

Self-operated Pressure Regulators

Pilot operated by the medium



Type 2333 Pressure Reducing Valve with pilot valve Type 2335 Excess Pressure Valve with pilot valve

ANSI version

Application

Pressure regulators for set points from **30 to 400 psi (2 bar to 28 bar)** · Valves in **NPS 6, 8, 10, 12¹⁾ and 16¹⁾** (DN 150 to 400) · Pressure rating **Class 125 to 300** · Suitable for liquids, gases and vapors up to **660 °F (350 °C)**

Type 2333: The valve **closes** when the **downstream** pressure rises

Type 2335: The valve **opens** when the **upstream** pressure rises

The differential pressure across the regulator is used as auxiliary energy to operate the valve. To open the regulator, this pressure must at least be as high as the minimum differential pressure Δp_{\min} specified in Table 1.

The attached pilot valve (either a pressure reducing valve or an excess pressure valve) determines the regulator's function.

Special features

- Low-maintenance proportional regulator requiring no auxiliary energy
- Particularly favorable control properties, while the offset remains small
- Easy set point adjustment on the pilot valve
- Single-seated globe valve with flanged body
- Regulators delivered ready-to-install

Versions

- Type 2422 Valve (modified) balanced by a bellows or a diaphragm, with soft-seated plug and internal closing spring
- Each regulator comes with a pilot valve (PV) which is used with a strainer and fixed restriction or Venturi nozzle
- Valve body made of cast iron A126B, cast steel A216 WCC or stainless steel A351 CF8M
- Valves balanced by a diaphragm preferable for use with water and non-flammable gases
- Version for steam (valves balanced by a bellows) with equalizing tank and needle valve

Type 2333 · Pressure reducing valve for liquids, vapors and gases. Used to control the downstream pressure p_2 to the set point adjusted at the pilot valve.

Equipped with a pilot valve suitable for the process medium.

Type 2335 · Excess Pressure Valve (Fig. 1) for liquids, vapors and gases. Used to control the upstream pressure p_1 to the set point adjusted at the pilot valve.

Equipped with a pilot valve suitable for the process medium.



Fig. 1 · Type 2335 Excess Pressure Valve (DN 150) with Type 44-7 Pilot Valve (modified)

Special versions

- With flow divider for noise reduction (not for liquids)
- Lower minimum required differential pressure Δp
- Larger nominal sizes
- Internal parts made of FPM (FKM), e.g. for use with mineral oils
- Version for flammable gases
- Version free of non-ferrous metal
- Version for deionized water
- Version for oxygen
- Additionally with solenoid valve for either emergency operation via a remote control unit or limitation when used in combination with an electric safety pressure limiter
- For higher differential pressures
- Reduced C_v (Kvs) coefficient

¹⁾ Class 150 only

Principle of operation (see Fig. 2)

The medium flows through the globe valve as indicated by the arrow. The position of the valve plug determines the flow rate across the area released between the plug (3) and seat (2). The travel position of the pilot valve (5) determines the pressure conditions across the valve.

The forces created by the upstream pressure p_1 acting on the plug surface and by the control pressure p_s and the positioning spring (3) are compared.

In the **Type 2333 Pressure Reducing Valve**, a rise in downstream pressure p_2 causes the pilot valve to close. The control pressure p_s increases, causing the plug of the main valve to close. When the pilot valve is closed ($p_s = p_1$), the pressure reducing valve (main valve) is also completely closed.

Together with the pilot valve, the fixed restrictor (6) or Venturi nozzle (8) create the control pressure p_s .

If the downstream pressure p_2 falls again below the set point, the pilot valve opens. The control pressure p_s decreases as a result. The force resulting from the upstream pressure p_1 acting on the plug surface causes the valve to open.

In the **Type 2335 Excess Pressure Valve**, a rise in upstream pressure p_1 causes the pilot valve and the main valve to open.

