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Differential pressure regulating valve for manifolds

code **140**300

bsi. FM 21654
UKAS MANAGEMENT SYSTEMS 003
ICIM CERTIFIED MANAGEMENT SYSTEM UNI EN ISO 9001:2015

Function

The differential pressure regulating valve keeps constant, at the set value, the difference in pressure existing between two points of a hydraulic circuit.
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 differential pressure regulating valve is compatible with 671 and 664 series manifolds.

Code 140300 Differential pressure regulating valve for manifolds ____ size DN 25 (1”)

Technical specifications

Materials

Δp regulator body:	dezincification resistant alloy CR EN 12165 CW602N
Fitting body:	brass EN12165 CW614N
Control stem and obturator:	dezincification resistant alloy CR EN 12164 CW602N
Δp regulator diaphragm:	EPDM
Δpregulator spring:	stainless steel (AISI 302)
Seals:	EPDM
Knob	PA6G30
Capillary pipe:	copper

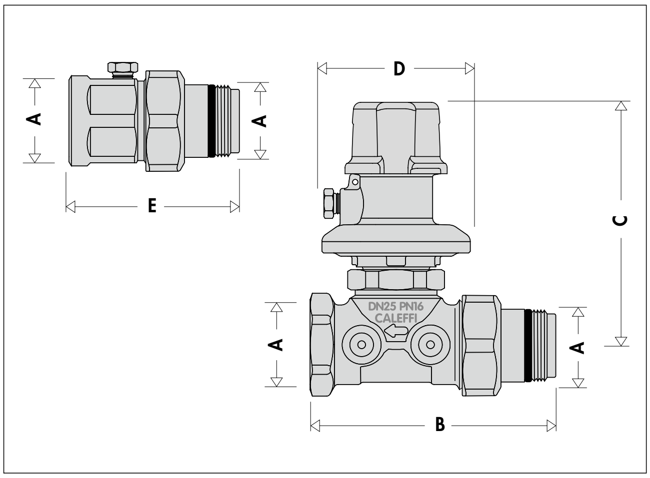
Performance

Medium:	water, glycol solutions
Max. percentage of glycol:	50%
Max. working pressure:	16 bar
Working temperature range:	-10–120°C
Diaphragm maximum differential pressure:	6 bar
Δp setting range:	5–30 kPa (50–300 mbar)
Accuracy:	±15%
Kv (fitting with pressure port):	28,4 (m^3/h)

Connections

- main:	1” F x 1” M (ISO 228-1)
- capillary pipe:	1/8” (for connecting the flow fitting)
Length of Ø 3 mm capillary pipe:	1,5 m

