INFORMATION SHEET

T 2500 EN

Self-operated Pressure Regulators

PN 16 to 40	·	**Class 125 to 300**
DN 15 to 400	·	**NPS ½ to 16**
G ⅜ to 1	·	**½ NPT to 1 NPT**
–10 to 350 °C	·	**15 to 660 °F**

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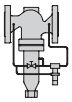
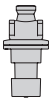
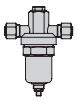
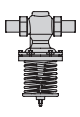
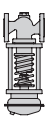
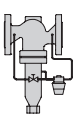
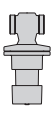
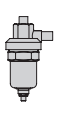
Pressure reducing valve · The valve closes when the downstream pressure rises

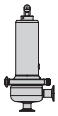
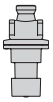
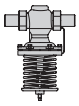
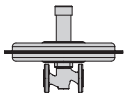
Can be used for	Steam	•	•	•	•		
	Water and other liquids	•	•	•		•	
	Oil	•	•	•		•	
	Gases [1]	•	•	•		•	
	District heating						
Connection	Female thread				•		
	Welding ends					•	
	Threaded ends						
	Flanges	•	•	•	•		
Valve size	DN	15 to 100	125 to 250	125 to 400	15, 25, 40, 50	20	
Connection size	G				½ to 1		
Pressure rating	PN	16 to 40	16 to 40	16 to 40	25	40, 50, 63	
Max. permissible temperature	°C	350	350	350	200	–196 to +200	
Set point ranges	bar	0.05 to 28	0.05 to 2.5	2 to 28	0.2 to 20	1 to 40	
Body material	Brass					•	
	Red brass				•		
	Cast iron	•	•	•			
	Sph. graphite iron	•	•	•	•		
	Cast steel	•	•	•			
	Stainless steel	•	•	•	• [4]		
Type		**41-23** [4]	**2422/2424** [4]	**2333** [4] [5]	**44-0 B**	**2357- ...**	
Data Sheet		▶ **T 2512**	▶ **T 2547**	▶ **T 2552**	▶ **T 2628**	▶ **T 2557/58/59/60**	
							

Excess pressure valves · The valve opens when the upstream pressure rises

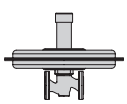
Can be used for	Steam		•	•	•	•	
	Water and other liquids	•	•	•	•	•	•
	Oil	•	•	•	•	•	•
	Gases [1]	•	•	•	•	•	•
	District heating						
Connection	Female thread					•	
	Welding ends	•					• [2]
	Threaded ends	•					
	Flanges	•	•	•	•	•	
Valve size	DN	15 to 50	15 to 100	125 to 250	125 to 400	15, 25, 40, 50	20
Connection size	G					½ to 1	
Pressure rating	PN	25	16 to 40	16 to 40	16 to 40	25	40, 50, 63
Max. permissible temperature	°C	150	350	350	350	200	–196 to +200
Set point ranges	bar	0.1 to 11	0.05 to 28	0.05 to 2.5	2 to 28	0.2 to 20	1 to 40
Body material	Brass						•
	Red brass	•				•	
	Cast iron		•	•	•		
	Sph. graphite iron	• [3]	•	•	•	•	
	Cast steel		•	•	•		
	Stainless steel		•	•	•	• [4]	•
Type		**44-7**	**41-73** [4]	**2422/2425** [4]	**2335** [4] [5]	**44-6 B**	**2357- ...**
Data Sheet		▶ **T 2723**	▶ **T 2517**	▶ **T 2549**	▶ **T 2552**	▶ **T 2626**	▶ **T 2557/58/59/60**
							

[1] Version for flammable gases on request [2] Soldering ends [3] DN 32 to 50 [4] Also in JIS version [5] Alternative: pilot-operated Type 2334 Universal Regulators

Pressure reducing valve · The valve closes when the downstream pressure rises

•	•	•		•	
•	•	•			
•	•	•	•	•	•
	•				
		•			
		•			
• [4]	•	•	•	•	•
15 to 50	15, 25, 40, 50	15 to 50	15 to 50	15 to 50	25 to 150
	½ to 1				
10 [5]	25	25	16 to 40	40	16 to 40
160	150 [7]	150	60 (150) [6]	80	–20 to +90
0.3 to 6	0.2 to 20	0.5 to 10.5	0.005 to 10	0.8 to 16	0.003 to 0.1
	•	•			•
			•		
	•	• [1]	•		•
			•		•
• [2]	• [3]		•	•	•
2371-10/11	**44-1 B**	**44-2**	**2405**	**2373**	**2404-1**
▶ T 2640	**▶ T 2626**	**▶ T 2623**	**▶ T 2520**	**▶ T 2534**	**▶ T 2538**
						

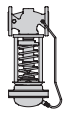
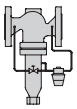
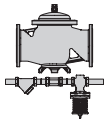
Excess pressure valves · The valve opens when the upstream pressure rises

•		•	
•			
•	•	•	•
•			
• [4]	•	•	•
15 to 50	15 to 50	15 to 50	65 to 400
10 [5]	16 to 40	40	16, 40
160	60 (150) [6]	80	–20 to +90 °C
0.3 to 6	0.005 to 10	0.8 to 16	0.005 to 0.2
			•
	•		
	•		•
	•		•
• [2]	•	•	•
2371-00/01	**2406**	**2375**	**2404-2**
▶ T 2642	**▶ T 2522**	**▶ T 2536**	**▶ T 2540**
				

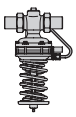
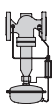
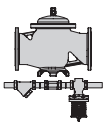
[1] DN 32 to 50 [2] Material: 1.4404 [3] Also in JIS version [4] Additional threaded and clamp connections [5] Max. operating pressure 10 bar

[6] Unbalanced version with FKM diaphragm and FKM soft seal [7] Special version up to 200 °C

Safety shut-off valves (SSV) · The valve closes when the downstream pressure rises · Typetested for water by TÜV

