ENGINEERING
TOMORROW

Data sheet

Pressure reduction controller (PN 16, 25, 40)

AFD / VFG 2(1) - for water

AFD / VFGS 2 - for steam

Description

The controller is a self-acting pressure reduction controller primarily for use in district heating systems. The controller is normally open and closes on rising pressure.

The controller has a control valve, an actuator with one control diaphragm and a spring for pressure setting.

Further on three valve versions are available:
- VFG 2 for water, with metallic sealing cone
- VFG 21 for water, with soft sealing cone
- VFGS 2 for steam, with metallic sealing cone

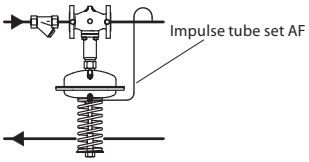
Main data:
- DN 15-250
- k_{VS} 4.0-400 m³/h
- PN 16, 25, 40
- Setting range:
  0.05-0.35 bar / 0.15-1.5 bar / 0.1-0.7 bar / 0.5-3 bar / 1-6 bar / 3-12 bar / 8-16 bar
- Temperature:
  – VFG -Circulation water / glycolic water up to 30 %: 2 … 150 / 200 °C
  – VFGS -Steam / circulation water / glycolic water up to 30 %: 2...200/300/350
- Connections:
  – Flange

Ordering

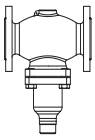
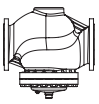
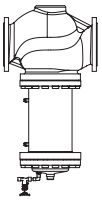
Example 1:
Pressure reduction controller; for water; DN 15; k_{VS} 4.0; PN 16; metallic sealing; setting range 0.15-1.5 bar; T_{max} 150 °C; flange;

- *1× VFG 2 DN 15 valve*
  Code no: ***065B2388***
- *1× AFD actuator*
  Code no: ***003G1005***
- *1× Impulse tube set AF*
  Code no: ***003G1391***

Products will be delivered separatly.



VFG 2 Valves (metallic sealing cone) – for water

Picture	DN (mm)	k_{VS} (m³/h)	Connections	T_{max} (°C)	Code No. PN 16	T_{max} (°C)	Code No. PN 25	Code No. PN 40
	15	4.0	Flanges acc. to EN 1092-1	150	**065B2388**	200 [1]	**065B2401**	**065B2411**
	20	6.3			**065B2389**		**065B2402**	**065B2412**
	25	8.0			**065B2390**		**065B2403**	**065B2413**
	32	16			**065B2391**		**065B2404**	**065B2414**
	40	20			**065B2392**		**065B2405**	**065B2415**
	50	32			**065B2393**		**065B2406**	**065B2416**
	65	50			**065B2394**		**065B2407**	**065B2417**
	80	80			**065B2395**		**065B2408**	**065B2418**
	100	125			**065B2396**		**065B2409**	**065B2419**
	125	160			**065B2397**		**065B2410**	**065B2420**
	150	280		150	**065B2398**	150	–	**065B2421**
	200	320			**065B2399**		–	**065B2422**
	250	400			**065B2400**		–	**065B2423**
	150 [2]	280			–	200 [1]	–	**On request**
	200 [2]	320			–		–	**On request**
	250 [2]	400			–		–	**On request**

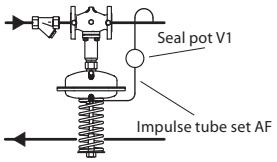
[1] *At temperatures above 150 °C only with seal pots (see Accessories)*
[2] *Valve has valve body extension (VBE)*

Ordering *(continuous)*

Example 2:
Pressure reduction controller; for water; DN 15; k_{VS} 4.0; PN 25; metallic sealing; setting range 0.15-1.5 bar; T_{max} 200 °C; flange;

- *1× VFG 2 DN 15 valve*
  Code no: ***065B2401***
- *1× AFD actuator*
  Code no: ***003G1005***
- *1× Impulse tube set AF*
  Code no: ***003G1391***
- *1× Seal pot V1*
  Code no: ***003G1392***

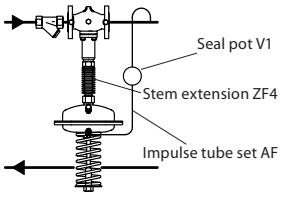
Products will be delivered separatly.



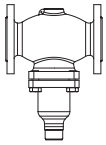
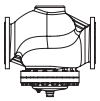
Example 3:
Pressure reduction controller; for steam; DN 15; k_{VS} 4.0; PN 25; metallic sealing; setting range 0.15-1.5 bar; T_{max} 350 °C; flange;

- *1× VFGS 2 DN 15 valve*
  Code no: ***065B2443***
  1× AFD actuator
  Code no: ***003G1005***
- *1× Impulse tube set AF*
  Code no: ***003G1391***
- *1× Seal pot V1*
  Code no: ***003G1392***
- *1× Stem extension ZF4*
  Code no: ***003G1394***

Products will be delivered separatly.