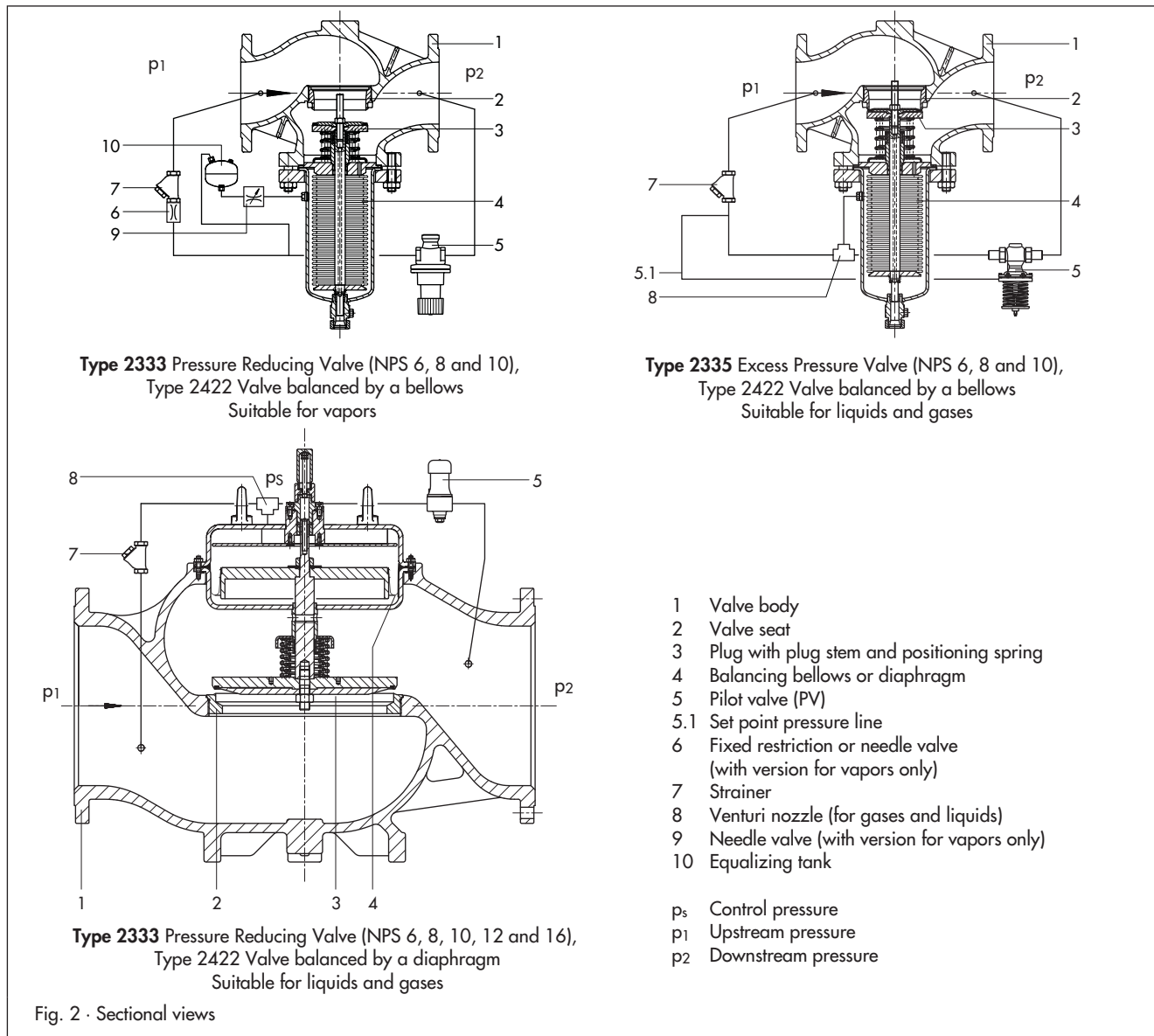
Together with the pilot valve, the Venturi nozzle (8) (fixed restrictor (6) and needle valve (9) for the steam version) create the control pressure p_s .

If the pilot valve remains closed, the valve is fully balanced. The upstream pressure p_1 counterbalances the control pressure p_s ($p_s = p_1$) acting on the outside of the balancing bellows (4) (or on the balancing diaphragm in the case of valves balanced by a diaphragm) between the pilot valve and the Venturi nozzle. The spring located below the plug closes the valve.

As the pilot valve opens, the control pressure p_s decreases and the differential pressure across the balancing bellows or diaphragm increases as a result. The force acting on the plug surface opposes the force of the positioning spring and opens the valve.