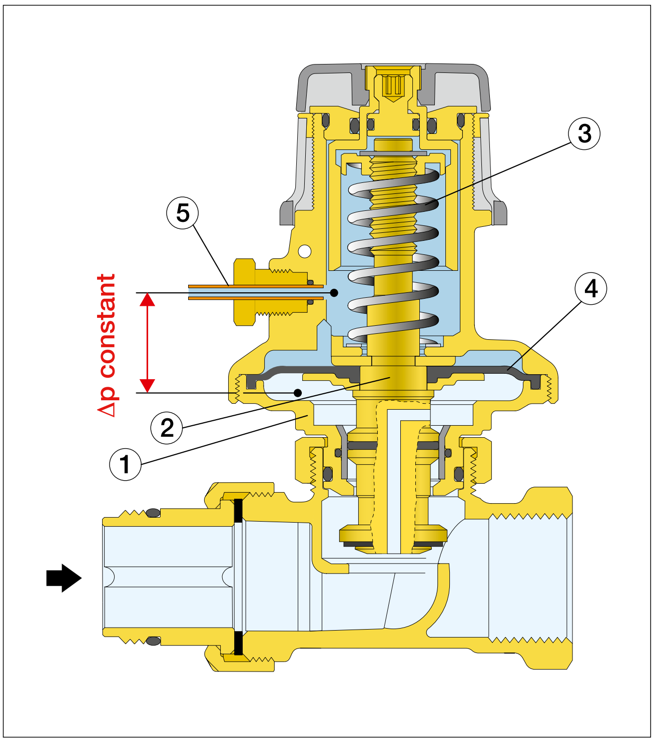
Dimensions

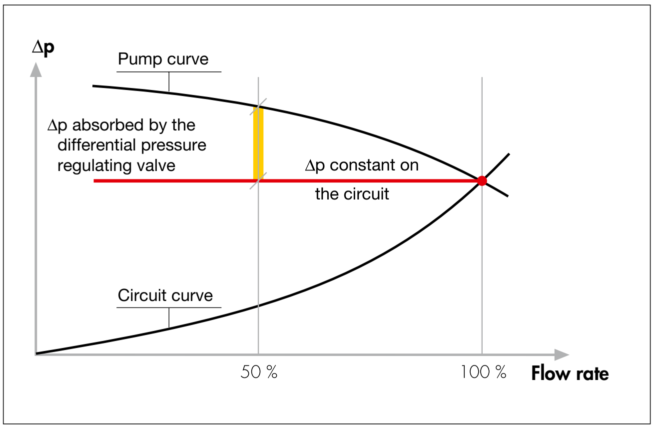


Code	DN	A	B	C	D	E	Mass (kg)
140300	25	1”	115	112	Ø 69	80	1.9

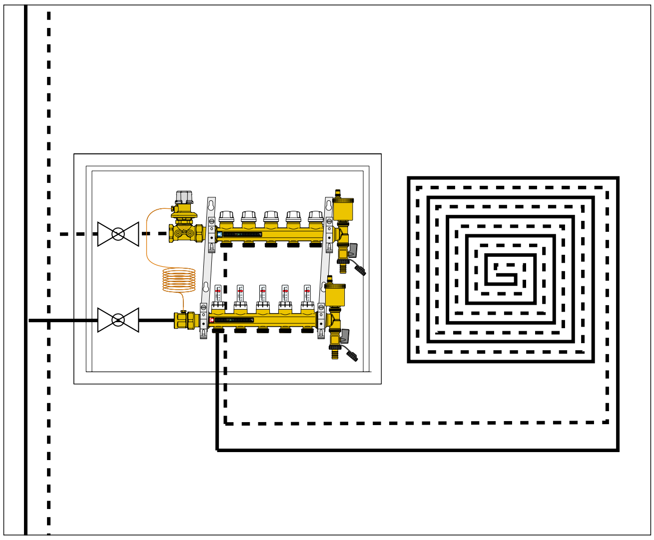
Operating principle

When installed in the return circuit of the distribution manifold in a radiant panel system, the Δp regulator allows the distribution system to operate under constant load conditions even when the system conditions change. The differential pressure regulating valve acts proportionally to re-establish the Δp conditions set on the valve while shut-off devices vary the flow rate. The flow pressure value is brought to the top surface of the membrane (4) by means of the connecting capillary pipe (5); the return pressure value is brought to the bottom surface of the membrane through the connecting pipe inside the control stem (2). 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 (3) 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 the thermostatic valves open to increase the flow rate to the heating terminals, according to the inverse physical process. The regulator action allows the flow rate regulation valves on the flow manifold to operate under constant load conditions; this means they can keep the flow rate at a constant level even when the operating conditions for the rest of the system change.





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



Construction details

CR alloy and stainless steel materials

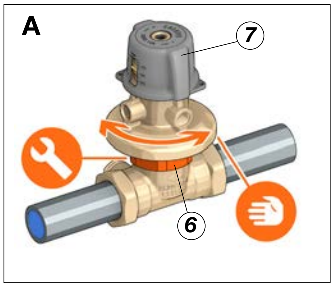
The valve body (1) and control stem (2) are made of CR dezincification resistant alloy, while the spring of the Δp differential regulating valve (3) is made of stainless steel. These materials prevent phenomena of corrosion, guarantee reliable performance over time and a use compatible with glycols and additives, which are often used in the circuits of heating systems.

Easy installation procedure

Both the Δp regulator and the fitting with pressure port have been designed with the specific structural features described below in points a) and b) to simplify installation. In fact their use often proves necessary during restructuring or when working on existing systems. In these conditions it is probable that the existing connection pipes "allow" only small spaces for work/installation, or positions that are difficult to reach.

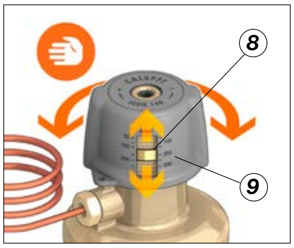
A. Smaller overall size and 140 series plate diameter
The two valves are compact while maintaining high accuracy, performance and a wide working range in terms of flow rate and adjustable Δp. The characteristics of the materials used in the Δp regulator and the design of its internal components have allowed an appreciable reduction of the largest element in devices of this type, which is the diameter of the plate containing the membrane (4).

