Flow rate metering device

683 series

01040/10 GB

ISO 9001 FM 21654

ISO 9001 No. 0003

Function

The flow rate metering device is used to measure the flow rate within a circuit. When used for central heating purposes, therefore, it allows monitoring of the thermal power supplied to the systems; in water treatment systems and industrial chemical or textile plants etc., it can be used to continuously monitor the water flowing through the circuits. This particular series of devices is equipped with quick-fit ports for easier differential pressure measurement.

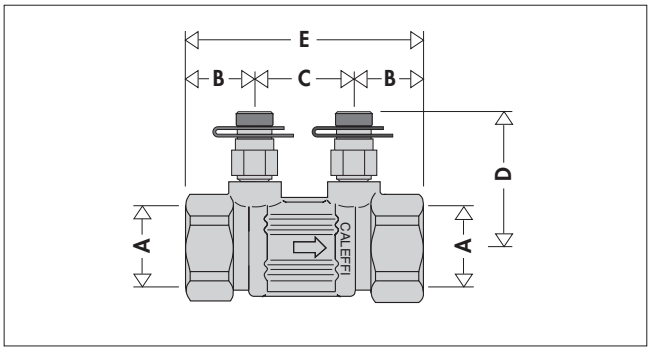
Product range

683 series Flow rate metering device, threaded connections ..... sizes 3/4" and 1"
683 series Flow rate metering device, flanged connections, to be coupled with counterflanges PN 6 ..... sizes DN 32–DN 100
683 series Flow rate metering device, flanged connections, to be coupled with counterflanges PN 16 ..... sizes DN 125–DN 200

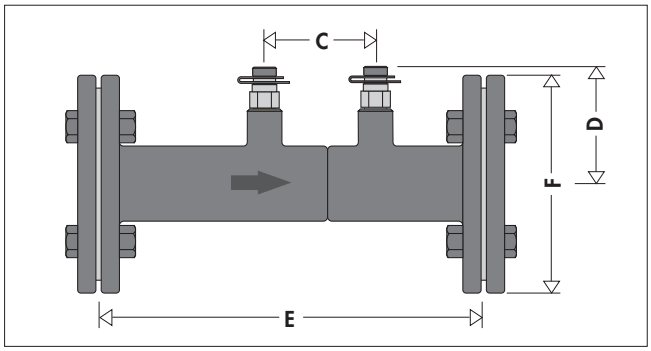
Technical specifications

series	683 threaded	683 flanged
Materials		
Body:	brass EN 12165 CW617N	painted steel
Gaskets:	-	asbestos free NBR fibre
Screws:	-	steel
Nuts:	-	steel
Pressure test ports:	brass EN 12164 CW614N	brass EN 12164 CW614N
Pressure test port seals:	EPDM	EPDM
Performance		
Medium:	water, glycol solutions	water, glycol solutions
Max. percentage of glycol:	50%	50%
Max. working pressure:	10 bar	6 bar (DN 32–DN 100), 16 bar (DN 125–DN 200)
Working temperature range:	-5–110°C	-5–110°C
Minimum Δp for measurement:	0,01 bar	0,01 bar
Connections		
Main:	3/4", 1" F	counterflange EN 1092-1 PN 6 (DN 32–DN 100) counterflange EN 1092-1 PN 16 (DN 125–DN 200)
Pressure test ports:	1/4" F	1/4" F

Dimensions



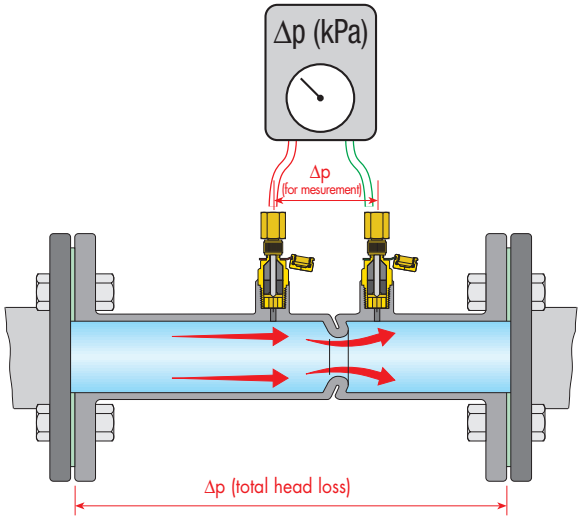
Code	A	B	C	D	E	Mass (kg)
683005	3/4"	23	32	51	78	0,30
683006	1"	29	32	54	90	0,43



