Differential pressure regulating valve
Shut-off and pre-regulation valve

140 - 142 series

CALEFFI

01250/17GB
replaces dp 01250/12GB

Function

The differential pressure regulator keeps the difference in pressure found in two points of a plumbing circuit at a constant level, according to the set value.
The balancing valve (shut-off and pre-regulation) regulates the thermal medium flow rate supplied to the part of the circuit controlled by the differential pressure regulating valve.
The possibility of regulating the differential pressure values, to suit predetermined design flow rates, prevents phenomena of noise and high speed in variable flow rate systems.
The application of the series proposed is indicated for any type of system:
- with zones or rising columns;
- systems with condensation boilers;
- district heating systems;
- variable flow rate systems, with two-way thermostatic or modulating valves.

The regulating and the shut-off and pre-regulation valves are also supplied complete with shell insulation, to ensure excellent thermal insulation of the system.

Product range

Code 1403.. Differential pressure regulating valve ____ sizes DN 15 (1/2"), DN 20 (3/4"), DN 25 (1"), DN 32 (1 1/4"), DN 40 (1 1/2"), DN 50 (2"); Δp setting range 5–30 kPa

Code 1404.. Differential pressure regulating valve ____ sizes DN 15 (1/2"), DN 20 (3/4"), DN 25 (1"), DN 32 (1 1/4"), DN 40 (1 1/2"), DN 50 (2"); Δp setting range 25–60 kPa

142 series Shut-off and pre-regulation valve ____ sizes DN 15 (1/2"), DN 20 (3/4"), DN 25 (1"), DN 32 (1 1/4"), DN 40 (1 1/2"), DN 50 (2")

Technical specifications

Materials
Δp regulator body:
- (DN 15 - DN 20 - DN 25): dezincification resistant alloy CR EN 12165 CW602N
- (DN 32 - DN 40 - DN 50): dezincification resistant alloy CR EN 1982 CB752S

Balancing valve body:
- (DN 15 - DN 20 - DN 25): dezincification resistant alloy CR EN 12165 CW602N
- (DN 32 - DN 40): dezincification resistant alloy CR EN 1982 CB752S
- (DN 50): dezincification resistant alloy EN 1982 CuZn21Si3PB CR

Control stem and obturator: dezincification resistant alloy CR EN 12164 CW602N

Δp regulating valve diaphragm: EPDM
Δp regulating valve spring: stainless steel (AISI 302)
Seals: EPDM
Knob: PA6G30
Capillary pipe: copper

Performance
Medium: water, glycol solutions
Max. percentage of glycol: 50%
Max. working pressure:
- 142 series: 16 bar
- 140 series (DN 15 - DN 20 - DN 25): 16 bar
- 140 series (DN 32 - DN 40 - DN 50): 10 bar

Working temperature range: -10–120°C
Diaphragm maximum differential pressure (140 series):
- (DN 15 - DN 20 - DN 25) 6 bar
- (DN 32 - DN 40 - DN 50) 2,5 bar

Δp setting range:
- code 140340/350/360/370/380/392: 5–30 kPa (50–300 mbar)
- code 140440/450/460/470/480/492: 25–60 kPa (250–600 mbar)

Accuracy: ±15%

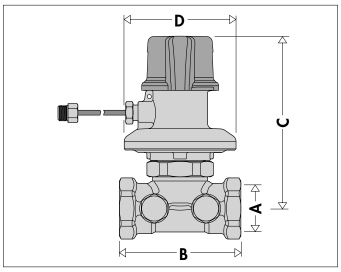
Connections
- main: 1/2", 3/4", 1", 1 1/4", 1 1/2", 2" F (ISO 228-1)
- capillary pipe: 1/8" (complete with adapter 1/4" M x 1/8" F for connection to 142 series valve on flow pipe) tightening torque: 4-7 N·m
- pressure test ports: 1/4" F (ISO 228-1) with plug

Length of Ø 3 mm capillary pipe: 1,5 m

Technical specifications of insulation

Material: EPP
Thickness: 15 mm
Density: 45 kg/m³
Thermal conductivity: 0,037 W/(m·K) at 10°C
Working temperature range: -5–120°C
Reaction to fire (UL 94): class HBF

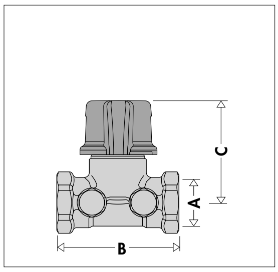
Dimensions



Code	DN	A	B	C	D	Mass (kg)
140▲4.	15	1/2	65	106,5	69	0,79
140▲5.	20	3/4	75	106,5	69	0,92
140▲6.	25	1"	85	112,5	69	1,18
140▲7.	32	1 1/4"	95	173	139	2,98
140▲8.	40	1 1/2"	100	176	139	3,31
140▲92*	50	2"	120	176	139	4,21

▲	Setting
3	5÷30 kPa
4	25÷60 kPa

* without insulation



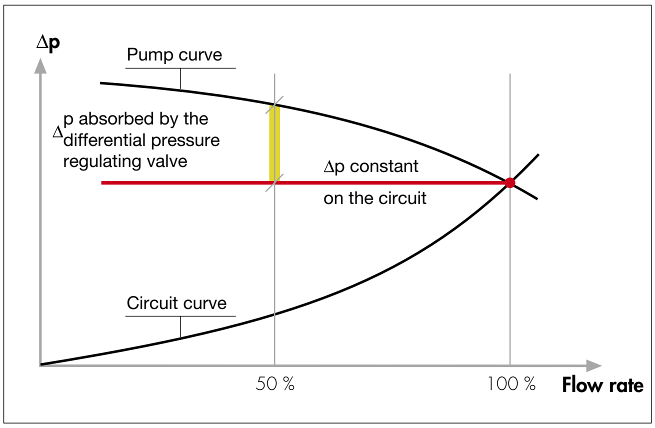
Code	DN	A	B	C	Mass (kg)
142 . 40	15	1/2	65	64	0,43
142 . 50	20	3/4	75	64	0,52
142 . 60	25	1"	85	64	0,67
142 . 70	32	1 1/4"	95	83	1,04
142 . 80	40	1 1/2"	100	86	1,36
142290*	50	2"	120	86	1,75

