

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

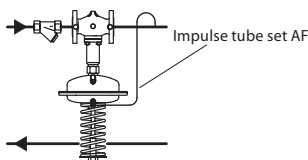
Ordering

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;

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

Products will be delivered separately.



VFG 2 Valves (metallic sealing cone) – for water

Picture	DN (mm)	k_{vs} (m ³ /h)	Connections	T_{max} (°C)	Code No.	T_{max} (°C)	Code No.	
					PN 16		PN 25	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	Flanges acc. to EN 1092-1	150	065B2398	150	–	065B2421
	200	320			065B2399		–	065B2422
	250	400			065B2400		–	065B2423
	150 ²⁾	280	Flanges acc. to EN 1092-1		–	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)

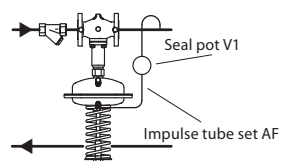
²⁾ Valve has valve body extension (VBE)

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;

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

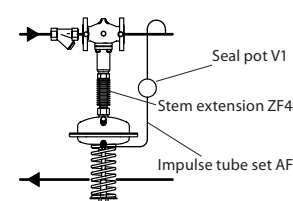
Products will be delivered separately.



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;

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

Products will be delivered separately.



VFG 21 Valves (soft sealing cone) – for water

Picture	DN (mm)	k_{vs} (m³/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} (m³/h)	$k_{vs}^{1)}$ (m³/h)	T_{max} (°C)	Code No.	T_{max} (°C)	Code No.	
					PN 16		PN 25	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

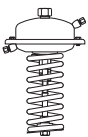
VBE – Valve with valve body extension

– Valve is not to be used

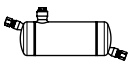
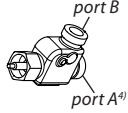
See Accessories

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	– 1x Copper tube Ø10 x 1 x 1500 mm – 1 x compression fitting for imp. tube connection to pipe (G 1/4) – 2 x 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 cm ²	–	003G1403
	Compression fitting ²⁾	For impulse tube Ø10 connections to controller	G 1/4	003G1468
	Combination piece KF3	For combination with pressure actuators. Electrical actuator connected on side (port B) only for ON/OFF function	G 1 1/4 / 2x G 1 1/4	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 installing into the valve, valve's kvs is reduced – see VFGS 2 table

⁴⁾ Port A - for connection of any type of actuator

Accessories – Stem extensions¹⁾

Picture	Type	For valves DN	T _{max} (°C)	Media		Used for sealing	Used for isolation	Code No.
				water	steam			
 D40 ZF4, 5 ZF6	ZF4	15-125	350	Yes	Yes ²⁾	Yes	Yes	003G1394
	ZF5		350		Yes		— ³⁾	003G1396
	ZF6		200		Yes ²⁾		Yes	003G1393
	D40		200					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	for VFG 21	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		m³/h	4.0	6.3	8.0	16	20	32	50	80	125	160	280	320	400
k _{vs} value ¹⁾			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		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		2 ... 150												
	VFGS 2 ³⁾		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 applications always accessories have to be used – see table on page 2 below

⁴⁾ On Request

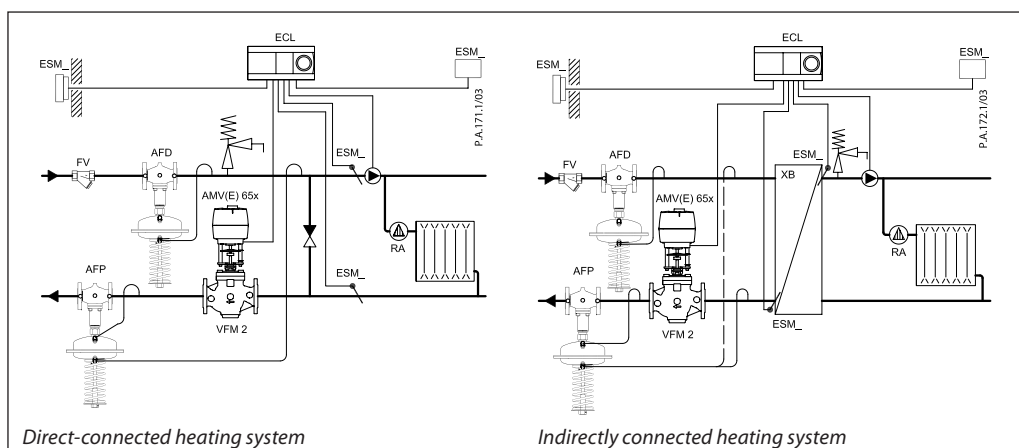
Technical data (continuous)

