FOREX®
Technology Products Services

Data sheet

Pressure independent balancing and control valve FB-QM DN 10-250

The FB-QM valve equipped with an actuator is a control valve with full authority and an automatic balancing function / fow limitation. Typical applications are: Temperature control with permanent automatic balancing on terminal units (chillers, air-handling units, fan coils, induction units, radiation panels and heat exchangers).

Description

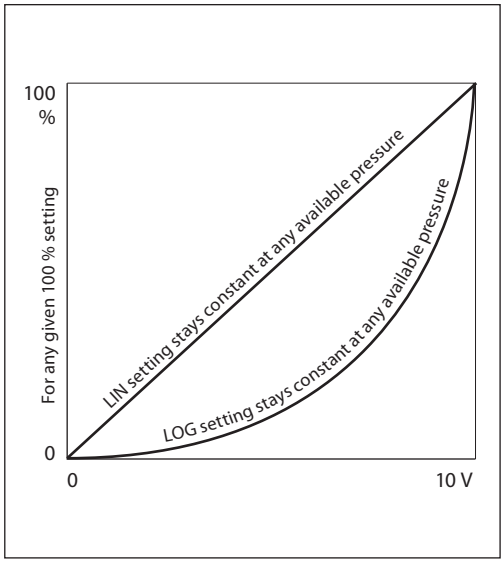
The **precise flow control performance** of the FB-QM with a Forex actuator provides increased comfort and **superior Total Cost of Ownership** because of savings made on:

- Efficient energy transfer and minimal pumping costs since there are no overflows at partial loads because of the exact pressure independent flow limitation.
- Smaller pump investments and lower energy consumption as the pump head needed is lower than in the traditional setup. With the built in test plugs it is easy to troubleshoot and find the optimal setpoint for the pump.
- Reduced movements of the actuator since the built-in differential pressure controller ensure the pressure fluctuations do not influence the room temperature.
- Achieving a stable temperature in a room leading to a lower average temperature at the same comfort level.
- Minimal flow complains, as the valve performs as designed.
- Minimal blockage complains, as the membrane design makes FB-QM less susceptible to blockage than a cartridge type constriction.
- Trouble-free segmentation of the building project. When sections of a project are finished they can normally not be handed over to the customer with a fully functional HVAC installation. However the FB-QM with a Forex actuator will automatically control the flow, even when other parts of the installation are still unfinished. It's not needed to adjust the FB-QM after finalisation of the project.
- Commissioning costs, the costs are close to zero because of a convenient setting procedure without the need for flow charts, calculations or measuring equipment. The FB-QM valves can be set to a precise design value even when the system is up and running.
- Halved mounting costs as the FB-QM valve covers two functions, Balancing & Control

Control performance

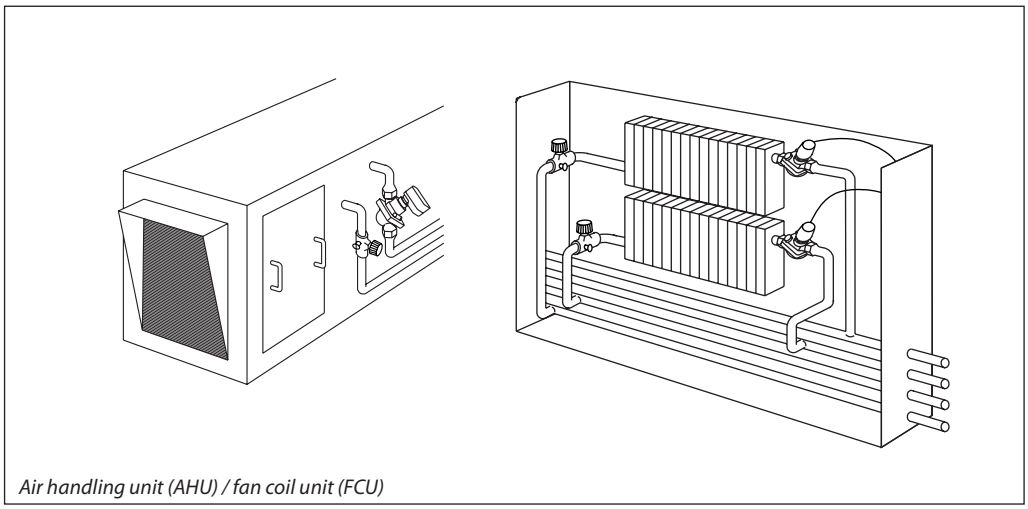
The FB-QM has a linear control characteristic. The FB-QM is pressure independent which means that the control characteristic is independent from the available pressure and is not influenced by a low authority.
The flow limitation on the FB-QM is achieved by limiting the stroke and the Forex actuators calibrate to the stroke of the valves. This means that the FB-QM keeps its linear characteristic independent of the setting or differential pressure.

Because of the predictable characteristic the actuators on the FB-QM can be used to change the response from linear to logarithmic (equal percentage). That makes the FB-QM suitable for all applications, including AHUs, where the equal percentage characteristic is needed to get a stable control loop. The actuators can be switched from linear to logarithmic by changing a dipswitch setting on the actuator.



Applications

- variable flow systems

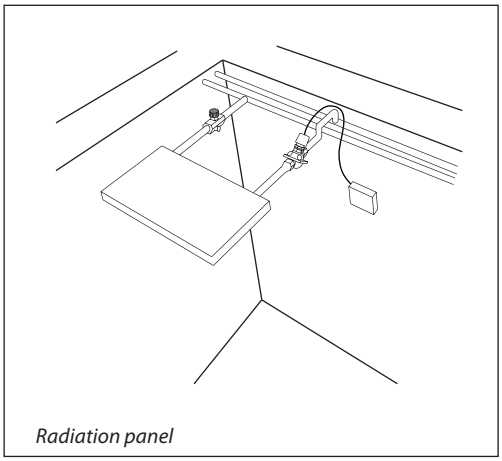


Air handling unit (AHU) / fan coil unit (FCU)

An FB-QM with a Forex actuator is used as a control valve for terminal units, like an AHU (Air Handling Unit), FCU (Fan Coil Unit) or radiation panel. The FB-QM ensures and control the required flow on every terminal unit and maintains Hydronic balance in the system.

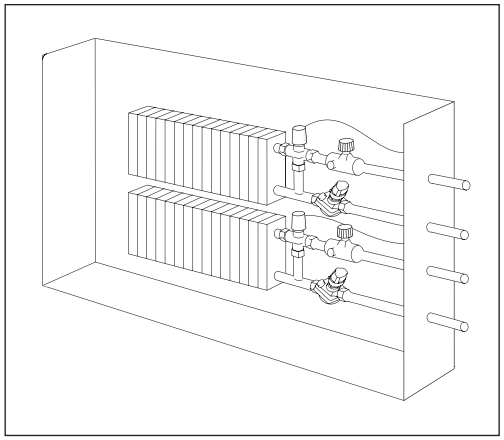
Because of the integrated differential pressure controller the control valve always has 100 % authority and therefore offers always stable control. At partial load there is no overflow, contrary to conventional solutions, because the F B-QM will always limit the flow to exactly what is needed. By installing the FB-QM the whole system is divided in completely independent control loops.

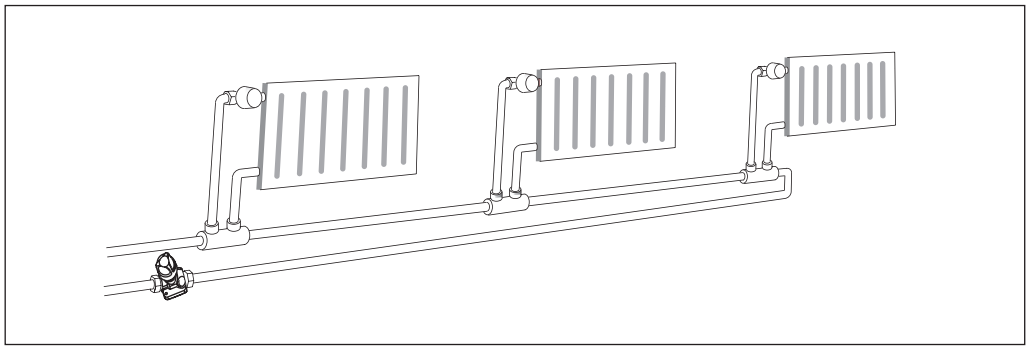
There is a full range of Forex actuators available for the FB-QM, suitable for every control strategy. Actuators are available for On/Off, 0-10 Volt, 4-20 mA or floating point.