•	Version
1	with insulation
2	without insulation

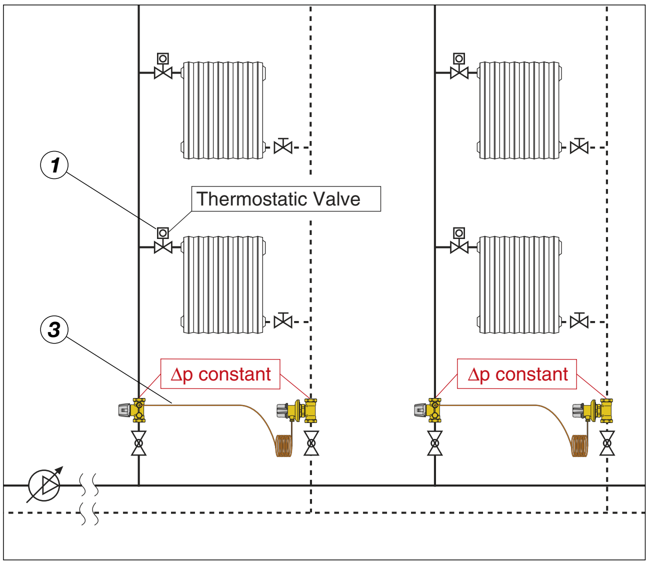
Operating principle

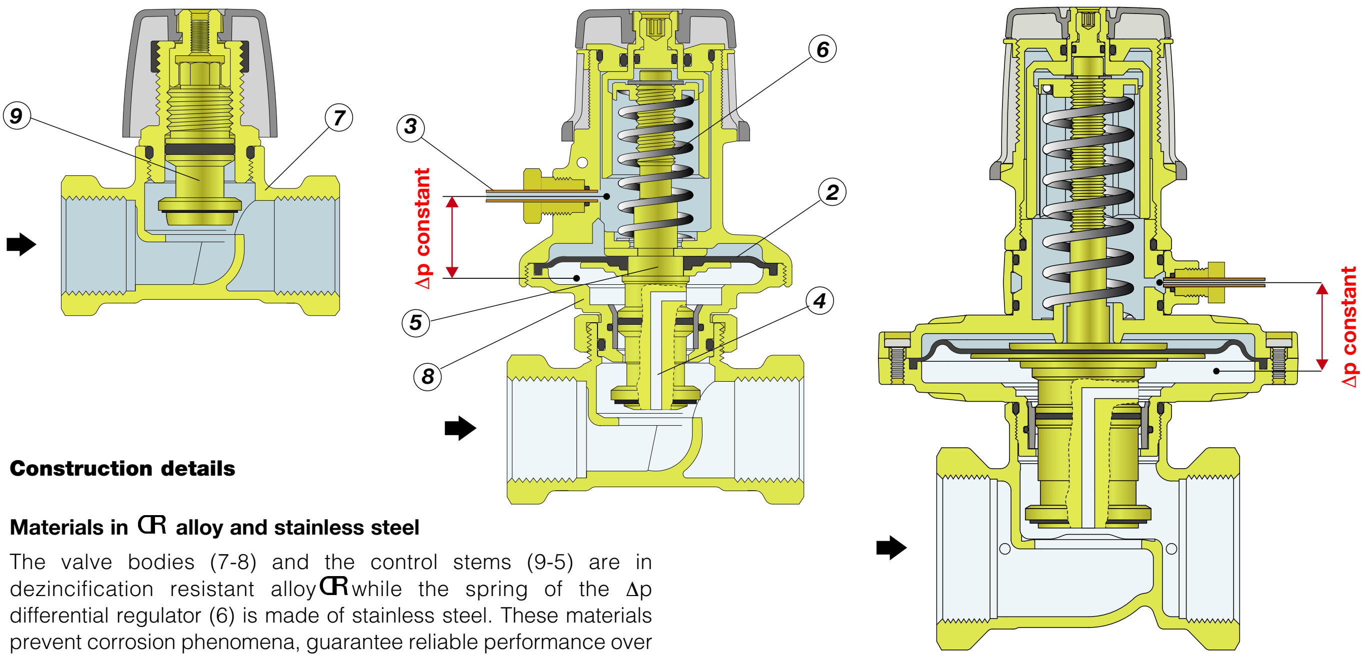
The circuit is controlled by the combined action of two devices: the balancing valve and the Δp regulator. Through a capillary tube connecting them, they act to control flow and differential pressure in the affected circuit area, at the variation of the operating conditions of the entire system. The balancing valve regulates the design flow rate by the action of a shaped obturator.
The differential pressure regulator acts proportionally to re-establish the preselected Δp conditions on the valve when changing the flow rate by means of devices such as for example, two-way thermostatic valves.

The flow pressure value is brought to the top surface of the membrane (2) by means of the connecting capillary pipe (3); the return pressure value is brought to the bottom surface of the membrane through the connecting pipe inside the control stem (4). The force generated by the pressure differential on the membrane exerts a thrust on the obturator stem (5), 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 (6) reach equilibrium on the set Δp 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.



The gradual closing of the ambient temperature control devices (1) causes an increase of the pressure differential between **flow** and **return** of the circuit zone.





Construction details

Materials in CR alloy and stainless steel

The valve bodies (7-8) and the control stems (9-5) are in dezincification resistant alloy CR while the spring of the Δp differential regulator (6) is made of stainless steel. These materials prevent corrosion phenomena, guarantee reliable performance over time, and use compatible with glycols and additives, often used in heating systems circuits.

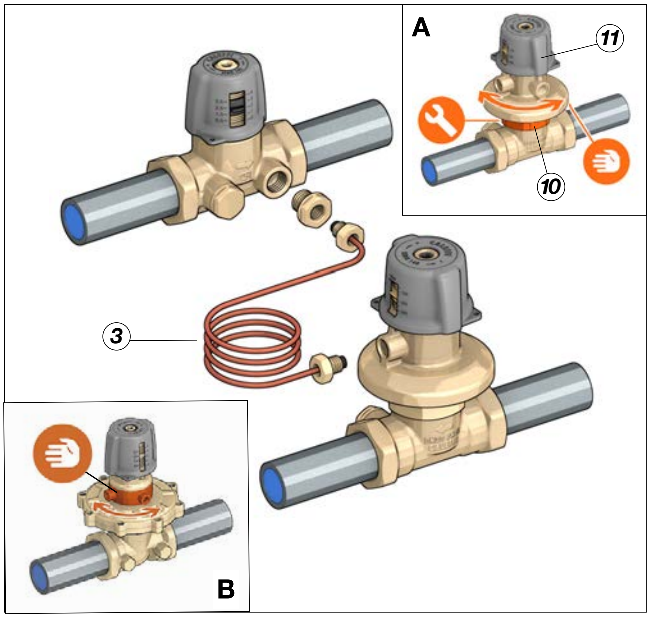
Easy installation procedure

Both the Δp regulator and the balancing valve have been designed with certain constructive features described in points a), b), c) below, in order to simplify the installation operations. In fact, their use often proves to be necessary during refurbishment or for works on existing systems. In these conditions, the pre-existing connection pipes are likely to “allow” low working/installation spaces or difficult to reach positions.

a) Reduced overall dimensions and plate diameter 140 series
The two valves have small dimensions across the range available while maintaining high accuracy, performance and wide working range in terms of adjustable flow rate and Δp.
On the 140 series valve, the characteristics of the materials used and the design of the internal components have made it possible to significantly reduce the element with greater dimensions in this type of device, i.e. the diameter of the plate containing the membrane (2).