Actuators¹⁾

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



Combinations

Example

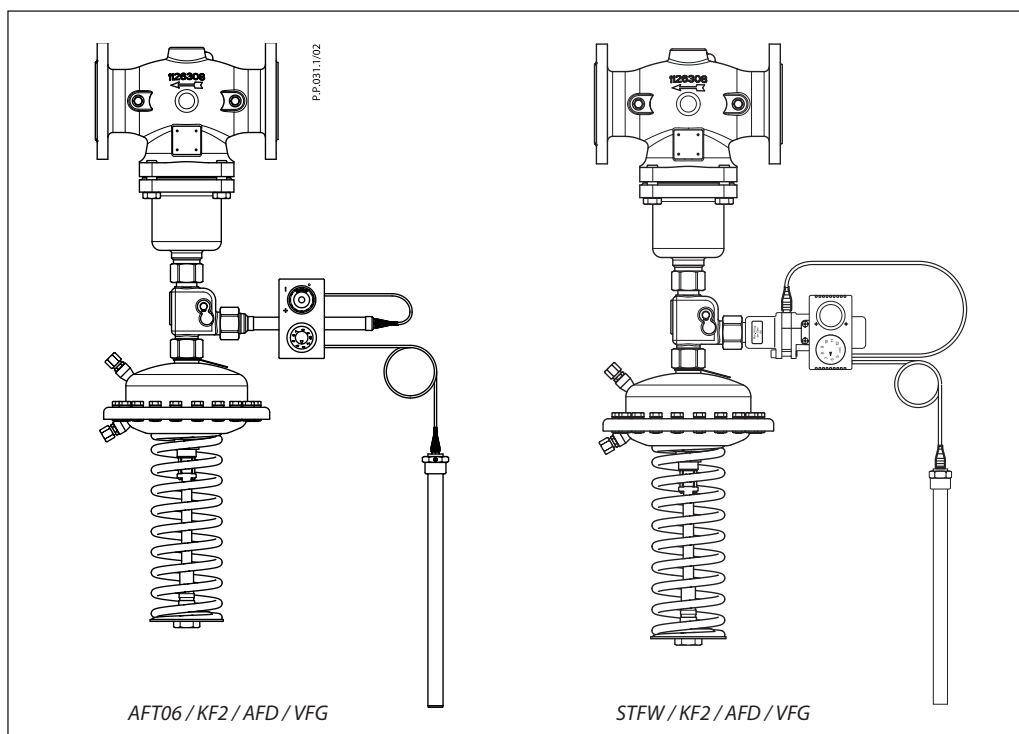
Pressure reduction and temperature controller AFD / AFT06 / VFG 2;
 k_{vs} 4.0; DN 15; PN 16; T_{max} 150 °C;
 0.15-1.5 bar; range 20 ... 90 °C

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

Parts will be delivered separately.

