

Self-operated Pressure Regulators

Pilot operated by the medium



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

ANSI version

Application

Pressure regulators for set points from **14.5 to 400 psi (1 bar to 28 bar)** · Valves in **NPS 6, 8, 10 and 12¹⁾** (DN 150, 200, 250 and 300) · 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 as a pressure reducing valve or an excess pressure valve - determines the regulator's function.

Special features

- Low-maintenance proportional regulator requiring no auxiliary energy
- High dynamic response and small offset, meaning high control accuracy due to the attached pilot valve
- Easy set point adjustment on the pilot valve
- Single-seated globe valve with flanges

Versions

- Type 2422 Valve (modified) balanced by a bellows or diaphragm with a soft-seated plug and an internal spring to close the valve (without actuator)
- 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 A 126 B, carbon steel A 216 WCC or stainless steel A 351 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. The standard version with Type 50 ES Pilot Valve particularly suitable for cold water applications.

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. The standard version is equipped with Type 44-6 B Excess Pressure Valve.

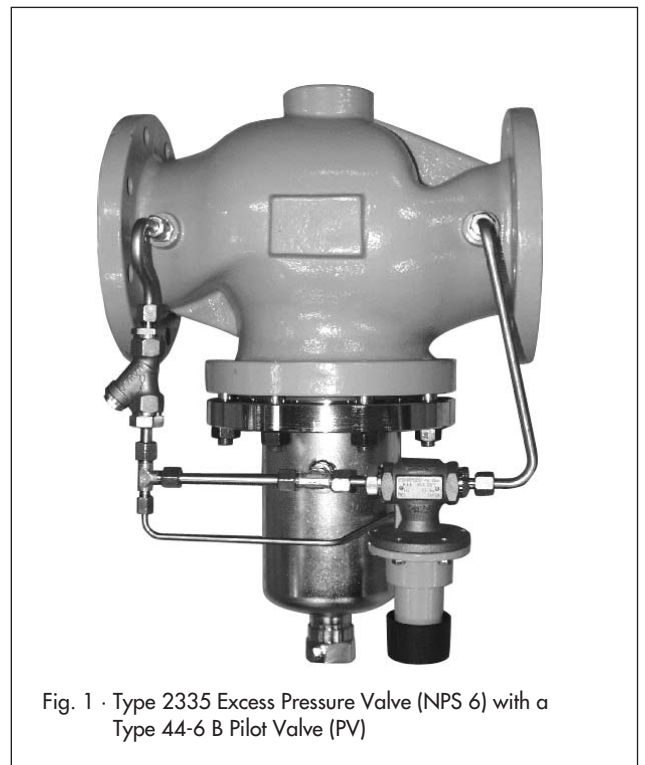


Fig. 1 · Type 2335 Excess Pressure Valve (NPS 6) with a Type 44-6 B Pilot Valve (PV)

Special versions

- With flow divider for noise reduction (not for liquids)
- Lower minimum required differential pressure
- Larger nominal sizes
- Oil-resistant version
- For flammable gases on request
- Version with metal sealing for temperatures above 430 °F (220 °C)
- Version free of non-ferrous metal
- Version for deionized water
- Version for oxygen
- Additionally with 2/2-way solenoid valve for either emergency operation via a remote control unit or limitation when used in combination with an electric safety pressure limiter

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.

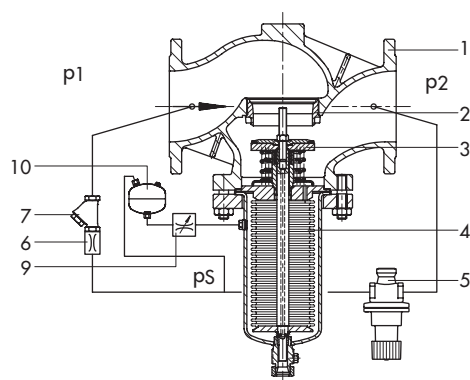
If the PV remains closed, the valve is fully balanced. The upstream pressure p_1 counterbalances the control pressure p_s ($p_s = p_1$) acting on the outside of the balancing bellows (4) (or on the balancing diaphragm in the case of valves balanced by a diaphragm) between the pilot valve and the fixed restrictor (6) or Venturi nozzle (8). The spring located below the plug closes the valve. By opening the PV, the differential pressure across the fixed restrictor (6) or Venturi nozzle (8) increases. The force acting on the plug opposes the force of the positioning spring and opens the valve.

