



GESTRA® Pressure-Reducing Valve Type 5801



Issue Date: 1/97

Pressure-Reducing Valves

PN 16/25/40
DN 15-200 mm
(1/2"-8")

A₄

5801

Purpose

Direct-acting pressure reducing valve suitable for steam and other fluids.

Application

In all energy and process systems where pressures should be kept constant or energy saved during periods of shutdown or reduced consumption.

Nominal Pressure Ratings (PN) and Nominal Sizes (DN)

Type 5801 F 616:
PN 16, DN 15-200 mm (1/2"-8") (grey-cast iron)
Type 5801 F 325:
PN 25, DN 200 mm (8") (cast steel)
Type 5801 F 340:
PN 40, DN 15-150 mm (1/2"-6") (cast steel)
Type 5801 F 540:
PN 40, DN 15-100 mm (1/2"-2") (stainless steel)

Design

The pressure-reducing valve is a balanced single-seat, proportional controller operating without auxiliary energy.

The pressure-reducing valve consists of body with stainless-steel internals, bellows, spring, handwheel and actuator. For steam and liquids at temperatures above 100 °C a water-seal pot is required to protect the actuator diaphragm.

The body with the internals, the bellows and the actuator are supplied as a complete unit ready for installation. The water-seal pot should be installed in accordance with the installation and maintenance instructions.

The sensing line (tube 17.2 x 2.6 mm) and the pilot line (tube 8 x 1 mm) have to be provided on site. The fittings on the actuator and the water-seal pot are supplied by us.

Operation

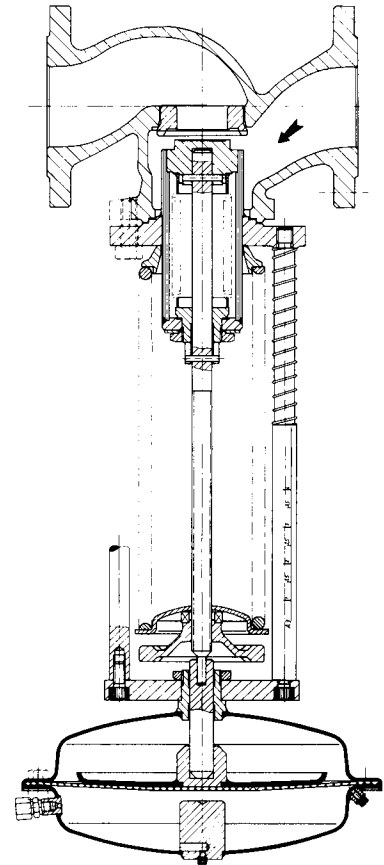
When the fluid flows through the valve a pressure drop is produced, leading to a reduced pressure downstream of the valve. This pressure is transmitted via a pilot line onto the diaphragm of the actuator. The force applied by the diaphragm opposes the force of the spring. As long as there is a state of equilibrium between both forces, the valve remains in position. Deviations in downstream pressure lead to a modification of the valve-cone position, such that the forces are again in equilibrium. The required pressure is set by adjusting the handwheel. The spindle is sealed by a stainless steel bellows which also balances the upstream pressure.

Order and Enquiry Specifications

GESTRA pressure-reducing valve type 5801 F...
DN...mm (in), PN...
k_v value...m³/h
Reduced pressure ...bar
Actuator ...

Materials

Body: grey-cast iron GG 25/cast steel
GS-C 25/stainless steel
Internals: stainless steel
Water-seal pot: Steel/Stainless steel



1. Determination of Nominal Size (DN)

To determine valve size calculate k_v value with the aid of the formulae given in table 1, increase the value obtained by 10 %, and select corresponding or next higher k_v value from table 2.

k_v Calculation

Table 1

	Pressure drop	for liquids	for gas	for steam
k_v	$\Delta p < \frac{p}{2}$	$= \frac{Q}{31.6} \sqrt{\frac{\rho}{\Delta p}}$	$= \frac{Q_N}{514} \sqrt{\frac{\rho_N \cdot T_1}{\Delta p \cdot p_2}}$	$= \frac{\dot{m}}{31.6} \sqrt{\frac{v''}{\Delta p}}$
	$\Delta p > \frac{p}{2}$		$= \frac{Q_N}{257 p_1} \sqrt{\rho_N \cdot T_1}$	$= \frac{\dot{m}}{31.6} \sqrt{\frac{2 \cdot v''}{p_1}}$

