DEVICES FOR CIRCUIT BALANCING

2017
The hydronic circuits serving air conditioning systems must be balanced, meaning that they must be constructed in such a way as to guarantee the design flow rates of the thermal medium. Depending on the type of system and the appliances installed, and also on the type of control to be implemented, specific balancing devices are required. Caleffi offers a complete line of products, as illustrated in this guide.

Air conditioning of modern buildings

Modern buildings must be designed and built to ensure the health and general wellness of their occupants, assisting the maintenance of various types of comfort: thermal, acoustic, architectural, functional, and so forth. In addition, the buildings must be constructed with the aim of achieving fundamental goals including energy economy and environmental protection, with reduced CO2 emissions. Controlling the climate of a confined space means creating the necessary conditions to guarantee the thermal comfort of the occupants.

Thermal comfort

Thermal comfort is the sensation of thermohygrometric well-being that a person experiences when conducting an activity in an enclosed space. In these comfort conditions the physiological mechanisms of the human body act correctly to control body temperature by exchanging heat energy and water vapour with the surrounding environment. The ideal reference situation is designated “thermal neutrality”, wherein the person does not perceive sensations of heat or cold. Air conditioning makes it possible to control the temperature, relative humidity and air velocity in living spaces irrespective of the outside climatic conditions or season. The ASHRAE, REHVA, and ISO organisations have issued specific standards for the achievement of thermal comfort, forming a body of references for the law applied to air conditioning issues both on the national and international levels.

Average reference conditions for thermal comfort

<table>
<thead>
<tr>
<th></th>
<th>Winter</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature (°C)</td>
<td>≥20</td>
<td>≤26</td>
</tr>
<tr>
<td>Minimum relative humidity (%)</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>Maximum relative humidity (%)</td>
<td>45</td>
<td>60</td>
</tr>
</tbody>
</table>

Thermal exchange terminals

The thermal exchange terminals used for air conditioning employ a thermal medium flow rate to control the thermal energy required to manage room temperature and humidity. The formula \( P = \text{const} \times G \times \Delta T \) establishes that the emission or subtraction of heat (P) by the terminals is a function of the flow rate of the medium (G) passing through them, given the deltaT (\( \Delta T \)) of the thermal medium in the terminal. The design flow rate at the terminal is also a necessary condition for the removal of air humidity condensing latent heat during dehumidification operation. On the basis of these physical laws it can be asserted that balancing and control of the flow rate are directly connected with the achievement and maintenance of thermal comfort conditions.
Fan coils
Fan coils are terminals that heat or cool the room due to forced convection. They can be floor-standing or ceiling mounted, with either exposed or recessed installation. They are composed of:
- box
- single or double finned thermal exchange coil
- centrifugal or tangential fan
- air inlet filter
- condensate drip tray
The units function with hot or chilled medium in heating or air conditioning mode. They control room relative humidity, either totally or partially.
*Hot thermal medium working T range: 45–65°C*
*Chilled thermal medium working T range: 7–12°C*

Radiant panels
Radiant panels are terminals that heat or cool the room due to irradiation. They are composed of plastic pipes embedded in the masonry structure of walls and floors. The units function with hot or chilled thermal media in heating or cooling mode. Radiant panels do not control relative ambient humidity.
*Hot thermal medium working T range: 22–45°C*
*Chilled thermal medium working T range: 16–20°C*

Air Handling Units (AHU)
These are modular units configured in such a way as to provide correct treatment of primary air before transferring it to the air conditioned space. The air is controlled thermally, in terms of temperature and relative humidity, and also in terms of air quality, by means of appropriate filtration. They are composed of:
- filter section
- heating section with finned heating coil
- cooling and dehumidification section with finned cooling coil and condensate drip tray
- humidification section, which can be of the water or vapour type
- post-heating section with finned heating coil
- flow and return section with fans
- section for heat recovery between inlet and outlet air
The units function with hot or chilled medium in heating or air conditioning mode. Air handlers also control relative ambient humidity.
*Hot thermal medium working T range: 40–60°C*
*Chilled thermal medium working T range: 7–12°C*

Radiators
Radiators are heating terminals that heat the room air due to natural convection and irradiation. Radiators are constructed in metal and are of the elements, plate or pipes type. They function exclusively with hot thermal medium in heating mode.
*Hot thermal medium working T range: 55–90°C*

Chilled beams
Chilled beams are terminals that heat or cool the room by the combined action of primary air and inlet air from the room. The beams are installed on the ceiling in either exposed or recessed configuration. They are composed of:
- a pressurised primary air adduction pipe
- single or double finned thermal exchange coil
- vents to supply treated air to the room
- air enclosure and ducting structure
The units function with hot or chilled thermal media in heating or cooling mode. Cooling beams do not directly control relative ambient humidity, which is instead managed by the primary air.
*Hot thermal medium working T range: 30–45°C*
*Chilled thermal medium working T range: 14–18°C*
Energy certification of buildings

Several years ago national and international laws and regulations were put in place to ensure the energy classification of buildings. In this context, buildings are designed in such a way as to restrict thermal energy and electricity requirements and to minimise carbon dioxide emissions (CO2).

Apart from defining the thermal insulation characteristics of the building, also the construction and operation of the air conditioning system are of critical importance and must be adequate to follow the thermal loads trend precisely during summer and winter.

The entire system, from the production zone to the area of emission or subtraction of thermal energy in the air conditioned space, must be correctly sized with a suitable choice of regulating components and must be commissioned using clearly defined instruments and procedures (test, adjustment and balancing).

Hydronic circuit - Flow rate control

Flow rate control devices can be classified in relation to the function performed in the specific points of the distribution network in which they are installed:

- **Flow rate balancing point**: guarantee the nominal design flow rate
- **Flow rate control point**: continuously adapt the flow rate in response to changes in the thermal load

In guaranteeing the correct flow rate to the thermal exchange terminal, it is possible to manage the two forms of thermal energy supplied to or removed from the space:

- sensible heat: linked to temperature variation
- latent heat: linked to relative humidity variation
Circuit balancing devices can be classified in accordance with their method of action and the type of control they perform in relation to the hydronic circuit. In this guide the devices are presented in accordance with a product evolution functional line, as can be seen from the following summary table. The same description appears at the beginning of each of the product sections. Moreover, the functional details associated with specific system design aspects are described by means of pages inserted in the various sections of the guide, in a rational presentation designed to aid the identification of products and allow them to be selected in the optimal manner.