Note:

For AFT 06 and STFW thermostat data see relevant data sheet



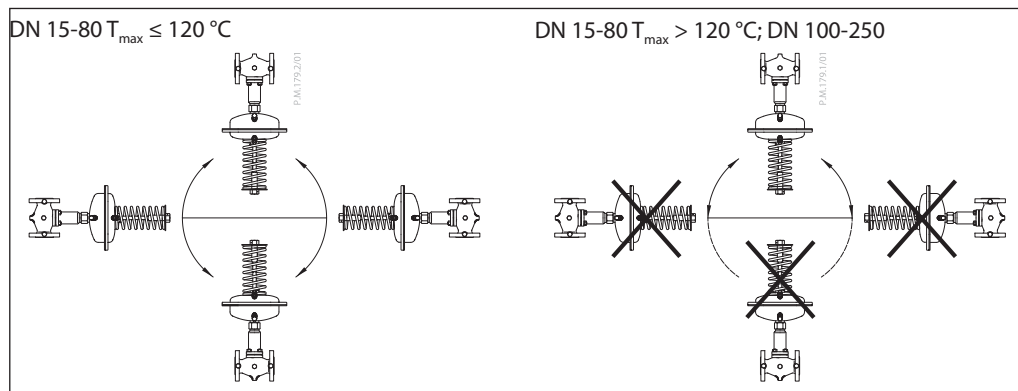
Installation position

DN 15-80 $T_{\max} \leq 120^\circ\text{C}$

The controllers can be installed in any position.

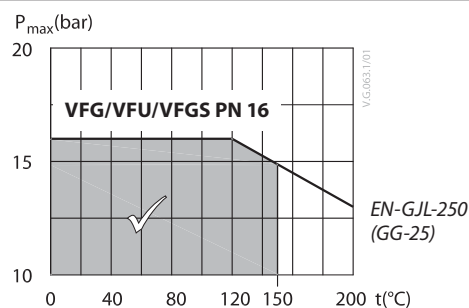
DN 15-80 $T_{\max} > 120^\circ\text{C}$; DN 100-250

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

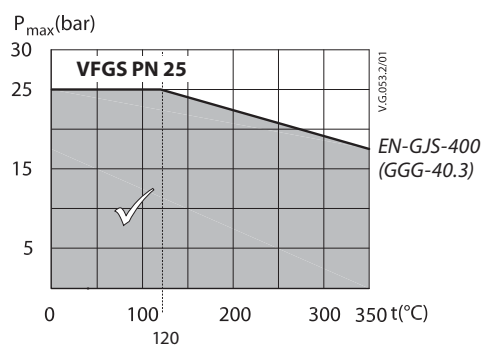
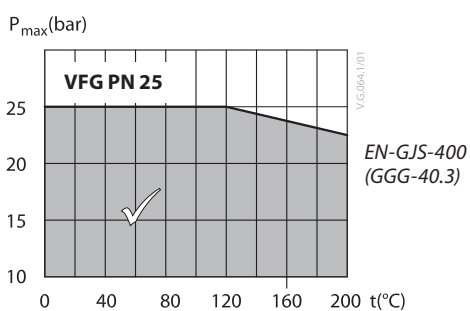


Pressure temperature diagram

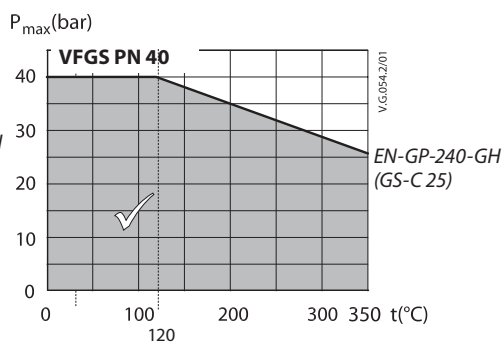
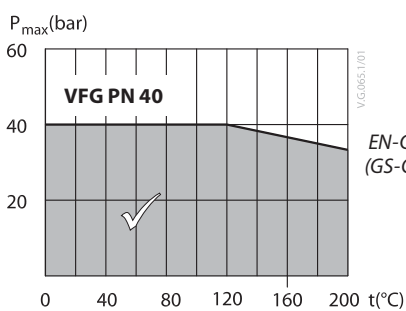
Working area is below P-T line and it ends at $T_{\max}$ for each valve