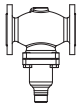
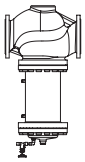


VFG 21 Valves (soft sealing cone) – for water

Picture	DN (mm)	k_{VS} (m^3/h)	Connections	T_{max} (°C)	Code No. PN 16
	15	4.0	Flanges acc. to EN 1092-1	150	**065B2502**
	20	6.3			**065B2503**
	25	8.0			**065B2504**
	32	16			**065B2505**
	40	20			**065B2506**
	50	32			**065B2507**
	65	50			**065B2508**
	80	80			**065B2509**
	100	125			**065B2510**
	125	160			**065B2511**
	150	280		150	**065B2512**
	200	320			**065B2513**
	250	400			**065B2514**

Note: *other valves available on special request.*

VFGS 2 Valves (metallic sealing cone) – for steam

Picture	DN (mm)	k_{VS} (m^3/h)	k_{VS} [1] (m^3/h)	T_{max} (° C)	Code No. PN 16	T_{max} (° C)	Code No. PN 25	Code No. PN 40
	15	4.0	2.5	150 [2]	**065B2430**	350 [2]	**065B2443**	**065B2453**
	20	6.3	4.0		**065B2431**		**065B2444**	**065B2454**
	25	8.0	6.3		**065B2432**		**065B2445**	**065B2455**
	32	16	10		**065B2433**		**065B2446**	**065B2456**
	40	20	16		**065B2434**		**065B2447**	**065B2457**
	50	32	25		**065B2435**		**065B2448**	**065B2458**
	65	50	40		**065B2436**		**065B2449**	**065B2459**
	80	80	63		**065B2437**		**065B2450**	**065B2460**
	100	125	100		**065B2438**		**065B2451**	**065B2461**
	125	160	125		**065B2439**		**065B2452**	**065B2462**
	150 [3]	280	200	150 [2]	**065B2440**	300 [2]	–	**065B2463**
	200 [3]	320	225		**065B2441**		–	**065B2464**
	250 [3]	400	280		**065B2442**		–	**065B2465**

[1] *Valves with built in flow divider for noise reduction (see accessories)*
[2] *Max. media temperatures for valves VFGS 2 (in steam applications always accessories have to be used – see table below)*
[3] *Valve has valve body extension (VBE) and pre-installed flow divider*

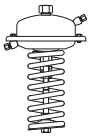
Max. media temperatures and use of accessories

Steam temp.	PN16		PN25		PN40	
	DN 15-125	DN 150-250	DN 15-125	DN 150-250	DN 15-125	DN 150-250
up to 150 °C	SP	SP + VBE	SP		SP	SP + VBE
up to 200 °C						
200 … 300 °C			SP + ZFx		SP + ZFx	SP + VBE
300 … 350 °C			SP + ZFx		SP + ZFx	

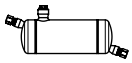
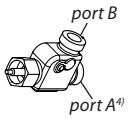
Remark – *following accessories have to be used as stated in table above:*
SP – Seal pot
ZF – Stem extension
VBE – Valve with valve body extension
– Valve is not to be used
See Accessories

Ordering *(continuous)*

AFD Actuators

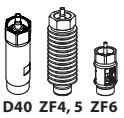
Picture	Pressure setting range (bar)	For DN	Code No.
	8-16	DN 15-125	**003G1000**
	3-12		**003G1001**
	1-6	DN 150-250	**003G1413**
	1-6	DN 15-125	**003G1002**
	0.5-3		**003G1003**
	0.15-1.5	DN 15-250	**003G1005**
	0.1-0.7		**003G1004**
	0.05-0.35		**003G1006**

Accessories

Picture	Type designation	Description	Connections	Code No.
	Impulse tube set AF	– 1× Copper tube Ø10 × 1 × 1500 mm – 1 × compression fitting for imp. tube connection to pipe (G ¼) – 2 × socket	–	**003G1391**
	Seal pot V1 [1]	Capacity 1 litre; with compression fittings for imp. tube Ø10	–	**003G1392**
	Seal pot V2 [1]	Capacity 3 litre; with compression fittings for imp. tube Ø10, for actuator size 630 cm²	–	**003G1403**
	Compression fitting [2]	For impulse tube Ø10 connections to controller	G ¼	**003G1468**
	Combination piece KF3	For combination with pressure actuators. Electrical actuator connected on side (port B) only for ON/OFF function	G 1¼ / 2× G 1¼	**003G1441**
	Combination piece KF2	For combination with thermostat - side connection to port B		**003G1440**
	Shut off valve	For impulse tube Ø10	–	**003G1401**
	Throttle valve			**065B2909**
	Flow dividers for VFGS 2 [3]	Flowdivider DN 15, 20	–	**065B2775**
		Flowdivider DN 25, 32		**065B2776**
		Flowdivider DN 40, 50		**065B2777**
		Flowdivider DN 65, 80		**065B2778**
		Flowdivider DN 100, 125		**065B2779**

[1] *Seal pot has to be used on impulse tubes when $T_{max} \geq 200$ °C and always in steam applications*
[2] *Consist of a nipple, compression ring and nut*
[3] *Flowdividers can be used in steam application for noise reduction ; after instaling into the valve, valve's kvs is reduced – see VFGS 2 table*
[4] *Port A - for connection of any type of actuator*