Code	DN	C	D	E	F	Mass (kg)
683030	32	64	74	205	120	5,55
683040	40	71	77	230	130	6,27
683050	50	88	83	307	140	7,56
683060	65	110	90,5	390	160	10,43
683080	80	140	101	451	190	16,03
683100	100	182	106	530	210	20,06
683120	125	75	145	275	250	48,00
683150	150	80	160	300	285	61,00
683170	175	85	175	325	315	74,00
683200	200	100	185	350	340	96,00

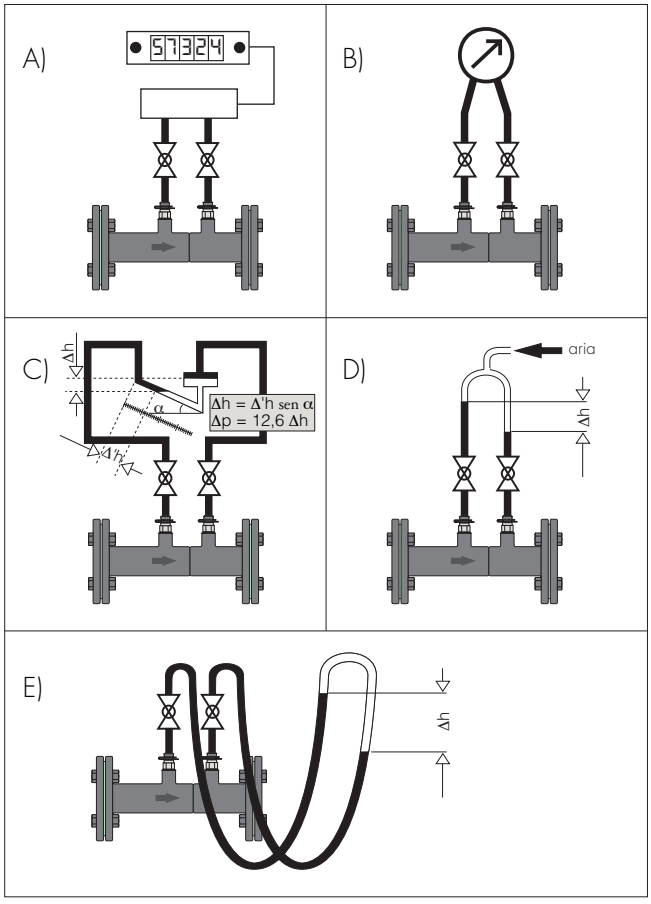
Operating principle

The 683 series flow rate metering device operation is based on the Venturi effect. The metering device contains a diaphragm that, by restricting the cross-section of the channel, speeds up the medium and generates an increased Δp (for measurement) at the ends, in order to guarantee precise flow rate metering. Each differential pressure value (measured at the ends of the diaphragm) has a corresponding accurate flow rate value, with the diaphragm Kv noted.
The total head loss for the metering device is, however, very low since the length of the pipe downstream from the diaphragm allows the medium to slow down and increase the pressure again.