Can be used for	Steam					
	Water and other liquids	•	•	•	•	•
	Oil	• [3]	• [3]			
	Gases [1]	• [3]	• [3]	•		
	District heating	•	•	•	•	•
Connection	Female thread					
	Welding ends	•	•			
	Threaded ends	•	•			
	Flanges	•	•	•	•	•
Valve size	DN	15 to 50	15 to 50	15 to 100	65 to 250	65 to 400
Pressure rating	PN	25	25	16 to 40	16 to 40	16 to 40
Max. permissible temperature	°C	150	150	150	150	150
Set point ranges	bar	2 to 10.5	2 to 10.5	2 to 10	1 to 10.5	See pilot valve
Body material	Brass					
	Red brass	•	•			
	Cast iron			•	•	•
	Sph. graphite iron	• [1]	• [1]	•	•	•
	Cast steel			•	•	•
	Stainless steel					
Type		**44-3**	**44-9**	**36-4**	**33-1**	**2334**
Data Sheet		**▶ T 2623**	**▶ T 2630**	**▶ T 2546-3**	**▶ T 2551**	**▶ T 3210**
						

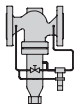
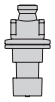
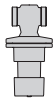
Safety excess pressure valves (SEV) · The valve opens when the upstream pressure rises · Typetested for water by TÜV

Can be used for	Steam					•
	Water and other liquids	•	•	•	•	•
	Oil	• [3]				•
	Gases [1]	• [3]	•	•		•
	District heating	•	•		•	• [2]
Connection	Female thread					
	Welding ends	•				
	Threaded ends	•				
	Flanges	•	•	•	•	•
Valve size	DN	15 to 50	15 to 100	65 to 250	65 to 400	15 to 250
Pressure rating	PN	25	16 to 40	16 to 40	16 to 40	16 to 40
Max. permissible temperature	°C	150	150	150	150	150/350
Set point ranges	bar	2 to 11	2 to 11	1 to 11	See pilot valve	1 to 10
Body material	Brass					
	Red brass	•				
	Cast iron		•	•	•	•
	Sph. graphite iron	• [1]	•	•	•	•
	Cast steel		•	•	•	•
	Stainless steel					•
Type		**44-4**	**36-8**	**33-7**	**2334**	**Type 1/4/9/2401**
Data Sheet		**▶ T 2632**	**▶ T 2546-2**	**▶ T 2551**	**▶ T 3210**	**▶ T 2519**
						 Safety devices

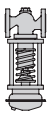
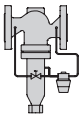
[1] DN 32 to 50 [2] Typetested as pressure limiter [3] Not typetested

ANSI versions

Pressure reducing valve · The valve closes when the downstream pressure rises

Can be used for	Steam		•	•	•	•	
	Water and other liquids		•	•	•		•
	Oil		•	•	•		•
	Gases [1]		•	•	•		•
	District heating						
Connection	Female thread					•	•
	Welding ends						
	Threaded ends						
	Flanges		•	•	•	•	•
Valve size		NPS	½ to 4	6 to 10	6 to 16	½ and 1	½ and 1
Connection size		NPT				½ to 1	½ to 1
Class			125 to 300	125 to 300	125 to 300	150/300 [4]	150/300 [4]
Max. permissible temperature		°F	660	660	660	390	300
Set point ranges		psi	0.75 to 400	0.75 to 35	30 to 400	3 to 290	3 to 290
Body material	Red brass (C83600)						
	Cast iron (A126B)		•	•	•		
	Cast steel (A216 WCC)		•	•	•		
	Stainless steel (A351 CF8M)		•	•	•	•	•
Type			**41-23**	**2422/2424**	**2333** [2]	**44-0 B**	**44-1 B**
Data Sheet			**▶ T 2513**	**▶ T 2548**	**▶ T 2554**	**▶ T 2629**	**▶ T 2627**
							

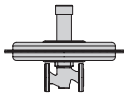
Excess pressure valves · The valve opens when the upstream pressure rises

Can be used for	Steam		•	•	•	•
	Water and other liquids		•	•	•	•
	Oil		•	•	•	•
	Gases [1]		•	•	•	•
	District heating					
Connection	Female thread					•
	Welding ends					
	Threaded ends					
	Flanges		•	•	•	•
Valve size		NPS	½ to 4	6 to 10	6 to 16	½ and 1
Connection size		NPT				½ to 1
Class			125 to 300	125 to 300	125 to 300	150/300 [4]
Max. permissible temperature		°F	660	660	660	390
Set point ranges		psi	0.75 to 400	0.75 to 35	30 to 400	3 to 290
Body material	Red brass (C83600)					
	Cast iron (A126B)		•	•	•	
	Cast steel (A216 WCC)		•	•	•	
	Stainless steel (A351 CF8M)		•	•	•	•
Type			**41-73**	**2422/2425**	**2335** [2]	**44-6 B** [3]
Data Sheet			**▶ T 2518**	**▶ T 2550**	**▶ T 2554**	**▶ T 2627**
						

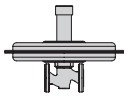
[1] Version for flammable gases on request
[2] Alternative: Type 2334 Pilot-operated Regulator
[3] Max. operating pressure 150 psi
[4] Max. input pressure 275 psi (19 bar)

ANSI versions

Pressure reducing valve · The valve closes when the downstream pressure rises

Can be used for	Steam			
	Water and other liquids	•		
	Oil	•		
	Gases [1]	•	•	•
	District heating			
Connection	Female thread			
	Welding ends			
	Threaded ends			
	Flanges	• [5]	•	•
Valve size	NPS	½ to 2	½ to 2	1 to 6
Connection size	NPT			
Class		150 [4]	125 to 300	125, 150, 300
Max. permissible temperature	°F	320	140 (300) [2]	–5 to 195 °F
Set point ranges	psi	5 to 90	0.075 to 150	0.045 to 1.5
Body material	Red brass (C83600)			
	Cast iron (A126B)		•	•
	Cast steel (A216 WCC)		•	•
	Stainless steel (A351 CF8M)	• [3]	•	•
Type		**2371-10/11**	**2405**	**2404-1**
Data Sheet		**▶ T 2640**	**▶ T 2521**	**▶ T 2538**
				