Accessories – Stem extensions[1]

Picture	Type	For valves DN	T_{max} (°C)	Media		Used for sealing	Used for isolation	Code No.
				water	steam			
	ZF4	15-125	350	Yes	Yes [2]	Yes	Yes	**003G1394**
	ZF5		350		Yes			**003G1396**
	ZF6		200		Yes [2]		– [3]	**003G1393**
	D40		200				Yes	**065B2986**

[1] *Stem extension has to be used always when $T_{max} > 200$ °C*
[2] *Condensate*
[3] *ZF6 can be used for stroke position indication*

Ordering *(continuous)*

Service kits

Picture	Type designation	DN (mm)	k_{vs} (m^3/h)	Code No. for VFG 2	Code No. for VFG 21	Code No. for VFGS 2
	Valve insert	15	4.0	**065B2796**	**065B2790**	**065B2802**
		20	6.3	**065B2797**	**065B2791**	**065B2803**
		25	8	**065B2798**	**065B2792**	**065B2804**
		32	16			
		40	20	**065B2799**	**065B2793**	**065B2805**
		50	32			
		65	50	**065B2800**	**065B2794**	**065B2806**
		80	80			
		100	125	**065B2801**	**065B2795**	**065B2807**
		125	160			
		150	280	**065B2964**	**065B2966**	–
		250	400	**065B2965**	–	–
	Stuffing cone (with EPDM O-rings)			**003G1464**		

Technical data

Valves

Nominal diameter		DN	15	20	25	32	40	50	65	80	100	125	150	200	250
k_{vs} value		m^3/h	4.0	6.3	8.0	16	20	32	50	80	125	160	280	320	400
k_{vs} value [1]		m^3/h	2.5	4.0	6.3	10	16	25	40	63	100	125	–	–	–
Cavitation factor z			0.6	0.6	0.6	0.55	0.55	0.5	0.5	0.45	0.4	0.35	0.3	0.2	0.2
Leakage acc. to standard IEC 534 (% of k_{vs})	VFG 2		≤ 0.03										≤ 0.05		
	VFG 21		≤ 0.01												
	VFGS 2		≤ 0.03										≤ 0.05		
Nominal pressure		PN	16, 25, 40												
Max. differential pressure	PN 16	bar	16								15		12	10	
	PN 25, 40	bar	20												
Media	VFG 2, VFG 21		Circulation water / glycolic water up to 30 %												
	VFGS 2		Steam /circulation water / glycolic water up to 30%												
Media pH			Min. 7, max. 10												
Media temperature	VFG 2	°C	2 … 150 / 2 … 200 [2]										2 … 150 (200 [4])		
	VFG 21	°C	2 … 150												
	VFGS 2 [3]	°C	2...200 / 2...300 /2...350										2 … 300		
Connections			Flange												
Materials															
Valve body	PN 16		Grey cast iron EN-GJL-250 (GG-25)												
	PN 25		Ductile iron EN-GJS-400(GGG-40.3)												
	PN 40		Cast steel GP240GH (GS-C 25)												
Valve seat			Stainless steel, mat. No. 1.4021										Stainless steel, mat. No. 1.4313		
Valve cone			Stainless steel, mat. No. 1.4404										Stainless steel, mat. No. 1.4021		
Sealing	VFG 2, VFGS 2		Metal												
	VFG 21		EPDM												
Pressure relieve system			Bellows (Stainless steel, mat. No. 1.4571)										Diaphragm (EPDM)		

[1] *Valves with built in flow divider for noise reduction (see Accessories)*
[2] *At temperatures above 150 °C only with seal pots (see Accessories)*
[3] *In steam aplications always accessories have to be used – see table on page 2 below*
[4] *On Request*

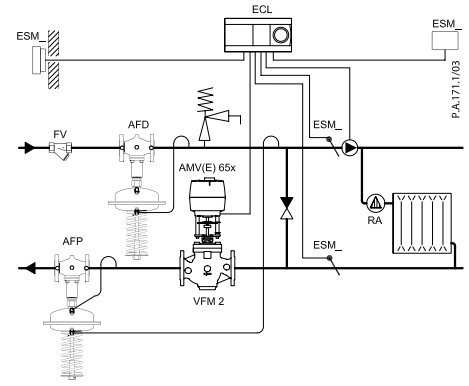
Technical data *(continuous)*

Actuators[1)]

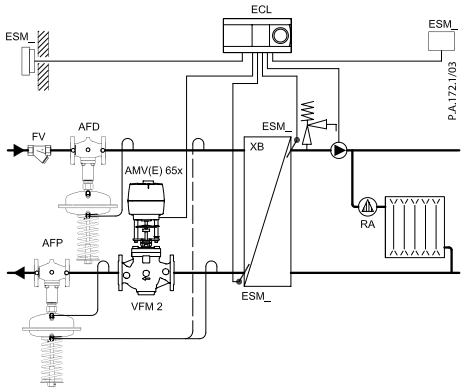
Type		AFD							
Actuator size	cm^2	32		80		160	250		630
Max. operating pressure	bar	25		25		25	25		16
Pressure setting ranges and spring colours	bar	black	red	red	yellow	blue	red	yellow	yellow
		8-16	3-12	1-6	0.5-3	1-6	0.15-1.5	0.1-0.7	0.05-0.35
Materials									
Actuator housing		Steel, mat. No. 1.0338, zinc plated							
Control diaphragm		EPDM (Rolling; fibre enforced)							