For safe operation of both valve types (pressure reducing valve and excess pressure valve), the minimum differential pressure Δp_{min} (see Table 1) must exist.

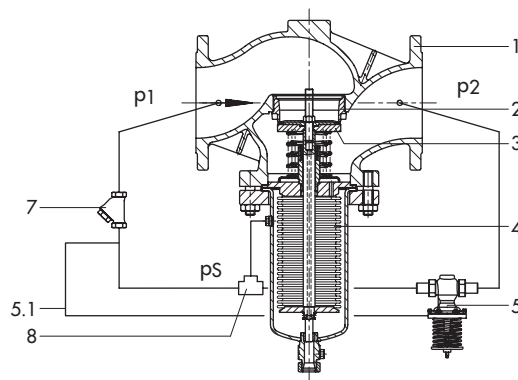
In the **Type 2333 Pressure Reducing Valve**, a rise in downstream pressure p_2 causes the pilot valve (5) to close. The control pressure p_s increases, and the plug (3) closes the valve. When the pilot valve (5) is closed ($p_s = p_1$), the pressure reducing valve is also completely closed.

In the **Type 2335 Excess Pressure Valve**, a rise in upstream pressure p_1 causes the pilot valve (5) to open. The control pressure p_s decreases. The valve opens against the force of the positioning springs.

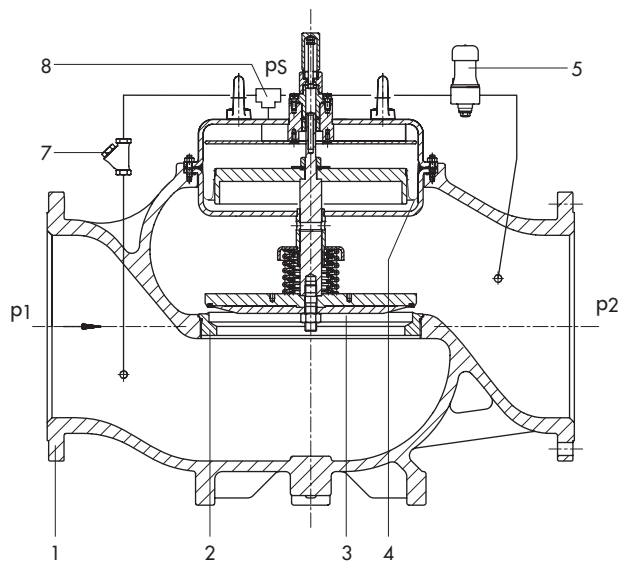
The **regulator versions for steam** are available only with valves balanced by a bellows. It has an equalizing tank (10) already fitted in the control line. Prior to start-up, the tank must be filled with water.



Type 2333 Pressure Reducing Valve (NPS 6, 8 and 10),
Type 2422 Valve balanced by a bellows
Suitable for vapors



Type 2335 Excess Pressure Valve (NPS 6, 8 and 10),
Type 2422 Valve balanced by a bellows
Suitable for liquids and gases



Type 2333 Pressure Reducing Valve (NPS 6, 8, 10 and 12),
Type 2422 Valve balanced by a diaphragm
Suitable for liquids and gases