Differential pressure measurement

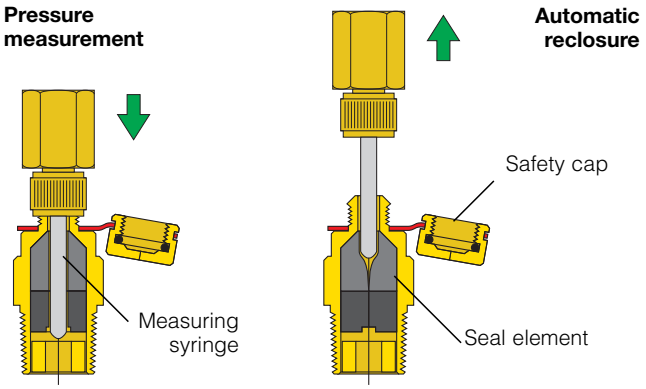
The differential pressure can be measured using any pressure gauge or meter capable of operating within the range 0–10 kPa (0–1000 mm w.g.; see adjacent figure). Whichever method or instrument is used, the air must be vented from the connection pipes to prevent errors when reading the differential pressure values.



A) Caleffi FLOMET electronic measuring station (130 series)
B) differential pressure gauges with dial
C) inclined U-shaped pressure gauges with mercury column
D) upturned U-shaped pressure gauges with water column
E) a transparent plastic hose (resistant to the static pressure of the system), system water functioning as pressure gauge fluid, air trapped in the hose acting as a separator.

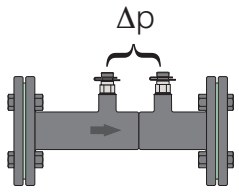
Construction details

Flow rate monitoring can take place at any moment, without any of the pipes being dismantled. The patented self-cleaning single-casting diaphragm profile and the quick-fit pressure test ports offer rapid and accurate differential pressure measurement.



Hydraulic characteristics

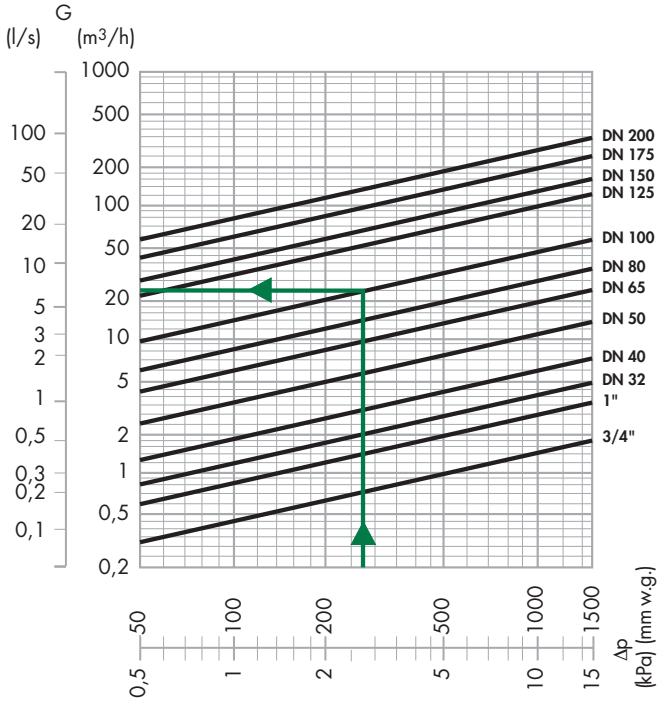
Flow rate measurement



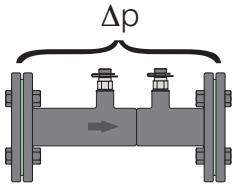
I.S. UNITS

G = Flow rate in l/s
Δp = Differential pressure in kPa
water density (ρ) 1 kg/dm³

Ø	
3/4"	$G = 0,129 \cdot \Delta p^{0,5}$
1"	$G = 0,229 \cdot \Delta p^{0,5}$
DN 32	$G = 0,337 \cdot \Delta p^{0,5}$
DN 40	$G = 0,533 \cdot \Delta p^{0,5}$
DN 50	$G = 0,989 \cdot \Delta p^{0,5}$
DN 65	$G = 1,654 \cdot \Delta p^{0,5}$
DN 80	$G = 2,438 \cdot \Delta p^{0,5}$
DN 100	$G = 4,029 \cdot \Delta p^{0,5}$
DN 125	$G = 9,032 \cdot \Delta p^{0,5}$
DN 150	$G = 11,290 \cdot \Delta p^{0,5}$
DN 175	$G = 15,806 \cdot \Delta p^{0,5}$
DN 200	$G = 22,580 \cdot \Delta p^{0,5}$