Radiation panel

Applications
- constant flow systems





In constant flow system with FCUs or in a one pipe heating system the ~~F~~B-QM can be installed as an automatic balancing valve in every riser. The FB-QM limits the flow to the set value, thus automatically achieving hydronic balance in the system.

There are numerous applications in which FB-QM can be used. Every time you need an automatic flow limiter or a control valve you can take advantage of the cost-saving properties of the FB-QM. That includes systems with (floor) heating/cooling, concrete core activation or radiation panels.

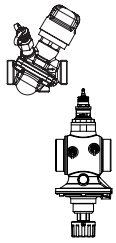
Note: For more application examples please contact your local Forex organization.

Easy implementation

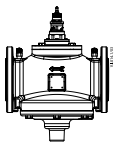
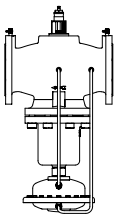
- No Kv or authority calculations needed. Flow is the only parameter to be considered when designing.
- The FB-QM always fits the application because the maximum setting of the FB-QM corresponds with international standards for flow velocity in pipes.
- The FB-QM can be used for all HVAC applications since it can have a linear or logarithmic characteristic when combined with thermal electric or gear actuators.
- Compact design, essential when only limited space is available. For example in fan-coil units.
- Easy commissioning. No specialized staff or measuring equipment needed.
- Easy trouble shooting.
- Fast start-up because AB-QM valves don't need to be flushed or de-aired before use.
- Trouble-free segmentation of the building project. The FB-QM will automatically control the flow, even when parts of the installation are still unfinished. It's not needed to adjust the FB-QM after finalisation of the building project.

Ordering

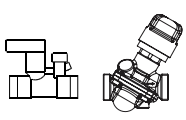
FB-QM threaded version (with test plugs and without test plugs)

Picture	DN	$Q_{max.}$ (l/h)	Ext. thread (ISO 228/1)	Code No.	FB-QM	Ext. thread (ISO 228/1)	Code No.
	10 LF	150	G ½A	**003Z1261**		G ½A	**003Z1251**
	10	275		**003Z1211**			**003Z1201**
	15 LF	275	G ¾A	**003Z1262**		G ¾A	**003Z1252**
	15	450		**003Z1212**			**003Z1202**
	20	900	G 1A	**003Z1213**		G 1A	**003Z1203**
	25	1.700	G 1 ¼A	**003Z1214**		G 1 ¼A	**003Z1204**
	32	3.200	G 1 ½A	**003Z1215**		G 1 ½A	**003Z1205**
	40	7.500	G 2A	**003Z0760**	*FB-QM (DN 10-32) can not be upgraded to FB-QM with test plugs!*		
	50	12.500	G 2 ½A	**003Z0761**			

FB-QM flanged version

Picture	DN	$Q_{max.}$ (l/h)	Flange connection	Code No.
	50	12.500	PN 16	**003Z0762**
	65	20.000		**003Z0763**
	80	28.000		**003Z0764**
	100	38.000		**003Z0765**
	125	90.000		**003Z0705**
	125 HF	120.000		**003Z0715**
	150	145.000		**003Z0706**
	150 HF	229.000		**003Z0716**
	200	190.000		**003Z0707**
	200 HF	300.000		**003Z0717**
	250	280.000		**003Z0708**
	250 HF	442.000		**003Z0718**

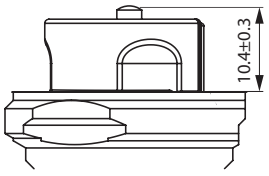
Set-pack (one MSV-S and one FB-QM without test plugs)

Picture	DN	$Q_{max.}$ (l/h)	Ext. thread (ISO 228/1)	Code No.
	15 LF	275	G ¾ A	**003Z1238**
	15	450		**003Z1242**
	20	900	G 1 A	**003Z1243**
	25	1.700	G 1 ¼ A	**003Z1244**
	32	3.200	G 1 ½ A	**003Z1245**

Ordering *(continuous)*

Accessories & spare parts

Type	Comments		Code No.
	To pipe	To valve	
Union connection (1 pcs.) 	R 3/8	DN 10	**003Z0231**
	R 1/2	DN 15	**003Z0232**
	R 3/4	DN 20	**003Z0233**
	R 1	DN 25	**003Z0234**
	R 1 1/4	DN 32	**003Z0235**
	R 1 1/2	DN 40	**003Z0279**
	R 2	DN 50	**003Z0278**
Tailpiece welding (1 pcs.) 	Weld.	DN 15	**003Z0226**
		DN 20	**003Z0227**
		DN 25	**003Z0228**
		DN 32	**003Z0229**
		DN 40	**003Z0270**
		DN 50	**003Z0276**
Tailpieces for soldering (2 nuts, 2 gaskets, 2 soldering nipples	12x1 mm	DN 10	**065Z7016**
	15x1 mm	DN 15	**065Z7017**
Shut-off & protection piece (max. closing pressure 16 bar)		DN 10-32	**003Z1230**
Shut-off - plastic (max. closing pressure 1 bar)			**003Z0240**
Handle AB-QM (necessary accessory if installing valve without actuator)		DN 40-100	**003Z0695**
		DN 125-250	**003Z0696**
Adapter for AB-QM DN 10, G ½ internal thread for AB-QM, G 3/8 internal thread (1 pcs.)			**003Z3954**
Adapter for AB-QM DN 15, G ¾ internal thread for AB-QM, G ¾A external thread (1 pcs.)			**003Z3955**
Adapter for AB-QM DN 20, G 1 internal thread for AB-QM, G 1A external thread (1 pcs.)			**003Z3956**
Adapter for AB-QM DN 25, G 5/4 internal thread for AB-QM, G 5/4A external thread (1 pcs.)			**003Z3957**
Adapter AMV(E) 15/16/25/35 (AB-QM DN 40-100, 2nd. generation)			**003Z0694**
Adapter AME 435 for AB-QM DN 40-100 (1st. generation)			**065Z0313**
Stroke limiter - TWA (5 pcs. in a bag)			**003Z1237**
Adapter AME 13 SU for AB-QM (1st. generation)			**003Z3959**
Adapter AME 13 SU for AB-QM (2nd. generation)			**003Z3960**
Stem heater for AB-QM DN 40-100 / AME 15 QM			**065B2171**
Stem heater for AB-QM DN 40-100 / AME 435 QM			**003Z0693**
Stem heater for AB-QM DN 125, 150 / AME 55 QM			**065Z7022**
Stem heater for AB-QM DN 200, 250 / AME 85 QM			**065Z7021**



Closing point (measure) for DN 10-32

Combinations FB-QM with electrical actuators (FB-QM DN 10-100) [1]

Valve type	Stroke (mm)	TWA-Z [3]	AMI 140	ABNM	AMV 110/120 NL AME 110/120 NL	AME 435 QM
		Recommended ordering code numbers (for details refer to data sheets for these actuators)				
		082F1266 NC, 230 V	**082H8048** AMI 140 24 V, 12 s/mm, 2-point control	**082F1191** Thermal act. LOG 24 V (0-10 V) **082F1193** Thermal act. LIN 24 V (0-10 V)	**082H8056** AMV 110 NL 24 V, 24 s/mm, 3-point control **082H8057** AME 110 NL 24 V, 24 s/mm, 0-10 V	**082H0171** AME 435 QM 24 V
DN 10-20	2.25	✓	✓	✓	✓	-
DN 25, 32	4.50	✓ [2]	✓	✓ [4]	✓	-
DN 40, 50	10	-	-	-	-	✓
DN 65-100	15	-	-	-	-	✓

[1] Minimum recommended AB-QM setting is 20 %
[2] up to 60 % of Q_{max}
[3] Please be aware that only this type of TWA actuator is to be used with AB-QM
[4] up to 90% od Q_{max}
Additional actuator's functionality available, for more info please contact your local organization.