### Static balancing devices

<table>
<thead>
<tr>
<th>Device Description</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual balancing valve, with Venturi device</td>
<td>130 series</td>
</tr>
<tr>
<td>Manual balancing valve, with variable orifice</td>
<td>130 series</td>
</tr>
<tr>
<td>Balancing valve with flow meter</td>
<td>132 series</td>
</tr>
</tbody>
</table>

### Dynamic balancing devices

<table>
<thead>
<tr>
<th>Device Description</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic flow rate regulator, fixed flow rate</td>
<td>127-128-121-126-120-125-103 series</td>
</tr>
<tr>
<td>Automatic flow rate regulator, adjustable flow rate</td>
<td>118 series</td>
</tr>
</tbody>
</table>

### Dynamic balancing and control devices

<table>
<thead>
<tr>
<th>Device Description</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure independent control valve (PICV)</td>
<td>145-146 series</td>
</tr>
</tbody>
</table>

### Differential pressure regulating devices

<table>
<thead>
<tr>
<th>Device Description</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential by-pass valve</td>
<td>519 series</td>
</tr>
<tr>
<td>Differential pressure regulating valve</td>
<td>140 series</td>
</tr>
<tr>
<td>Shut-off and pre-regulation valve</td>
<td>142 series</td>
</tr>
</tbody>
</table>

### Dynamic thermostatic balancing devices

<table>
<thead>
<tr>
<th>Device Description</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multifunction thermostatic regulator for domestic hot water recirculation loops</td>
<td>116 series</td>
</tr>
</tbody>
</table>
**Static balancing devices**

- Manual balancing valve, with Venturi device
  
  130 series

- Manual balancing valve, with variable orifice
  
  130 series

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### 130

Hydraulic circuits balancing valve with fixed orifice. Flow meter with Venturi device. dezincification resistant alloy body, obturator in stainless steel. Complete with quick-fit pressure test ports.

- Manual balancing valve, with Venturi device
  
  130 series

- Manual balancing valve, with variable orifice
  
  130 series

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Technical specifications

<table>
<thead>
<tr>
<th>Code</th>
<th>Size</th>
<th>Kvs (m³/h)</th>
</tr>
</thead>
<tbody>
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<td>DN 15</td>
<td>1/2”</td>
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<td>130500</td>
<td>DN 20</td>
<td>3/4”</td>
</tr>
<tr>
<td>130600</td>
<td>DN 25</td>
<td>1”</td>
</tr>
<tr>
<td>130700</td>
<td>DN 32</td>
<td>1 1/4”</td>
</tr>
<tr>
<td>130800</td>
<td>DN 40</td>
<td>1 1/2”</td>
</tr>
<tr>
<td>130900</td>
<td>DN 50</td>
<td>2”</td>
</tr>
</tbody>
</table>

**Operating principle**

The balancing valve is a hydraulic device that makes it possible to regulate the medium flow rate passing through it. Regulation is performed using a knob that governs the movement of an obturator to regulate the flow of the medium. The flow rate is controlled according to the value of Δp that is measured with two piezometric connections suitably positioned on the valve.

**Venturi device for flow rate measurement**

The 130 series valves of size from 1/2” to 2” are equipped with a flow rate measuring device based on the Venturi principle. It is housed in the valve body and is located upstream of the valve’s obturator, as shown in the figure.

This system provides the following benefits:

1. Provides stable measurement during flow rate regulation. Balancing valves normally have their pressure test ports upstream and downstream of the valve obturator. This means that when the valve is closed to less than 50% of its full opening, the turbulence created downstream of the obturator causes instability in the pressure signal resulting in significant measurement errors.

2. The Venturi system makes for a faster process of measurement and manual circuit balancing. The flow rate is now only a function of the Δp measured upstream and downstream of the fixed orifice of the Venturi meter, upstream of the obturator, and no longer through the entire valve.

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**Performance**

Medium: water, non-hazardous glycol solutions excluded from the guidelines of directive 67/548/EC

- Maximum percentage of glycol: 50%
- Maximum working pressure: 16 bar
- Working temperature range: -20–120°C

Accuracy: ±10%

**Series**

<table>
<thead>
<tr>
<th>Code</th>
<th>Size</th>
<th>Kvs (m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>130062</td>
<td>DN 65</td>
<td>129</td>
</tr>
<tr>
<td>130082</td>
<td>DN 80</td>
<td>148</td>
</tr>
<tr>
<td>130102</td>
<td>DN 100</td>
<td>256</td>
</tr>
<tr>
<td>130122</td>
<td>DN 125</td>
<td>509</td>
</tr>
<tr>
<td>130152</td>
<td>DN 150</td>
<td>699</td>
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<tr>
<td>130200</td>
<td>DN 200</td>
<td>710</td>
</tr>
<tr>
<td>130250</td>
<td>DN 250</td>
<td>1188</td>
</tr>
<tr>
<td>130300</td>
<td>DN 300</td>
<td>1504</td>
</tr>
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</table>

**Operating principle**

The balancing valve is a hydraulic device that makes it possible to regulate the medium flow rate passing through it. Regulation is performed using a knob that governs the movement of an obturator to regulate the flow of the medium. The flow rate is controlled according to the value of Δp that is measured with two piezometric connections suitably positioned on the valve.
Static balancing devices

Adjustment knob
The shape of the adjustment knob is the outcome of research into ergonomics to ensure the greatest operator comfort and accurate adjustment.
- The range of adjustment with 5 complete turns permits great accuracy when balancing hydraulic circuits.
- The micrometric scale graduations are large and clear and make it easy to refine the flow rate adjustment.
- The knob is made of high-strength, corrosion-proof, reinforced polymer.

Setting the balancing valve
Flow rate regulation in the variable orifice balancing valves calls for a suitable differential pressure measurement instrument. In this valve type each position of the setting knob is associated with a specific characteristic curve. This requires a fresh data entry each time the position is changed. It is thus essential to use a specific electronic instrument and follow a stringent calibration procedure.