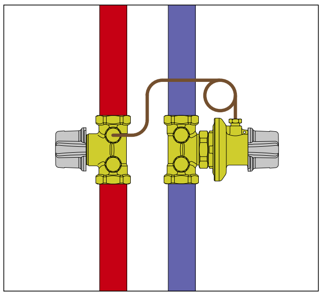
b) Adjustable pressure test port connection on 140 series

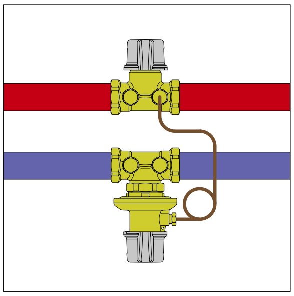
In valves DN 15-20-25, for an optimal position of the connecting capillary pipe, after releasing the locking nut (10) of the Δp regulating valve by around 45° with a hexagonal spanner, the valve's upper section (11) can be manually rotated (fig.A). In DN 32-40-50 valves, just manually adjust the capillary connection (Fig. B).



c) Installation positions

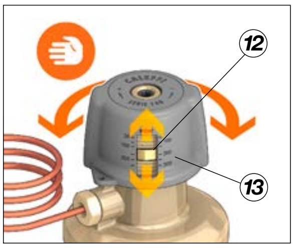
The valves can be installed in any position without creating operation faults or hydraulic sealing problems.





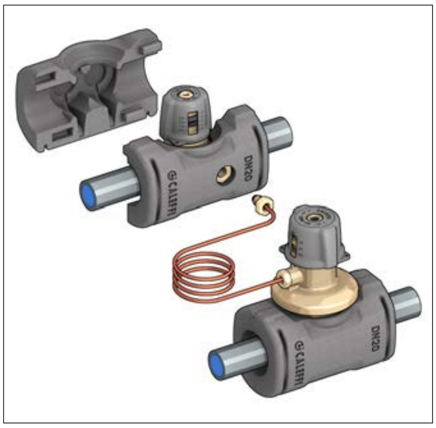
Δp indicator on 140 series

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



Insulation

The valves (excluding DN 50) are supplied both with preformed shell insulation. This system guarantees excellent insulation to reduce the heat dispersion in favour of thermal performance of the whole system.



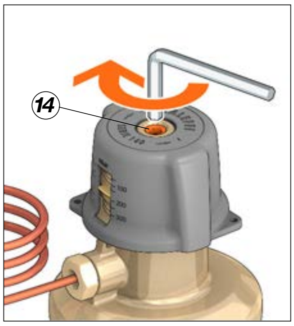
Shut-off and systems for keeping setting value

If, for space reasons, it is not possible to install upstream and downstream of the two valves, the appropriate shut-off devices, it is possible to isolate the circuit zone controlled by the Δp differential regulator. The systems to stop the flow, which are built-in inside the two valves 140 and 142 series and described below in points d) and e), also allow the setting values set on them to be maintained.

d) Shut-off and keeping of the setting value Δp, 140 series

The circuit is closed by inserting an Allen wrench in the hole (14) and turning it fully clockwise. The Δp 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.

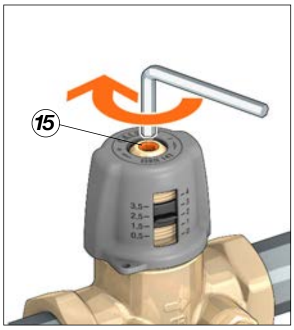


e) Shut-off and Memory stop, 142 series

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.

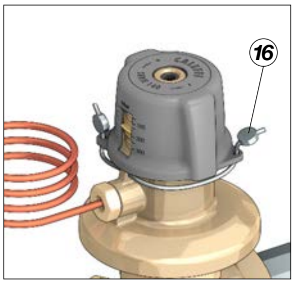
This operation ensures that the valve is set at maximum open position: if necessary the circuit can be closed by turning the knob manually fully clockwise.

To return the valve to the set balancing position turn the knob fully counterclockwise.



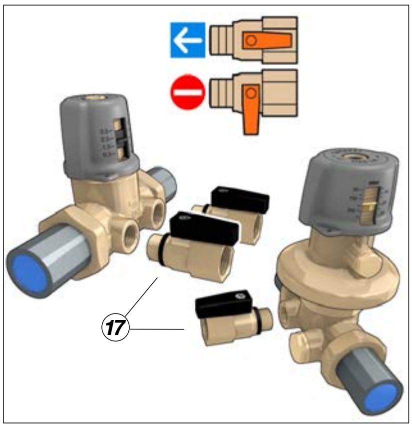
Locking/sealing the regulation position

The knobs and valve bodies are provided with special holes that can be used to lead seal the devices once the adjustment operations (16) have been completed. The use of lead seal makes it quick, during any control inspection of the system, to verify that the system has not been tampered with.



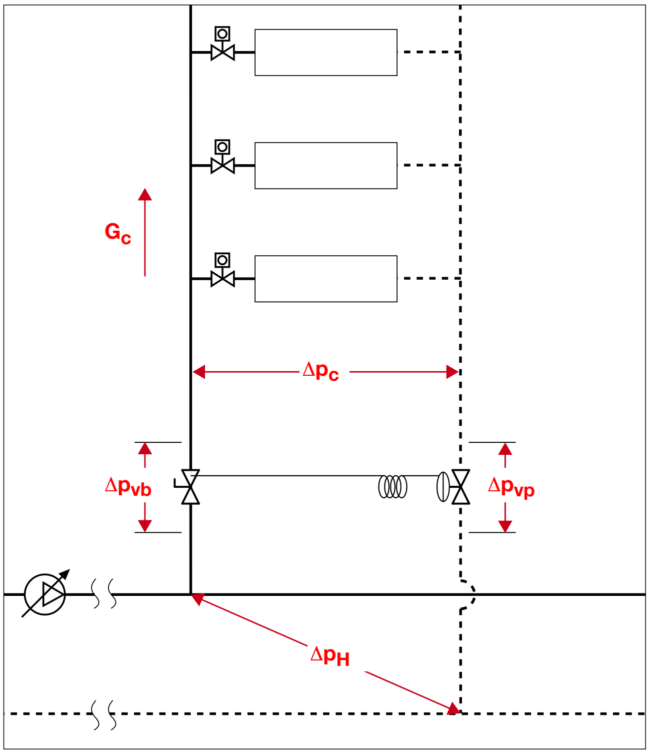
Connection accessories - Sizes DN 15, 20 and 25

For this range of sizes, in alternative to traditional shut-off devices, the valves can be connected using the manual accessory valve code 538203 (17) to shut-off the circuits and perform the etting operations.