Ordering *(continuous)*

Combinations FB-QM with electrical actuators (FB-QM, DN 125-250)

Valve type	Stroke (mm)	AME 55 QM	AME 85 QM
		Recommended ordering code numbers (for details refer to data sheets for these actuators)	
		082H3078 24 V, 8 s/mm, 0-10 V	**082G1453** 24 V, 8 s/mm, 0-10 V
DN 125	25	✓	-
DN 150	25	✓	-
DN 200	27	-	✓
DN 250	27	-	✓

Operational pressure for all FB-QM valves is 4 bar. Closing pressure for all actuators is 6 bar.
Additional actuator's functionality available, for more info please contact your local organization.

Technical data

FB-QM (*thread version)*

Nominal diameter		**DN**	**10 Low Flow**	**10**	**15 Low Flow**	**15**	**20**	**25**	**32**	**40**	**50**
Flow range	Q_{min} (20 %) [3]	l/h	30	55	55	90	180	340	640	1.500	-
	Q_{min} (40 %) [3]		-	-	-	-	-	-	-	-	5.000
	Q_{max} (100 %)		150	275	275	450	900	1.700	3.200	7.500	12.500
Diff. pressure [1]		kPa	16-400					20-400		30-400	
Pressure stage		PN	16								
Control range			Acc. to standard IEC 534 control range is high as Cv characteristic is linear (1:3000)								
Control valve's characteristic			Linear (could be converted by actuator to equal percentage)								
Leakage acc. to standard IEC 534			No visible leakage (at 100N)							max. 0.05 % of Q_{max} at 500N	
For shut off function			Acc. to ISO 5208 class A - no visible leakage								
Flow medium			Water and water mixture for closed heating and cooling systems according to plant type I for DIN EN 14868. When used in plant Type II for DIN EN 14868 appropriate protective measures are taken. The requirements of VDI 2035, part 1 + 2 are observed.								
Medium temperature		°C	–10 ... +120								
Stroke		mm	2.25					4.5		10	
Connection	ext. thread (ISO 228/1)		G ½ A	G ½ A	G ¾ A	G ¾ A	G 1 A	G 1¼ A	G 1½ A	G 2 A	G 2½ A
	actuator		M30 × 1.5								
Materials in the water											
Valve bodies			Brass (CuZn40Pb2 - CW 617N)							Grey iron EN-GJL-250 (GG 25)	
Membranes and O-rings			EPDM								
Springs			W.Nr. 1.4568, W.Nr. 1.4310								
Cone (Pc)			W.Nr. 1.4305							CuZn40Pb3 - CW 614N, W.Nr. 1.4305	
Seat (Pc)			EPDM							W.Nr. 1.4305	
Cone (Cv)			CuZn40Pb3 - CW 614N								
Seat (Cv)			CuZn40Pb2 - CW 617N							W.Nr. 1.4305	
Screw			Stainless Steel (A2)								
Flat gasket			NBR								
Sealing agent (only for valves with test plugs)			Dimethacrylate Ester								
Materials out of the water											
Plastic parts			PA							POM	
Insert parts and outer screws			CuZn39Pb3 - CW 614N; W.Nr. 1.4310; W.Nr. 1.4401							-	

[1] Δp = (P1–P3) min~max
[2] according suitability and usage especially in not oxygen tight systems please mind the instructions given by the coolant producer
[3] Flow limitations below Q_{min} is possible. Regardless of the flow limitations valve can modulate till 0 % of the settings.
Pc - pressure controller part
Cv - Control valve part

Technical data *(continuous)*

FB-QM (flange version)

Nominal diameter		**DN**	**50**	**65**	**80**	**100**
Flow range	Q_{min} (40 %) [2]	l/h	5.000	8.000	11.200	15.200
	Q_{max} (100 %)		12.500	20.000	28.000	38.000
Diff. pressure [1]		kPa	30-400			
Pressure stage		PN	16			
Control range			Acc. to standard IEC 534 control range is high as Cv characteristic is linear. (1:3000)			
Control valve's characteristic			Linear (could be converted by actuator to equal percentage)			
Leakage acc. to standard IEC 534			max. 0.05 % of Q_{max} at 500 N			
For shut off function			Acc. to ISO 5208 class A - no visible leakage			
Flow medium			Water and water mixture for closed heating and cooling systems according to plant type I for DIN EN 14868. When used in plant Type II for DIN EN 14868 appropriate protective measures are taken. The requirements of VDI 2035, part 1 + 2 are observed.			
Medium temperature		°C	–10 ... +120			
Stroke		mm	10	15		
Connection	flange		PN 16			
	actuator					
Materials in the water						
Valve bodies			Grey iron EN-GJL-250(GG25)			
Membranes/ Bellow			EPDM			
O-rings			EPDM			
Springs			W.Nr. 1.4568, W.Nr. 1.4310			
Cone (Pc)			CuZn40Pb3 - CW 614N, W.Nr. 1.4305			
Seat (Pc)			W.Nr. 1.4305			
Cone (Cv)			CuZn40Pb3 - CW 614N			
Seat (Cv)			W.Nr. 1.4305			
Screw			Stainless Steel (A2)			
Flat gasket			NBR			

Nominal diameter		**DN**	**125**	**125 HF**	**150**	**150 HF**	**200**	**200 HF**	**250**	**250 HF**
Flow range	Q_{min} (40 %) [2]	l/h	36.000	48.000	58.000	91.600	76.000	120.000	112.000	176.800
	Q_{max} (100 %)		90.000	120.000	145.000	229.000	190.000	300.000	280.000	442.000
Diff. pressure [1]		kPa	30-400 (60-400 for HF version)							
Pressure stage		PN	16							
Control range			Acc. to standard IEC 534 control range is high as Cv characteristic is linear.							
Control valve's characteristic			Linear (could be converted by actuator to equal percentage)							
Leakage acc. to standard IEC 534			max.0.01 % of Q_{max} at 650N		max. 0.01 % of Q_{max} at 1000N					
Flow medium			Water and water mixture for closed heating and cooling systems according to plant type I for DIN EN 14868. When used in plant Type II for DIN EN 14868 appropriate protective measures are taken. The requirements of VDI 2035, part 1 + 2 are observed.							
Medium temperature		°C	–10 ... +120							
Stroke		mm	25		25		27		27	
Connection	flange		PN 16							
	actuator									
Materials in the water										
Valve bodies			Grey iron EN-GJL-250 (GG 25)							
Membranes/ Bellow			W.Nr.1.4571		EPDM					
O-rings			EPDM							
Springs			W.Nr.1.4401		W.Nr.1.4310					
Cone (Pc)			W.Nr.1.4404NC		W.Nr.1.4021					
Seat (Pc)			W.Nr.1.4027							
Cone (Cv)			W.Nr.1.4404NC		W.Nr.1.4021					
Seat (Cv)			W.Nr.1.4027							
Screw			W.Nr.1.1181							
Flat gasket			Graphite gasket		Non asbestos					