[1)] *Actuator and impulse tubes minimum temperature is 2 °C to prevent media from freezing*

Application principles



Direct-connected heating system



Indirectly connected heating system

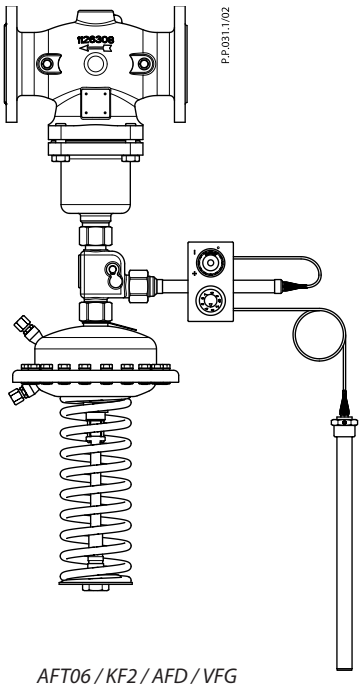
Combinations

Example
Pressure reduction and temperature controller AFD / AFT06 / VFG 2; k_{VS} 4.0; DN 15; PN 16: T_{max} 150 °C; 0.15-1.5 bar; range 20 … 90 °C

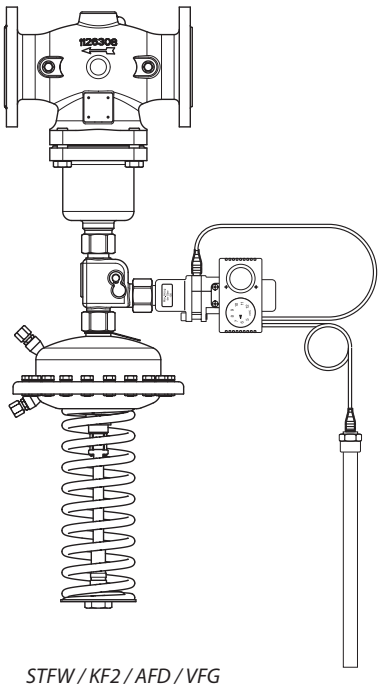
- *1× VFG 2 DN 15 valve*
  *Code no: **065B2388***
- *1× AFD actuator*
  *Code no: **003G1005***
- *1× AFT06 thermostat*
  *Code no: **065-4391***
- *1× Combination piece KF2*
  *Code no: **003G1440***
- *1× Impulse tube set AF*
  *Code no: **003G1391***

Parts will be delivered separately.

Note:
For AFT 06 and STFW thermostat data see relevant data sheet



AFT06 / KF2 / AFD / VFG



STFW / KF2 / AFD / VFG

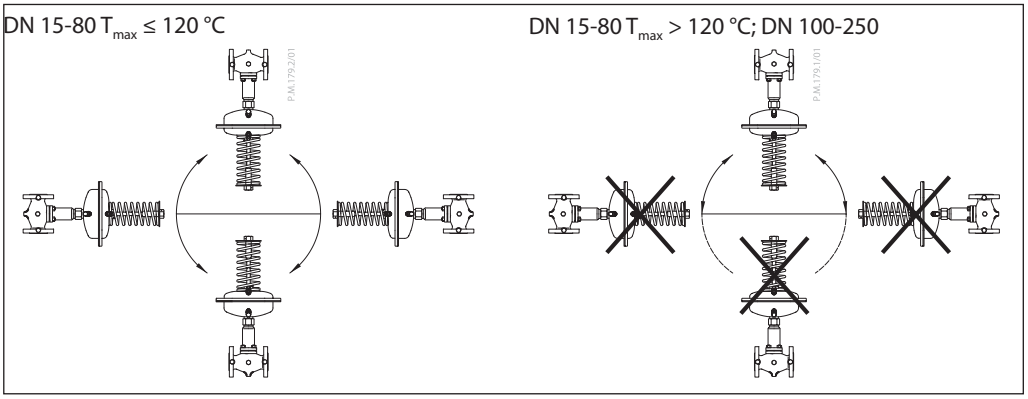
Installation position

DN 15-80 T_{max} ≤ 120 °C

The controllers can be installed in any position.

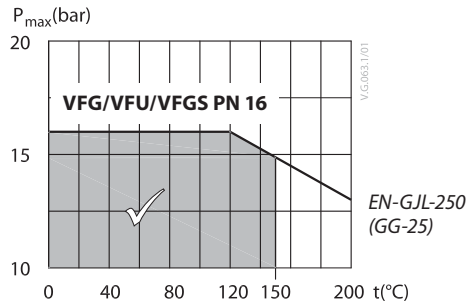
DN 15-80 T_{max} > 120 °C; DN 100-250

The controllers can be installed in horizontal pipes only, with a pressure actuator oriented downwards.