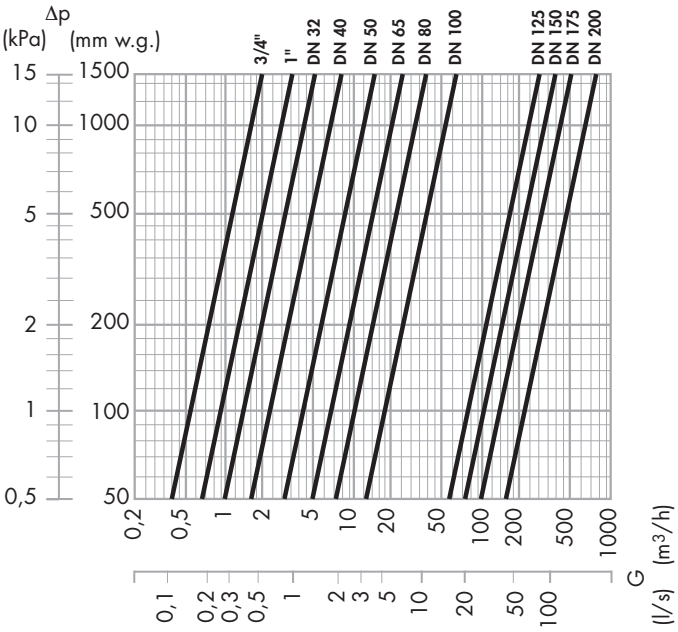
Kv coefficients, localised losses and equivalent lengths, head losses



I.S. UNITS

G = Flow rate in l/s
Δp = Differential pressure in kPa
water density (ρ) 1 kg/dm³

Ø	Kv (1 kPa)	ξ	le (m)	Δp = f (G)
3/4"	0,154	12	7	$\Delta p = 41,8769 \cdot G^2$
1"	0,273	10	8	$\Delta p = 13,3637 \cdot G^2$
DN 32	0,403	13	15	$\Delta p = 6,1579 \cdot G^2$
DN 40	0,637	10	13	$\Delta p = 2,4652 \cdot G^2$
DN 50	1,182	7	14	$\Delta p = 0,7153 \cdot G^2$
DN 65	1,978	7	18	$\Delta p = 0,2557 \cdot G^2$
DN 80	2,914	6	20	$\Delta p = 0,1178 \cdot G^2$
DN 100	4,913	6	27	$\Delta p = 0,04142 \cdot G^2$
DN 125	23,290	0,7	5	$\Delta p = 0,001 \cdot G^2$
DN 150	29,144	1	8	$\Delta p = 0,001 \cdot G^2$
DN 175	40,822	0,9	9	$\Delta p = 0,6 \cdot 10^{-3} \cdot G^2$
DN 200	58,352	0,7	9	$\Delta p = 0,293 \cdot 10^{-3} \cdot G^2$



Correction for liquids with different density

The following notes apply to liquids with viscosity ≤3°E (water and glycol mixtures, for example).
If using liquids with a density different to that of water at 20°C (ρ = 1 kg/dm^3), the head loss value Δp measured may be corrected using the formula:

$$\Delta p' = \Delta p / \rho' \qquad (1)$$

where: $\Delta p'$ = reference head loss
Δp = measured head loss
ρ' = liquid density in kg/dm^3

The value $\Delta p'$ is used when measuring flow rate G', using the graphs or the formula (2):

$$G' = Kv \cdot \sqrt{\Delta p'} \qquad (2)$$

Example of correction for liquid with different density

Metering device DN 100
Liquid density ρ' = 1,1 kg/dm^3
Head loss measured on Venturi Δp = 3 kPa
Let us use formula (1):

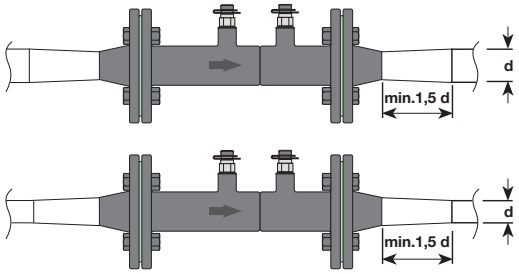
Reference head loss $\Delta p'$ = 3/1,1 = 2,72 kPa