[1] *Δp = (P1–P3) min~max*

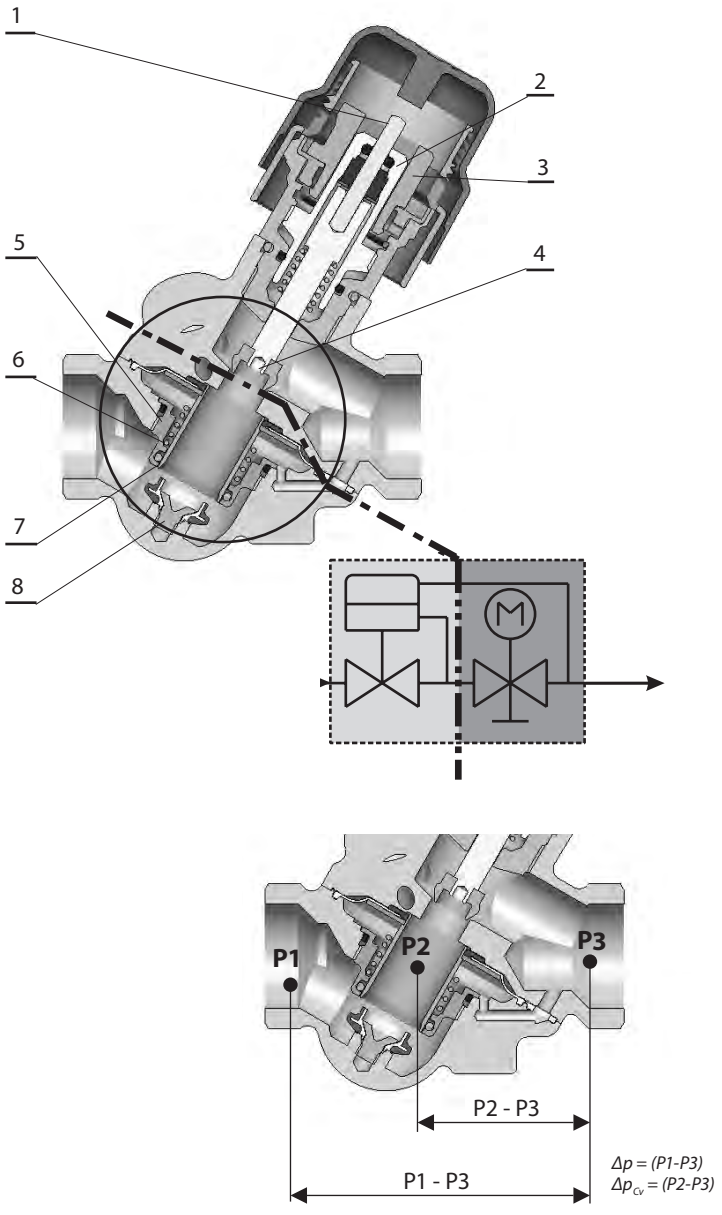
[2] *Flow limitations below Q_{min} is possible. Regardless of the flow limitations valve can modulate till 0% of the settings.*

[3] *according suitability and usage especially in not oxygen tight systems please mind the instructions given by the coolant producer*

Pc - pressure controller part
Cv - Control valve part

Design

1 Spindle
2 Stuffing box
3 Pointer
4 Control valve's cone
5 Membrane
6 Main spring
7 Hollow cone (pressure controller)
8 Vulcanized seat (pressure controller)



AB-QM DN 10-32

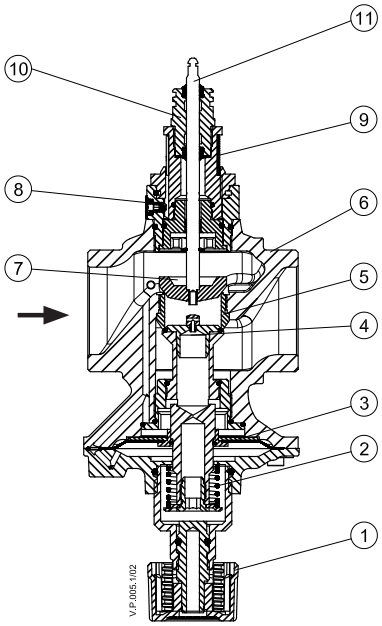
Function:
The FB-QM valve consists of two parts:
1. Differential pressure controller
2. Control valve

1. Differential pressure controller DPC
The differential pressure controller maintains a constant differential pressure across the control valve. The pressure difference Δp_{Cv} (P2-P3) on the membrane is balanced with the force of the spring. Whenever the differential pressure across the control valve changes (due to a change in available pressure, or movement of the control valve) the hollow cone is displaced to a new position which brings a new equilibrium and therefore keeps the differential pressure at a constant level.

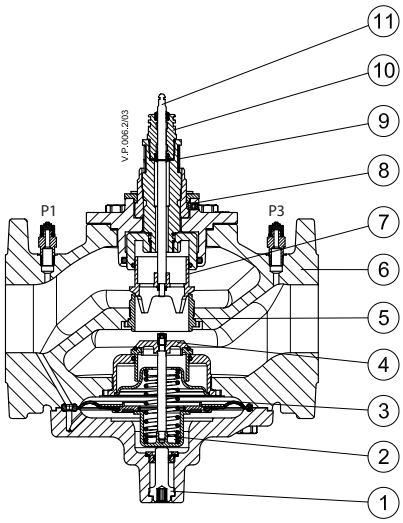
2. Control valve Cv
The control valve has a linear characteristic. It features a stroke limitation function that allows adjustment of the Kv value. The percentage marked on the scale equals the percentage of 100 % flow marked on the pointer. Changing the stroke limitation is done by lifting the blocking mechanism and turning the top of the valve to the desired position, showed on the scale as a percentage. A blocking mechanism automatically prevents unwanted changing of the setting.

Design *(continuous)*

1. Shut off screw
2. Main spring
3. Membrane
4. DP cone
5. Seat
6. Valve body
7. Control valves cone
8. Locking screw
9. Scale
10. Stuffing box
11. Spindle

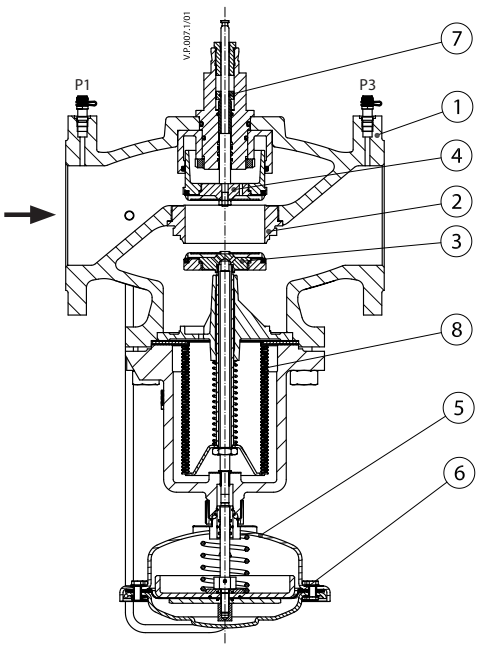


FB-QM DN 40, 50

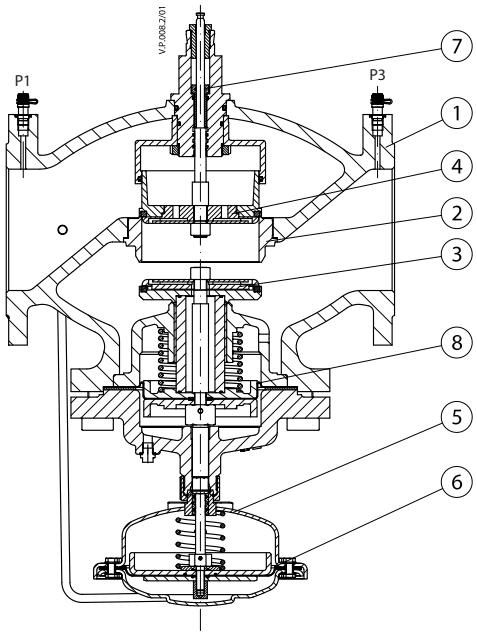


FB-QM DN 50-100

1. Valve body
2. Valve seat
3. DPC cone
4. CV cone
5. Controller casting
6. Rolling diaphragm
7. Adjusting screw
8. Bellow for pressure relief on DPC cone