Excess pressure valves · The valve opens when the upstream pressure rises

Can be used for	Steam			
	Water and other liquids	•		
	Oil	•		
	Gases [1]	•	•	•
	District heating			
Connection	Female thread			
	Welding ends	• [5]		
	Threaded ends			
	Flanges	• [5]	•	•
Valve size	NPS	½ to 1	½ to 2	2½ to 16
Connection size	NPT			
Class		150 [4]	125 to 300	150, 300
Max. permissible temperature	°F	320	140 (300) [2]	–5 to 195 °F
Set point ranges	psi	5 to 90	0.075 to 150	0.075 to 3
Body material	Red brass (C83600)			
	Cast iron (A126B)		•	•
	Cast steel (A216 WCC)		•	•
	Stainless steel (A351 CF8M)	• [3]	•	•
Type		**2371-00/01**	**2406**	**2404-2**
Data Sheet		**▶ T 2642**	**▶ T 2523**	**▶ T 2540**
				

[1] Version for flammable gases on request

[2] For unbalanced versions with FKM diaphragm and FKM soft seal

[3] Material: 316L

[4] Max. operating pressure 150 psi

[5] Additional threaded and clamp connections

Principle of operation (see Fig. 1)

Self-operated pressure regulators are control devices whose measuring units draw their energy from the process medium which creates sufficient force to move the final control element (plug with plug stem).

The regulators consist of a valve and an actuator, which either opens or closes the valve when the pressure increases. The regulators are proportional regulators controlled by the process medium. Each deviation from the adjusted set point is assigned a certain valve plug position.

Pressure reducing valves

Pressure reducing valves or pressure reducing stations withdraw as much energy from a pressure vessel with a higher pressure level as needed to maintain a nearly constant pressure level in downstream equipment, although consumption fluctuates.

The pressure p_2 to be controlled (controlled variable x) produces the force $F_m = p_2 \times A$, which is proportional to the controlled variable, on the actuator area A. This force corresponds to the actual value and is compared at the plug stem with the spring force F_S = set point w. F_S is adjustable at the set point adjuster. If the pressure p_2 changes and in this way also the force F_m, the valve plug is being adjusted until $F_m = F_S$.

In the version functioning as a pressure reducing valve, the valve closes when the pressure to be maintained constant rises. The regulator, in this case a pressure reducing valve, regulates the pressure p_2 downstream of the valve to the value adjusted at the set point adjuster.

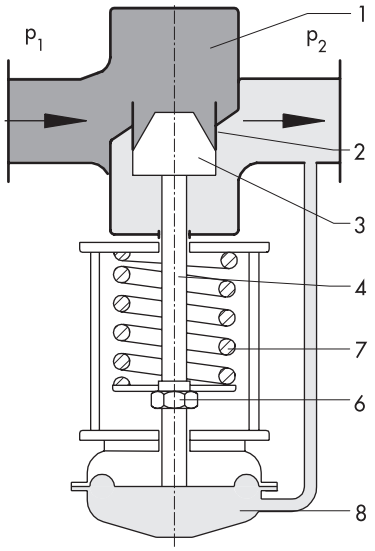
Excess pressure valves

The pressure p_1 to be controlled (controlled variable x) is picked up in the valve body and applied to one side of the actuator diaphragm. The force of the actuator $F_m = p_1 \times A$ is compared over the plug stem to the force F_S = set point w of the set point spring. In steady state (x = w) F_m is equal to F_S. If the pressure p_1 increases, the actuator force increases and the travel of the plug increases against the force of the set point spring. This causes the outlet flow to increase and the pressure p_1 to decrease until a new equilibrium is reached between actuator and spring force.

In the version functioning as an excess pressure valve, the valve opens when the pressure to be maintained constant rises. The regulator regulates the pressure p_1 upstream of the valve to the value adjusted at the set point adjuster.

Abbreviations

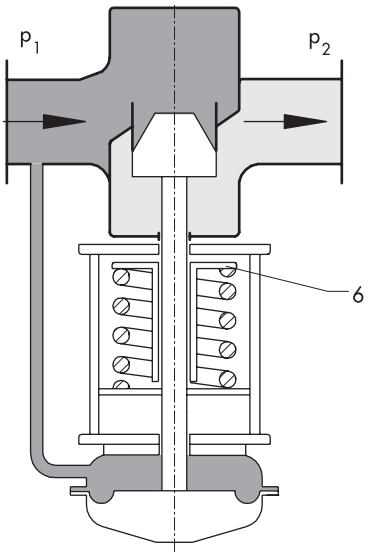
A	—	Actuator area in mm²
F	—	Force in N
F_M	—	Force acting on the diaphragm
F_S	—	Force of the set point spring
p_1	—	Upstream pressure in bar
p_2	—	Downstream pressure in bar
W	—	Set point
X	—	Controlled variable



Valve closed: $p_2 > p_1$

Pressure reducing valves

The valve closes when the downstream pressure rises ($p_2 > p_1$)



Valve closed: $p_1 < p_2$

Excess pressure valve

The valve opens when the upstream pressure rises ($p_1 > p_2$)

1 Valve body
2 Valve seat
3 Plug
4 Plug stem
5 Set point adjuster
6 Set point spring
8 Actuator

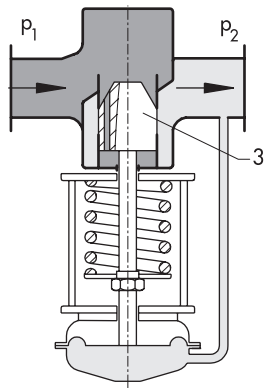
Fig. 1: *Functional diagram*

Details concerning pressure regulators

Pressure balancing

The control accuracy (offset) and stability of the control process depend on the disturbances occurring in the loop (for example, changes in upstream pressure and flow rate). The regulators are designed in such a way that the effect of these disturbances is relatively small. The force acting on the valve plug depending on, for example either the upstream or differential pressure can be eliminated by balancing the plug correspondingly. In unbalanced valves, the effect on the plug is a force resulting from the cross-sectional seat area and the differential pressure ($\Delta p = p_1 - p_2$). In regulators with pressure-balanced plugs, this effect is largely neutralized.