Main applications - Manual balancing valves
- Constant flow rate circuits with 3-way regulating valves
- Chillers or heat generators connected in parallel with dedicated pumps
- Fire fighting water distribution circuits, with hydrants
- Flow rate and head control on pumps flow line
- Regulating circuits with flow temperature control, with coupled primary-secondary circuits

To balance zone branches in circuits with three-way valves
To balance by-pass and direct lines in circuits with three-way valves
To balance the circuits that serve chiller unit evaporators or condensers
## Static balancing devices

### Balancing valve with flow meter

#### 132


<table>
<thead>
<tr>
<th>Code</th>
<th>Flow rate range (l/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>132402</td>
<td>DN 15 2–7</td>
</tr>
<tr>
<td>132512</td>
<td>DN 20 5–13</td>
</tr>
<tr>
<td>132522</td>
<td>DN 20 7–28</td>
</tr>
<tr>
<td>132602</td>
<td>DN 25 10–40</td>
</tr>
<tr>
<td>132702</td>
<td>DN 32 20–70</td>
</tr>
<tr>
<td>132802</td>
<td>DN 40 30–120</td>
</tr>
<tr>
<td>132902</td>
<td>DN 50 50–200</td>
</tr>
</tbody>
</table>

#### 132


<table>
<thead>
<tr>
<th>Code</th>
<th>Flow rate range (l/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13260</td>
<td>DN 65 5–24</td>
</tr>
<tr>
<td>13280</td>
<td>DN 80 8–32</td>
</tr>
<tr>
<td>132100</td>
<td>DN 100 12–48</td>
</tr>
</tbody>
</table>

### Technical specifications

**Performance**
- Medium: water, glycol solutions
- Maximum percentage of glycol: 50%
- Max. working pressure: 10 bar
- Working temperature range: -10–110°C.
- Flow rate adjustment range unit of measurement: l/min
- Accuracy: ±10%

### Operating principle

The balancing valve is a hydraulic device that makes it possible to regulate the medium flow rate passing through it. The regulating action is performed by a ball obturator (1), operated by a control stem (2). The flow rate is controlled by means of a flow meter (3) housed in a by-pass circuit on the valve body, that can be shut off during normal functioning. The flow rate value is indicated by a metal sphere (4) sliding within a transparent guide (5) marked alongside by a graduated scale (6).

### Flow meter for flow rate measurement

Flow rate measurement is provided directly by a flow meter housed in a by-pass circuit on the valve body, which can be automatically excluded during normal operation.

### Main applications - Manual balancing valves with flow meter

- constant flow rate circuits, with limited extension
- domestic hot water recirculation circuits
- circuits with closely spaced pipes, for easy reading and setting

To adjust the flow rate supplied to each riser

To balance domestic water distribution circuits
Unbalanced circuits have characteristics such as to create problems in distributing the flow rates to the terminals. To overcome these problems it is normal practice to fit two types of balancing device:

- **Static devices.** These are conventional devices suitable for use in constant flow rate circuits or circuits subject to limited load variations.
- **Dynamic devices.** Modern automatic devices, mainly suitable for variable flow rate systems with thermal loads that change frequently.

In the case of unbalanced circuits, the hydraulic imbalance between terminals creates areas with non-uniform temperatures, and as a consequence, problems with thermal comfort and higher energy consumption.

**Static balancing**

Traditionally, hydraulic circuits are balanced using manual calibration valves. With these static-type devices, such circuits are difficult to balance perfectly and have **operating limitations** in the case of partial closure by means of the control valves. The flow rate in the open circuits does not remain constant at the nominal value.

**Dynamic balancing**

Dynamic devices can balance the hydraulic system automatically, ensuring each terminal receives the design flow rate. Even in the case of partial circuit closure by means of the control valves, the flow rates in the open circuits remain constant at the nominal value. The system always guarantees the greatest comfort and the highest energy savings.
**Dynamic balancing devices**

- Automatic variable flow rate regulator, fixed flow rate 120-125-103 series

**120 AUTOFLOW**
Combination of automatic flow rate regulator and ball valve. dezincification resistant alloy body. Stainless steel cartridge.

**125 AUTOFLOW**
Automatic flow rate regulator. dezincification resistant alloy body. Stainless steel cartridge.

For the choice of single flow rates, \( \Delta p \) range and complete code, refer to the price list or technical brochure.

**Technical specifications**

<table>
<thead>
<tr>
<th>Performance</th>
<th>120</th>
<th>125</th>
<th>103</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medium:</strong></td>
<td>water, glycol solutions</td>
<td>water, glycol solutions</td>
<td>water, glycol solutions</td>
</tr>
<tr>
<td><strong>Maximum percentage of glycol:</strong></td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Maximum working pressure:</strong></td>
<td>25 bar</td>
<td>25 bar</td>
<td>16 bar</td>
</tr>
<tr>
<td><strong>Working temperature range:</strong></td>
<td>0–110°C</td>
<td>-20–110°C</td>
<td>-20–110°C</td>
</tr>
<tr>
<td><strong>( \Delta p ) range:</strong></td>
<td>7–100 kPa; 22–220 kPa; 35–410 kPa</td>
<td>7–100 kPa; 22–220 kPa; 35–410 kPa</td>
<td>22–220 kPa; 35–410 kPa</td>
</tr>
<tr>
<td><strong>Flow rates:</strong></td>
<td>0.12–15.5 m³/h</td>
<td>0.12–22.5 m³/h</td>
<td>0.12–22.5 m³/h</td>
</tr>
<tr>
<td><strong>Accuracy:</strong></td>
<td>±5%</td>
<td>±5%</td>
<td>±5%</td>
</tr>
</tbody>
</table>

**Available up to DN 800 and with flow rates up to 3850 m³/h**
**Dynamic balancing devices**

**Operating principle**
The regulating element of these devices is composed of a cylinder and a piston with fixed and variable geometry side open tubes through which the fluid flows. These apertures are governed by the piston movement actuated by the pressure of the medium. A specially calibrated spring counteracts this movement. AUTOFLOW devices are high-performance automatic regulators. They regulate the flow rates selected within a very tight tolerance (approx. 5%) and offer a wide control range.

**Within the control range**

If the differential pressure is contained within the control range, the piston compresses the spring and gives the medium a free flow area to permit regular flow at the nominal rate for which the AUTOFLOW is set up.

**Main applications - AUTOFLOW automatic flow rate regulators**

- variable flow rate circuits with 2-way regulating valves and complex extended networks
- circuits with adjustment on the terminal, with 2-way valves
- circuits with ON/OFF or modulating flow rate adjustment
- circuits to supply the Air Handling coils in air based or air-water systems
- district heating circuits for control of the primary side of the substations

To balance circuits that serve air handling units

To balance the circuits that serve chiller unit evaporators or condensers

To balance circuits serving cooling towers

To ensure the required amount of medium flows through each terminal
Dynamic balancing devices

- Automatic flow rate regulator, fixed flow rate 127-128-121-126 series

**127 AUTOFLOW**
Compact automatic flow rate regulator.
Brass body.

Cartridge: 1/2"–1 1/4" high-strength polymer.
1 1/2" and 2" high-strength polymer and stainless steel.