To ensure proper functioning, the minimum differential pressure Δp_{min} listed in Table 1 must be available as specified depending on the field of application.

The regulator version for **vapors** is only available with valves balanced by a bellows. This version has an equalizing tank (10) already fitted in the control line. The needle valve (9) is open and its setting is lead-sealed. Prior to start-up, the equalizing tank must be filled with water until it flows over the top of the filler neck.



Pilot valves for Type 2333 Pressure Reducing Valve

Type 50 ES · Suitable for cold water, mineral oil and non-flammable gases (120 °F/50 °C)

Type 44-2 · Suitable for liquids and mineral oil (300 °F/150 °C), non-flammable gases (175 °F/80 °C)

Type 44-1 B · Suitable for liquids (300 °F/150 °C) and non-flammable gases (175 °F/80 °C), nitrogen (300 °F/150 °C)

Type 44-0 B · Suitable for steam (390 °F/200 °C)

Type 41-23 · Suitable for gases, liquids and steam (660 °F/350 °C)

Type 2405 · Suitable for gases (-5 to +140 °F/-20 to +60 °C)

Pilot valves for Type 2335 Excess Pressure Valve

Type 44-7 · Suitable for liquids and mineral oil (300 °F/150 °C), non-flammable gases (175 °F/80 °C)

Type 44-6 B · Suitable for liquids (300 °F/150 °C), non-flammable gases (175 °F/80 °C) and steam (390 °F/200 °C) and nitrogen (300 °F/150 °C)

Type 41-73 · Suitable for gases, liquids and steam (660 °F/350 °C)

Type 2406 · Suitable for gases (-5 to +140 °F/-20 to +60 °C)

Table 1 · Pilot valves · Overview, technical data

Pilot valve	Pressure rating	Connection ¹⁾	Material	C _v /K _{vS}	Set point range	Process medium	Data Sheet
Type 50 ES Pressure Reducing Valve	PN 16	G ½	Brass	C _v 1/ K _{vS} 0.93	2.5 to 10 bar	Water, liquids and non-flammable gases up to 120 °F (50 °C)	T 2555 EN
Type 44-2 Pressure Reducing Valve	PN 25	DN 15	Red brass · Spheroidal graphite iron	C _v 1.2/ K _{vS} 1	2 to 10.5 bar	Liquids up to 300 °F (150 °C)	T 2623 EN
Type 44-7 Excess Pressure Valve					2 to 11 bar	Non-flammable gases up to 175 °F (80 °C)	T 2723 EN
Type 44-0 B Pressure Reducing Valve	Class 250	G ½ DN 15	Red brass · Spheroidal graphite iron Stainless steel	C _v 1.2/ K _{vS} 1	30 to 290 psi/ 2 to 20 bar	Steam up to 390 °F (200 °C)	T 2628 EN
Type 44-1 B Pressure Reducing Valve						Liquids and mineral oil up to 300 °F (150 °C)	T 2626 EN
Type 44-6 B Excess Pressure Valve						Non-flammable gases up to 175 °F (80 °C) · Nitrogen up to 300 °F (150 °C)	
Type 2405 Pressure Reducing Valve	Class 125 to 300	NPS ½/ DN 15	Cast iron · Cast steel · Spheroidal graphite iron · Stainless steel · Forged steel	C _v 1.2/ K _{vS} 1	30 to 75 psi/ 2 to 5 bar	Gases in the temperature range between -5 and +140 °F (-20 to +60 °C)	T 2520 EN
Type 2406 Excess Pressure Valve	Class 125 to 300	NPS ½/ DN 15	Cast iron · Cast steel · Spheroidal graphite iron · Stainless steel · Forged steel	C _v 1.2/ K _{vS} 1	30 to 75 psi/ 2 to 5 bar	Gases in the temperature range between -5 and +140 °F (-20 to +60 °C)	T 2522 EN
Type 41-23 Pressure Reducing Valve	Class 125 to 300	NPS ½/ DN 15	Cast iron · Cast steel · Spheroidal graphite iron · Stainless steel · Forged steel	C _v 1.2/ K _{vS} 1	30 to 400 psi/ 2 to 28 bar	Gases, liquids and steam up to 660 °F (350 °C)	T 2512 EN
Type 41-73 Excess Pressure Valve							T 2517 EN