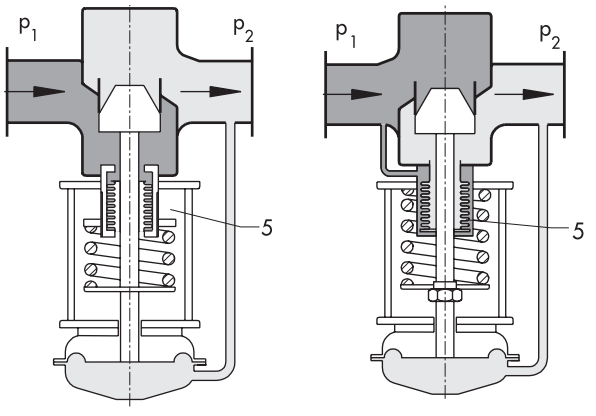
This version is, therefore, suitable for handling large pressure drops. Fig. 2 shows a plug balanced by a piston.



3 Plug balanced by a piston

Fig. 2: *Balanced by a piston*

In the regulator in Fig. 3 (left), the metal bellows balances the upstream pressure and provides an absolutely tight and frictionless plug stem seal. The right drawing shows a bellows arrangement for upstream and downstream pressure balancing.



Upstream pressure balancing and plug stem seal by a metal bellows

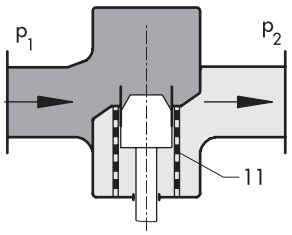
Upstream/downstream pressure balancing by a metal bellows

5 Metal bellows

Fig. 3: *Balanced by a metal bellows*

Low-noise operation with a flow divider

All regulators come with low-noise valve plugs. The valves (Fig. 4) used in the Type 41-23, Type 2422/2424, Type 41-73 and Type 2422/2425 Regulators can be equipped with a flow divider in special versions. Flow dividers are effective and reliable components used to reduce the noise level or to avoid critical conditions inside the valve. The maximum flow rate is restricted on using a flow divider.



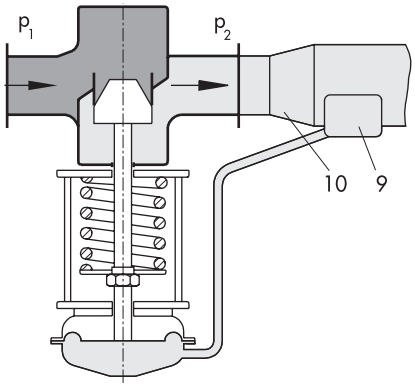
11 Flow divider

Fig. 4: *Valve with flow divider*

For noise calculation according to VDMA 24422, the correction terms ΔL_G for gases and vapors as well as ΔL_F for liquids are required on using flow dividers. Refer to the associated data sheet of the pressure regulator for more details.

Steam pressure control

In a steam pressure control application (Fig. 5), a compensation chamber is installed at the point of measurement. It allows steam to condense and protects the connected diaphragm system against high temperatures. Since the steam volume increases as the steam pressure decreases, it is often necessary to enlarge the piping diameter downstream of the regulator by installing a conical expansion piece. This expansion piece can double the nominal outlet diameter of the pipeline (e.g. DN 100 to 200).

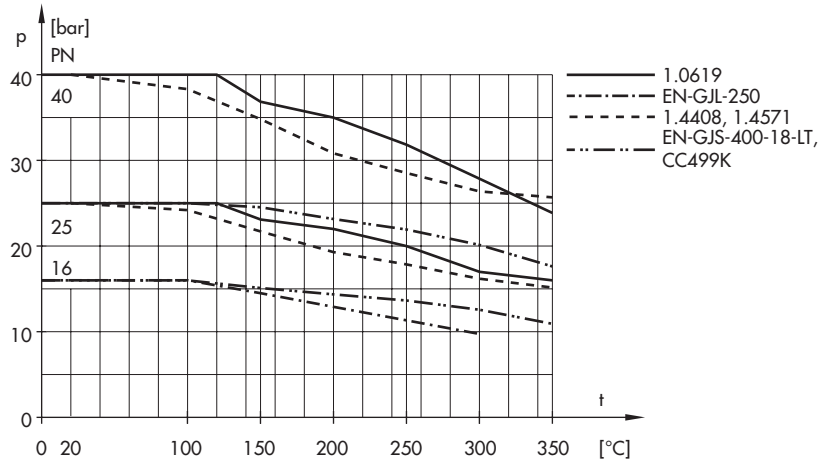


9 Compensation chamber
10 Conical expansion piece

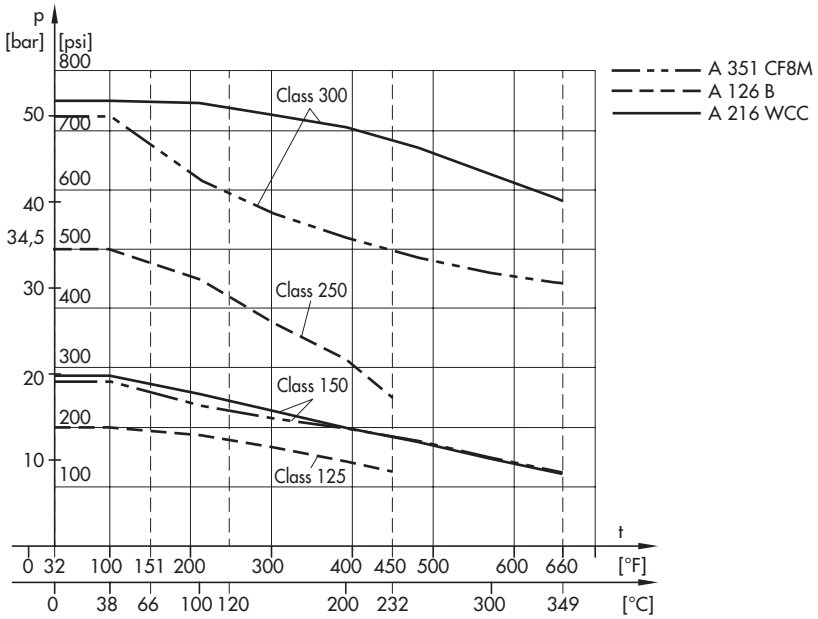
Fig. 5: *Steam pressure control*

Pressure-temperature diagram (DIN)

For DIN materials, the diagrams were created based on DIN EN 12516-1. For materials in accordance with US standards, these were created in compliance with ASME B16.1 and ASME B16.34.