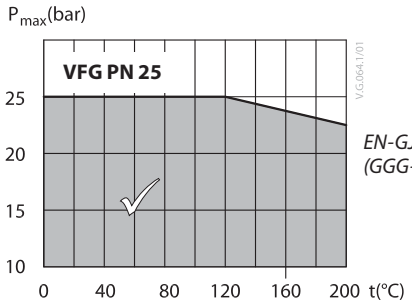


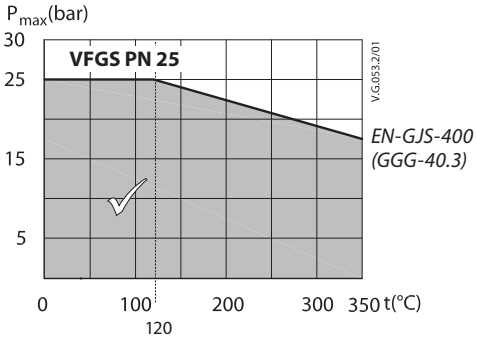
Pressure temperature diagram

Working area is below P-T line and it ends at T_{max} for each valve

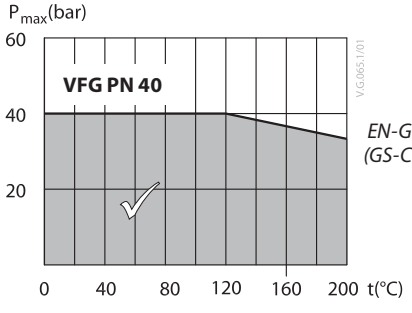


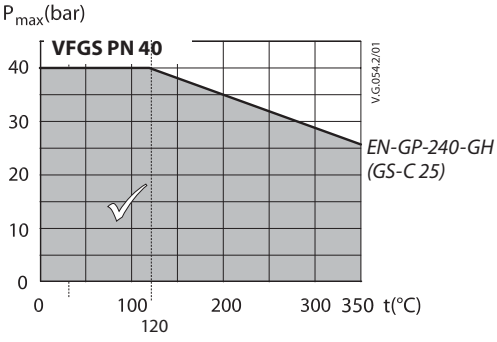
Maximum allowed operating pressure as a function of media temperature (according to EN 1092-2)





Maximum allowed operating pressure as a function of media temperature (according to EN 1092-2)





Maximum allowed operating pressure as a function of media temperature (according to EN 1092-1)

Sizing – water

Pressure reduction controller has to control 6.0 bar behind the controller. Max. flow through the system is less than 4.0 m³/h, min. flow pressure is 7.5 bar.

Given data:
Q_{max} = 35 m³/h
$p_{1\,min}$ = 7.5 bar
$p_{reduced}$ = 6.0 bar

Nominal pressure PN 25
The min. differential pressure across the controller is calculated from the formula:

$\Delta p_{AFD} = p_{1\,min} - p_{reduced} = 7.5 - 6.0$

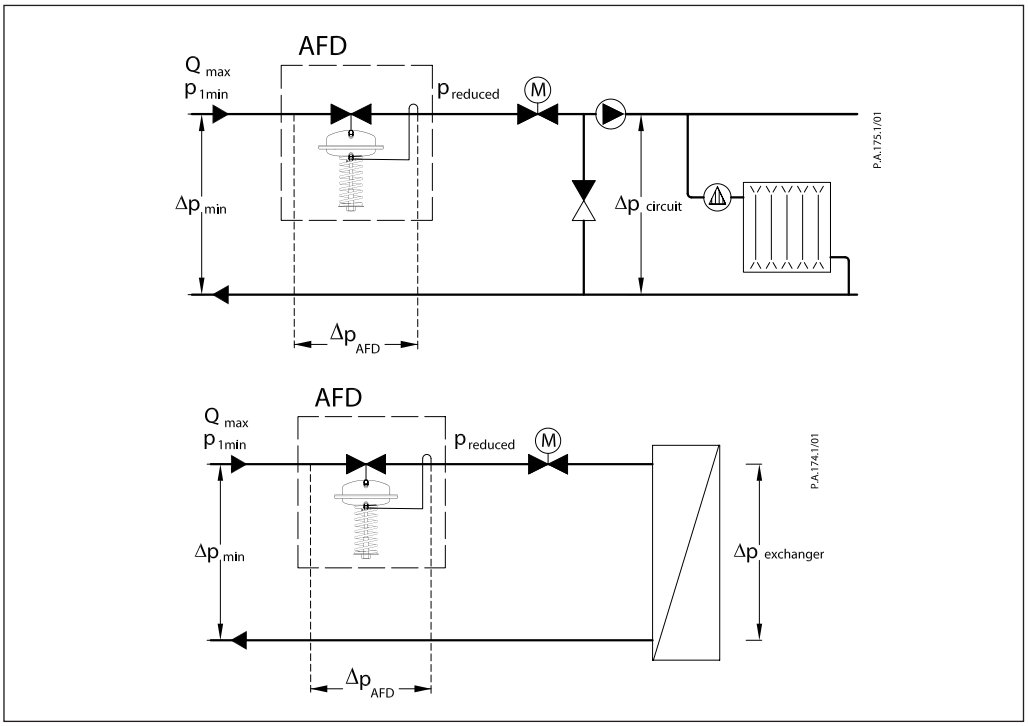
$\Delta p_{AFD} = 1.5$ bar

k_v value is calculated according to formula:

$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AFD}}} = \frac{35}{\sqrt{1.5}}$$

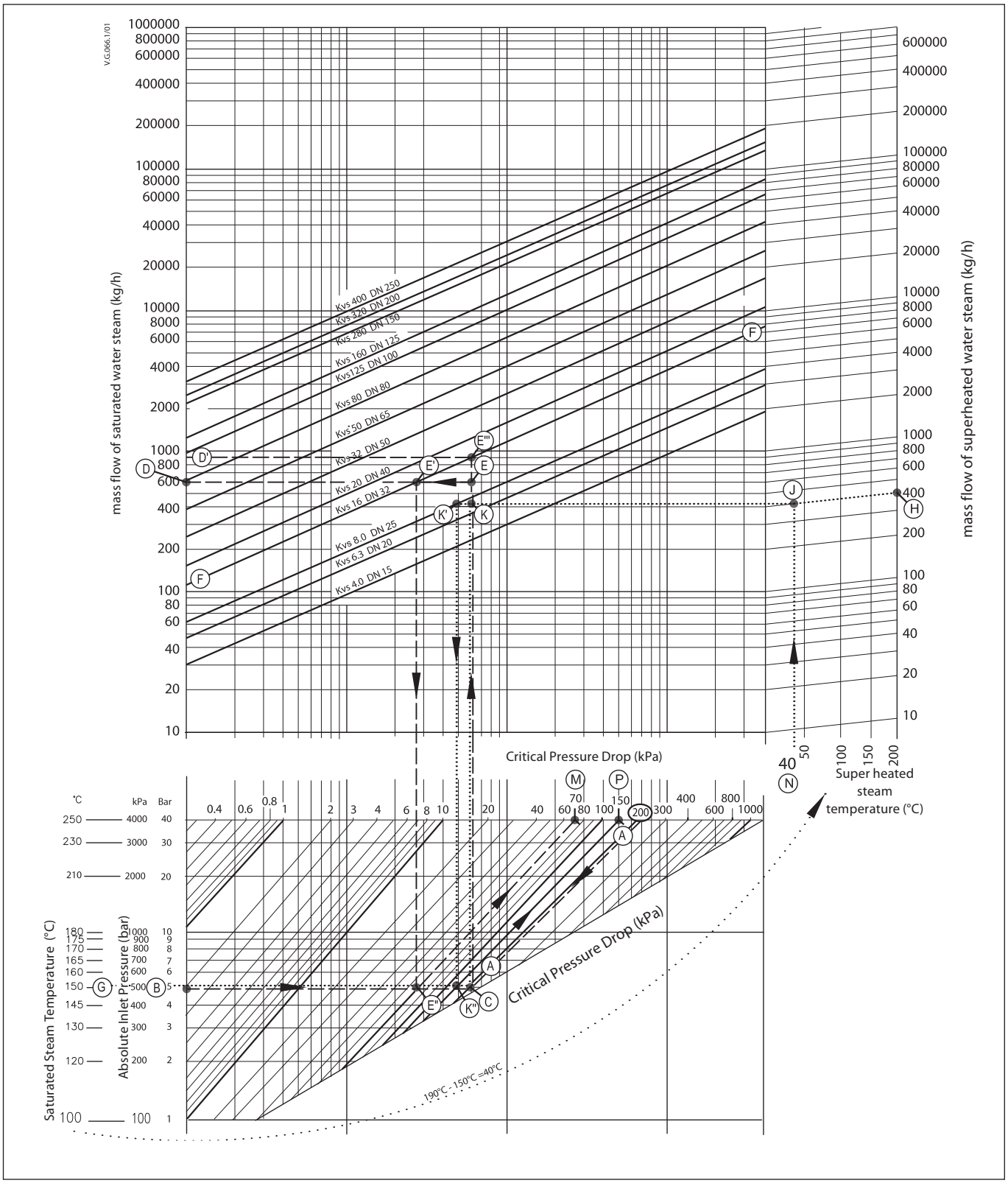
$k_v = 28.6$ m³/h

Solution:
The example selects VFG2 DN 65, k_{VS} value 50, with pressure actuator setting range 3-12 bar.



Sizing – steam

Max. Δp in low pressure steam application variance from 0.5 bar to 6 bar (see page 2)



Steam valve sizing is based on 40 % of the absolute steam pressure (immediately upstream of the valve) being dropped across the valve when fully open. At this condition the steam is travelling at or close to its critical velocity (approx. 300 m/s) and throttling will occur over the full valve stroke. If the steam is travelling slower than this then the first part of the valve stroke will merely increase the velocity of the steam without reducing the volumetric flow.

Control valve sizing diagram for steam
(continued)

1 For saturated steam

Design data:
Flow rate: 600 kg/h
Absolute inlet pressure: 5 bar (500 kPa)

– follow dashed line –

The absolute inlet pressure is 500 kPa. 40% of this is 200 kPa.

Locate the diagonal line corresponding to the pressure drop of 200 kPa (line A-A).