B. Adjustable pressure port connection on the 140 series
For an optimal position of the connecting capillary pipe (5), after loosening the locking nut (6) of the Δp regulator by approximately 45°, the upper body of the valve (7) can be manually rotated with a hexagonal key



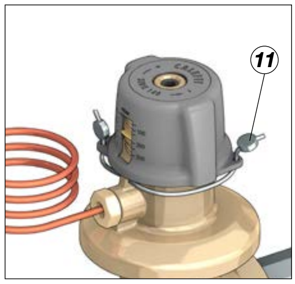
Δp indicator on 140 series

Setting the Δp differential regulating valve is simplified by the presence of a mobile indicator (8) and a scale (9) graduated in mbar on the valve knob.



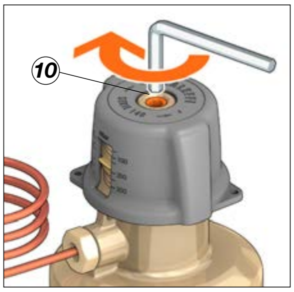
Locking/sealing the regulation position

There are special holes on the knob and valve body that can be used to seal the devices once they have been set (11). The application of sealing means that, during any inspections, it can be rapidly ensured that the system has not been tampered with.



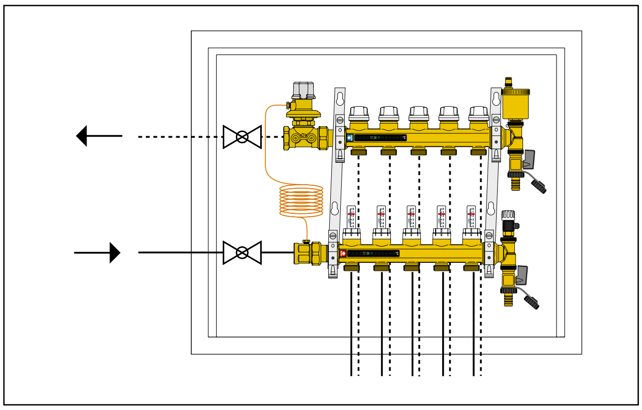
Shut-off and systems for keeping setting value

Where, for reasons of space, it is not possible to install suitable shut-off devices upstream and downstream from the two valves, it is still possible to isolate the circuit zone controlled by the Δp differential regulating valve. The circuit is shut off by inserting an Allen wrench in the hole (10) and turning it fully clockwise. The set Δp position does not change. This procedure allows shut-off to be carried out for system maintenance operations, and restoring operation, without having to reset the valves.

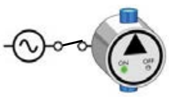


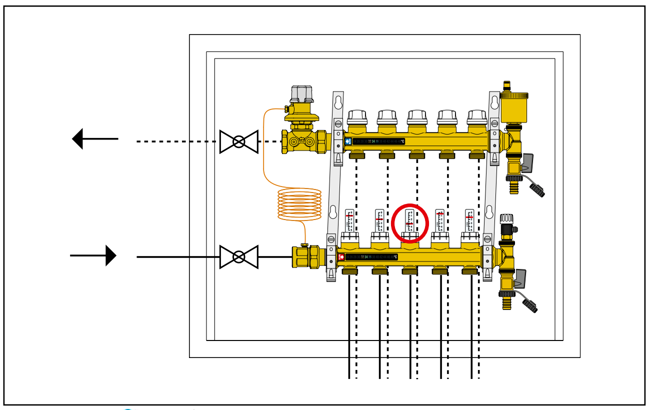
Optimum commissioning procedure

1. Install the differential pressure regulating valve and the fitting with pressure port. Connect the capillary pipe.

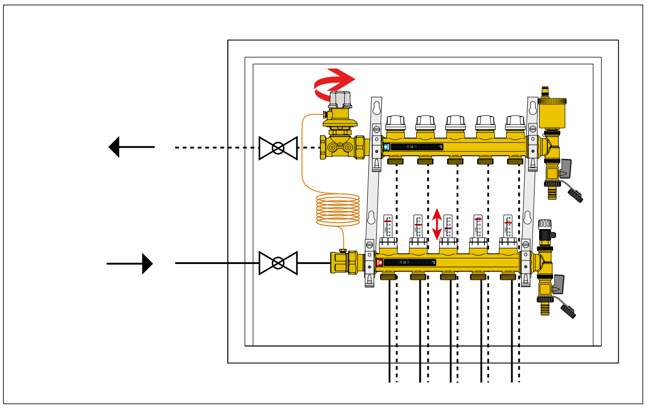


2. Operate the circulator and find the most disadvantaged circuit (the one with the smallest capacity, checking that all the circuits are in the "fully open" position).