- 1 Valve body
 - 2 Valve seat
 - 3 Plug with plug stem and positioning spring
 - 4 Balancing bellows or diaphragm
 - 5 Pilot valve (PV)
 - 5.1 Set point pressure line
 - 6 Fixed restriction or needle valve (with version for steam only)
 - 7 Strainer
 - 8 Venturi nozzle (for gases and liquids)
 - 9 Needle valve
 - 10 Equalizing tank
- p_s Control pressure
 p_1 Upstream pressure
 p_2 Downstream pressure

Fig. 2 · Sectional views

Table 1 · Technical data · All pressures as gauge pressures

Type 2422 Valve · Balanced by a bellows · Suitable for liquids, gases and vapors				
Pressure rating		Class 125 to 300		
Nominal size		NPS 6 · DN 150	NPS 8 · DN 200	NPS 10 · DN 250
Flow coefficients	C_V	420	610	730
	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
Version for gases and liquids Min. differential pressure Δp_{min}		13 psi · 0.9 bar	9 psi · 0.6 bar	
Version for vapors Min. differential pressure Δp_{min}		14.5 psi · 1.0 bar	12 psi · 0.8 bar	
Max. permissible differential pressure Δp_{max}		175 psi · 12 bar	145 psi · 10 bar	
Leakage rate		$\leq 0.1\%$ of C_V (K_{VS}) coefficient ¹⁾		
Max. permissible temperature, depending on the pilot valve used		Type 50 ES: 120 °F (50 °C) · Types 44-2/44-7: 300 °F (150 °C) · Types 44-0 B/44-6 B/M 44-2: max. 390 °F (200 °C) · Type 44-1 B: max. 300 °F (150 °C) Types 41-23/41-73: max. 660 °F (350 °C)		
Set point ranges, continuously adjustable at the pilot valve	psi	Type 50 ES: 15 to 60; 35 to 90; 60 to 145 · Type 44-2: 15 to 60; 30 to 63; 36 to 94; 90 to 155 · Type 44-7: 15 to 60; 30 to 66; 36 to 100; 90 to 165 · Types M 44-2/M 44-7: 15 to 75; 60 to 180 · Types 44-0 B/44-1 B/44-6 B: 15 to 60; 30 to 90; 60 to 150; 120 to 290 Types 44-1 B/44-6 B: 120 to 290 bar · Types 41-23/41-73: 10 to 35; 30 to 75; 65 to 145; 115 to 230; 145 to 290; 290 to 400		
	bar	Type 50 ES: 1 to 4; 2.5 to 6; 4 to 10 · Type 44-2: 1 to 4; 2 to 4.2; 2.4 to 6.3; 6 to 10.5 · Type 44-7: 1 to 4; 2 to 4.4; 2.4 to 6.6; 6 to 11 · Types M 44-2/M 44-7: 1 to 5; 4 to 12 · Types 44-0 B/44-1 B/44-6 B: 1 to 4; 2 to 6; 4 to 10; 8 to 20 bar · Types 44-1 B/44-6 B: 8 to 20 bar · Types 41-23/41-73: 0.8 to 2.5; 2 to 5; 4.5 to 10; 8 to 16; 10 to 22; 20 to 28		