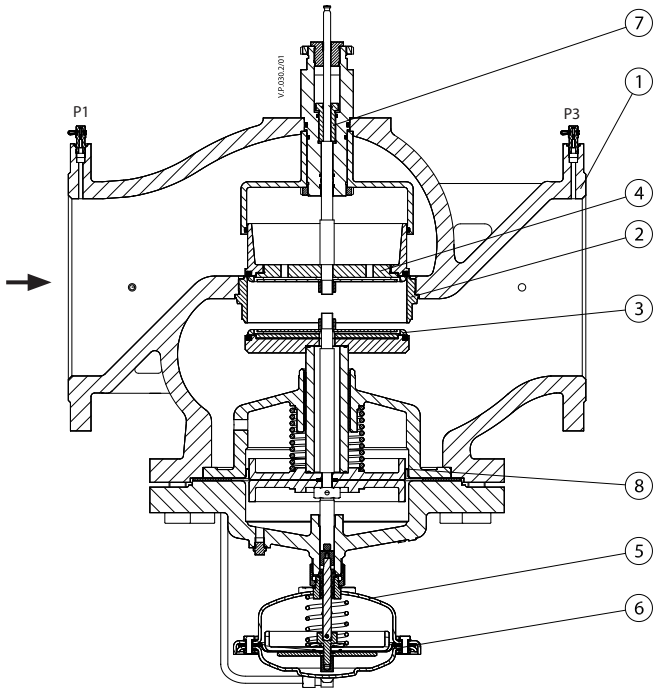
FB-QM DN 125



FB-QM DN 150

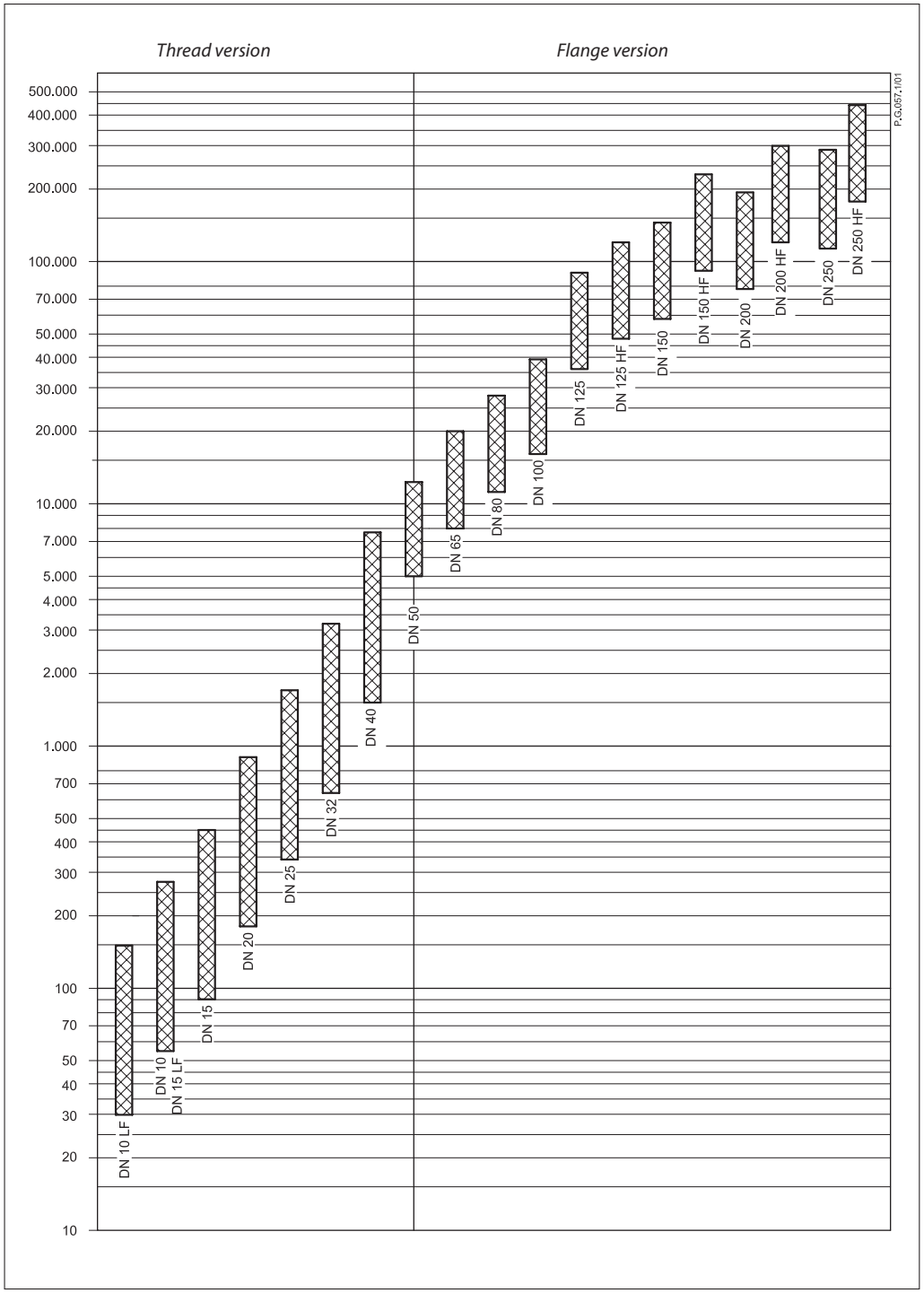
Design *(continuous)*

1. Valve body
2. Valve seat
3. DPC cone
4. CV cone
5. Controller casting
6. Rolling diaphragm
7. Adjusting screw
8. Bellow for pressure relief on DPC cone



FB-QM DN 200, 250

Sizing


Thread version
Flange version
P-GL057.1/01
500.000
400.000
300.000
200.000
100.000
70.000
50.000
40.000
30.000
20.000
10.000
7.000
5.000
4.000
3.000
2.000
1.000
700
500
400
300
200
100
70
50
40
30
20
10
DN 10 LF
DN 10
DN 15 LF
DN 15
DN 20
DN 25
DN 32
DN 40
DN 50
DN 65
DN 80
DN 100
DN 125
DN 125 HF
DN 150
DN 150 HF
DN 200
DN 200 HF
DN 250
DN 250 HF

Sizing *(continuous)*

Example 1: Variable flow system

Given:
Cool requirement per unit : 1000 W
Flow temperature in the system: 6 °C
Return temperature in the system: 12 °C

*Required - **control and balancing valves:***
FB-QM and actuators type for BMS system.
Solution:
Flow in the system: Q (l/h)
Q = 0.86×1000/(12–6) = 143 l/h

Selected:
FB-QM DN 10 mm with Q_{max} = 275 l/h presetting on 143/275 = 0.52 = 52 % of maximum opening.
Actuators: AMV 110NL - 24 V
Remarks:
required minimum differential pressure across the FB-QM DN 10: 16 kPa.

Example 2: Constant flow system

Given:
Cool requirement per unit : 4000 W
Flow temperature in the system : 6 °C
Return temperature in the system : 12 °C

*Required - **automatic flow limiter:***
FB-QM and presetting.

Solution:
Flow in the system : Q (l/h)
Q = 0.86 × 4000 / (12 – 6) = 573 l/h

Selected:
FB-QM DN 20 mm with Q_{max} = 900 l/h presetting on 573/900 = 0.64 = 64 % of maximum opening.

Remarks:
required minimum differential pressure across the FB-QM DN 20: 16 kPa.

Example 3: Sizing FB-QM according pipe dimension

Given:
Flow in system 1.4 m^3/h (1400 l/h = 0.38l/s), pipe dimension DN 25 mm

*Required - **automatic flow limiter:***
FB-QM and presetting.