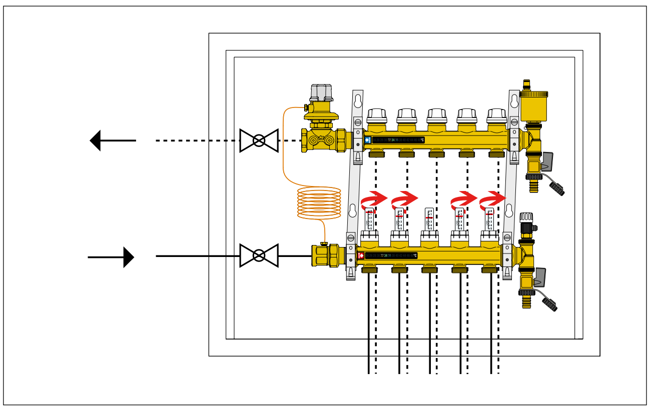




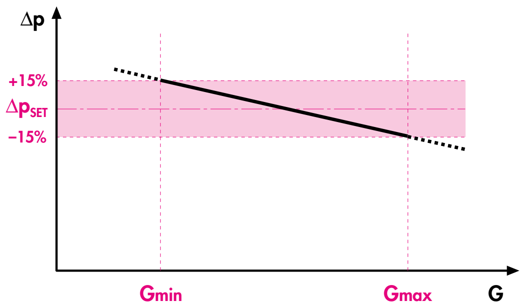
3. Set the differential pressure regulator to the desired flow rate (displayed on the flow meter on the manifold of the most "disadvantaged" branch).



4. Use the regulating valves to set the desired flow rate in the remaining circuit loops



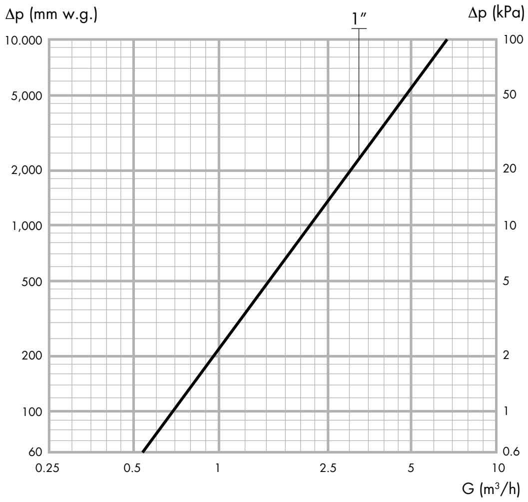
Hydraulic characteristics of the 140 series Δp regulating valve



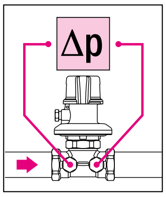
Flow rate range

	Δp setting					
	5 kPa	10 kPa	15 kPa	20 kPa	25 kPa	30 kPa
Gmin (m^3/h)	0.25	0.25	0.25	0.25	0.25	0.25
Gmax (m^3/h)	0.90	1.20	1.50	1.55	1.60	1.70