<table>
<thead>
<tr>
<th>Code</th>
<th>DN 15</th>
<th>DN 20</th>
<th>DN 25</th>
<th>DN 32</th>
<th>DN 40</th>
<th>DN 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>1271141</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
<td>1&quot;</td>
<td>1 1/4&quot;</td>
<td>1 1/2&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>1271151</td>
<td>0,02–1,4</td>
<td>0,02–1,6</td>
<td>0,5–5,0</td>
<td>0,5–5,0</td>
<td>4,5–11,0</td>
<td>4,5–11,0</td>
</tr>
</tbody>
</table>

New polymer regulator
The flow-rate regulator element is made entirely of high resistance polymer, specially chosen for use in air-conditioning and plumbing systems. Its mechanical behaviour is excellent in a wide range of working temperatures, it features high abrasion resistance due to the medium flowing continuously, it is insensitive to the deposit of scale and is fully compatible with the glycols and additives used in circuits.

**128 AUTOFLOW**
Compact automatic flow rate regulator.
Brass body.

AUTOFLOW cartridge in high resistance polymer.
Max. working pressure: 16 bar.
Temperature range: 0–100°C.
Max. percentage of glycol: 50%.
Flow rates: 0,085–1,4 m³/h. Accuracy: ±10%.

<table>
<thead>
<tr>
<th>Code</th>
<th>DN 15</th>
<th>DN 20</th>
<th>DN 25</th>
<th>DN 32</th>
<th>DN 40</th>
<th>DN 50</th>
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</thead>
<tbody>
<tr>
<td>1281141</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
<td>1&quot;</td>
<td>1 1/4&quot;</td>
<td>1 1/2&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>1281151</td>
<td>0,02–1,2</td>
<td>0,02–1,4</td>
<td>0,5–5,0</td>
<td>0,5–5,0</td>
<td>4,5–11,0</td>
<td>4,5–11,0</td>
</tr>
</tbody>
</table>

**126 AUTOFLOW**
Combination of automatic flow rate regulator and ball valve.
CR dezincification resistant alloy body.

Cartridge: 1/2"–1 1/4" high-strength polymer.
1 1/2" and 2" high-strength polymer and stainless steel.

**Technical specifications**

<table>
<thead>
<tr>
<th>series</th>
<th>127</th>
<th>121-126</th>
<th>128</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium:</td>
<td>water, glycol solutions</td>
<td>water, glycol solutions</td>
<td>water, glycol solutions</td>
</tr>
<tr>
<td>Maximum percentage of glycol:</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Maximum working pressure:</td>
<td>16 bar</td>
<td>25 bar</td>
<td>16 bar</td>
</tr>
<tr>
<td>Working temperature range:</td>
<td>0–100°C</td>
<td>-20–100°C</td>
<td>0–100°C</td>
</tr>
<tr>
<td>Ap range:</td>
<td>15–200 kPa</td>
<td>15–200 kPa</td>
<td>15–200 kPa</td>
</tr>
<tr>
<td>Flow rates:</td>
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<td>0,085–11,0 m³/h</td>
<td>0,02–1,2 m³/h</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>±10%</td>
<td>±10%</td>
<td>±10%</td>
</tr>
</tbody>
</table>

For the choice of single flow rates, Ap ranges and complete code, refer to the price list or technical brochure.
Dynamic balancing devices

Operating principle
The regulating element of these devices is composed of a cylinder and a piston with fixed and variable geometry side open tubes, which the fluid flows through. These apertures are governed by the piston movement actuated by medium fluids. A specially calibrated spring counteracts this movement.

AUTOFLOW devices are high-performance automatic regulators. They regulate the flow rates selected within a very tight tolerance (approx. 10%) and offer a wide control range.

Within the control range
If the differential pressure is contained within the control range, the piston compresses the spring and gives the medium a free flow area to permit regular flow at the nominal rate for which the AUTOFLOW is set up.

Main applications - AUTOFLOW automatic flow rate regulators
- variable flow rate circuits with 2-way regulating valves and complex extended networks
- circuits with adjustment on the terminal, with 2-way valves
- circuits with ON/OFF or modulating flow rate adjustment
- circuits to supply Air Handling coils in air based or air-water systems

To use in line with various types of heat emitters: radiators, convectors, fan coils, fan convectors, thermal strips, etc.

To ensure the required amount of medium flows through each terminal

To balance domestic water distribution circuits

To adjust the flow rate to each riser or secondary branch of a system
Dynamic balancing devices

- Automatic flow rate regulator, adjustable flow rate

1 1 8

Automatic flow rate regulator with cartridge adjustable from the outside dezincification resistant alloy body. Polymer adjustable cartridge with HNBR diaphragm.

Flow rate adjustment
With this type of cartridge the flow rate can be set to the required value operating from the outside and without having to shut off the valve. The special operating spanner is used to set the adjustment mechanism, reading off the desired position on the graduated reference scale. Precise flow rate regulation is possible thanks to a double gauge with scale from 1 to 5 and decimal division from 1 to 9.

Depending on the pressure range and the flow rate range, the cartridges are available in various colours to permit easy identification. The same colours appear on the outside, on the adjuster screw and on the safety cover.

Code

<table>
<thead>
<tr>
<th>Code</th>
<th>Size</th>
<th>Flow rate range (m³/h)</th>
<th>Cartridge colour</th>
<th>Cartridge code number</th>
</tr>
</thead>
<tbody>
<tr>
<td>118141</td>
<td>DN 15</td>
<td>0,10–0,40</td>
<td>Black</td>
<td>1YB</td>
</tr>
<tr>
<td>118151</td>
<td>DN 20</td>
<td>0,15–0,60</td>
<td>Green</td>
<td>1YG</td>
</tr>
<tr>
<td>118161</td>
<td>DN 25</td>
<td>0,24–0,90</td>
<td>Black</td>
<td>1GB</td>
</tr>
<tr>
<td>118171</td>
<td>DN 32</td>
<td>0,40–1,30</td>
<td>Red</td>
<td>1YR</td>
</tr>
</tbody>
</table>

Technical specifications

Performance
Medium: water, glycol solutions
Max. percentage of glycol: 50%
Maximum working pressure: 25 bar
Working temperature range: 0–100°C
Ap range: 17–210 kPa; 17–400 kPa; 30–400 kPa; 35–400 kPa
Flow rates: 0,10–5,80 m³/h
Accuracy: ±5%

Operating principle

With reference to the drawing shown, p1 and p3 are the pressures in the circuit

\[ \Delta p = (p_1 - p_3) \]

is the total pressure difference between upstream and downstream of the valve

Pressure \( p_2 \) is determined by the diaphragm in reaction to the pressure \( p_1 \) that acts on the upper chamber of the diaphragm.