Sizing method

Reference circuit



G_c = design flow rate to circuit
Δp_c = head loss of the circuit referred to G_C
Δp_{vp} = head loss of the differential pressure regulating valve
Δp_{vb} = head loss of the balancing valve

Δp_H = total head loss of the circuit = $\Delta p_{vb} + \Delta p_C + \Delta p_{vp}$

Example
For the sizing and setting of the control devices of the differential pressure to be inserted into a heating system, it is necessary to know the project flow rate and head losses of the circuit in question (G_c and Δp_c).

Choice and setting of the differential pressure regulating valve, when the design flow rates and head losses of the circuit are known:

G_c = 0,8 m³/h
Δp_c = 20 kPa

Using the table Δp_{set} , we choose a valve which, when set at a pressure differential = Δp_C = 20 kPa should be of such a size that the value G_C is between G_{min} and G_{max}, shown in the table.
In the table it is highlighted in yellow that, on the setting 20 kPa, (1) the value of Gc (0,8 m³/h) is between G_{min} (2) and G_{max} (3) for the valve size DN 20 (4).
DN 20 is chosen, as a compromise between adjustment requirements, head loss and economic installation.

$p_{SET\ POINT}$ 5÷30 kPa (50÷300 mbar)														
Code	DN	Size	5 kPa		10 kPa		15 kPa		20 kPa (1)		25 kPa		30 kPa	
			Gmin (m³/h)	Gmax (m³/h)	Gmin (m³/h)	Gmax (m³/h)	Gmin (m³/h)	Gmax (m³/h)	Gmin (m³/h)	Gmax (m³/h)	Gmin (m³/h)	Gmax (m³/h)	Gmin (m³/h)	Gmax (m³/h)
140340	15	1/2"	0,05	0,45	0,05	0,60	0,05	0,70	0,05	0,75	0,05	0,80	0,05	0,90
140350	20 (4)	3/4"	0,10	0,65	0,10	0,85	0,10	1,00	0,10 (2)	1,05 (3)	0,10	1,10	0,10	1,20
140360	25	1"	0,25	0,90	0,25	1,20	0,25	1,50	0,25	1,55	0,25	1,60	0,25	1,70
140370	32	1 1/4"	0,40	3,50	0,40	4,50	0,40	5,00	0,40	5,50	0,40	6,00	0,40	6,00
140380	40	1 1/2"	0,50	4,50	0,50	5,50	0,50	6,00	0,50	7,00	0,50	7,50	0,50	7,50
140392	50	2"	0,80	10,0	0,80	10,0	0,80	10,0	0,80	12,0	0,80	12,0	0,80	12,0

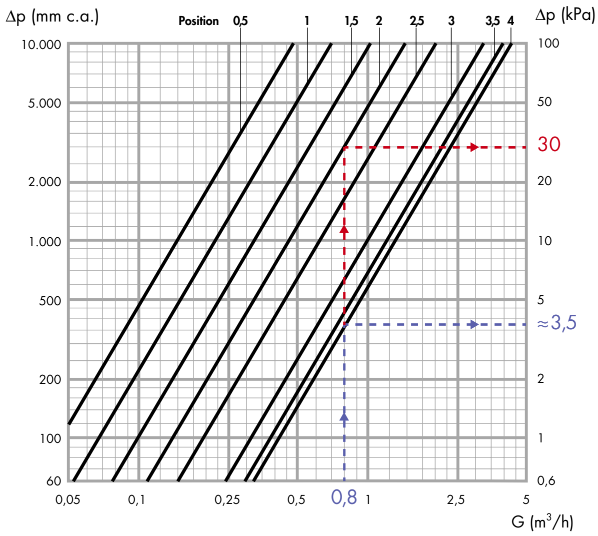
A 140 series valve will be chosen, DN 20 and set to 20 kPa

Calculation of Δp_H for sizing the pump:

$\Delta p_H = \Delta p_{vb} + \Delta p_{pc} + \Delta p_{vp}$

Δp_{vb}: *presuming that a DN 20 Δp regulating valve has been chosen, the head loss of the balancing valve starts from a minimum value ("fully open" position for the most disadvantaged circuit) up to an increasing value in relation to the flow rate setting in the less disadvantaged circuits. Graphically this gives:*

Cod. 142150 3/4"

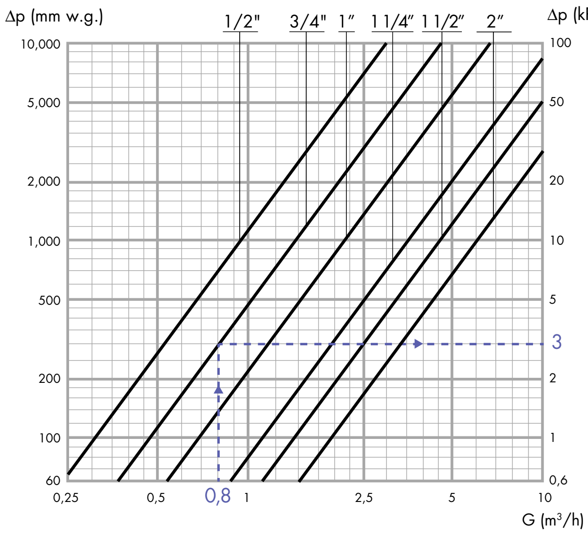


Δp_{vb} = *3,5 kPa, valve fully open-blue line*
Δp_{vb} = *30 kPa, valve in flow rate regulation-red line*

Δp_c = *head loss of the circuit referred to G_C =20 kPa*

Δp_{vp}: *the head loss of the Δp regulating valve is obtained using the Kvs diagram with the device in 'fully open' position, the ideal operating condition. Graphically this gives:*

140 series Kvs diagram



Δp_{vp} = *3 kPa*

The total head loss of the circuit to be used to calculate the size of the pump is as follows:

Δp_H = *3,5 + 20 + 3 =* ***26,5 kPa***

Note: in cases where G_C and Δp_C must be "estimated" and not calculated in the project or in the case of practical setting in the field, it is preferable to calculate Δp_{VP} using the Kv_{nom} diagram of the 140 series valve, which represents the mean regulation conditions.