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:

$$Q_{\max} = 35 \text{ m}^3/\text{h}$$

$$p_{1\min} = 7.5 \text{ bar}$$

$$p_{\text{reduced}} = 6.0 \text{ bar}$$

Nominal pressure PN 25

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

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

$$\Delta p_{\text{AFD}} = 1.5 \text{ bar}$$

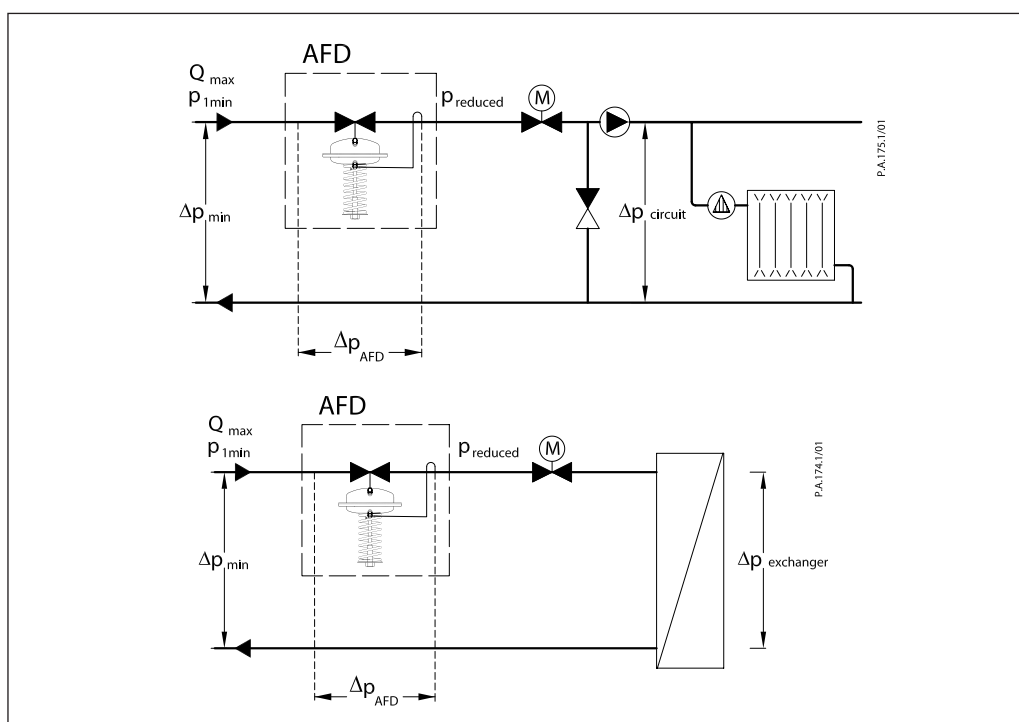
k_v value is calculated according to formula:

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

$$k_v = 28.6 \text{ m}^3/\text{h}$$

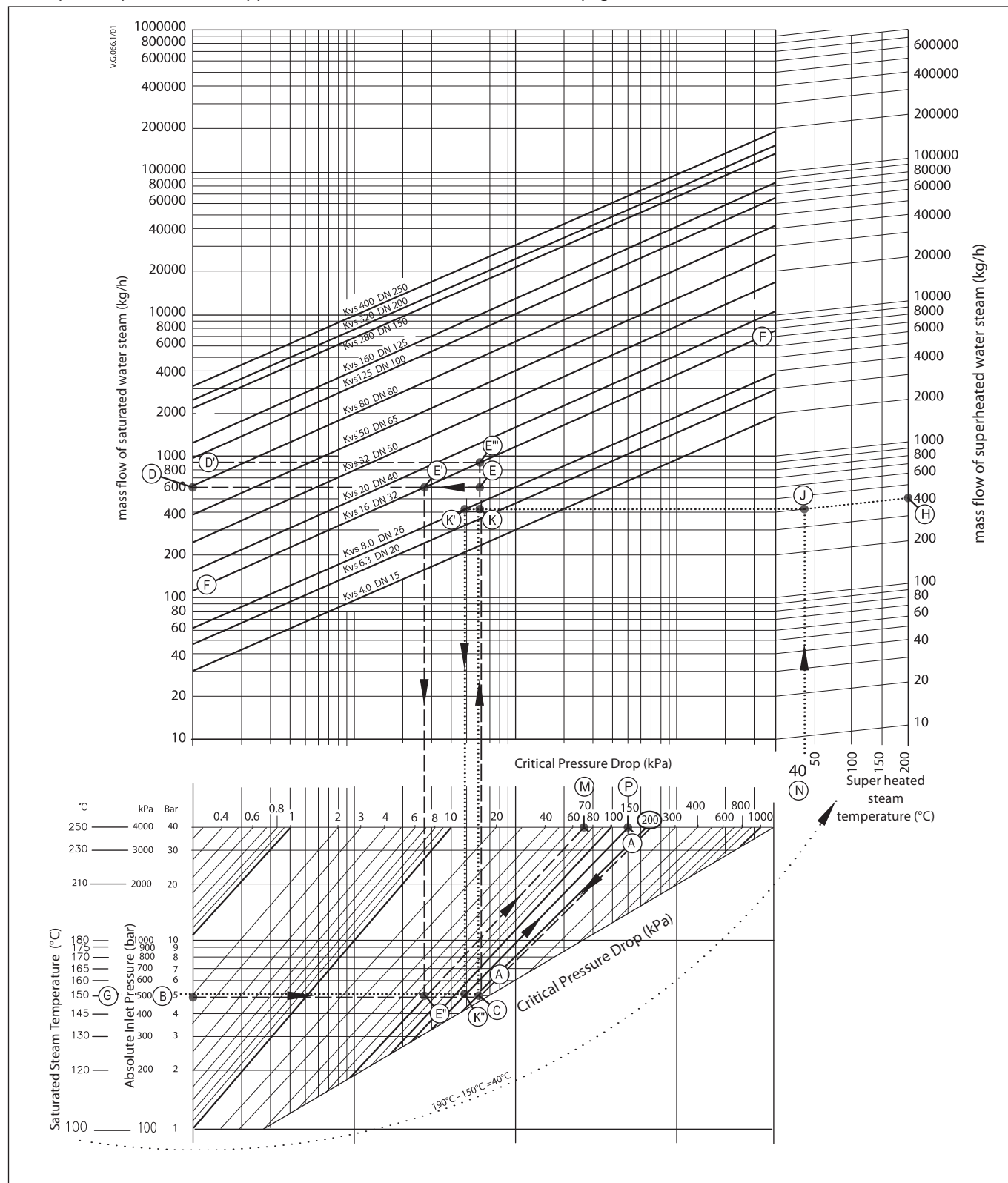
Solution:

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.