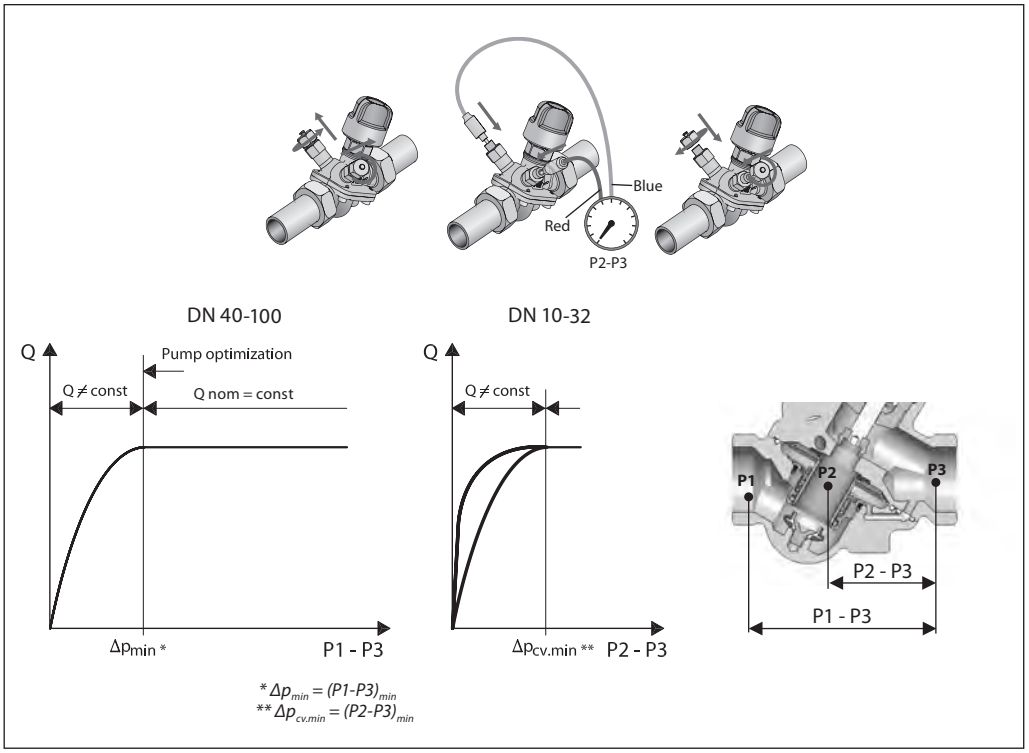
Solution:
In this case we can selected FB-QM DN 25 mm with Q_{max} = 1700 l/h

In this case it will be recommended to check the maximum velocity in the pipe. For this we calculate velocity in the pipe for condition:
DN 25 mm – Di 27.2 mm

Dimension and condition acceptable, veloscity below 1.0 m/s.

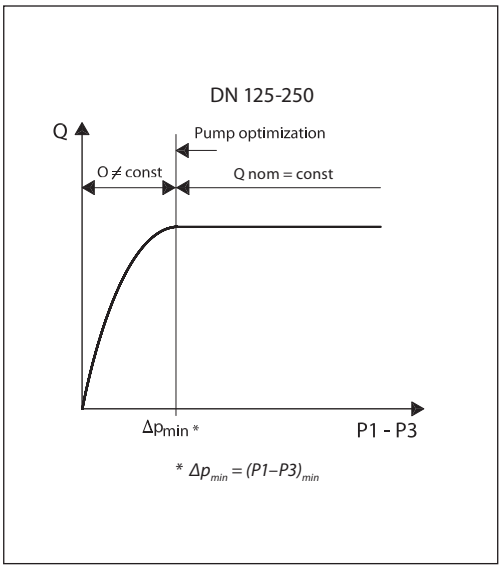
Preseting on the valve FB-QM DN 25 mm
1400/1700 = 0.82 = 82 % of maximum opening.
Remarks:
required minimum differential pressure across the FB-QM DN 25: 20 kPa.

Pump optimising / Trouble shooting



The FB-QM (DN 10-32) features test plugs that allow measuring of the pressure difference Δp_{cv}(P2-P3) across the control valve while FB-QM (DN 40-250) measuring is done between P1 to P3. If the pressure difference exceeds the minimal required pressure is operational and the flow limitation is achieved. The measuring function can be used to verify if enough pressure difference is available and thus verify the flow.

It can also be used to optimize the pump head. The pump head can be decreased until no more than the minimal required pressure is available on the most critical valve (in terms of hydronic). This optimal point is to be found when proportionality between pump head and measured differential pressure cease to exist. Verifying the pressure can be done by using for example Forex PFM device (for more details please refer to FB-QM Tech Note).



Presetting
DN 10-32

The calculated flow can be adjusted easily without using special tools.

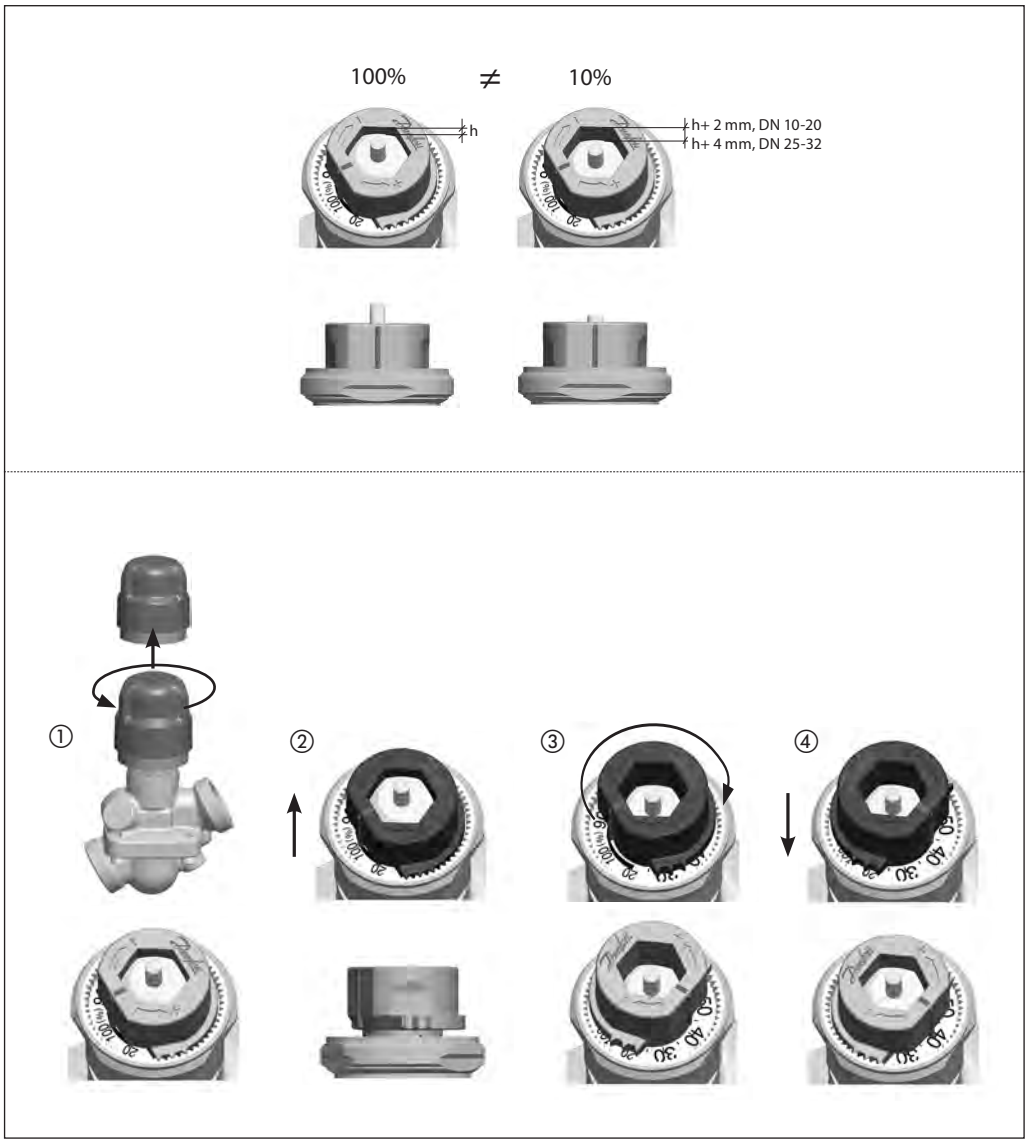
To change the presetting (factory setting is 100%) follow the four steps below:

① Remove the blue protective cap or the mounted actuator
② Raise the grey pointer
③ Turn (clock wise to decrease) to the new presetting
④ Press grey pointer back into lock position. After click presetting is locked.

The presetting scale indicates values from 100 % flow to 0 %. Clock wise turning would decrease the flow value while counter clock wise would increase it.

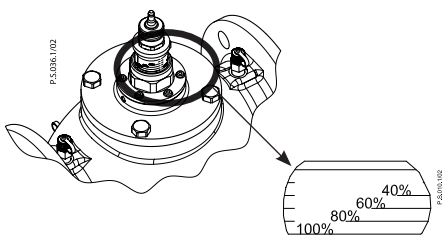
If the valve is a DN 15 then the max flow = 450 l/h =100 % presetting. To set a flow of 270 l/h you have to set: 270/450 = 60 %.