Interacting with the spring, the difference \( p_1 - p_2 \) remains constant, keeping a constant \( \Delta p_A \) through the orifice (A).

The outcome is a constant flow rate through the valve irrespective of changes in the upstream/downstream pressure difference.

Main applications - Adjustible automatic flow rate regulators

- Adjustable automatic flow rate regulators

✓ variable flow rate circuits with 2-way regulating valves and limited extension networks
✓ circuits subject to design flow rate modification

To use in line with various types of heat emitters: radiators, convectors, fan coils, fan convectors, thermal strips, etc.

To ensure that the required amount of medium flows through each terminal

To adjust the flow rate to each riser or secondary branch of a system

circuits for which the design flow rate is not known with sufficient precision

To adjust the flow rate to each riser or secondary branch of a system
DYNAMIC BALANCING AND CONTROL

If the two functions of dynamic balancing and control are combined in the same device, the hydraulic circuit is balanced with continuous control of thermal loads. All the circuits supplied remain independent and the flow rate remains constantly at the value corresponding to each partial load, irrespective of the operating conditions of the circuit. Flow rate modulation to the necessary value for each circuit is not affected by the closure or partial control of the other circuits.

- Pressure independent control valve (PICV)

**145 series**

**Technical specifications**

**145 series control valve performance.**

- **Medium:** water, glycol solutions
- **Max. percentage of glycol:** 50%
- **Maximum working pressure:** 16 bar
- **Max. differential pressure with actuator code 145014 and 656 series thermo-electric actuators:** 5 bar
- **Temperature range:** -20–120°C
- **Nominal \( \Delta p \) control range:** 25–400 kPa
- **Flow rate regulation range:** 0,08–0,4 m³/h
- **Accuracy:** ±15%

**Actuator code 145014 performance.**

- **Proportional linear actuator for 145 series control valve.**
  - **Electric supply:** 24 V (ac/dc)
  - **Power consumption:** 2,5 VA (ac) 1,5 W (dc)
  - **Control signal:** 0–10 V
  - **Protection class:** IP 43
  - **Ambient temperature range:** 0–50°C
  - **Supply cable length:** 1,5 m
  - **Connection:** M30 p.1,5

---

**Male threaded union connections.**

<table>
<thead>
<tr>
<th>Code</th>
<th>DN</th>
<th>Connection</th>
<th>Flow rate range (m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>145430 H40</td>
<td>15</td>
<td>3/8&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145430 H80</td>
<td>15</td>
<td>3/8&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145440 H40</td>
<td>15</td>
<td>1/2&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145440 H80</td>
<td>15</td>
<td>1/2&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145550 H40</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145550 H80</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145551 1H2</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,12–1,20</td>
</tr>
<tr>
<td>145550 1H8</td>
<td>25</td>
<td>3/4&quot;</td>
<td>0,18–1,80</td>
</tr>
<tr>
<td>145560 H40</td>
<td>20</td>
<td>1&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145560 H80</td>
<td>20</td>
<td>1&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145560 1H2</td>
<td>20</td>
<td>1&quot;</td>
<td>0,12–1,20</td>
</tr>
<tr>
<td>145560 1H8</td>
<td>25</td>
<td>1&quot;</td>
<td>0,18–1,80</td>
</tr>
<tr>
<td>145660 3H0</td>
<td>25</td>
<td>1 1/4&quot;</td>
<td>0,30–3,00</td>
</tr>
<tr>
<td>145770 1H8</td>
<td>25</td>
<td>1 1/4&quot;</td>
<td>0,30–3,00</td>
</tr>
<tr>
<td>145770 3H0</td>
<td>25</td>
<td>1 1/4&quot;</td>
<td>0,30–3,00</td>
</tr>
</tbody>
</table>

**Euroconus male connections.**

<table>
<thead>
<tr>
<th>Code</th>
<th>DN</th>
<th>Connection</th>
<th>Flow rate range (m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>145552 H40</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145552 H80</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145552 1H2</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,12–1,20</td>
</tr>
</tbody>
</table>

**Pressure independent control valve (PICV).**

**145 series**

**Technical specifications**

**145 series control valve performance.**

- **Medium:** water, glycol solutions
- **Max. percentage of glycol:** 50%
- **Maximum working pressure:** 16 bar
- **Max. differential pressure with actuator code 145014 and 656 series thermo-electric actuators:** 5 bar
- **Temperature range:** -20–120°C
- **Nominal \( \Delta p \) control range:** 25–400 kPa
- **Flow rate regulation range:** 0,08–0,4 m³/h
- **Accuracy:** ±15%

**Actuator code 145014 performance.**

- **Proportional linear actuator for 145 series control valve.**
  - **Electric supply:** 24 V (ac/dc)
  - **Power consumption:** 2,5 VA (ac) 1,5 W (dc)
  - **Control signal:** 0–10 V
  - **Protection class:** IP 43
  - **Ambient temperature range:** 0–50°C
  - **Supply cable length:** 1,5 m
  - **Connection:** M30 p.1,5

---

**Male threaded union connections.**

<table>
<thead>
<tr>
<th>Code</th>
<th>DN</th>
<th>Connection</th>
<th>Flow rate range (m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>145430 H40</td>
<td>15</td>
<td>3/8&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145430 H80</td>
<td>15</td>
<td>3/8&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145440 H40</td>
<td>15</td>
<td>1/2&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145440 H80</td>
<td>15</td>
<td>1/2&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145550 H40</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145550 H80</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145551 1H2</td>
<td>20</td>
<td>3/4&quot;</td>
<td>0,12–1,20</td>
</tr>
<tr>
<td>145550 1H8</td>
<td>25</td>
<td>3/4&quot;</td>
<td>0,18–1,80</td>
</tr>
<tr>
<td>145560 H40</td>
<td>20</td>
<td>1&quot;</td>
<td>0,08–0,40</td>
</tr>
<tr>
<td>145560 H80</td>
<td>20</td>
<td>1&quot;</td>
<td>0,08–0,80</td>
</tr>
<tr>
<td>145560 1H2</td>
<td>20</td>
<td>1&quot;</td>
<td>0,12–1,20</td>
</tr>
<tr>
<td>145560 1H8</td>
<td>25</td>
<td>1&quot;</td>
<td>0,18–1,80</td>
</tr>
<tr>
<td>145660 3H0</td>
<td>25</td>
<td>1 1/4&quot;</td>
<td>0,30–3,00</td>
</tr>
<tr>
<td>145770 1H8</td>
<td>25</td>
<td>1 1/4&quot;</td>
<td>0,30–3,00</td>
</tr>
<tr>
<td>145770 3H0</td>
<td>25</td>
<td>1 1/4&quot;</td>
<td>0,30–3,00</td>
</tr>
</tbody>
</table>
Dynamic balancing and regulating devices

Operating principle

The pressure independent control valve (PICV) is designed to regulate a flow rate of fluid that is:
- adjustable in accordance with the requirements of the part of the circuit controlled by the device;
- constant despite any variation in differential pressure conditions in the circuit.