¹⁾ Main valve DN 300/400: All pilot valves with connection G ½/DN 25, C_v 6/K_{vS} 5 (threaded connection) or C_v 9.6/K_{vS} = 8 (flanged connection)

Table 2 · Materials · Type 2422 Valve, balanced by a bellows · Material numbers according to ASTM and DIN EN

Type 2422 Valve, balanced by a bellows			
Pressure rating	Class 125		Class 150 · Class 300
Body	Cast iron A126B		Cast steel A216 WCC
Valve seat	1.4006		1.4571
Plug	Standard version	1.4301 with PTFE soft seal ¹⁾ , max. 430 °F (220 °C)	
	Version for steam	PTFE soft seal, max. 430 °F (220 °C) · Metal seal, max. 660 °F (350 °C)	
Pressure balancing	Balancing cases of sheet steel DD11 · Balancing bellows made of 1.4571		
Gasket	Graphite with metal core		

¹⁾ Optionally with PTFE soft sealing, max. 300 °F (150 °C)

Table 2.1 · Materials · Type 2422 Valve, balanced by a diaphragm · Material numbers according to ASTM and DIN EN

Type 2422 Valve, balanced by a diaphragm			
Pressure rating	Class 125	Class 150 · Class 300	Class 150 · Class 300
Body	Cast iron A126B	Cast steel A216 WCC	Stainless steel A351 CF8M
Valve seat	NPS 6 to 10: Red brass ¹⁾ · NPS 12 and 16: Stainless steel 1.4301		1.4571
Plug Standard version	NPS 6 to 10: Red brass ¹⁾ · NPS 12 and 16: Stainless steel 1.4301 With EPDM soft seal ²⁾ , max. 300 °F (150 °C)		1.4571 with PTFE soft seal, max. 300 °F (150 °C)
Pressure balancing	Balancing cases of sheet steel DD11 · EPDM balancing diaphragm, max. 300 °F (150 °C)		

¹⁾ Optionally 1.4409

²⁾ Optionally with PTFE soft seal, max. 300 °F (150 °C)

Table 3 · Technical data · Type 2422 Valve, balanced by a bellows · All pressures specified as gauge pressures

Type 2422 Valve · Balanced by a bellows · Suitable for liquids, gases and vapors			
Valve size	NPS 6 · DN 150	NPS 8 · DN 200	NPS 10 · DN 250
Pressure rating	Class 125 to 300		
Flow coefficients, standard			
Flow coefficients	C_v 420	600	720
	K_{vs} 360	520	620
Flow coefficient with flow divider St I	C_v 310	460	590
	K_{vs} 270	400	500
Flow coefficient with flow divider St III	C_v 210	300	355
	K_{vs} 180	260	310
Minimum differential pressure Δp_{min}			
Version for water	15 psi · 1 bar		10 psi · 0.7 bar
Version for steam	30 psi · 2 bar		19 psi · 1.3 bar
Max. perm. differential pressure Δp_{max}	175 psi · 12 bar		145 psi · 10 bar
Flow coefficients, reduced			
Flow coefficient	C_v 145	420	420
	K_{vs} 125	360	360
Flow coefficient with flow divider St I	C_v 110	315	315
	K_{vs} 95	270	270
Flow coefficient with flow divider St III	C_v 70	210	210
	K_{vs} 60	180	180
Minimum differential pressure Δp_{min}			
Version for water/air	3 psi · 0.2 bar ¹⁾		15 psi · 1 bar
Version for steam	–		30 psi · 2 bar
Max. perm. differential pressure Δp_{max}	230 psi · 16 bar		175 psi · 12 bar
xFZ value	0.3		
Leakage class acc. to IEC 60534-4	≤ 0.05 % of C_v (K_{vs}) coefficient ²⁾		
Max. perm. temperature, depending on pilot valve used	Type 50 ES: 120 °F (50 °C) · Type 44-2/44-7: 300 °F (150 °C) · Type 44-0 B/44-1 B/44-6 B: max. 390 °F (200 °C) · Type 2405/2406: max. 300 °F (150 °C) · Type 41-23/41-73: 660 °F (350 °C)		
Set point ranges, continuously adjustable at the pilot valve	psi	Type 50 ES: 35 to 90, 60 to 145 · Type 44-2: 30 to 63, 36 to 94, 90 to 15 Type 44-7: 30 to 66, 36 to 100, 90 to 165 Type 44-0 B/44-1 B/44-6 B: 30 to 90, 60 to 150, 120 to 290 · Type 2405/2406: 29 to 72.5, 65 to 145 Type 41-23/41-73: 30 to 75, 65 to 145, 115 to 230, 145 to 290, 290 to 400	
	bar	Type 50 ES: 2.5 to 6, 4 to 10 · Type 44-2: 2 to 4.2, 2.4 to 6.3, 6 to 10.5 Type 44-7: 2 to 4.4, 2.4 to 6.6, 6 to 11 Type 44-0 B/44-1 B/44-6 B: 2 to 6, 4 to 10, 8 to 20 bar Type 2405/2406: 2 to 5, 4.5 to 10 · Type 41-23/41-73: 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28	