Read the absolute inlet pressure on the lower left hand scale (point B), and draw a horizontal line across until it meets the pressure drop diagonal (A-A) at point C.

From this point extend a vertical line upwards until it meets the horizontal line representing the steam flow of 600 kg/h from point D. The intersection of this is point E.

The nearest diagonal kvs line above this is line F-F with a k_{vs} 16 (point E'). If the ideal valve size is not available the next largest size should be selected to ensure design flow.

The pressure drop through valve at the flow rate is found by the intersection of the 600 kg/h line with F-F (point E') and dropping a vertical; this actually hits the horizontal line for 500 kPa (point E'') inlet pressure at a pressure drop diagonal of 70 kPa (point M). This is only 14 % of the inlet pressure and the control quality will not be good until the valve has partially closed. As with all steam valves this compromise is necessary since the next smaller valve would not pass the required flow (maximum flow would have been about 480 kg/h).

The maximum flow for same inlet pressure is found by extending the vertical line (C-E) through point E until it crosses the k_{VS} 16 line F-F (point E''') and reading off the flow 900 kg/h (point D').

Solution:
The example selects AFD DN 32, k_{VS} value 16, with pressure setting range 0.15-1.5 bar

2 For superheated steam

Design data:
Flow rate: 400 kg/h
Absolute inlet pressure: 5 bar (500 kPa)
Steam temperature: 190 °C

The procedure for superheated steam is much the same as for saturated steam, but uses a different flow scale which slightly elevates the readings according to the degree of superheat.

– follow dotted line –

As before, the diagonal pressure drop line A-A is located as before for 40 % of 500 (200 kg/h). The horizontal inlet pressure line through point B is now extended to the left to read off the corresponding saturated steam temperature at point G (150 °C). The difference between the saturated steam temperature and the superheated steam temperature is 190 °C – 150 °C = 40 °C (point N).

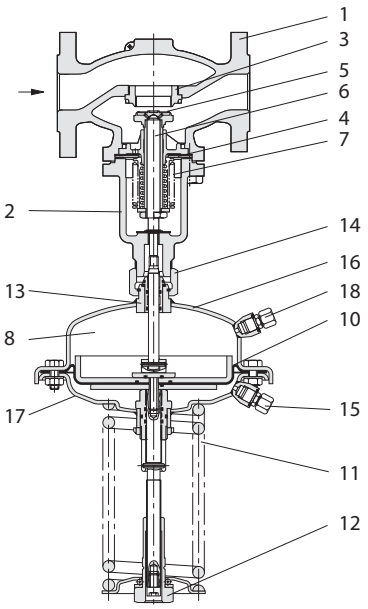
The superheated steam flow is found on the upper right hand scale, point H, and the diagonal line is followed down from here until it meets a vertical line from the steam temperature elevation (40 °C) at point J.

As before, the horizontal line through point B is drawn to cut line A-A at point C and the point where the vertical line from this point meets the horizontal line from point J is the operating point (point K). This horizontal line, J-K, is the corrected flow line. The nearest diagonal line above this is for k_{vs} 8 (point K'). A vertical line dropped from the intersection of J-K with the k_{vs} 8 line intersects the 500 kPa inlet pressure line (point K'') at a pressure drop diagonal of about 150 kPa (point P). This is about 30% of the inlet pressure which will give reasonable control quality (compared to recommended ratio of 40%).

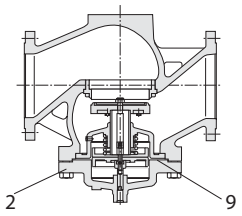
Solution:
The example selects AFD DN 25, k_{VS} value 8, with pressure setting range 0.15-1.5 bar

Design

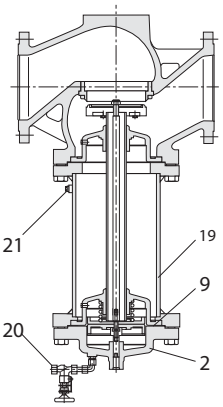
1. Valve body
2. Cover
3. Valve seat
4. Valve insert
5. Pressure relieved valve cone
6. Valve stem
7. Bellows for pressure relief of valve cone
8. Actuator
9. Diaphragm for pressure relief of valve cone
10. Control diaphragm for pressure control
11. Setting spring for pressure control
12. Adjuster for pressure setting, prepared for sealing
13. Stuffing cone
14. Union nut
15. Compression fitting for impulse tube
16. Upper casing of diaphragm
17. Lower casing of diaphragm
18. Air space bore
19. Valve body extension
20. Shut off valve for water filling
21. Closing plug



AFD /VFG(S) DN 15-125



VFG DN 150-250, T_{max} 150 °C



VFG DN 150-250, T_{max} 200 °C
VFGS DN 150-250 T_{max} 300 °C

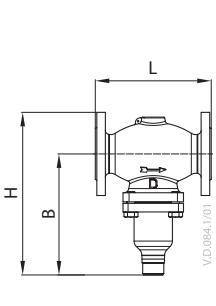
Function

The pressure behind of the control valve is being transferred through the impulse tube to the actuator chamber and act on control diaphragm for pressure control. On the other side of the diaphragm atmospheric pressure is acting (through air space bore). Control valve is normally opened. It closes on rising pressure and opens on falling pressure to maintain constant pressure.