Nomenclature

k_v [m ³ /h]	Valve flow coefficient
Q [m ³ /h]	Flowrate of liquids
Q_N [Nm ³ /h]	Volume flowrate of gases (0 °C, atmospheric pressure)
\dot{m} [kg/h]	Mass flowrate of steam
p_1 [bara]	Upstream pressure (inlet)
p_2 [bara]	Downstream pressure (outlet)
Δp [bar]	Pressure drop across valve ($p_1 - p_2$)
ρ [kg/m ³]	Density of fluid with operating condition at T_1 and p_2
ρ_N [kg/m ³]	Density of gases (0 °C, atmospheric pressure)
v'' [m ³ /kg]	Specific steam volume at p_2 and T_1
	or if $\Delta p > \frac{p_1}{2}$ at $\frac{p_1}{2}$
T_1 [K]	Absolute temperature ($T = 273 + t$ °C)

k_v Values (m³/h)

Before selecting valve size, check flow velocity for suitability.

For steam the flow velocity at the valve outlet must not exceed 100 m/s.

Table 2

DN mm in	15-25 1/2-1	15 1/2	20 3/4	25 1	32 1 1/4	40 1 1/2	50 2	65 2 1/2	80 3	100 4	125 5	150 6	200 8
k_v ¹⁾	2.1	3.6	6	9.6	12	18	30	46	71	104	180	245	305

The regulating ratio is 1 : 10

¹⁾ C_v (U.S.) = 1.17 · k_v
 C_v (U.K.) = 0.98 · k_v

2. Determination of Nominal Pressure Rating

Determine nominal pressure rating with the aid of the pressure/temperature table below (table 3)

Pressure/Temperature Rating

Table 3

PN	°C	-10	120	200	250	300	350	400
16 (GG-25)	barg psig	16 230	16 230	13 185	13 185	13 185	- -	- -
25 (GS-C25)	barg psig	25 360	25 360	22 320	20 290	17 245	16 230	13 185
40 (GS-C25/S.S.)	barg psig	40 580	40 580	35 510	32 465	28 405	24 350	21 305

The values are based on DIN 2401

3. Selection of Valve Actuator

Select actuator in accordance with table 4 as a function of valve size and reduced pressure p_2 required.

Valve Actuator Selection

Table 4

DN mm in	15 1/2	20 3/4	25 1	32 1 1/4	40 1 1/2	50 2	65 2 1/2	80 3	100 4	125 5	150 6	200 8
Control range (CR) barg	8-20	8-20	8-20	8-20	8-20	8-20	8-20	8-20	8-20	8-20	8-20	8-20
Proportional band of CR ± bar	0.23	0.37	0.56	0.64	0.90	1	1.92	1.21	1.99	1.75	2.12	2.21
Actuator	B1	B1	B1	B1	B1	B1	B1	A1	B2	A1	A1	A1
Control range (CR) barg	1.1-10	1.1-10	1.1-10	1.1-10	1.1-10	2.4-10	2.4-10	3.2-10	3.2-10	3.2-10	3.2-10	3.2-10
Proportional band of CR ± bar	0.11	0.19	0.29	0.32	0.43	0.43	0.68	0.59	1.02	1.04	1.27	1.32
Actuator	A1	A1	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2
Control range (CR) barg	0.1-1.4	0.1-1.4	0.1-1.4	0.1-1.4	0.1-1.4	0.8-3	0.8-3	1.2-4	1.2-4	1.8-4.5	1.8-4.5	1.8-4.5
Proportional band of CR ± bar	0.016	0.024	0.036	0.044	0.059	0.16	0.23	0.32	0.48	0.65	0.79	0.82
Actuator	A4	A4	A4	A4	A4	A3	A3	A3	A3	A3	A3	A3
Control range (CR) barg						0.1-1	0.1-1	0.4-1.5	0.4-1.5	0.8-2.2	0.8-2.2	0.8-2.2
Proportional band of CR ± bar						0.055	0.078	0.107	0.144	0.235	0.284	0.296
Actuator						A4	A4	A4	A4	A4	A4	A4
Control range (CR) barg								0.1-0.6	0.1-0.6	0.4-1.1	0.4-1.1	0.4-1.1
Proportional band of CR ± bar								0.053	0.07	0.12	0.144	0.151
Actuator								A5	A5	A5	A5	A5
Control range (CR) barg										0.1-0.6	0.1-0.6	0.1-0.6
Proportional band of CR ± bar										0.064	0.076	0.079
Actuator										A6	A6	A6