This value is marked on the x-axis of the graph corresponding to the Δp measured with the Venturi (green line); the point at which this value meets the line for the DN 100 metering device indicates the corresponding flow rate G' = 7 l/s on the y-axis. Similarly, by using formula (2):

$$G' = 4028{,}96 \cdot 10^{-3} \sqrt{2{,}72} = 6{,}64 \text{ l/s}$$

Sizing method

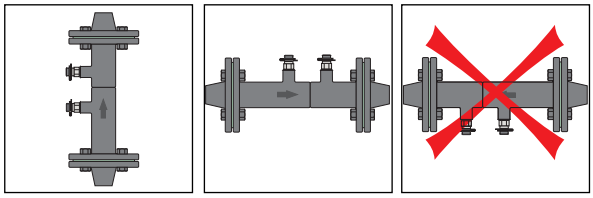
The size of the metering device should be selected so that, when operating at the design flow rate, it has a corresponding minimum measured Δp of 100 mm w.g. (1 kPa). Sometimes, to achieve this condition, it may be necessary to use a metering device with a diameter which is different to that of the pipe. In this case, a tapered fitting should be used (as illustrated in the figure below).



Installation

The metering device should be installed in the system during the initial setup phase, observing the flow direction indicated on its body and in accordance with the following instructions:

- installation on the return pipe, in a position where it can be easily accessed for measurement purposes, with the pressure test ports facing upwards in order to prevent impurities from building up.
  The return water temperature has fewer variations, which increases measurement accuracy.
- installation on a straight length of piping, either horizontally or vertically but not turned upside down, well away from twists or devices which may disrupt flow, particularly at the inlet, during measurement.



In thermal installations, the metering device can be used in supply systems with several risers, branches or zones, to monitor the value of the individual flow rates or wherever metering of heating costs is required. The rapid flow rate monitoring keeps the system at optimal running conditions, making it possible to identify balancing variations caused by lockshield valves or other balancing and regulation devices, or by tampering. The application diagrams at the end of the brochure indicate the optimal points for flow rate monitoring:

1) installation on the boiler circuit,
2) installation on each riser, for system balancing monitoring,
3) installation on the horizontal sections of supply columns, as an alternative to point 2,
4) installation on each zone, for balancing throughout the system.

Accessories

100

Pair of fast-plug pressure/temperature test ports.
Their special construction allows rapid and accurate measurements, guaranteeing a perfect hydraulic seal.
Cap clamp available in the following colours:
- **Red** for upstream pressure test port.
- **Green** for downstream pressure test port.

Brass body.
EPDM seals.
Female 1/4" threaded connection.
Working temperature range: -5–130°C
Max. working pressure: 30 bar.

Code

100000	

100

Pair of fittings with fast-plug 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.