Pressure-temperature diagram (ANSI)



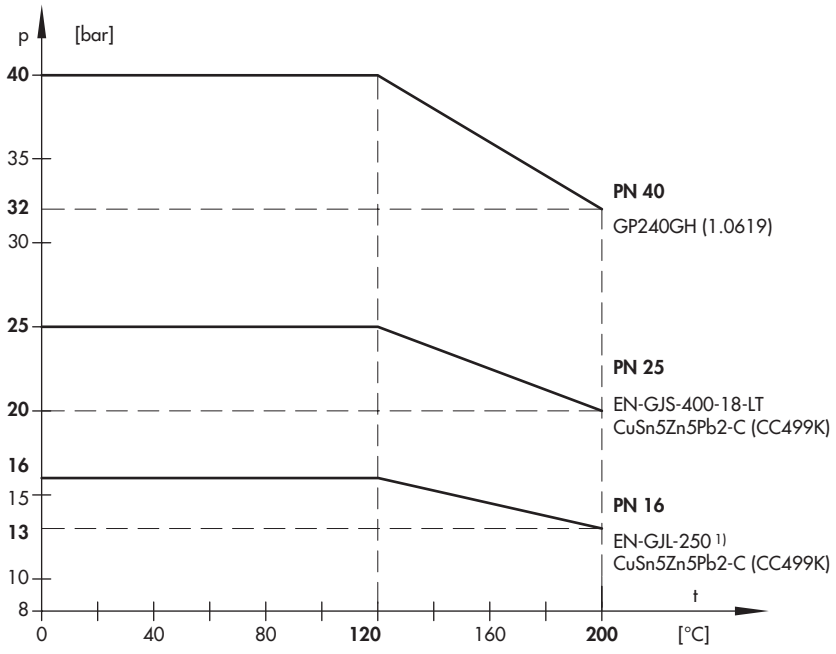
The diagram below applies to the use of regulators for district heating (see DIN 4747-1)

Pressure-temperature diagram according to DIN 4747-1 for selected materials

The materials for valves and connecting pieces must be suitable for sizing and the operating conditions.

In this case, material is selected according to DIN 4747-1.

Depending on the valve material, various pressure ratings are also permissible at different temperatures.



1) Permissible when network's flow temperature $\delta_{VN} \leq 130$ °C · $\delta_{VN} > 130$ °C only up to DN 100

Fig. 6: *Pressure-temperature diagrams (DIN EN material number)*

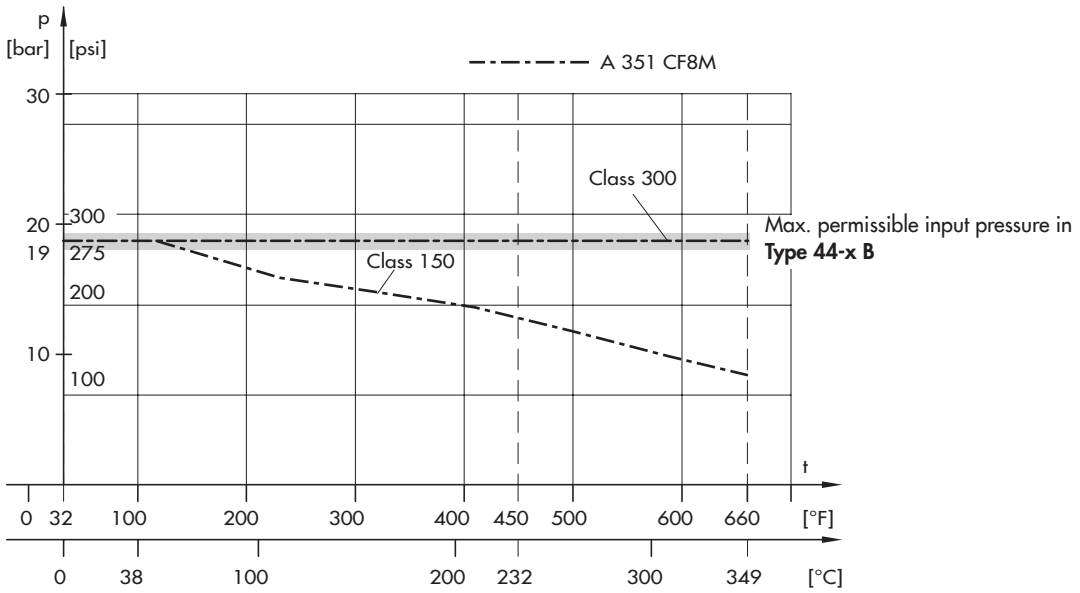


Fig. 7: *Pressure-temperature diagrams for **Type 44-x B** with ANSI materials*

Conversion factors

K_{VS} and C_V coefficient

The exact calculation is performed according to IEC 60534, parts 2-1 and 2-2. The ISA-S75.01-1-1985 standard and VDI/VDE directive 2173 are also used. The calculation of the K_V coefficient according to this directive is sufficiently accurate in most cases. The equations are also listed in the SAMSON Application Notes AB 04.