The device layout is shown in the diagram below:

![Diagram of the device layout](image)

Where:
- \( p_1 \) = upstream pressure
- \( p_2 \) = intermediate pressure
- \( p_3 \) = downstream pressure
- \( (p_1 - p_3) \) = total valve \( \Delta p \)

Concisely:
Since \( G = K_v \times \sqrt{\Delta p} \)
- by manually or automatically adjusting device B, \( K_v \) value and consequently \( G \) value can be set;
- once \( G \) value has been set, it remains constant thanks to the action of (A), which maintains \((P_2 - P_3) = \text{const.}\) in response to circuit pressure changes.

Working range
For the device to keep the flow rate constant independently from the circuit’s differential pressure conditions, total valve \( \Delta p \) (\( p_1 - p_3 \)) must be in the range from the minimum \( \Delta p \) value and the maximum value of 400 kPa.

Adjustment procedure

Maximum flow rate adjustment
Unscrew the protective plug by hand to gain access to the maximum flow rate adjustment nut, which can be turned with a hexagonal wrench. The adjustment nut is fixed to a 10-position graduated scale, divided into steps corresponding to 1/10 of the maximum available flow rate, which is also shown on the scale (1). Turn the adjustment nut to the numerical position corresponding to the required flow rate (design flow rate), referring to the “Flow rate adjustment table” in the technical brochure. The notch (2) on the valve body is the physical positioning reference.

Turning adjustment nut (1), which determines the number associated with the “Adjustment position”, results in opening/closing of the bore cross section in the external obturator (3). Hence, each bore cross section set on the adjustment nut corresponds to a specific \( G_{max} \) value.

Automatic flow rate adjustment with actuator and external regulator
After adjusting the maximum flow rate, fit the actuator (0–10 V) code 145014 (6) to the valve. Under the control of an external regulator the actuator can automatically adjust the flow rate from the maximum set value (E.g.: \( G_{max} \)) to the minimum value in accordance with the thermal load to be controlled. The actuator acts on the vertical displacement of control stem (4). This results in additional opening/closing, on the maximum bore cross section, by the internal obturator (5). For example, if the maximum flow rate has been set to position 8, the flow rate can be adjusted automatically by the actuator from \( G_{max} \) to completely closed (zero flow rate).
**Dynamic balancing and regulating devices**

**Flow rate adjustment curve**

The valve adjustment curve is of the linear type. An increase or decrease in the valve opening cross section corresponds to a directly proportional increase or decrease of the device’s hydraulic coefficient $K_v$.

The following advantages are obtained thanks to this characteristic: the flow rate can be fine-tuned to intermediate/partial values that can be fully controlled in terms of modulation for optimal tracking of changes in thermal load; automatic and servo-assisted control is achieved with $0–10$ V actuators, which are widely used for applications of this type.

---

**145**


<table>
<thead>
<tr>
<th>Code</th>
<th>DN</th>
<th>Conn.</th>
<th>Flow rate range (m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>145771</td>
<td>32</td>
<td>1 1/4”</td>
<td>0.86–4.63</td>
</tr>
<tr>
<td>145881</td>
<td>40</td>
<td>1 1/2”</td>
<td>1.9–13.65</td>
</tr>
<tr>
<td>145991</td>
<td>50</td>
<td>2”</td>
<td>1.9–13.65</td>
</tr>
</tbody>
</table>

**145**


<table>
<thead>
<tr>
<th>Code</th>
<th>Tension V</th>
<th>Control</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>145015</td>
<td>24</td>
<td>0–10 V</td>
<td>DN 32</td>
</tr>
<tr>
<td>145016</td>
<td>24</td>
<td>0–10 V</td>
<td>DN 40 - DN 50</td>
</tr>
</tbody>
</table>
**146**
Pressure independent control valve.  
Grey cast iron body.  
Flanged connections PN 16.  
Max. working pressure: 16 bar.  
Temperature range: -10–120°C.  
Max. percentage of glycol: 50%.  
Ap range: 30–400 kPa.  
With pressure ports.  
To be coupled with flat counterflanges EN 1092-2.

<table>
<thead>
<tr>
<th>Code</th>
<th>DN</th>
<th>Flow rate range (m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>146060</td>
<td>65</td>
<td>5–28</td>
</tr>
<tr>
<td>146080</td>
<td>80</td>
<td>6–38</td>
</tr>
<tr>
<td>146100</td>
<td>100</td>
<td>8–75</td>
</tr>
<tr>
<td>146120</td>
<td>125</td>
<td>14–125</td>
</tr>
<tr>
<td>146150</td>
<td>150</td>
<td>16–160</td>
</tr>
</tbody>
</table>

**146**
Manual actuator for pressure independent control valve 146 series.

<table>
<thead>
<tr>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>146000</td>
</tr>
</tbody>
</table>

**Control characteristic (linear)**

After installing the rotational actuator or the manual actuator on the valve body, the valve regulation is performed by setting the maximum flow rate value through the graduated handle.
Connect a differential pressure gauge to the test point shown, and measure the differential pressure $\Delta P_{1-2}$. Calculate the flow rate by the means of the formula:

$$Q = K_{v1-2} \sqrt{\Delta P_{1-2}}$$

### Main applications - Pressure independent control valve

- Variable flow rate circuits with adjustment on the terminal, in complex extended networks
- Circuits with modulating flow rate control, with limited adjustment requirements
- Circuits controlled by building automation systems
- Circuits to supply the Air Handling coils in air based or air-water systems
- To use in line with various types of heat emitters: radiators,
- To ensure the required amount of medium flows through each terminal,
- To balance circuits that serve air handling units,
- To guarantee the design flow rates (with open or closed valve) to the various zones of a system,
- To adjust flow rate in applications with chilled beams.
Continuous regulation of the flow rate to track the requirements for adaptation to variable thermal loads causes continuous changes in the differential pressure on the terminal. To solve problems of noise emissions, over-stressing of the components and rapid wear of the system, suitable devices should be installed to regulate and control the differential pressure in the various points of the distribution circuit. There are essentially two methods for this type of control:

- **Δp control devices in by-pass.** These are simple conventional devices designed to control systems operating with fixed speed pumps having globally constant flow rates. In these applications control of the temperature on the return flow from circuit to central heating system is secondary with respect to the solution’s simplicity and economy.