¹⁾ With Type 2420 Actuator, 640 cm² effective diaphragm area

²⁾ ≤ 0.1 % of C_v (K_{vs}) coefficient with metal-seated plug

Table 3.1 · Technical data · Type 2422 Valve, balanced by a diaphragm · All pressures specified as gauge pressures

Type 2422 Valve · Balanced by a diaphragm · Suitable for liquids, gases and vapors						
Valve size		NPS 6 · DN 150	NPS 8 · DN 200	NPS 10 · DN 250	NPS 12 · DN 300	NPS 16 · DN 400
Pressure rating		Class 125 to 300			Class 125 to 150	
Flow coefficients	C _v	445	760 ¹⁾	930 ¹⁾	1440	2300
	K _{vS}	380	650 ¹⁾	800 ¹⁾	1250	2000
x _{FZ} value		0.35	0.3 ¹⁾		0.2	
Minimum differential pressure Δp _{min}	psi	12	6 ¹⁾		7	4.5
	bar	0.8	0.4 ¹⁾		0.5	0.3
Max. perm. differential pressure Δp _{max}	psi	175	145 ¹⁾			
	bar	12	10 ¹⁾			6
Leakage class acc. to ANSI/FCI 70-2		≤ 0.01 % of C _v (K _{vS}) coefficient				
Max. perm. temperature, depending on pilot valve used		Type 50 ES: 120 °F (50 °C) · Type 44-2/44-7, Type 44-1 B/44-6 B: 300 °F (150 °C) · Type 2405/2406: 300 °F (150 °C) · Type 41-23/41-73: 300 °F (150 °C) Pressure regulator for steam as special version on request				
Set point ranges, continuously adjustable at the pilot valve	psi	Type 50 ES: 35 to 90, 60 to 145 · Type 44-2: 30 to 63, 36 to 94, 90 to 15 Type 44-7: 30 to 66, 36 to 100, 90 to 165 Type 44-0 B/44-1 B/44-6 B: 30 to 90, 60 to 150, 120 to 290 · Type 2405/2406: 29 to 72.5, 65 to 145 Type 41-23/41-73: 30 to 75, 65 to 145, 115 to 230, 145 to 290, 290 to 400				
	bar	Type 50 ES: 2.5 to 6, 4 to 10 · Type 44-2: 2 to 4.2, 2.4 to 6.3, 6 to 10.5 Type 44-7: 2 to 4.4, 2.4 to 6.6, 6 to 11 Type 44-0 B/44-1 B/44-6 B: 2 to 6, 4 to 10, 8 to 20 bar · Type 2405/2406: 2 to 5, 4.5 to 10 Type 41-23/41-73: 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28				

¹⁾ Version with reduced C_v (K_{vS}) coefficient possible. In this case, the technical data are same as for version in NPS 6 (DN 150).