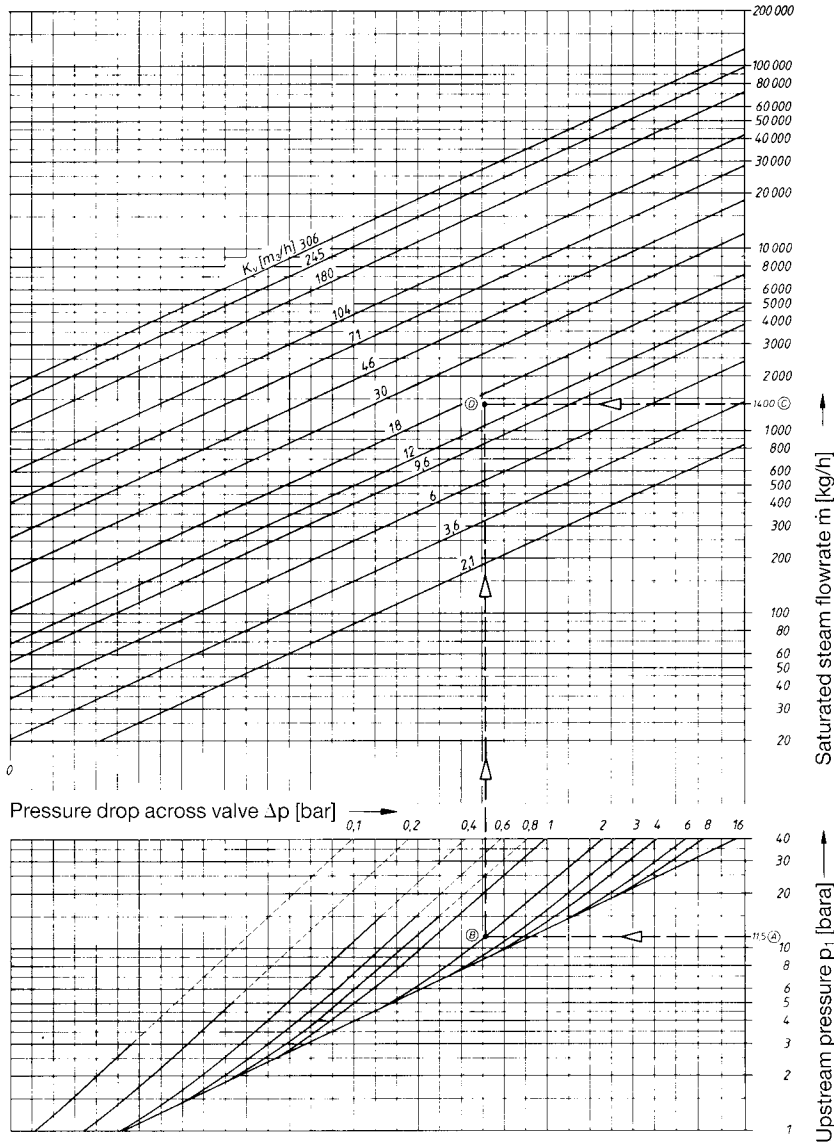
The proportional band from the control range is, e. g. for DN 125 mm, actuator A2 ±1.04 bar.

The proportional band depends on the utilization of the flowrate range.

If, for instance, in our example only 138 m³/h are used of the k_v 180 m³/h, i.e. 77 %, the deviation is ±1.04 bar x 0.77 = ±0.8 bar.

For a rough sizing of the valve, the k_v value can be determined with the aid of the charts below.
 In the case of a hypercritical pressure drop ($p_2 < p_1/2$) we shall be pleased to assist you in the sizing.