¹⁾ $\leq 0.05\%$ of K_{VS} coefficient with soft-seated plug

Type 2422 Valve · Balanced by a diaphragm · Suitable for liquids and gases					
Pressure rating		Class 125 to 300			
Nominal size		NPS 6 · DN 150	NPS 8 · DN 200	NPS 10 · DN 250	NPS 12 · DN 300
Flow coefficients	C_V	445	760	930	1440
	K_{VS}	380	650	800	1250
Minimum differential pressure Δp_{min}	psi	6.5	6		4.5
	bar	0.45	0.4		0.3
Max. permissible differential pressure Δp_{max}	psi	175	145		
	bar	12	10		
Leakage rate		$\leq 0.05\%$ of C_V (K_{VS}) coefficient			
Max. permissible temperature, depending on the pilot valve used		Type 50 ES: 120 °F (50 °C) · Type 44-2/44-7, Types 44-1 B/44-6 B/M 44-2/M 44-7: 300 °F (150 °C) for water, 175 °F (80 °C) for non-flammable gases · Steam pressure regulator as special version on request			
Set point ranges, continuously adjustable at the pilot valve	psi	Type 50 ES: 14.5 to 60; 35 to 90; 60 to 145 · Type 44-2: 15 to 60; 30 to 63; 36 to 94; 90 to 155 · Type 44-7: 15 to 60; 30 to 66; 36 to 100; 90 to 165 · Types M 44-2/M 44-7: 15 to 75; 60 to 180 · Types 44-1 B/44-6 B: 15 to 60; 30 to 90; 60 to 145; 120 to 290			
	bar	Type 50 ES: 1 to 4; 2.5 to 6; 4 to 10 · Type 44-2: 1 to 4; 2 to 4.2; 2.4 to 6.3; 6 to 10.5 · Type 44-7: 1 to 4; 2 to 4.4; 2.4 to 6.6; 6 to 11 · Type M 44-2/M 44-7: 1 to 5; 4 to 12 · Types 44-1 B/44-6 B: 1 to 4; 2 to 6; 4 to 10; 8 to 20			

Pilot valves for Type 2333 Pressure Reducing Valve

- **Type 50 ES** · For cold water, oil and non-flammable gases 120 °F (50 °C)
- **Type 44-2** · For liquids and oil 300 °F (150 °C), non-flammable gases 175 °F (80 °C)
- **Type 44-1 B** · For liquids 300 °F (150 °C), non-flammable gases 175 °F (80 °C)
- **Type 44-0 B** · For steam 390 °F (200 °C)
- **Type M 44-2** · For liquids 300 °F (150 °C), non-flammable gases 175 °F (80 °C) and steam 390 °F (200 °C)
- **Type 41-23** · For liquids, steam 660 °F (350 °C), non-flammable gases 175 °F (80 °C)

Pilot valves for Type 2335 Excess Pressure Valve

- **Type 44-7** · For liquids and oil 300 °F (150 °C), non-flammable gases 175 °F (80 °C)
- **Type 44-6 B** · For liquids 300 °F (150 °C), non-flammable gases 175 °F (80 °C) and steam 390 °F (200 °C)
- **Type M 44-7** · For liquids 300 °F (150 °C), non-flammable gases 175 °F (80 °C) and steam 390 °F (200 °C)
- **Type 41-73** · For liquids, steam 660 °F (350 °C), non-flammable gases 175 °F (80 °C)

Table 2 · Pilot valves, overview · Technical data

Pilot valve (PV)	Nom. pressure	Connection	Material	C_V K_{VS}	Set point ranges	Medium	Data Sheet
Type 50 ES PRV	PN 16	G ½	Brass	$C_V = 1.2/$ $K_{VS} = 0.93$	1 to 10 bar	Water, liquids and gases up to 120 °F (50 °C)	T 2555 EN
Type 44-2 PRV	PN 25	DN 15	Red brass	$C_V = 1.2/$ $K_{VS} = 1$	1 to 10.5 bar	Liquids and oil up to 300 °F (150 °C), gases up to 175 °F (80 °C)	T 2623 EN and T 2723 EN
Type 44-7 EPV					1 to 11 bar		
Type 44-1B PRV	Cl 250/ PN 25	G ½	Red brass or CrNiMo steel	$C_V = 1.2/$ $K_{VS} = 1$	14.5 to 290 psi/ 1 to 20 bar	Liquids and oil up to 300 °F (150 °C), gases up to 175 °F (80 °C)	T 2626 EN/ T 2627 EN
Type 44-0 B PRV						Steam up to 390 °F (200 °C)	
Type 44-6 B EPV						Liquids and oil up to 300 °F (150 °C), gases up to 175 °F (80 °C), steam up to 390 °F (200 °C)	
Type M 44-2 PRV	PN 40	G ½, DN 15	CrNiMo steel	$C_V = 1.8/$ $K_{VS} = 1.5$	30 to 175 psi/ 1 to 12 bar	Liquids and gases up to 265 °F (130 °C), steam up to 390 °F (200 °C)	T 2530 EN
Type M 44-7 EPV	PN 25						T 2532 EN
Type 41-23 PRV	Cl 125 to 300	NPS ½/ DN 15	EN-JL 1040, 1.0619, EN-JS 1049, CrNiMo steel	$C_V = 1.2/$ $K_{VS} = 1$	10 to 400 psi/ 0.8 to 28 bar	Liquids and steam up to 660 °F (350 °C), gases up to 175 °F (80 °C)	T 2512 EN/ T 2513 EN
Type 41-73 EPV	PN 16 to 40						T 2517 EN/ T 2518 EN