For fast sizing, in a precautionary way and under medium conditions, it is possible to estimate:

$\Delta p_H \geq 1{,}5 \cdot \Delta p_c$

Correction of the flow rate on the circuit, using only the Δp regulating valve

Once the valves have been set, it may be necessary to correct the flow rate to the controlled circuit.
This operation may be performed by adjusting the Δp setting of the differential regulating valve according to the equation:

$G_2 = G_1 \cdot \sqrt{(\Delta p_2 / \Delta p_1)}$, *which means:*

$\boldsymbol{\Delta p_2 = G_2^2 / G_1^2 \cdot \Delta p_1}$ ***(1)***

For example, if we have to increase Gc by 15% (which corresponds to an increase of the flow rate from G_1 = 0,8 m³/h to $G_2 = G_1$ ± 15% = 0,92 m³/h), using the formula (1), we find the new setting value Δp_2 of the differential pressure regulating valve:

$\Delta p_2 = 0{,}92^2/0{,}80^2 \cdot 20 = \mathbf{26{,}45\ kPa}$

The setting of the regulating valve will be modified from 20 kPa to ≈ 26,5 kPa.

Correction for liquids of different density

If using liquids with a density different from water at 20°C ($\rho \approx 1$ kg/dm³), correct the value of the measured head loss Δp using the following formula:

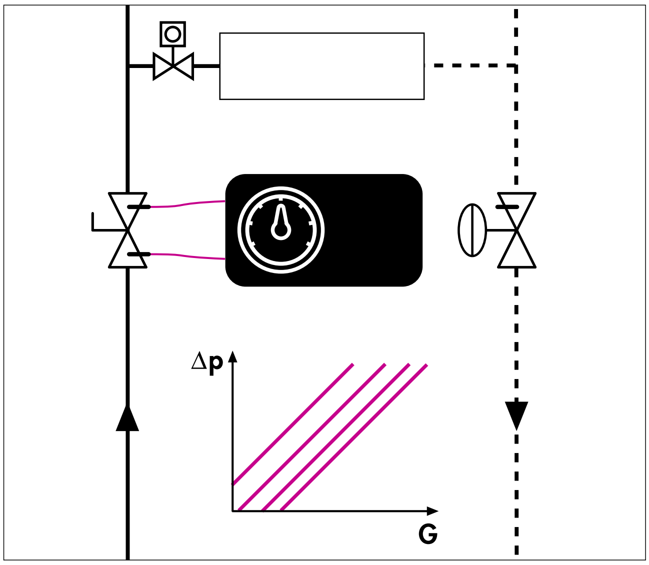
$$\Delta p' = \frac{\Delta p}{\rho}$$

where: $\Delta p'$ = reference head loss
Δp = measured head loss
ρ = medium density in kg/dm³

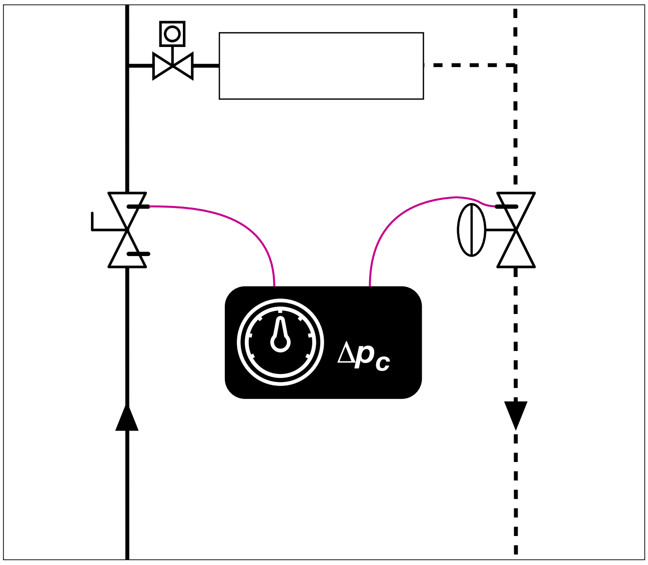
Use the value $\Delta p'$ to measure the flow rate.

Optimum commissioning procedure

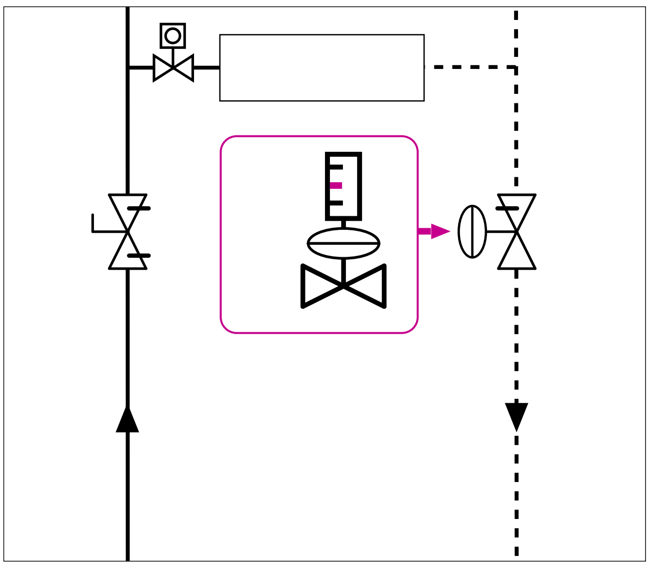
1) System fully open.
Setting of the balancing valve:
$G_{design} = G_C$