$K_{VS} = 0.86 \times C_V$ K_{VS} [m³/h]

$C_V = 1.17 \times K_{VS}$ C_V [U.S. gallons/min]

Pressure

1 pound/square inch [lbs/in² = psi] = 0.06895 bar

1 bar = 14.5 psi

Area

1 square inch [sq. in; in²] = 6.452 cm²

1 cm² = 0.155 in²

Ground

1 pound [lb] = 0.4536 kg 1 kg = 2.2046 lb

Mass flow

1 pound per second [lb/s] = 0,4536 kg/s

1 kg/s = 2.2046 lb/s

Flow rate

1 U.S. gallon per min [US gal/min] = 0.227 m³/h

1 m³/h = 4.4 US gal/min

Temperature

$°F = \frac{9}{5} °C + 32$

$°C = \frac{5}{9} (°F - 32)$

Pressure regulators for general applications

Self-operated regulators for general applications

- Low-maintenance, medium-controlled proportional regulators requiring no auxiliary energy
- Standard low-noise plug. Special version with flow divider ST 1 for further noise reduction
- Exchangeable set point springs and actuator
- Flanges

Type 41-23 · Pressure reducing valve

Type 41-73 · Excess pressure valve

- Frictionless plug stem seal with stainless steel bellows
- Single-seated valve with upstream and downstream pressure balancing
- Control line kit available for tapping the pressure directly at the valve body
- All wetted parts are free of non-ferrous metal

Technical data

Type 41-23 **Type 41-73**	**Data Sheet ▶ T 2512 · ▶ T 2513** **Data Sheet ▶ T 2517 · ▶ T 2518**
Set point ranges	0.05 to 28 bar · 0.75 to 230 psi
Valve size · Connection	DN 15 to 100 · NPS ½ to 4
Pressure rating	PN 16 to 40 · Class 125 to 300
Temperature ranges	
Liquids and steam	Up to 350 °C · Up to 660 °F
Gases	Up to 80 °C[1] · Up to 175 °F

[1] At the actuator

Type 2422/2424 · Pressure reducing valve

Type 2422/2425 · Excess pressure valve

- Convenient set point adjustment using a set point adjuster
- Spring-loaded, single-seated valve with upstream and downstream pressure balancing

Technical data

Type 2422/2424 **Type 2422/2425**	**Data Sheets ▶ T 2547 · ▶ T 2548** **Data Sheets ▶ T 2549 · ▶ T 2550**
Set point ranges	0.05 to 2.5 bar · 0.75 to 35 psi
Valve size · Connection	DN 125 to 250 · NPS 6 to 10
Pressure rating	PN 16 to 40 · Class 125 to 300
Temperature ranges	
Liquids and steam	Up to 350 °C · Up to 660 °F
Gases	Up to 80 °C[1] · Up to 175 °F

[1] At the actuator

Accessories

The Type 41-23, Type 41-73, Type 2422/2424 and Type 2422/2425 Regulators may require accessories, e.g. compensation chamber or screw joint with restriction.

For Type 41-23 and Type 41-73 Regulators, ready-made pipeline kits are available for the pressure tapping directly at the regulator body (set point range 0.8 bar) including a compensation chamber and screw joint with restriction.

The control line is ready for mounting and the regulator is ready to operate within a short time.

Data Sheet ▶ T 2595 contains a detailed description of accessories.

Type 41-23 Pressure Reducing Valve

Type 2422/2425 Excess Pressure Valve

Fig. 8: *Pressure regulators for general applications*

Series 44 Pressure Regulators

For pressure control of liquids, non-flammable gases and steam in pipelines up to DN 50 or G 2.

- Low-maintenance proportional regulators requiring no auxiliary energy
- Set point adjustment by changing the spring compression
- Upstream and downstream pressures are transmitted to the actuator through a bore hole in the valve body or over an attached control line

Type 44-0 B · Steam pressure reducing valve
Type 44-1 B · Pressure reducing valve
Type 44-6 B · Excess pressure valve

- Spring-loaded, single-seated valve with plug balanced by a stainless steel bellows
- Stainless steel operating bellows as operating element
- Control line integrated in the body
- Compact design
- Threaded connection
- Valve body made of spheroidal graphite iron, red brass or stainless steel

Technical data

Type 44-0 B	**Data Sheet ▶ T 2628 · ▶ T 2629**
Type 44-1 B · Type 44-6 B	**Data Sheet ▶ T 2626 · ▶ T 2627**
Set point ranges	0.2 to 20 bar · 3 to 290 psi
Valve size · Connection	DN 15, 25, 40 and 50 · ½ to 1 NPT
Pressure rating	PN 25 · Class 150/300 [1]
Temperature ranges	
Type 44-1 B/Type 44-6 B	
Liquids	Up to 150 °C · Up to 300 °F
Gases	Up to 80 °C · Up to 175 °F
Type 44-0 B	
Steam	Up to 200 °C · Up to 390 °F

[1] Max. input pressure 275 psi (19 bar)

Type 44-0 B Steam Pressure Reducing Valve in red brass

Type 44-0 B Steam Pressure Reducing Valve in stainless steel

Fig. 9: *Series 44 Regulators*

Regulators and equipment for safety requirements

Safety shut-off valves (SSV) and safety excess pressure valves (SEV)

These regulators meet enhanced safety requirements.

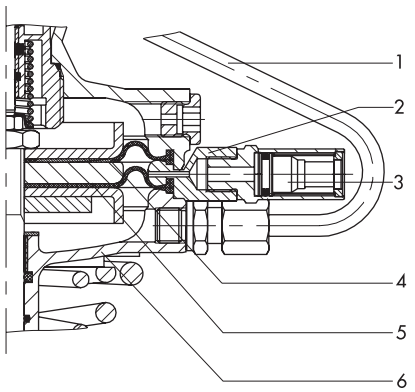
- Low-maintenance proportional regulators requiring no auxiliary energy
- Especially suitable for applications in district heating plants designed in accordance with DIN 4747-1. The regulators comply with AGFW (German District Heating Association) regulations for regulators with backup diaphragm.