Installation

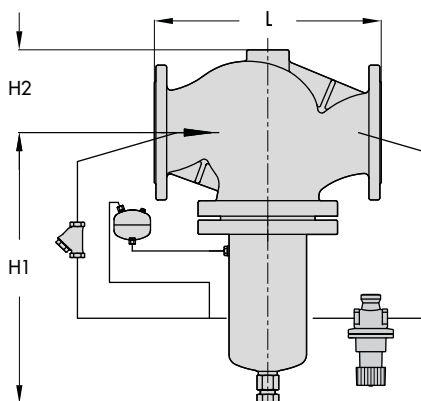
- Installation in horizontal pipelines
- Direction of flow as indicated by the arrow on the valve body
- **Valve balanced by a bellows:** the valve bonnet including the body must be suspended downward;
- **Valve balanced by a diaphragm:** installation with the balancing diaphragm pointing upward
- Install a strainer (for example, a SAMSON Type 2 N/Type 2 NI Strainer) upstream of the valve
- Do not insulate pilot valve when handling hot media



Refer to Mounting and Operating Instructions EB 2552 EN for more details.

Dimensions and weights

Type 2422 Valve · Balanced by a bellows



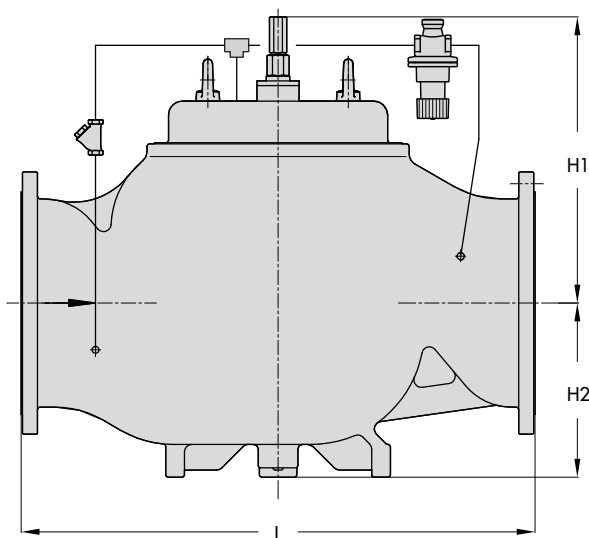
Type 2333 Pressure Reducing Valve/
Type 2335 Excess Pressure Valve
NPS 6 to 10 · Version balanced by a bellows

Valve size NPS		6	8	10
Length L	Class 125/ 150	17.75" 451 mm	21.4" 543 mm	26.5" 673 mm
	Class 300	18.6" 473 mm	22.4" 568 mm	27.9" 708 mm
Height H1, approx.		23.2" 590 mm	28.7" 730 mm	
Height H2, approx.		6.9" 175 mm	10.2" 260 mm	
Weight ¹⁾ , approx.	lb	260	573	672
	kg	118	260	305

¹⁾ +10 % for A216 WCC and stainless steel A351 CF8M

Drawing shows the version with Type 44-0 B Pressure Reducing Valve as the pilot valve

Type 2422 Valve · Balanced by a diaphragm



Type 2333 Pressure Reducing Valve/
Type 2335 Excess Pressure Valve
NPS 6 to 16 · Version balanced by a diaphragm

Valve size	NPS	6	8	10	12	16
Length L	Class 125/ 150	17.75" 451 mm	21.4" 543 mm	26.5" 673 mm	29" 737 mm	40" 1016 mm
	Class 300	18.6" 473 mm	22.4" 568 mm	27.9" 708 mm	30.5" 775 mm	-
Height H1, approx.		12.2" 310 mm	14.9" 380 mm	20" 510 mm	24" 610 mm	
Height H2, approx.		6.9" 175 mm	10.2" 260 mm	11.4" 290 mm	15.4" 390 mm	
Weight ¹⁾	lb	154	463	585	695	1378
	kg	70	210	220	315	625

¹⁾ Specifications based on Class 125 with Type 50 ES Pilot Valve
+10 % for A216 WCC and stainless steel A351 CF8M

Drawing shows the version with Type 44-1 B Pressure Reducing Valve as the pilot valve

Fig. 3 · Dimensions

Ordering text

Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve

NPS ..., balanced by a bellows/diaphragm (NPS 6 and higher)

Body material ..., Class ...

With pilot valve Type..., set point range ... psi (bar)

Medium ..., max. medium temperature ... °F (°C)

Optionally, special version ...

Specifications subject to change without notice



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2014-07