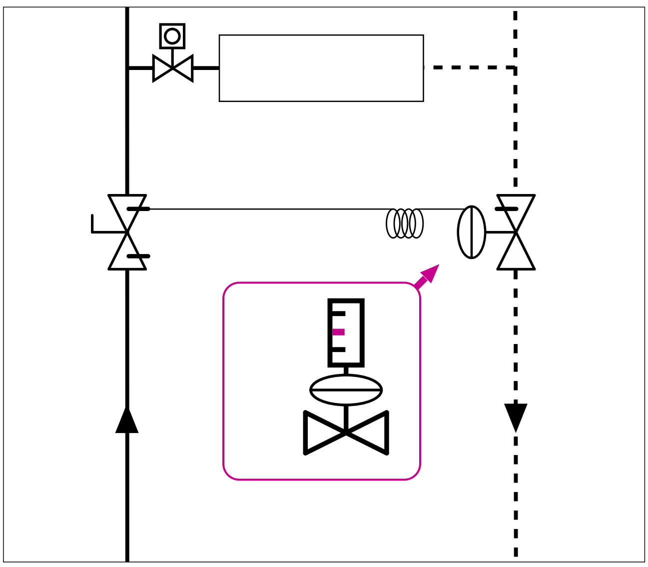
2) Checking the real Δp of the circuit:
$\Delta p_{real} = \Delta p_C$



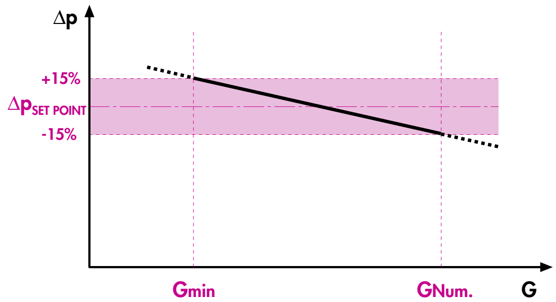
3) Setting of the differential pressure regulating valve at the measured Δp_C value



4) Connection of the capillary pipe to the differential pressure regulating valve



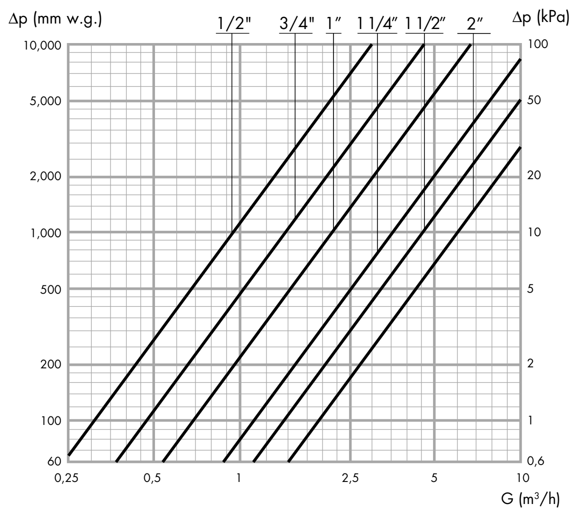
Hydraulic characteristics of the Δp regulating valve 140 series



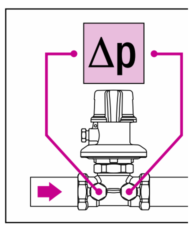
Δp SET POINT 5–30 kPa (50–300 mbar)														
Code	DN	Size	5 kPa		10 kPa		15 kPa		20 kPa		25 kPa		30 kPa	
			Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)
140340	15	1/2"	0,05	0,45	0,05	0,60	0,05	0,70	0,05	0,75	0,05	0,80	0,05	0,90
140350	20	3/4"	0,10	0,65	0,10	0,85	0,10	1,00	0,10	1,05	0,10	1,10	0,10	1,20
140360	25	1”	0,25	0,90	0,25	1,20	0,25	1,50	0,25	1,55	0,25	1,60	0,25	1,70
140370	32	1 1/4”	0,40	3,50	0,40	4,50	0,40	5,00	0,40	5,50	0,40	6,00	0,40	6,00
140380	40	1 1/2”	0,50	4,50	0,50	5,50	0,50	6,00	0,50	7,00	0,50	7,50	0,50	7,50
140392	50	2”	0,80	10,0	0,80	10,0	0,80	10,0	0,80	12,0	0,80	12,0	0,80	12,0

Δp SET POINT 25–60 kPa (250–600 mbar)																		
Code	DN	Size	25 kPa		30 kPa		35 kPa		40 kPa		45 kPa		50 kPa		55 kPa		60 kPa	
			Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)	Gmin (m³/h)	GNum. (m³/h)
140440	15	1/2"	0,05	0,80	0,05	0,90	0,05	0,95	0,05	1,00	0,05	1,05	0,05	1,10	0,05	1,10	0,05	1,20
140450	20	3/4"	0,10	1,10	0,10	1,20	0,10	1,30	0,10	1,40	0,10	1,45	0,10	1,50	0,10	1,55	0,10	1,60
140460	25	1”	0,25	1,60	0,25	1,70	0,25	1,75	0,25	1,75	0,25	1,80	0,25	1,85	0,25	1,90	0,25	2,00
140470	32	1 1/4”	0,40	6,00	0,40	6,00	0,40	6,50	0,40	6,50	0,40	6,50	0,40	6,50	0,40	6,50	0,40	6,50
140480	40	1 1/2”	0,50	7,50	0,50	7,50	0,50	7,50	0,50	7,50	0,50	8,00	0,50	8,00	0,50	8,00	0,50	8,00
140492	50	2”	0,80	12,0	0,80	12,0	0,80	12,0	0,80	13,0	0,80	14,0	0,80	14,0	0,80	14,0	0,80	14,0

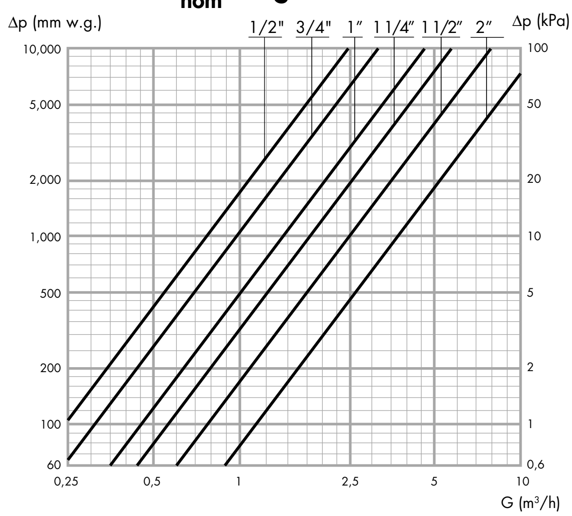
140 series Kvs diagram



DN	15	20	25	32	40	50
Size	1/2"	3/4"	1”	1 1/4”	1 1/2”	2”
Kvs (m³/h)	3,02	4,59	6,91	11,30	14,40	18,32