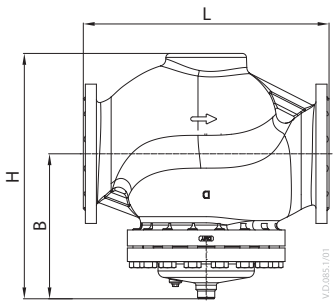
Settings

Pressure setting
Pressure setting is being done by the adjustment of the setting spring for pressure control. The adjustment can be done by means of spring for pressure setting and pressure indicators.

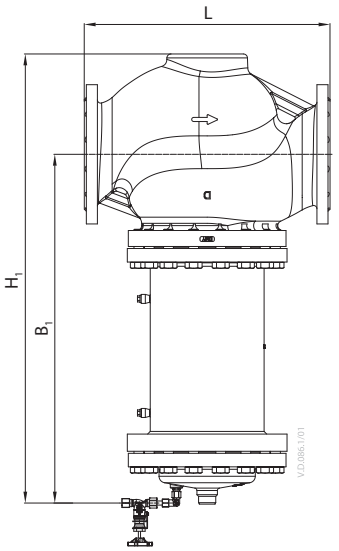
Dimensions



VFG(S) DN 15-125



VFG DN 150-250

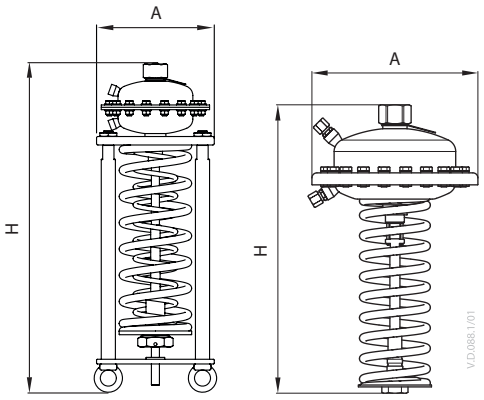


VFG(S) DN 150-250
with valve body extension
up to 200 (300) °C

VFG 2, VFG 21, VFGS 2 Valves

DN			**15**	**20**	**25**	**32**	**40**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**
L		mm	130	150	160	180	200	230	290	310	350	400	480	600	730
B		mm	213	213	239	239	241	241	276	276	381	381	326	354	401
H		mm	267	267	304	304	323	323	370	370	505	505	505	591	661
Weight	PN 16 / 25	kg	7.5	8.5	10	12	15	18	27.5	30	58	68	115	185	323
	PN 40	kg							30	32.5	60.5	69	141	253	333
B_1		mm											620	852	1199
H_1		mm											700	994	1359
Weight (valve with body extension)	PN 16 / 25	kg											154	301	469
	PN 40	kg											179	336	505

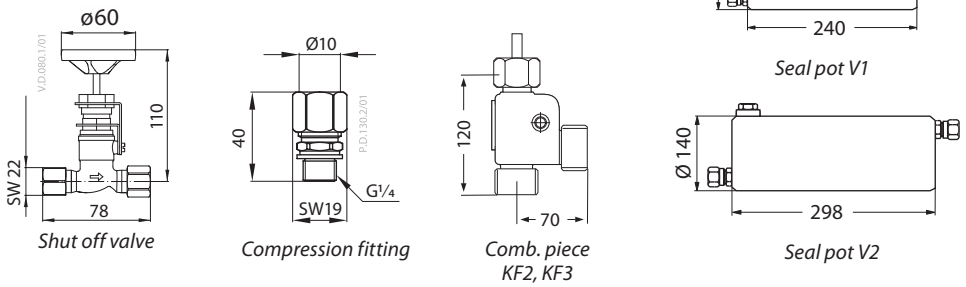
Dimensions *(continuous)*



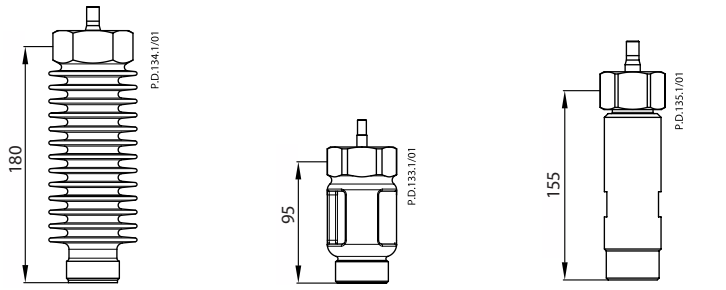
AFD (160 cm²) *AFD (32/80/250/630 cm²)*

AFD Actuator

Actuator size	cm²	32	80	160	250	630
Ø A	mm	172	172	250	263	380
H	mm	435	430	710	470	520
Weight	kg	7.5	7.5	32.4	13	28



Shut off valve *Compression fitting* *Comb. piece KF2, KF3* *Seal pot V1* *Seal pot V2*



Valve stem extension ZF4, ZF5 *Valve stem extension ZF6* *Valve stem extension D40*

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