- **Δp control devices in line.** These are more complex devices designed to control systems operating with variable speed pumps and globally variable flow rates. In these applications, temperature control of the return flow from circuit to central heating room is optimal, as required in systems with condensing boilers or connected to district heating networks.

### Δp control in by-pass

The job of the by-pass valve is to maintain the pump operating point as close as possible to its nominal value. Starting from a situation of circuit that is manually balanced at the individual terminal, without the use of the by-pass valve, when the flow rate in the circuit decreases due to partial closure of the two-way valves, the head losses increase in the circuit.

The by-pass valve, set to the nominal head value of the pump, makes it possible to limit the pressure increase, by-passing flow rate ΔG. This behaviour is guaranteed at any closing condition of the system regulating valves. In fact, once the position of the valve control knob has been established, the operating pressure value is more or less constant as the discharge flow rate varies.

### Δp control in line

The circuit is regulated by the combined action of two devices: the balancing valve and the Δp regulating valve. By means of a capillary tube that connects them, they control the flow rate and differential pressure in the zone of the circuit concerned, as the operating conditions vary in the whole system. Starting from a situation of circuit that is manually balanced at the individual terminal, gradual closing of the room temperature control devices, e.g. thermostatic valves, causes an increase in the pressure differential between flow and return of the circuit zone. The in line regulator uses the flow pressure signal received on the capillary tube and closes the passage of the medium to absorb the pressure differential increase that has arisen and return to the set value.

The pressure differential value is kept constant between flow and return of the circuit zone, even when, according to the inverse physical process, the thermostatic valves open to increase the flow rate to the heating terminals.
Differential pressure regulating devices

- Differential by-pass valve

519
Adjustable differential by-pass valve with graduated scale.

<table>
<thead>
<tr>
<th>Code</th>
<th>Setting range m w.g.</th>
</tr>
</thead>
<tbody>
<tr>
<td>519500</td>
<td>3/4&quot;  1–6</td>
</tr>
<tr>
<td>519504</td>
<td>3/4&quot;  10–40</td>
</tr>
<tr>
<td>519700</td>
<td>1 1/4&quot;  1–6</td>
</tr>
</tbody>
</table>

Technical specifications

Performance

Medium: water, glycol solutions
Max percentage of glycol: 30%
Temperature range: 0–110°C
Maximum working pressure: 10 bar

Operating principle

When the compression spring (1) is adjusted using the control knob (2), the force acting on the obturator (3) changes, thus modifying the differential activation pressure value of the valve. The obturator only opens, activating the by-pass circuit, when it is subjected to a differential pressure sufficient to generate a greater thrust than that exerted by the contrast spring. This allows flow discharge through outlet (4), limiting the pressure difference between the two points in the system where the valve is fitted.

Setting

To regulate the valve, turn the knob to the value required on the graded scale; the values correspond to the differential pressure in m w.g. at which the by-pass is opened. To carry out rapid adjustment of the by-pass valve it is possible to use the following practical method, which can be applied, for example, to the system in an apartment fitted with thermostat valves: the system must be operating, the regulating valves must be fully open and the by-pass valve must be set to the maximum value (a). Close approximately 30% of the thermostatic valves. Gradually open the valve using the control knob. Use a thermometer, or simply your hand, to check that the hot water is flowing into the by-pass circuit (b). As soon as a temperature rise is noted, open the thermostatic valves again and check that the hot water stops flowing into the by-pass (c).

Main applications - By-pass valves

- simple circuits with constant overall flow rate with thermostatic valves, of limited extension
- circuits with constant speed pumps
- circuits with conventional type generators

Small-medium size system, by-pass in central plant

Medium-large size system, by-pass on top of risers
Operating principle

The flow pressure value is brought to the top surface of the membrane (1) by means of the connecting capillary tube (2); the return pressure value is brought to the bottom surface of the membrane through the connecting passage inside the control stem (3). The force generated by the pressure differential on the membrane exerts a thrust on the obturator stem, closing the passage of medium on the return of the circuit zone until the thrust force of the membrane and the counter-thrust force of the counter-spring reach equilibrium on the set \( \Delta p \) value. This is the pressure differential value that is kept constant between flow and return of the circuit zone, even when, according to the inverse physical process, the thermostatic valves open to increase the flow rate to the heating terminals.

**Technical specifications**

**Performance**

- Medium: water, glycol solutions
- Max. percentage of glycol: 50%
- Maximum working pressure: - 142 series: 16 bar
  - 140 series (DN 15–DN 25): 16 bar
  - 140 series (DN 32–DN 50): 10 bar
  - 140 series (DN 65–DN 150): 16 bar
- Temperature range: -10–120°C
- Membrane maximum differential pressure (140 series):
  - (DN 15–DN 25): 6 bar
  - (DN 32–DN 50): 2.5 bar
  - (DN 65–DN 150): 16 bar
- Accuracy (140 and 142 series): \( \pm 15\% \)

**Operating principle**

The flow pressure value is brought to the top surface of the membrane (1) by means of the connecting capillary tube (2); the return pressure value is brought to the bottom surface of the membrane through the connecting passage inside the control stem (3). The force generated by the pressure differential on the membrane exerts a thrust on the obturator stem, closing the passage of medium on the return of the circuit zone until the thrust force of the membrane and the counter-thrust force of the counter-spring reach equilibrium on the set \( \Delta p \) value. This is the pressure differential value that is kept constant between flow and return of the circuit zone, even when, according to the inverse physical process, the thermostatic valves open to increase the flow rate to the heating terminals.
Differential pressure regulating devices

Shut-off and maintenance of the $\Delta p$ setting, 140 series
The circuit is closed by inserting an Allen wrench in the hole (14) and turning it fully clockwise. The $\Delta p$ setting position is not changed. This operation makes it possible to shut off the flow for system maintenance and restore operation without having to reset the valves.

Shut-off and Memory stop, 142 series
Once the flow rate has been balanced, you can use the “Memory stop” mechanism by inserting an Allen wrench in the hole (15) on the balancing valve and turning it fully clockwise without exerting excessive force. This operation ensures that the valve is set at maximum open position: if necessary the circuit can be closed by turning the knob manually fully clockwise. To return the valve to the set balancing position turn the knob fully counterclockwise.

$\Delta p$ indicator on 140 series
The operation to set up the $\Delta p$ differential regulator is simplified by the presence of the mobile indicator (12) and the graduated scale (13) in mbar on the valve knob.