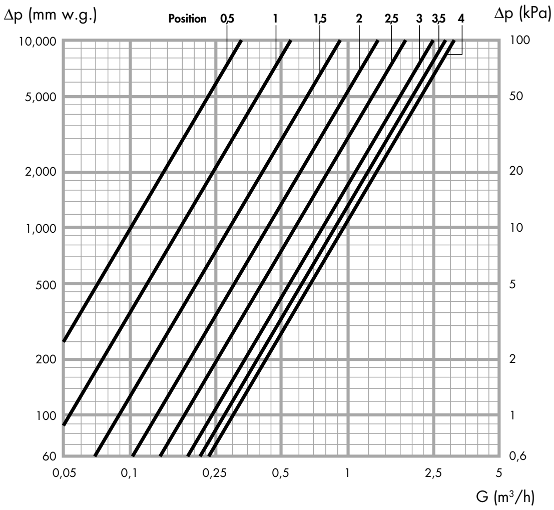
140 series Kv_{nom} diagram

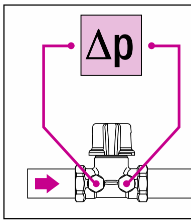


DN	15	20	25	32	40	50
Size	1/2"	3/4"	1”	1 1/4”	1 1/2”	2”
Kv_{nom} (m³/h)	2,47	3,10	4,53	5,60	7,90	11,60

Hydraulic characteristics of the balancing valve 142 series

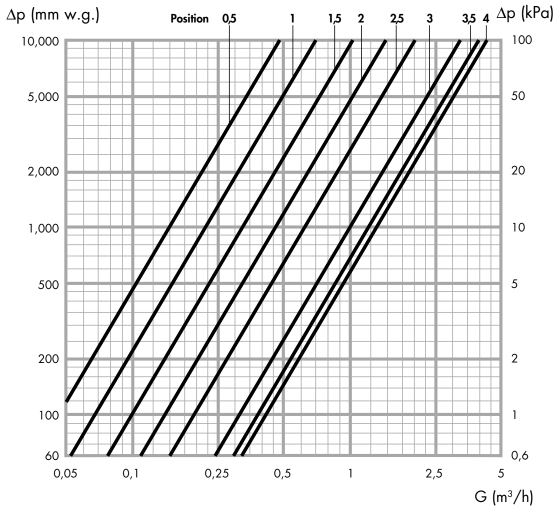
Code 142140 1/2"





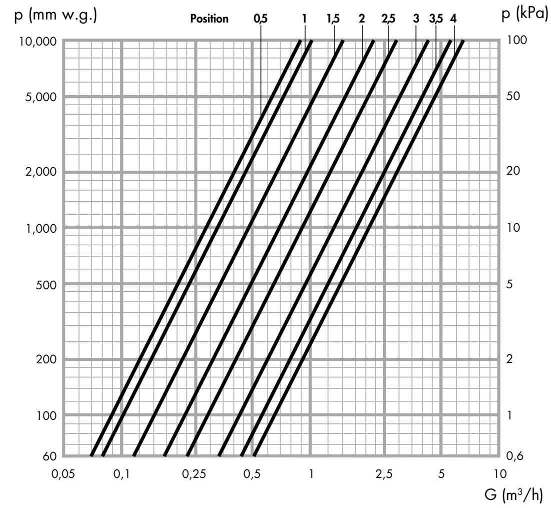
DN 15	Position							
Size 1/2"	0,5	1	1,5	2	2,5	3	3,5	4 (Kvs)
Kv (m³/h)	0,32	0,54	0,92	1,38	1,84	2,50	2,81	2,96

Code 142150 3/4"



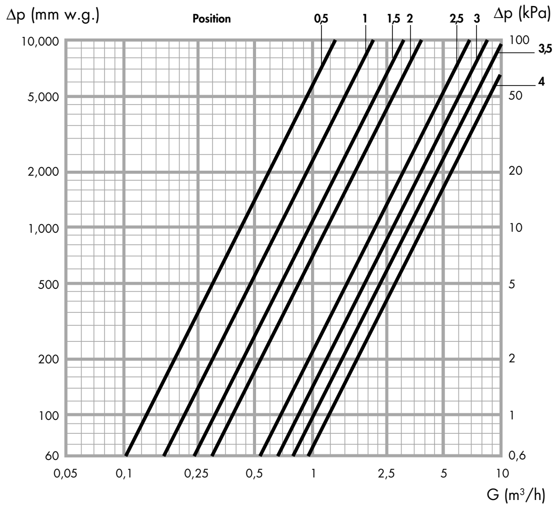
DN 20	Position							
Size 3/4"	0,5	1	1,5	2	2,5	3	3,5	4 (Kvs)
Kv (m³/h)	0,47	0,70	1,04	1,48	2,05	3,20	3,81	4,35

Code 142160 1"



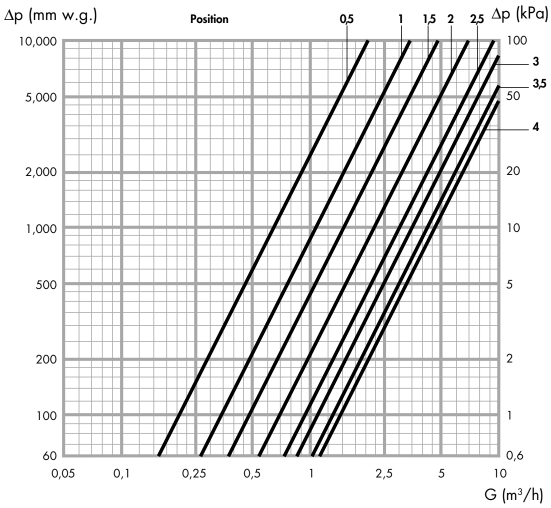
DN 25	Position							
Size 1"	0,5	1	1,5	2	2,5	3	3,5	4 (Kvs)
Kv (m³/h)	0,88	1,03	1,51	2,20	2,88	4,36	5,63	6,52

Code 142170 1 1/4"



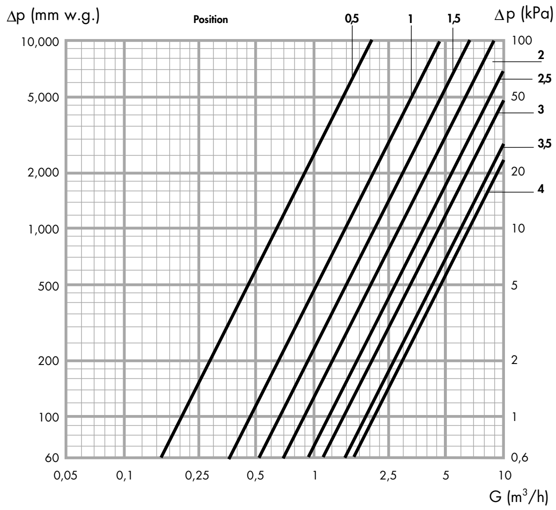
DN 32	Position							
Size 1 1/4"	0,5	1	1,5	2	2,5	3	3,5	4 (Kvs)
Kv (m³/h)	1,29	2,20	3,14	3,88	6,63	8,70	10,21	11,19