Code

100010	

130 FLOMET

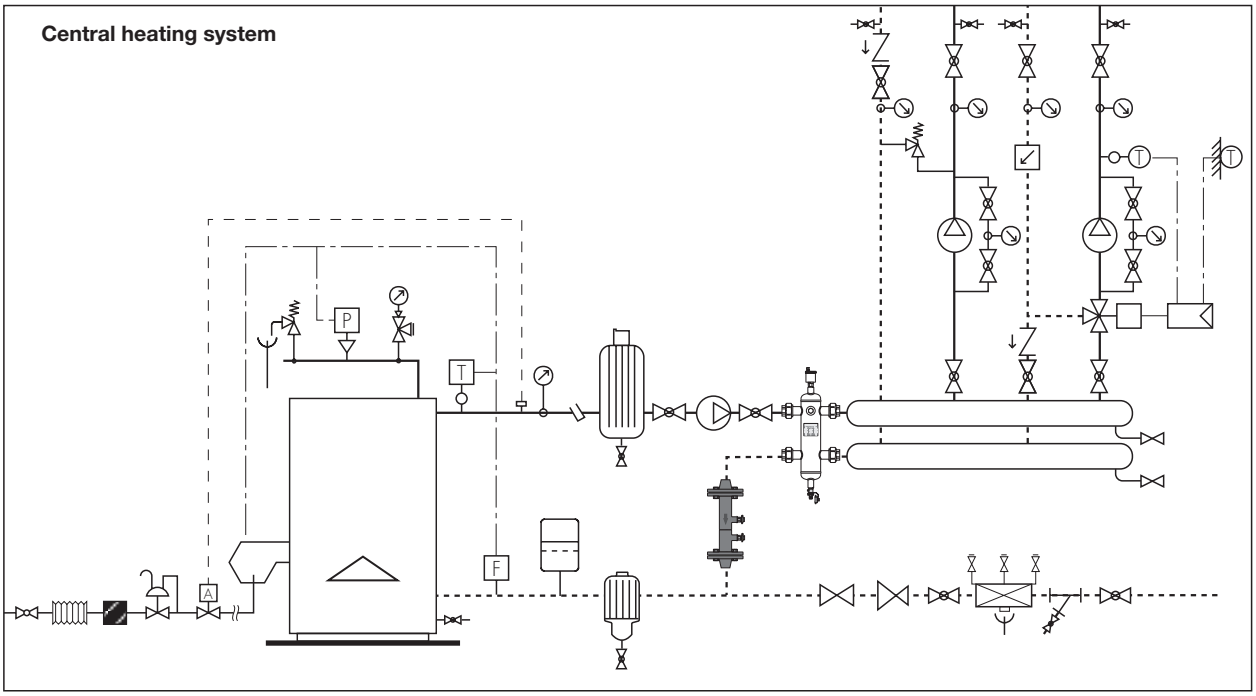
Flow rate and differential pressure electronic measuring station. Supplied complete with shut-off and connection fittings. Can be used for checking the correct operation of AUTOFLOW® devices.
Measurement range: 0,05–200 kPa.
Differential Pmax: 250 kPa.

Code

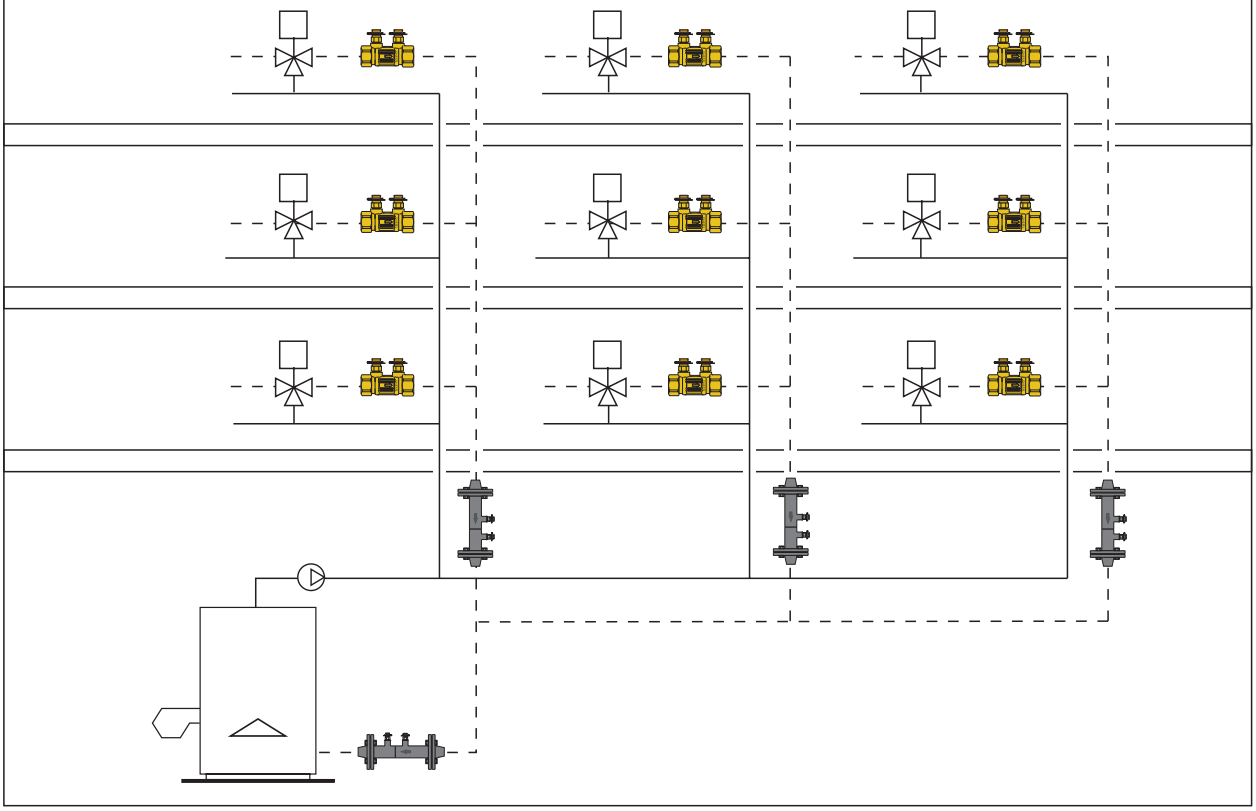
130000	Supply voltage 230 V (ac)
130001	Battery operated