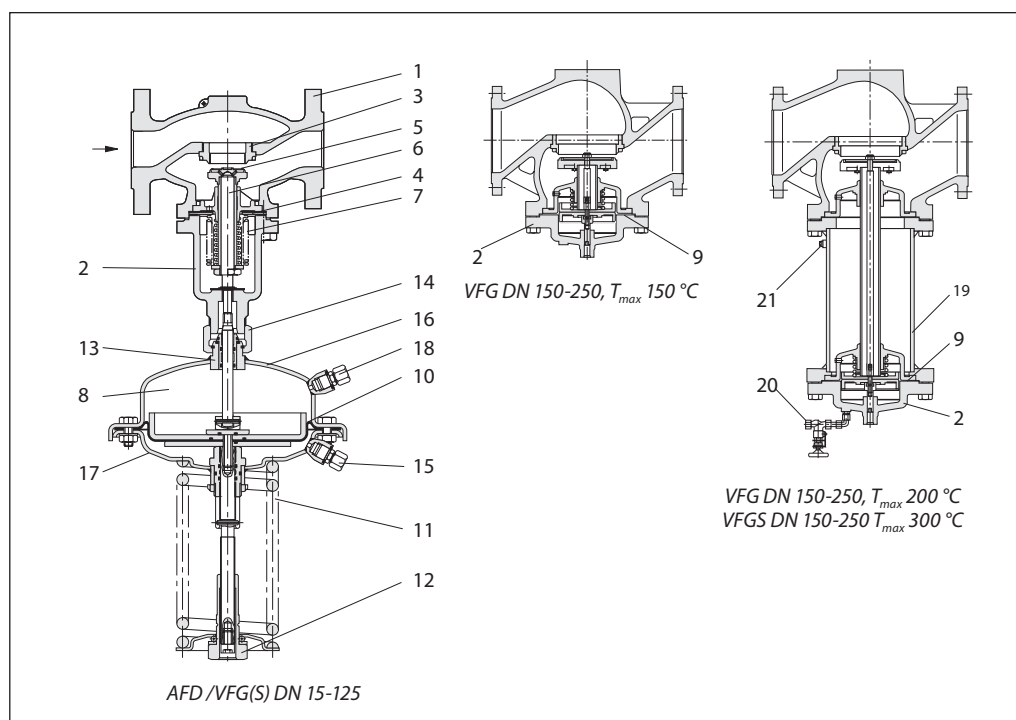
As before, the horizontal line through point B is drawn to cut line A-A at point C and the point where the vertical line from this point meets the horizontal line from point J is the operating point (point K). This horizontal line, J-K, is the corrected flow line. The nearest diagonal line above this 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



Function

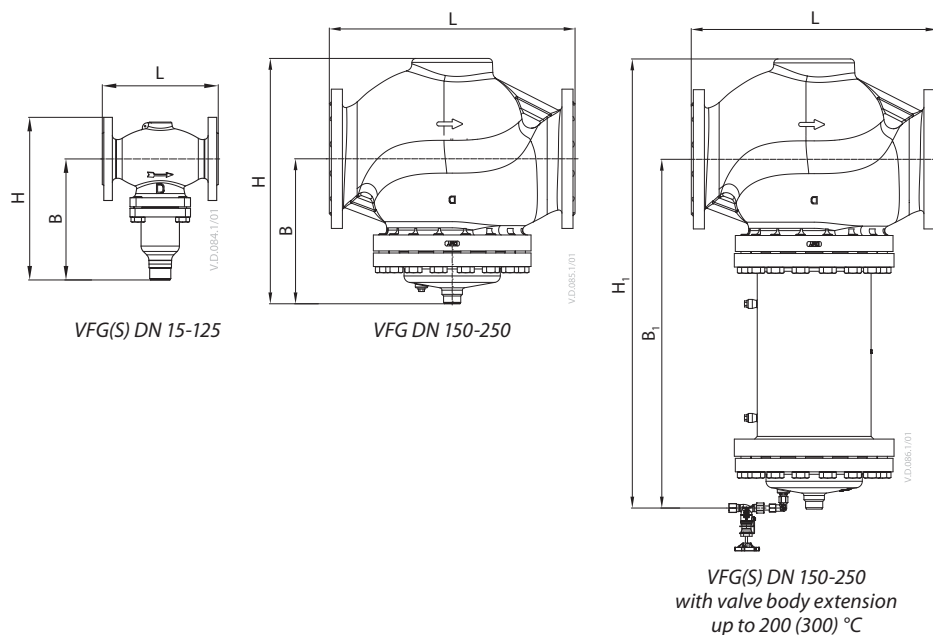
The pressure behind of the control valve is being transferred through the impulse tube to the actuator chamber and act on control diaphragm for pressure control. On the other side of the diaphragm atmospheric pressure is acting (through air space bore). Control valve is normally opened. It closes on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