Code 142180 1 1/2"



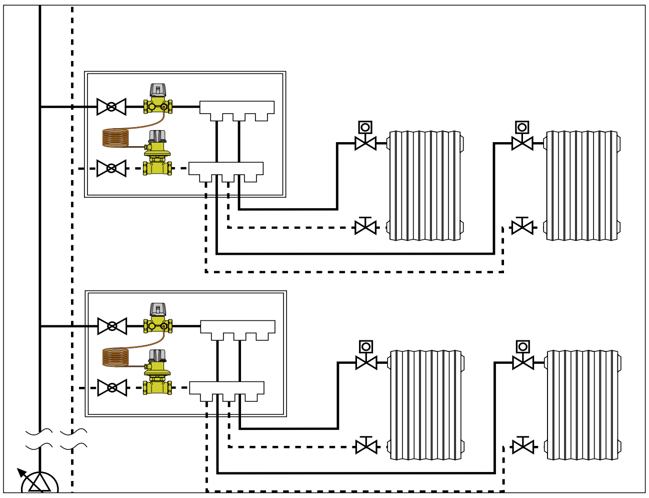
DN 40	Position							
Size 1 1/2"	0,5	1	1,5	2	2,5	3	3,5	4 (Kvs)
Kv (m³/h)	1,76	2,85	4,86	7,00	9,35	11,57	12,83	14,49

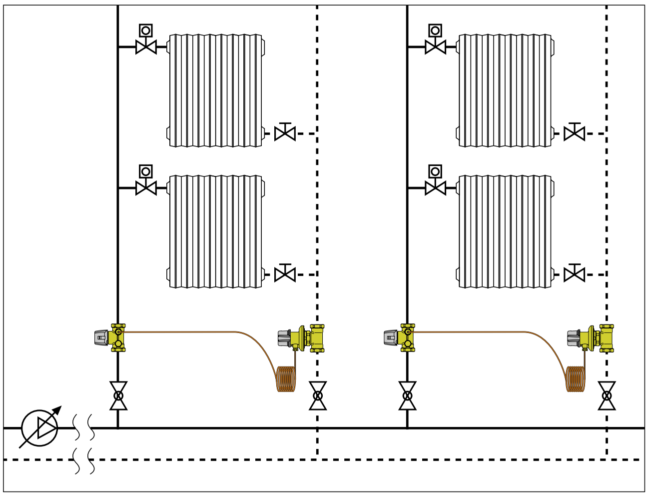
Code 142290 2"



DN 50	Position							
Size 2"	0,5	1	1,5	2	2,5	3	3,5	4 (Kvs)
Kv (m³/h)	1,99	4,73	6,25	8,78	11,39	14,73	17,25	19,00

Application diagrams





Accessories

100000

tech. broch. 01041

Couple of quick-fit pressure/temperature ports
Brass body.
EPDM seals.
Maximum working pressure: 30 bar.
Working temperature range: -5–130°C.
Connections: 1/4” M.

100010

tech. broch. 01041

Pair of fittings with quick-fit syringe for connection of pressure test ports to measuring instruments.
Female 1/4” threaded connection.
Maximum working pressure: 10 bar.
Max. working temperature: 110°C.

538203

Manual shut-off cock.
Brass body.
Seals in non-asbestos fibre.
Maximum working pressure: 16 bar.
Working temperature range: -10–120°C.
Connections: 1/4” M x 1/4” F.

130

Electronic flow rate and differential pressure measuring station.
Supplied complete with shut-off valves and connection fittings.
May be used for Δp measurements and setting of balancing valves.
Bluetooth® transmission between Δp measuring station and remote control unit.
Versions complete with remote control unit with Android® or with Android® application for Smartphone and Tablet.

Measurement range: 0-1000 kPa.
static Pmax: 1000 kPa.
Electric supply from battery.

CE

Code	
130006	with remote control unit, with Android® app
130005	without remote control unit, with Android® app

SPECIFICATION SUMMARY

140 series

Adjustable setting pressure differential regulating valve. Size DN 15 (from DN 15 to DN 50). Main connections 1/2” (from 1/2” to 2”) F (ISO 228-1). Connections for capillary pipe 1/8” (complete with adapter 1/4” M x 1/8” F for connection of pressure test ports to 142 series valve). Pressure test port connections 1/4” F (ISO 228-1) with plug. Body, control stem and obturator in dezincification resistant alloy. Stainless steel spring. Diaphragm and seals in EPDM. PA6G30 control knob. Copper capillary pipe. Medium water and glycol solutions; maximum percentage of glycol 50%. Maximum working pressure 16 bar for DN 15 sizes (from DN 15 to DN 25), 10 bar for DN 32 sizes (from DN 32 to DN 50). Working temperature range -20–120°C. Membrane maximum differential pressure 6 bar for DN 15 sizes (from DN 15 to DN 25), 2,5 bar for DN 32 sizes (from DN 32 to DN 50). Differential pressure setting range 5–0 kPa (and 25-60 kPa). Accuracy ±15%. Length of capillary pipe Ø 3 mm, 1,5 m. Complete with pre-formed shell insulation in EPP (excluding DN 50).

142 series

Shut-off and pre-regulation valve. Size DN 15 (from DN 15 to DN 50). Main connections 1/2” (from 1/2” to 2”) F (ISO 228-1). Pressure test port and capillary pipe connections 1/4” F (ISO 228-1) with plug. Body, control stem and obturator in dezincification resistant alloy. EPDM seals. PA6G30 control knob. Number of regulation turns 4. Saving of the adjustment position. Medium water and glycol solutions; maximum percentage of glycol 50%. Maximum working pressure 16 bar. Working temperature range -10–120°C. Accuracy ±15%. Complete with pre-formed shell insulation in EPP (excluding DN 50).

CALEFFI Hydronic Solutions

Caleffi S.p.A.
S.R. 229 no. 25 · 28010 Fontaneto d’Agogna (Novara) · Italy
Tel. +39 0322 8491 · Fax +39 0322 863723
info@caleffi.com · www.caleffi.com