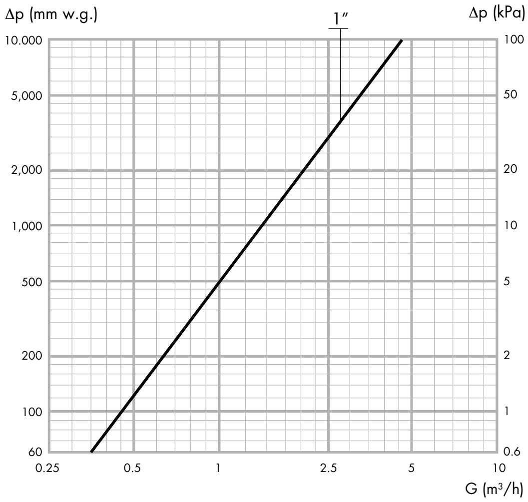
140 series Kvs diagram



DN	25
Size	1”
Kvs (m^3/h)	6.91

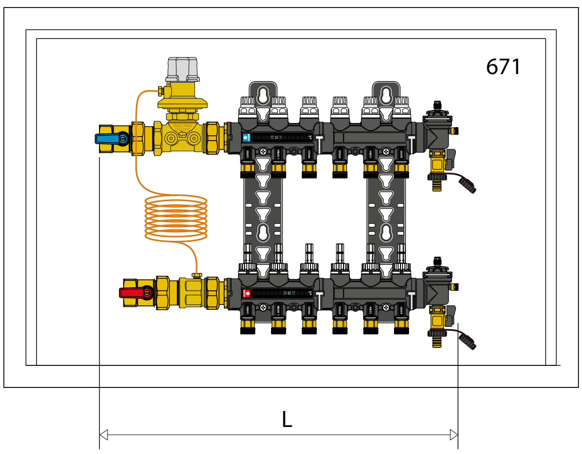


140 series Kv diagram$_{nom}$

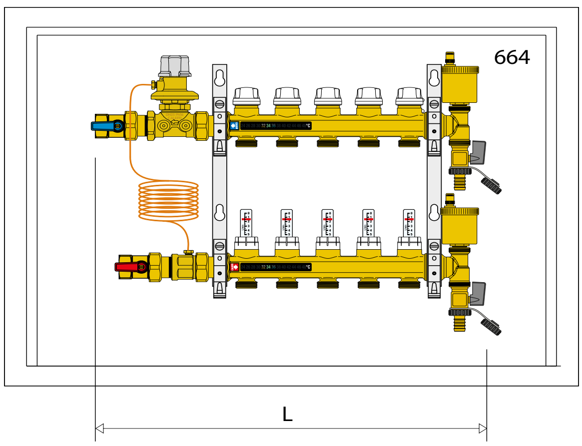


DN	25
Size	1”
Kv_{nom}(m^3/h)	4.53

Choice of box size according to the number of outlets



outlets	3	4	5	6	7	8	9	10	11	12	13	14
L (mm)	400	450	500	550	600	650	700	750	800	850	900	950

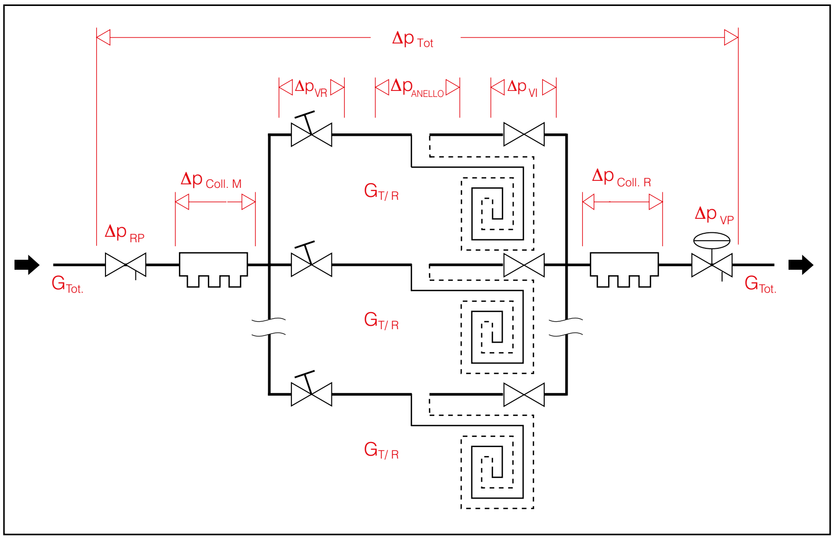


outlets	2	3	4	5	6	7	8	9	10	11	12	13
L (mm)	355	415	465	515	565	625	675	725	775	825	875	915

Example of calculation

Hydraulic characteristics

In order to determine the hydraulic characteristics of the circuit, it is necessary to calculate the pressure drop of the medium as it flows through the devices that make up the manifold assembly and the radiant panel circuits. From a hydraulic point of view, the system consisting of the manifold assembly and the circuits can be considered a set of hydraulic elements arranged in series and in parallel.