Chart for Determination of k_v Values for Saturated Steam



k_v tolerances ($\pm 10\%$ in acc. with VDI/VDE 2173) are already considered in the charts

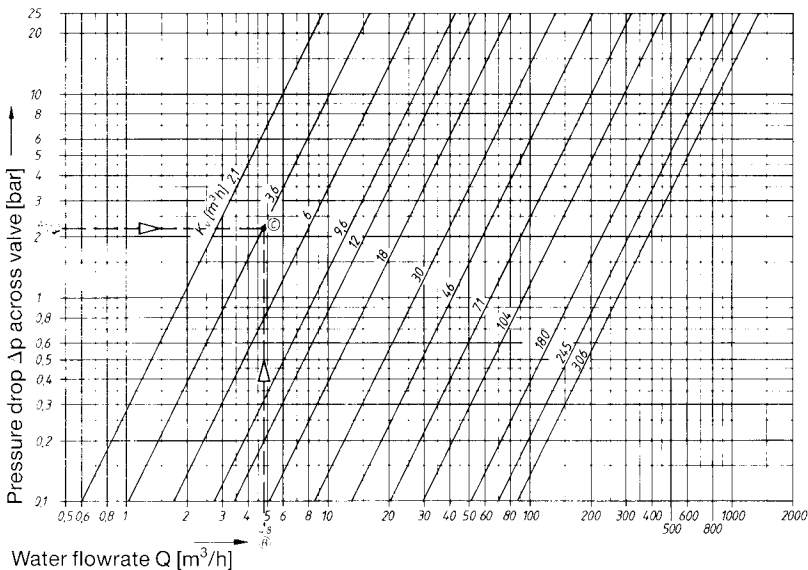
Example

Saturated steam
 p_1 11.5 bara
 Δp 2 bar
 t_1 186 °C
 \dot{m} 1400 kg/h

Result:
 k_v 18 m³/h

See points of intersection \textcircled{A} \textcircled{B} \textcircled{C} in chart.
 Point \textcircled{A} lies between k_v 12 m³/h and k_v 18 m³/h.
 Always select the larger k_v , in our example 18 m³/h.

Chart for Determination of k_v Values for Water



Example

Water
 Δp 2.2 bar
 Q 4.8 m³/h

Result:
 k_v 3.6 m³/h

See points of intersection \textcircled{A} \textcircled{B} \textcircled{C} in chart.
 Point \textcircled{C} lies on the k_v line 3.6. Select a valve with k_v 3.6. If the point of intersection is situated between two k_v values always select the higher one.

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Pressure-Reducing Valves
PN 16/25/40
DN 15-200 mm
(1/2"-8")

5801



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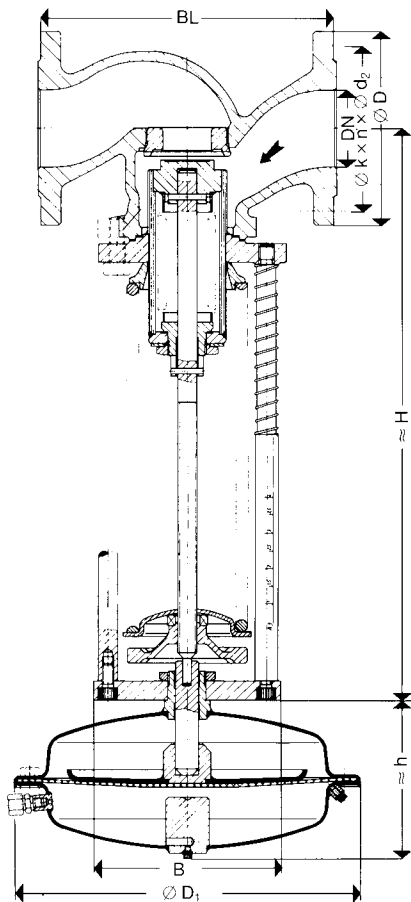
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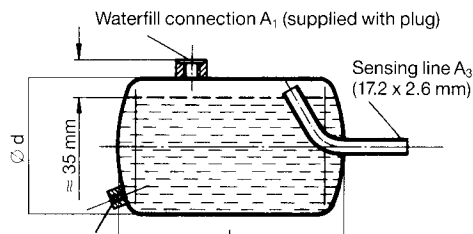
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Materials, Dimensions (mm) and Weights (kg)