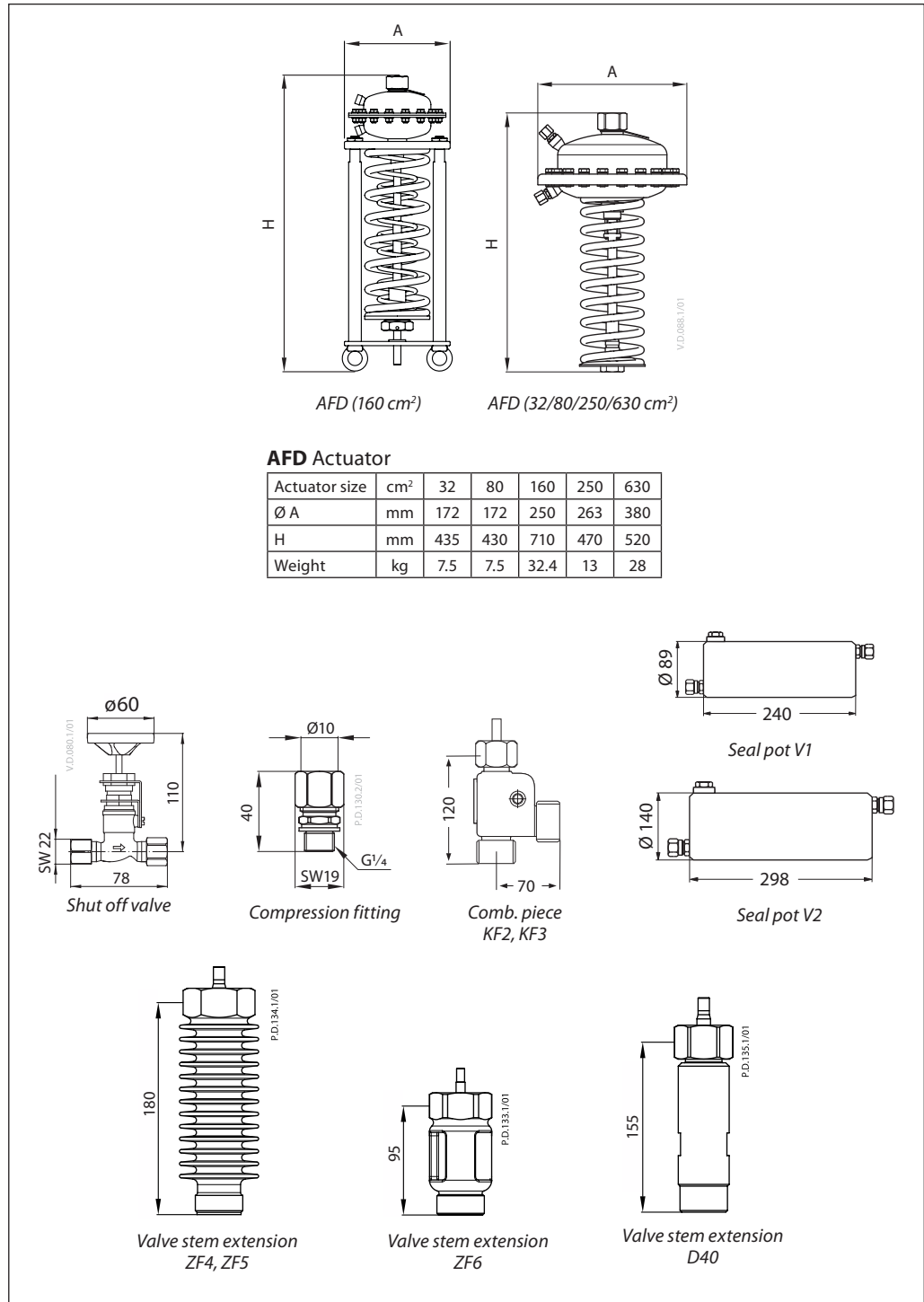
VFG 2, VFG 21, VFGS 2 Valves

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			213	213	239	239	241	241	276	276	381	381	326	354	401
H			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								30	32.5	60.5	69	141	253	333
B ₁		mm											620	852	1199
H ₁													700	994	1359
Weight (valve with body extension)	PN 16 / 25	kg											154	301	469
	PN 40												179	336	505

Data sheet

Pressure reduction controller AFD/VFG, VFGS

Dimensions (continuous)



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