Backup diaphragm

The regulators are equipped with two operating diaphragms. In case the actual operating diaphragm ruptures, the backup diaphragm ensures emergency operation or the regulator moves to the fail-safe position. To monitor the diaphragm condition, the intermediate ring is equipped with a visual diaphragm rupture indicator or a pressure switch can be optionally used to indicate the condition (see Fig. 10).

Type test

The listed safety shut-off valves (SSV) and safety excess pressure valves (SEV) have been typetested for water by the German technical surveillance association TÜV.



1 Control line (turned into the plane of projection)
2 Distance ring
3 Diaphragm rupture indicator
4 Backup diaphragm
5 Operating diaphragm
6 Actuator (housing)

Fig. 10: *Version with backup diaphragm*

Type 44-2 · Pressure reducing valve

Type 44-3 · Safety shut-off valve (SSV) with pressure reducing valve

Type 44-7 · Excess Pressure Valve

Type 44-9 · Safety shut-off valve (SSV) with pressure reducing valve · Typetested for water by TÜV

Type 44-8 · Safety excess pressure valve (SEV)

- Standard easy-to-replace diaphragm for all set point ranges
- Single-seated valve with balanced plug
- Low-noise valve plug with soft seal
- Type 44-3/44-9 (SSV) and Type 44-4 (SEV) comply with AGFW (German District Heating Association) regulations concerning components in house substations (regulators with backup diaphragm)
- Connection nuts with welding ends

Type 44-2 · Type 44-3 · Type 44-7

- Type 44-3 (SSV): the backup diaphragm takes over the control task in the event that the operating diaphragm ruptures.

Technical data

Type 44-2 · Type 44-3 **Type 44-7**	**Data Sheet ▶ T 2623** **Data Sheet ▶ T 2723**
Set point ranges	0.2 to 10.5[1]/0.1 to 11 bar
Valve size [2]	DN 15 to 50
Pressure rating	PN 25
Temperature ranges	
Non-flammable gases	Up to 80 °C
Liquids	Up to 150 °C

[1] Type 44-2 and Type 44-3
[2] G ¾ to G 2½ male thread for coupling nut to connect welding ends or threaded ends · DN 32 to 50 also with flanged valve body

Type 44-3

Regulator with integrated pressure reducing valve and two diaphragms

Fig. 11: *Type 44-3* Safety Shut-off Valve (SSV)

Type 44-4 · Type 44-9

- In the event that a operating diaphragm ruptures, the backup diaphragm moves the valve plug into the fail-safe position open (SEV) and closed (SSV).

Technical data

Type 44-9 **Type 44-4**	**Data Sheet ▶ T 2630** **Data Sheet ▶ T 2632**
Set point ranges	2 to 11 bar
Valve size [1]	DN 15 to 50
Pressure rating	PN 25
Temperature ranges	
Non-flammable gases	Up to 80 °C
Liquids	Up to 150 °C

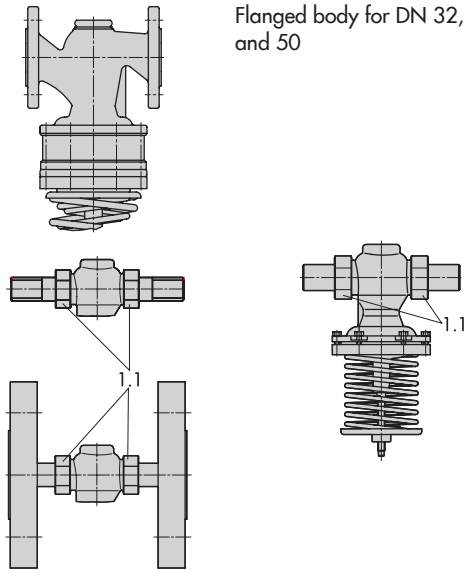
[1] G ¾ to G 2½ male thread for coupling nut to connect welding ends or threaded ends · DN 32 to 50 also with flanged valve body

End connections

The Types 44-2, 44-3, 44-4, 44-7 and 44-9 Regulators are available with sealing screwed connections (coupling nuts) and welding ends.

Optionally, threaded ends are available.

For nominal size DN 32, 40 and 50, flanged valve bodies made of spheroidal graphite iron are also available (not for Type 44-2).



Flanged body for DN 32, 40 and 50

1.1 Screwed connection (coupling nut)

Fig. 12: *End connections*

Type 36-4 · Safety shut-off valve (SSV) with pressure reducing valve

Type 36-8 · Safety excess pressure valve (SEV)

- Spring-loaded, single-seated valve with balanced plug
- Actuator with two diaphragms working independently from each other (regulator with backup diaphragm)
- Flanges

Technical data

Type 36-4 **Type 36-8**	**Data Sheet ▶ T 2546-3** **Data Sheet ▶ T 2546-2**
Set point ranges	2 to 10 bar/11 bar [1]
Valve size	DN 15 to 100
Pressure rating	PN 16 to 40
Temperature ranges	
Water and other liquids	Up to 150 °C
Air and non-flammable gases	Up to 80 °C

[1] Type 36-8

Type 36-4

Regulator with integrated pressure reducing valve and two diaphragms

Fig. 13: Type 36-4 Safety Shut-off Valve (SSV)

Pressure regulators with pilot valves

Regardless of whether a pressure reducing valve or excess pressure valve is used, the upstream pressure p_1 is transmitted to the pilot valve as auxiliary energy.

The pilot valve regulates the pressure to create a control pressure p_S dependent on the set point adjustment, which is compared to the pressure to be controlled acting from the top of the operating diaphragm.

