3.1 VA
	Control voltage	0-10 V DC
	Actuator stroke	12.7 mm
	Stroke time	110 s
	Actuating force	220 N
	Ambient temperature	
	operating	0-50°C
	storage	-40-70°C
	Protection class	IP40
	Ambient humidity	0 - 95%
	Connecting cable	Color-coded fly lead, 1.5 m long, 3 core
	Housing	Moulded plastic housing (fire resistance to UL94V-0)
	CE conformity	EN 60730-1

Actuator	Article	Description
	80597.0103	AVUE - modulating actuator 24 V operating voltage

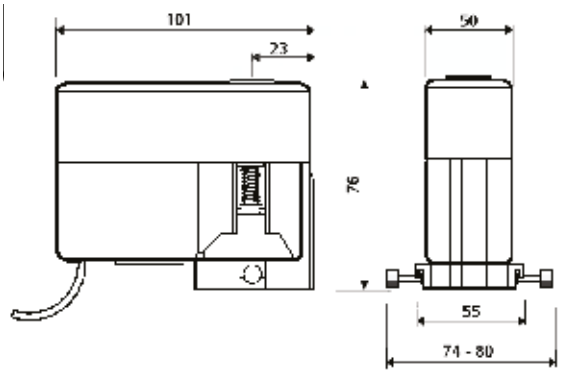


Connection of the actuator.

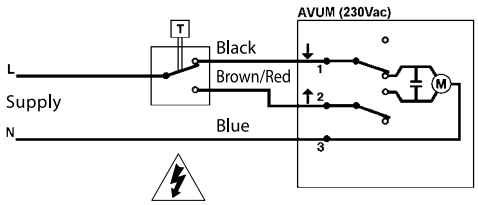


Connection of the actuator.

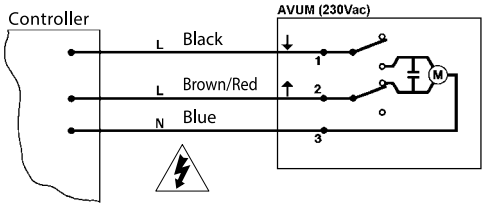
6.2.6 ON/OFF ACTUATOR 230 V

Dimensions	Specifications	
	**Operating voltage**	230 V AC
	Operating power	3.6 VA
	Control voltage	230 V AC
	Actuator stroke	12.7 mm
	Stroke time	110 s
	Actuating force	220 N
	Ambient temperature	
	operating	0-50°C
	storage	-40-70°C
	Protection class	IP40
	Ambient humidity	0 - 95%
	Connecting cable	Color-coded fly lead, 1.5 m long, 3 core
	Housing	Moulded plastic housing (fire resistance to UL94V-0)
	CE conformity	EN 60730-1

Actuator	Article	Description
	80597.0102	AVUE - modulating actuator 230 V operating voltage

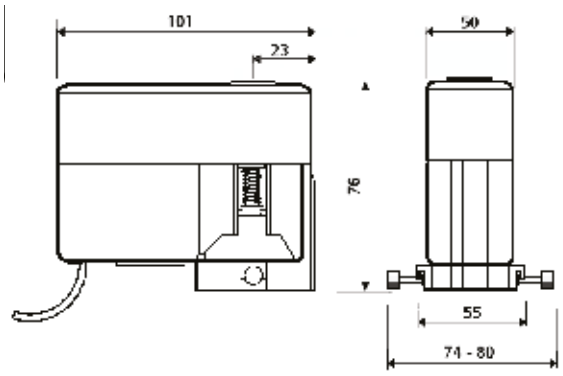


Connection of the actuator.

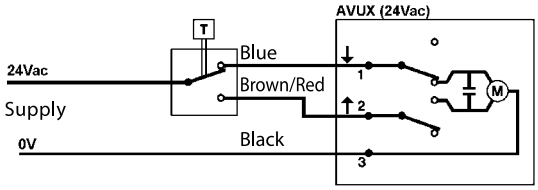


Connection of the actuator.

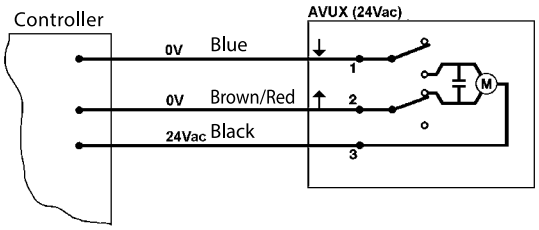
6.2.7 ON/OFF ACTUATOR 24 V

Dimensions	Specifications	
	**Operating voltage**	24 V AC
	Operating power	2.3 VA
	Control voltage	24 V AC
	Actuator stroke	12.7 mm
	Stroke time	110 s
	Actuating force	220 N
	Ambient temperature	
	operating	0-50°C
	storage	-40-70°C
	Protection class	IP40
	Ambient humidity	0 - 95%
	Connecting cable	Color-coded fly lead, 1.5 m long, 3 core
	Housing	Moulded plastic housing (fire resistance to UL94V-0)
	CE conformity	EN 60730-1

Actuator	Article	Description
	80597.0101	AVUX - ON/OFF actuator 24 V AC operating voltage



Connection of the actuator.



Connection of the actuator.

7. NOTES

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Pegler Yorkshire

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CONNECT + CONTROL

Tectite
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Henco
Terrier
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Prestex
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