Pilot valve designation: PRV = Pressure Reducing Valve, EPV = Excess Pressure Valve

Material designations according to ANSI: A126 B (EN-JL 1040) · A 216 WCC (1.0619) · A 395 (EN-JS 1049)

Table 3 · Materials · Material numbers according to ASTM and DIN

Type 2422 Valve · Balanced by a bellows			
Pressure rating	Class 125	Class 150	Class 150 · Class 300
Body	Cast iron A 126 WCB	Carbon steel A 216 WCC	Stainless carbon steel A 351 CF8M
Valve seat	Stainless steel 1.4006		1.4581
Plug	Standard version ¹⁾	Stainless steel (1.4301) with PTFE soft sealing, max 430 °F (220 °C)	
	Oil-resistant version	PTFE soft sealing, max. 430 °F (220 °C)	
	Version for steam	PTFE soft sealing, max. 430 °F (220 °C) · Metal sealing, max. 660 °F (350 °C)	
Pressure balancing	Balancing cases of sheet steel DD11 · Balancing bellows of 1.4571		
Gasket	Graphite on metal core		

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

Table 4 · Materials · Material numbers according to ASTM and DIN

Type 2422 Valve · Balanced by a diaphragm			
Pressure rating		Class 125	Class 150 · Class 300
Body		Cast iron A 126 B	Carbon steel A 216 WCC
Valve seat		Class 150 · Class 300 ²⁾	
Valve seat		NPS 6 to 10: Red brass · NPS 12: Stainless steel 1.4006	1.4571
Plug	Standard version	NPS 6 to 10: Red brass · NPS 12: Stainless steel (1.4301) with EPDM soft sealing 1), max. 300 °F (150 °C)	
Pressure balancing		Balancing cases of sheet steel DD11 · EPDM balancing diaphragm, max. 300 °F (150 °C) NBR balancing diaphragm, max. 140 °F (60 °C)	
Gasket		Graphite on metal core	

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

²⁾ NPS 6 to 10

Pressure-temperature diagram - Materials acc. to ASTM -

The scope of application, the permissible pressures and temperatures are restricted by the specifications in the pressure-temperature diagram and by the pressure rating.