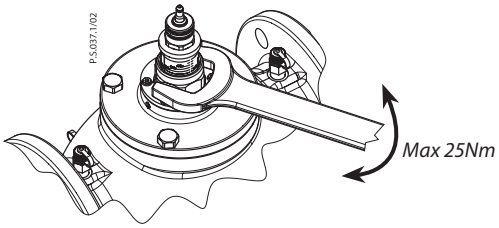
Forex recomends a presetting/flow from 20 % to 100 %. Factory presetting is 100 %.



Presetting *(continuous)*

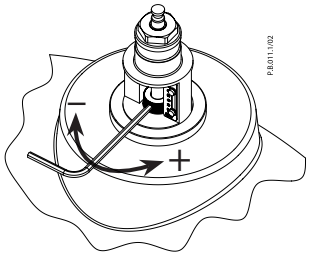
DN 40-100



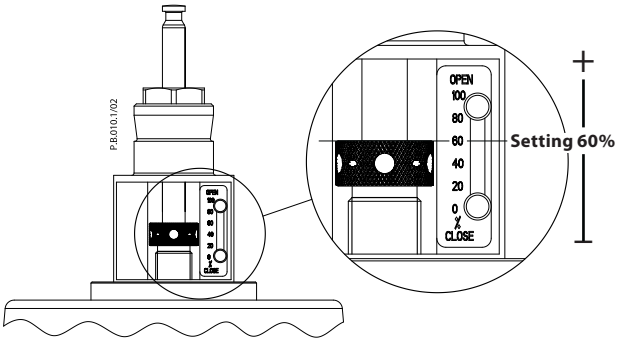


Note: 1 turn = 10%

DN 125-250



Note:
DN 125 & 150: 1 turn = 6.0 %
DN 200 & 250: 1 turn = 5.5 %



Service

DN 10-32
For the service shut off function, it is recommended to install the valve in the supply water pipe.

Valves are equipped with plastic shut-off mechanism that is to be used for isolating function up to 1 bar differential pressure. When closing against higher differential pressure please use accessory - shut-off & protection piece (003Z1230) or set the value to 0%.

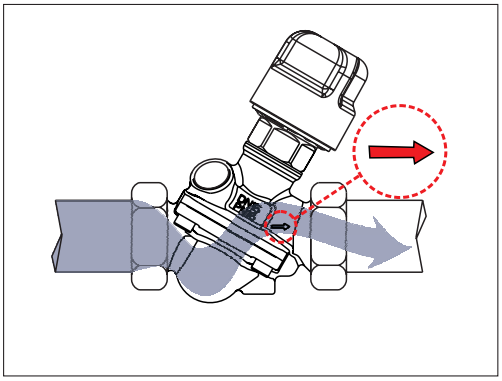
DN 40-100 (125- 250)
For the service shut off function, the valve can be installed in either supply or return pipe.

Valves are equipped with manual shut-off for isolating function up to 16 bar.

Installing

FB-QM valve is mono-directional meaning that the valve operates when arrow on the valve body is aligned with flow direction. When this rule is disobeyed the valve acts like variable orifice that cause water hammer at sudden closing when available pressure has increased or valve have been set to lower value.

In case when system condition allows backflows it is strongly recommended to use backflow preventer in order to avoid possible water hammer that can damage the valve as well as other elements in the system.

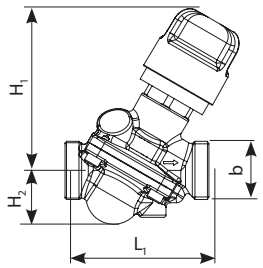


Tender text

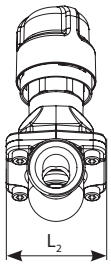
1. The pressure independent balancing and control valve should be comprised of a linear control valve and an integrated membrane based pressure controller.
2. The pressure independent balancing and control valve should be available in the range from DN 10- 250.
3. The valve could be used as an automatic flow limiter.
4. The valve should have a mechanism to adjust the flow stepless from 100 to 0 % of the maximum flow.
5. Minimum possible flow in combination with a modulating actuator should be 30 l/h.
6. At the minimum setting of 30 l/h modulation to 0 % of the flow should be possible.
7. Shut off service function should be possible with setting mechanism.
8. The adjustment should be performed without a tool for dimensions up to DN 32 or a standard tool for valves bigger than DN 32.
9. The setting, which can be locked, should be visible from the top for valves DN 32 and from the side for DN 40-250.
10. The control valve stuffing box should be serviceable under pressure for valves up to DN 32.
11. The valves should have a shut-off function (positive), separated from the setting mechanism, for valves DN 40-250.
12. The leakage rate should be: No visible leakage at force of the thermal actuator (90 N) for valves up to DN 32 and for valves up to DN 100 0.05 % of the kv at 500 N. All actuators should be able to close against 600 kPa differential pressure.
13. The authority of the pressure independent control valve should be 1 at all settings (control valve characteristic is not changed).
14. Control valve should have flow – control signal as a linear characteristic at all settings. Control ratio of the pressure independent balancing and control valve should be higher than 1:300 (**Supplier of the valve should provide lab test results** [1)]).
15. Control valve should have the possibility to change linear characteristic to equal percentage characteristic at all sizes and settings by adjusting actuator settings.
16. Minimum starting differential pressure for flow limitation should be 16 kPa for valves up to DN 20, 20 kPa valves up to DN 32. (**Supplier of the valve should provide lab test results** [1)]). Nominal pressure rating 16 bar (PN 20 on request), maximal test pressure 25 bar.
17. Test plug for pump optimization and flow verification should be available for DN 10-250.

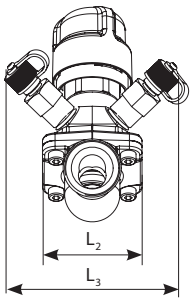
Nominal diameter:	_____
Connection:	_____
Adjustment range from - to	_____ m^3/h
Produced by:	Forex
Type:	FB-QM
Ordering no.:	003Z ____

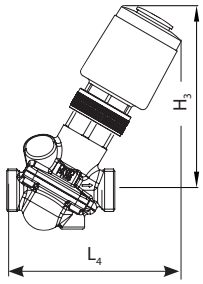
Dimensions



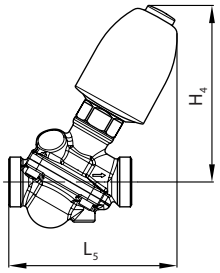
FB-QM DN 10-32



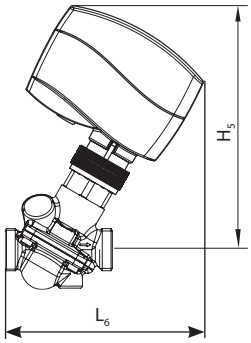




TWA-Z + FB-QM

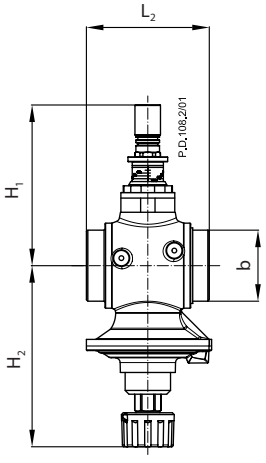


ABNM + FB-QM

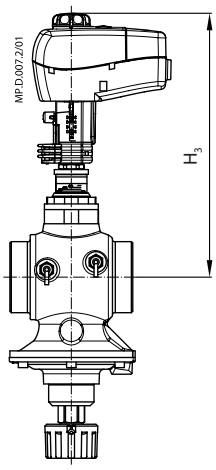


AMV (E) 110 NL + FB-QM
AMI 140 + FB-QM

Type	L_1	L_2	L_3	L_4	L_5	L_6	H_1	H_2	H_3	H_4	H_5	b	Valve weight
	mm											ISO 228/1	(kg)
DN 10	53	36	79	92	104	109	73	20	100	104	138	G ½	0.38
DN 15	65	45	79	98	110	116	75	25	102	108	141	G ¾	0.48
DN 20	82	56	79	107	120	125	77	33	105	112	143	G 1	0.65
DN 25	104	71	79	124	142	142	88	42	117	124	155	G 1 ¼	1.45
DN 32	130	90	79	142	154	160	102	50	128	136	166	G 1 ½	2.21