Materials

Valve type	5801 F 616	5801 F 325, 340	5801 F 540
Nominal pressure	PN 16	PN 25, 40	PN 40
Body	Cast iron GG-25 (0.6023)	Cast steel GS-C 25 (1.0619)	Stainless steel G X 5 CrNiMoNb 18 10 (1.4581)
Head	C 22.8 (1.0460) St 35.4 (1.0309) St 41 KT	C 22.8 (1.0460) St 35.4 (1.0309) St 41 KT	Stainless steel X 6 CrNiMoTi 17 2 2 (1.4571)
Bellows	Austenitic stainless steel X 6 CrNiTi 1810 (1.4541)		
Flat joint gaskets	Pure graphite		
Seat	Stainless steel X 20 Cr 13 (1.4021)	A.S.S. (1.4571)	
Valve cone	Austenitic stainless steel X 6 CrNiNb 18 10 (1.4550)		
Spindle	Stainless steel X 20 Cr 13 (1.4021)		
Spring	Stainless steel 50 CrV 4 (1.8159)	1.7103	
Actuator housing	Cast iron GG-20 (0.6020) Steel St 14-4 (1.0336)	St 14-4 (1.0336)	
Diaphragm	Actuator A 1-3: Chlorobutadiene rubber (CR) B1, B2: Chlorobutadiene rubber (CR) A4, A5: Acrylonitrilebutadiene rubber (NBR)		



Pilot line connection A₂ (compression fitting for tube 8 x 1 mm supplied by us)

Dimensions of Water Seal Pot

Size	1	∅ d	A ₁ , A ₃	A ₂	For valve DN
1	206	88.9	3/8" BSP	1/8" BSP	15- 65 mm
2	172	152.4	3/8" BSP	1/8" BSP	80-100 mm
3	250	152.4	3/8" BSP	1/8" BSP	125-200 mm

Dimensions (mm), Weights (kg)

Actuator	A 1	A 2	A 3	A 4	A 5	A 6	B 1	B 2
Diaphragm ∅ D 1	125	160	195	270	365	510	125	160
≈ h	90	100	100	120	165	220	90	110
Weight approx. kg	2.8	4.5	6.0	4.5	10	28	3.5	5.5

Body	DN mm in	15	20	25	32	40	50	65	80	100	125	150	200
		1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8
Dimensions	BL	130	150	160	180	200	230	290	310	350	400	480	600
	≈ H	390	390	390	408	425	500	505	590	590	705	725	760
	B	125	125	125	125	125	145	145	195	195	260	260	260
Cast iron, PN 16 DN 15-200 mm (1/2"-8") 5801 F 616	∅ D	95	105	115	140	150	165	185	200	220	250	285	340
	∅ k	65	75	85	100	110	125	145	160	180	210	240	295
	n	4	4	4	4	4	4	4	8	8	8	8	8
	∅ d ₂	14	14	14	18	18	18	18	18	18	18	23	23
Cast steel, PN 25 DN 200 mm (8") 5801 F 325	∅ D	-	-	-	-	-	-	-	-	-	-	-	360
	∅ k	-	-	-	-	-	-	-	-	-	-	-	310
	n	-	-	-	-	-	-	-	-	-	-	-	12
	∅ d ₂	-	-	-	-	-	-	-	-	-	-	-	27
Cast steel, PN 40 DN 15-150 mm (1/2"-6") 5801 F 340 S.S., PN 40, 5801 F 540	∅ D	95	105	115	140	150	165	185	200	235	270	300	-
	∅ k	65	75	85	100	110	125	145	160	190	220	250	-
	n	4	4	4	4	4	4	8	8	8	8	8	-
	∅ d ₂	14	14	14	18	18	18	18	18	23	27	27	-
Weight 5801 F 616	kg	7	8	9	12	14	18	26	40	50	77	112	170
5801 F 325/340	kg	7	8	9	12	14	19	27	40	54	82	115	176
5801 F 540	kg	7	8	9	12	14	19	-	-	-	-	-	-

Supply in accordance with our general terms of business.

Technical modifications reserved.