Δp_{Tot} = Total pressure drop across the differential regulating valve (Flow + Return + Loop)

Δp_{VR} = Local pressure drop of the loop balancing valve (loop flow rate)

Δp_{Anello} = Loop pressure drop (loop flow rate)

Δp_{VI} = Local pressure drop of the panel circuit shut-off valve (loop flow rate)

$\Delta p_{Coll.\ M}$ = Distributed pressured drop of the flow manifold (total flow rate)

$\Delta p_{Coll.\ R}$ = Distributed pressure drop of the return manifold (total flow rate)

Δp_{RP} = Local pressure drop of the pressure port fitting

Δp_{RP} = Local pressure drop of the differential pressure valve

$$\Delta p_{Tot} = \Delta p_{VR} + \Delta p_{Anello} + \Delta p_{VI} + \Delta p_{Coll.\ M} + \Delta p_{Coll.\ R} + \Delta p_{VP} + \Delta p_{RP} \qquad (1.1)$$

When the hydraulic characteristics of each component and the design flow rates are known, the total pressure drop can be calculated as the sum of the partial pressure drops for each specific component in the system, as given by the formula (1.1).

Manifold 664

	Kv	$Kv_{0,01}$
Flow-rate regulating valve fully open (RV)	1,10	110
Panel circuit shut-off valve (SV)	4,10	410

- Kv = flow rate in m³/h for a pressure drop of 1 bar
- $Kv_{0.01}$ = flow rate in l/h for a pressure drop of 1 kPa

	Kv	$Kv_{0,01}$
Flow manifold 2–7 ports	11,10*	1110*
Return manifold 2–7 ports	16,70*	1670*
Flow manifold 8–13 outlets	6,90*	690*
Return manifold 8–13 outlets	10,40*	1040*

**Average value*

Example of total pressure drop calculation

Supposing we need to calculate the pressure drop of a three-port manifold with the following characteristics:

Total manifold flow rate: 940 l/h

The flow rate and pressure drop in the pipes of the eight loops are as follows:

Circuit 1	Circuit 2	Circuit 3	Circuit 4	Circuit 5	Circuit 6	Circuit 7	Circuit 8
Δp_1 = 10 kPa	Δp_2 = 10 kPa	Δp_3 = 7 kPa	Δp_4 = 11 kPa	Δp_5 = 6 kPa	Δp_6 = 9 kPa	Δp_7 = 10 kPa	Δp_8 = 7 kPa
G_1 = 120 l/h	G_2 = 150 l/h	G_3 = 80 l/h	G_4 = 140 l/h	G_5 = 110 l/h	G_6 = 110 l/h	G_7 = 120 l/h	G_8 = 110 l/h

Each term in the formula *(1.1)* is calculated using the following relationship: $\Delta p = G^2/Kv_{0,01}{}^2$

- G = flow rate in l/h
- Δp = pressure drop in kPa (1 kPa ~100 mm w.g.)
- $Kv_{0,01}$ = flow rate in l/h through the device that corresponds to a pressure drop of 1 kPa

It should be stressed that the Δp_{Tot} must be calculated considering the circuit that has greatest pressure drops distributed along the entire panel pipe loop.
In the case we are examining, the relevant circuit is No. 4.

It follows that:

$\Delta p_{VR4} = 140^2/110^2 = 1,62$ kPa $\quad \Delta p_{VI4} = 140^2/410^2 = 0,12$ kPa $\quad \Delta p_{V\ coll\ rit} = 940^2/1040^2 = 0,82$ kPa

$\Delta p_{Anello4} = 11$ kPa $\quad \Delta p_{V\ coll\ mand} = 940^2/690^2 = 1,86$ kPa

Summing all the calculated terms, we have:

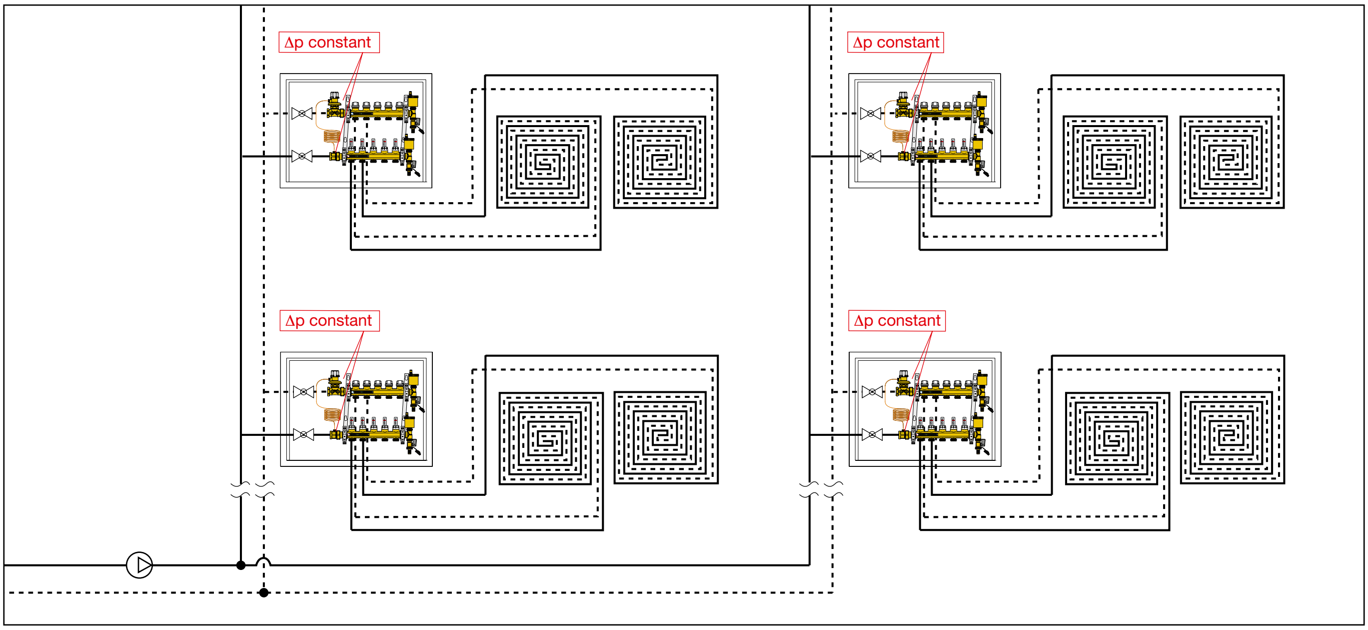
$\Delta p_{Tot} = 1,62 + 11 + 0,12 + 1,86 + 0,82 \cong 15$ kPa

Note: With a pressure drop of approximately 15 kPa, the differential regulating valve shall be set to 15 kPa.

The total pressure drop calculation must include Δp_{RP} (pressure port fitting) and Δp_{VP} (differential pressure valve): $\Delta p_{RP} = 940^2/2840^2 = 0,11$ kPa / $\Delta p_{VP} = 940^2/453^2 = 4,31$ kPa

The total pressure drop across the complete circuit will be: $\Delta p_{Tot} = 0,11 + 4,31 + 15 \cong 20$ kPa.

Application diagrams



Accessories

100000

tech. broch. 01041

Couple of quick-fit pressure/temperature ports
Brass body.
EPDM seals.
Max. 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.
Max. working pressure: 10 bar.
Max. working temperature: 110°C.

130

Electronic flow rate and differential pressure measuring station.
Supplied 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® app for Smartphones and Tablets.
Measurement range: 0–1000 kPa.
static Pmax: 1000 kPa.
Electric supply from battery.

Caleffi Smart Balancing
Smartphone app available.
Download the version for your Android® mobile phone.

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

SPECIFICATION SUMMARY

Code 140300

Adjustable setting pressure differential regulating valve. Size DN 25. 1” main connections. 1/8” capillary pipe connections (for connection to the valve on the flow pipe). Dezincification resistant alloy body. Stainless steel spring. EPDM diaphragm and seals. PA6G30 control knob. Copper capillary pipe. Medium water and glycol solutions; maximum percentage of glycol 50%. Maximum working pressure 16 bar. Working temperature range -10–120°C. Membrane maximum differential pressure 6 bar. Differential pressure setting range 5–30 kPa (50–300 mbar). Accuracy ±15%. Length of Ø 3 mm capillary pipe, 1,5 m. Complete with pressure port fitting. Brass fitting body. Medium water and glycol solutions; maximum percentage of glycol 50%. Maximum working pressure 16 bar. Working temperature range -10–120°C.