Main applications - $\Delta p$ regulators

- ✔ variable flow rate circuits with thermostatic valves, in extended networks
- ✔ circuits with condensing boiler type generators or district heating
- ✔ circuits with variable speed pumps
- ✔ circuits with modulating regulating valves with high control requirements

$\Delta p$ control on manifold type systems

$\Delta p$ control on riser type systems
Commissioning

After selecting and installing the components, the system commissioning stage is of fundamental importance for correct operation. In practice, the first requirement is to prepare the system with the specific flow rate and temperature measuring devices. Then the regulating and balancing devices must be adjusted to ensure the hydraulic circuit is operating in the design conditions.
- Fully open all the control valves, all the circuits and all the devices.
- Set the static and dynamic balancing valves to the required flow rate value.
In this delicate stage the choice of the measuring instruments and optimal use of the same in accordance with specific procedures may prove decisive for the purpose of rapid and accurate system set-up.

Electronic flow rate and differential pressure measuring station 130 series
The electronic measuring station makes it possible to measure the water flow rate in air-conditioning systems. The system is composed of a Δp measuring sensor and a remote control unit (terminal) including the Caleffi Balance programming software. The terminal can be supplied already in the package or you can use your own Android® device by downloading the special app. The sensor measures the differential pressure and communicates with the terminal via Bluetooth®. The software also contains the data of most commercially available balancing valves.

Product range
Code 130006  Electronic flow rate and differential pressure measuring station complete with remote control unit, with Android® app
Code 130005  Electronic flow rate and differential pressure measuring station without remote control unit, with Android® app

Technical specifications

<table>
<thead>
<tr>
<th>Range of measurement</th>
<th>0–1000 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential pressure</td>
<td>&lt; 1000 kPa</td>
</tr>
<tr>
<td>Static pressure</td>
<td>-30–120°C</td>
</tr>
<tr>
<td>System temperature</td>
<td></td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>&lt; 0.1% of full scale</td>
</tr>
</tbody>
</table>

Sensor
- Battery capacity: 6600 mAh
- Operating time: 35 hours of continuous operation
- Charging time: 6 hours
- IP class: IP 65

Ambient temperature of the instrument
- During operation and charging: 0–40°C
- During storage: -20–60°C
- Ambient humidity: maximum 90% relative humidity

Sensor weight: 540 g
Full case: 2.8 kg

Characteristic components
- Measuring sensor
- 2 measuring pipes
- 2 measuring needles
- Touchscreen terminal with active licence and accessories
- Sensor battery charger
- Terminal battery charger
- Communication cable between terminal and PC
- Instructions with licence to download the Android® app (for code 130005)
- Instruction manual
- CD containing the instruction manual, measurement and balancing software, valves database and the report viewing tool.
- Calibration protocol. The sensor is supplied with a specific calibration protocol drawn up by a certified laboratory

Operating principle

The operator chooses the balancing valve from the list on the terminal (manufacturer, model, size and position with the corresponding Kv). The data of the valve, together with the measured Δp, are the basis for calculating the flow rate that is displayed on the terminal screen. If the valve on which you are making the measurement is not available in the database, it is still possible to enter the Kv value manually.

Methods of measurement
The complete device allows to choose 3 methods of measurement:

1) Measurement with set position. The display shows the flow rate calculated by the device in relation to the chosen valve and assigned position.
2) Measurement with set flow rate. The position is calculated to assign to the valve in order to obtain the desired flow rate.
3) Simple measurement Δp. The screen shows the differential pressure value measured by the sensor.

Characteristic components of the Δp measuring station

1. Upstream pressure test port
2. Downstream pressure test port
3. Setting by-pass knob
4. Mini USB port
5. Socket for charging
6. Ports for temperature probes (optional)
7. Bluetooth® OFF
8. Reset button
9. ON/OFF button
10. Bluetooth® ON indicator
11. Battery charging indicator
12. ON/OFF indicator
The terminal provided in the package is already equipped with the Caleffi Balance software which is loaded with all the data relating to Caleffi balancing valves and the main commercially available balancing valves. The device allows you to make measurements using the methods described above, view the results and save them.

Following the procedure described in the package you can download the Caleffi Balance app to your terminal running the Android™ operating system (Smartphone or Tablet). It includes all the data relating to Caleffi balancing valves and the main balancing valves that are commercially available.

The device allows you to make measurements using the methods described above, view the results and save them. In addition it enables a graphic display of the results.

Transmission via Bluetooth® to the terminal with Windows Mobile®

Transmission via Bluetooth® to Smartphone/Tablet with Android® app

The values obtained with the measurements, and the corresponding valve data, can be saved and viewed directly on the terminal screen or sent to a PC for later processing.

The Report Viewer software supplied on the CD-ROM in the package can be installed on a PC. It enables collecting the measured data and drafting a report. In addition, this software allows you to load the project before making any measurements and export the data on the terminal to help save the measurements in an orderly fashion.

The CD-ROM also contains the Valve Browser software which provides a simulation of the measurement in order to estimate the behaviour of the various valves during the design phase.
**Thermocline**

If necessary, the regulator is already equipped with a thermal disinfection function, which is useful if the system temperature is to be increased to values over 55–60°C. This function can be completely automatic, activated by a dedicated second thermostatic cartridge that trips at 70°C, or controlled with a thermo-electric actuator.

**Cartridge replacement for electrically controlled disinfection**

**Operating modes**

Here following the regulator’s operating modes according to the variation of the water temperature of the circuit it is installed on.

**Diagram of thermostatic regulator 116 series**

**Thermostatic adjustment**

**Minimum flow rate**

**Thermostatic disinfection**

**Thermal closing**

**Electrically controlled disinfection**

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**Operating principle**

In domestic hot water distribution circuits, to respect modern plant requirements for the prevention of Legionnaires’ disease, it is essential to ensure that all sections are kept at the correct temperature. The recirculation network must be balanced, to avoid non-uniform temperature distribution, with cold sections at risk of Legionella proliferation. The thermostatic regulator, installed on each return branch of the recirculation circuit, automatically maintains the set temperature. This device modulates the medium flow rate in accordance with the water inlet temperature by means of the action of a dedicated internal thermostatic cartridge. When the water temperature approaches the set value, the obturator progressively reduces the passage. The medium flow rate supplied by the recirculation pump is thus distributed to the other network branches, resulting in effective automatic thermal balancing.
Main applications - Multifunction thermostatic regulator

✅ Domestic water recirculation loops, installation on risers and branches.