Application diagrams

Central heating system



Riser and zone systems



- Shut-off valve
- Ball valve
- BALLSTOP
- Temperature gauge
- Differential by-pass valve
- Flow switch
- Backflow preventer
- Zone valve
- Pump
- AUTOFLOW®
- Dirt separator
- Temperature probe
- Safety thermostat
- Temperature controller
- Expansion vessel
- 3-way cock
- Pressure switch
- Inspection pocket
- Gas filter
- Gas regulator
- Pressure reducing valve
- Deaerator
- Fuel shut-off valve
- Anti-vibration joint
- Pocket
- Safety valve
- Y-strainer

SPECIFICATION SUMMARY

683 series
Flow rate metering device. Threaded connections 3/4" and 1" F. Brass body. Brass pressure test ports. EPDM pressure test port seals. Threaded connections 1/4" F for pressure test ports. Medium water, glycol solutions. Maximum percentage of glycol 50%. Working temperature range -5–110°C. Maximum working pressure 10 bar. Minimum Δp for measurement 0,01 bar. Complete with quick-fit pressure test ports.

683 series
Flow rate metering device. Flanged DN 32–DN 200 connections. Painted steel body. Asbestos-free fibre NBR gaskets. Steel screws. Steel nuts. Brass pressure test ports. EPDM pressure test port seals. Threaded connections 1/4" F for pressure test ports. Flanged connections. Coupling with counterflanges EN 1092-1 DN 32–DN 100, PN 6; DN 125–DN 200, PN 16. Working temperature range -5–110°C. Maximum working pressure 6 bar (DN 32–DN 100), 16 bar (DN 125–DN 200). Minimum Δp for measurement 0,01 bar. Complete with fast-plug pressure test ports, counterflanges, bolts and gaskets.

130 series FLOMET
Flow rate and differential pressure electronic measuring station. Supplied complete with shut-off and connection fittings. It can be used to check AUTOFLOW® device operation falls within the working range. It can also be used to measure the flow rate of series 131 and 135 balancing valves, and of the 683 series metering device. Measurement range 0,05–200 kPa. Unit of measurement can be selected from Pa, kPa, mmW, mW, inW, mbar, PSI. Maximum line pressure 16 bar. Maximum differential pressure tolerated 250 kPa.

100 series
Pair of fast-plug pressure and temperature test ports. threaded connections 1/4" M. Brass body. EPDM internal elements. Working temperature range -5–130°C. Maximum working pressure 30 bar.

100 series
Pair of fittings with fast-plug syringe. Threaded connection 1/4" F. Maximum working temperature 110°C. Maximum working pressure 10 bar.

CALEFFI

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