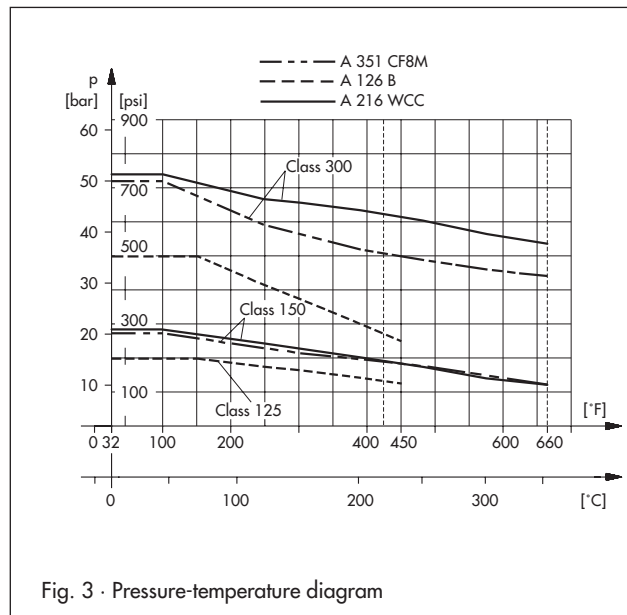


Fig. 3 · Pressure-temperature diagram

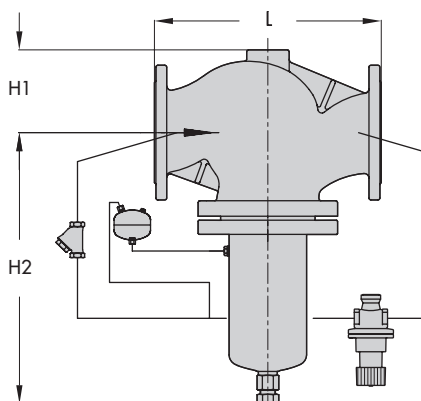
Installation

- 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 vertically suspended;
 - **Valve balanced by a diaphragm:** installation with the balancing diaphragm pointing upwards
 - 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

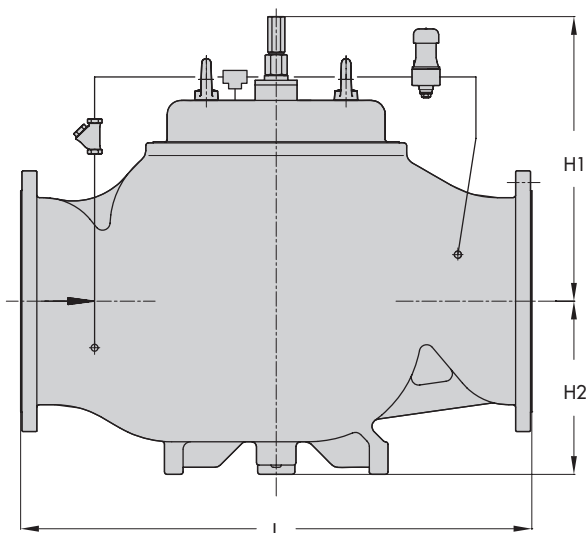


Type 2333 Pressure Reducing Valve/
Type 2335 Excess Pressure Valve
NPS 6 to 10 · Version balanced by a bellows

Nominal size NPS	6	8	10	
Length L	Cl 125/150	17.75" 451 mm	21.4" 543 mm	26.5" 673 mm
	Cl 300	18.6" 473 mm	22.4" 568 mm	27.9" 708 mm
Height H2, approx.	23.2" 590 mm	28.7" 730 mm		
Height H1, approx.	6.9" 175 mm	9.25" 235 mm	10.2" 260 mm	
Weight ¹⁾ , approx.	lb	260	573	672
	kg	118	260	305

¹⁾ +10 % for A 216 WCC/Class 150 and A 351 CF8M

Type 2422 Valve · Balanced by a diaphragm



Type 2333 Pressure Reducing Valve/
Type 2335 Excess Pressure Valve
NPS 6 to 12 · Version balanced by a diaphragm

Nominal size NPS	6	8	10	12	
Length L	Cl 125/150	17.75" 451 mm	21.4" 543 mm	26.5" 673 mm	29" 737 mm
	Cl 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		
Height H2, approx	6.9" 175 mm	10.2" 260 mm	11.4" 290 mm		
Weight ¹⁾ (Cl 125 with Type 50 ES)	lb	188	563	589	844
	kg	70	210	220	315

¹⁾ +10 % for A 216 WCC/Class 150 and A 351 CF8M

Drawings show the version with Type 50 ES Pressure Reducing Valve as the pilot valve

Fig. 4 · Dimensions

Ordering text

Pressure Reducing Valve Type 2333/Excess Pressure Valve Type 2335

NPS ...

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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