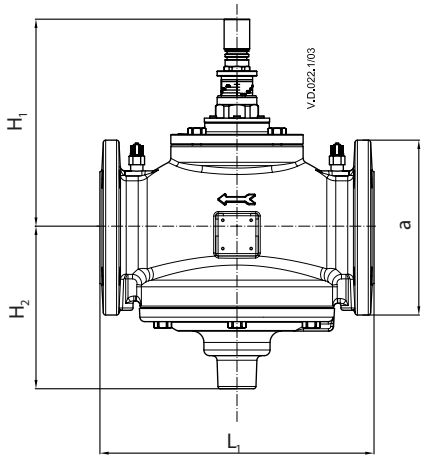
FB-QM DN 40, 50



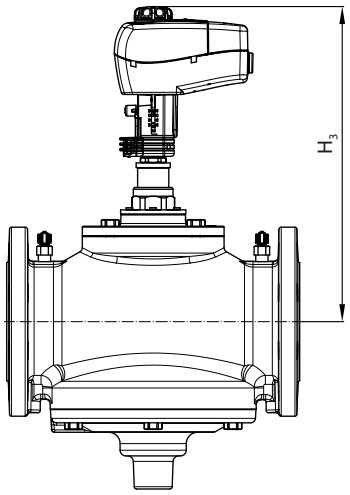
AME 435 QM + FB-QM

Type	L_1	H_1	H_2	H_3	b	Weight
	mm				ISO 228/1	kg
DN 40	110	170	174	280	G 2	6.9
DN 50	130	170	174	280	G 2 ½	7.8

Dimensions *(continuous)*



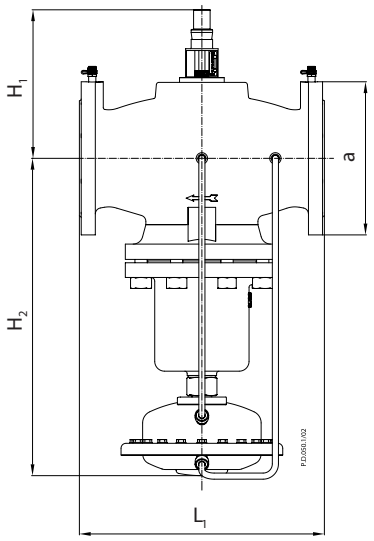
FB-QM DN 50-100



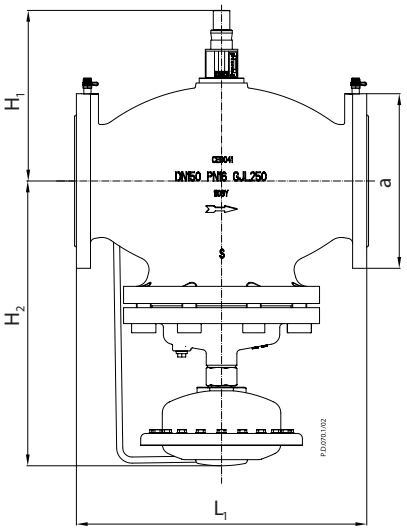
AME 435 QM + FB-QM

Type	L_1	H_1	H_2	H_3	a (EN 1092-2)	Weight (kg)
	mm					
DN 50	230	170	174	280	165	14.2
DN 65	290	220	172	330	185	38.0
DN 80	310	225	177	335	200	45.0
DN 100	350	240	187	350	220	57.0

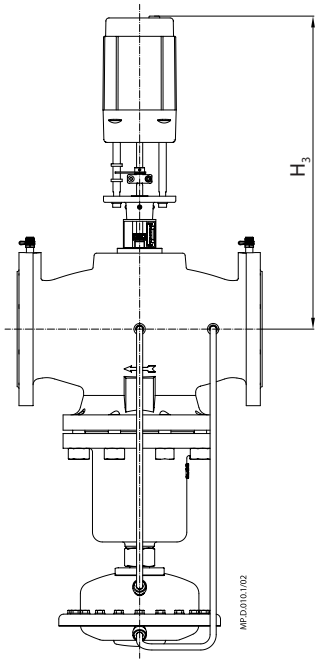
Dimensions *(continuous)*



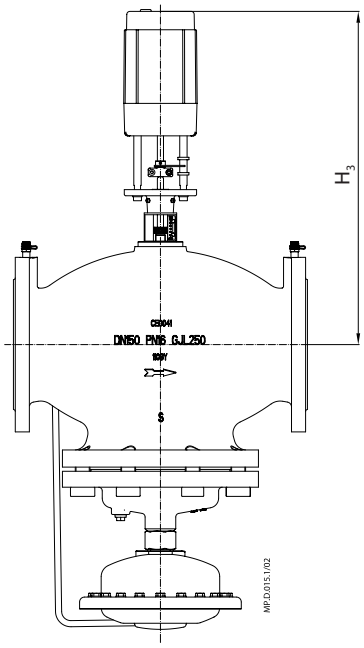
FB-QM DN 125



FB-QM DN 150



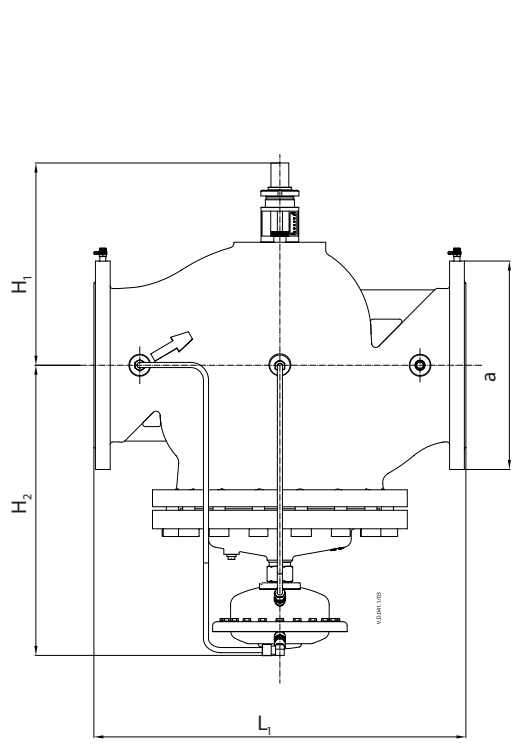
AME 55 QM + FB-QM DN 125



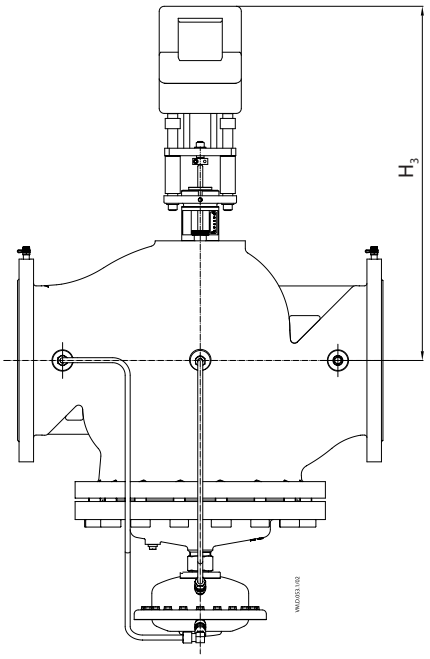
AME 55 QM + FB-QM DN 150

Type	L_1	H_1	H_2	H_3	a	Weight
	mm				(EN 1092-2)	(kg)
DN 125	400	272	518	507	250	85.3
DN 150	480	308	465	518	285	138

Dimensions *(continuous)*



FB-QM DN 200, 250



AME 85 QM + FB-QM DN 200, 250

Type	L_1	H_1	H_2	H_3	a	Weight
	mm				(EN 1092-2)	(kg)
DN 200	600	434	483	618	340	219
DN 250	730	430	533	708	405	342