- Pilot operated by the process medium
- Convenient set point adjustment at the pilot valve
- High dynamic response and small system deviation, i.e. excellent control accuracy

Type 33-1 · Safety shut-off valve (SSV) with pressure reducing valve

Type 33-7 · Safety excess pressure valve (SEV)

- Single-seated valve with upstream and downstream pressures balanced by a metal bellows
- Flanges

Technical data

Type 33-1 · Type 33-7	Data Sheet ▶ T 2551
Set point ranges	1 to 11 bar
Valve size	DN 65 to 250
Pressure rating	PN 16 to 40
Temperature ranges	
Water and other liquids	Up to 150 °C

Type 2333 · Pressure reducing valve for liquids and non-flammable gases

Type 2335 · Excess pressure valve for liquids and non-flammable gases

- Single-seated globe valve with flanged end connections

Technical data

Type 2333 · Type 2335	Data Sheets ▶ T 2552 · ▶ T 2554
Set point ranges	2 to 28 bar · 30 to 400 psi
Valve size	DN 65 to 400 · NPS 2½ to 16
Pressure rating	PN 16 and 25 · Class 125 to 300
Temperature range	
Liquids	Up to 150 °C · Up to 300 °F
Gases	Up to 80 °C · Up to 175 °F
Steam	Up to 350 °C · Up to 660 °F

Type 2334 · Pressure, differential pressure, flow rate, temperature or combined regulators, optionally with additional electric actuator

- Single-seated globe valve with flanged end connections
- Wide control range and high useable rangeability at low pressure loss
- Suitable for district heating plants in accordance with DIN 4747-1 (requirements stipulated by AGFW (German District Heating Association) concerning components in house substations)

Technical data

Type 2334	Data Sheet ▶ T 3210
Set point ranges	Depending on the pilot valve
Valve size	DN 65 to 400
Pressure rating	PN 16 to 40
Temperature ranges	
Water and other liquids	Up to 350 °C
non-flammable gases	Up to 80 °C

Type 2335 Excess Pressure Valve with Type 44-7 Pilot Valve (modified)

Type 33-7 Safety Excess Pressure Valve (SEV)

Type 33-1 Safety Shut-off Valve (SSV)

Fig. 14: *Pressure regulators with pilot valves and safety shut-off valves (SEV/SSV)*

Pressure regulators for small set point ranges

Type 2404-1 · Pressure reducing valve with pilot valve for small set point ranges

Type 2404-2 · Excess pressure valve with pilot valve for small set point ranges

Pressure regulators for gases and for the control of inert gases

- Pilot operated by the process medium
- Single-seated globe valve with flanged end connections
- Pilot valve with internal set point springs
- High control accuracy
- Meets strict fugitive emission requirements
- Minimum leakage class IV
- Suitable for sour gas service (NACE)

Technical data

Type 2404-1	**Data Sheet ▶ T 2538**
Set point ranges	3 to 10 mbar · 0.045 to 1.5 psi
Valve size	DN 25 to 150 · NPS 1 to 6
Pressure rating	PN 16, 25, 40 · Class 125, 150, 300
Temperature range	
Gases	–20 to +90 °C · –5 to +195 °F

Type 2404-2	**Data Sheet ▶ T 2540**
Set point ranges	5 to 200 mbar · 0.075 to 3 psi
Valve size	DN 65 to 400 · NPS 2½ to 16
Pressure rating	PN 16, 40 · Class 125, 300
Temperature range	
Gases	–20 to +90 °C · –5 to +195 °F

Type 2404-1 Pressure Reducing Valve with pilot valve for small set point ranges

Type 2404-2 Excess Pressure Valve with pilot valve for small set point ranges

Fig. 15: *Pressure regulators with pilot valve for small set point ranges*

Pressure regulators for special applications

Series 2357 Pressure Regulators for cryogenic service

Types 2357-1/-11 · Pressure reducing valve (globe valve)

Type 2357-21 · Excess pressure valve (globe valve)

Types 2357-3 · Pressure build-up regulator with safety function and integrated excess pressure valve

Pressure regulators for cryogenic gases and liquids as well as other liquids, gases and vapors

- Wide set point range and convenient set point adjustment
- Rugged design and low overall height
- Suitable for oxygen service
- Soldering ends/welding ends

Technical data

Type 2357-1 · Type 2357-2	Data Sheet ▶ T 2557
Set point ranges	0.2 to 40 bar
Valve size	DN 20
Connection	G ¾ A conical joint · G ¾ female thread Welding end Ø18 for pipe DN 15x1.5
Pressure rating	PN 50
Temperature range	–196 to 200 °C

Technical data

Type 2357-3	Data Sheet ▶ T 2559
Set point ranges	2 to 40 bar
Valve size	DN 25
Connection	M40x2 conical joint M26x1.5 conical joint
Pressure rating	PN 40
Temperature range	–196 to 200 °C

Technical data

Type 2357-11 · Type 2357-21	Data Sheet ▶ T 2560
Set point ranges	1 to 40 bar
Valve size	DN 20
Connection	G ¾ A
Pressure rating	PN 63
Temperature range	–196 to 200 °C

Series 2357-1 Pressure Regulators for the food and pharmaceutical industries

Type 2371-10 · Pressure reducing valve with pneumatic set point adjustment

Type 2371-11 · Pressure reducing valve with mechanical set point adjustment

Type 2371-00 · Excess pressure valve with pneumatic set point adjustment

Type 2371-01 · Excess pressure valve with manual set point adjustment

Pressure regulators for the food and pharmaceutical industries (for liquids and gases)

- Without external control line
- Compact design
- Threaded, clamp, flange connections or welding ends
- Body made of stainless steel 1.4404 (316L) with smooth surfaces

Technical data

Types 2357-10/11 Types 2357-00/01	Data Sheet ▶ T 2640 Data Sheet ▶ T 2642
Set point ranges	0.3 to 6 bar · 5 to 90 psi
Valve size	DN 15 to 50 · NPS ½ to 2
Connection	Welding ends and threaded, clamp, flange connections
Operating pressure (input pressure)	Max. 10 bar · Max. 150 psi
Temperature range	–10 to 160 °C · 14 to 320 °F

Type 2357-1 Pressure Regulator

Type 2357-11 Pressure Reducing Valve

Type 2357-00 Excess Pressure Valve

Fig. 16: *Pressure regulators for special applications · Cryogenic service as well as food processing and pharmaceutical industries*

Pressure regulators for special applications

Pressure regulators for corrosive media

Type 2373 · Pressure reducing valve

Type 2375 · Excess pressure valve

Pressure regulators for gases and liquids

- Body made of stainless steel or special material for sea-water
- Flanges

Technical data

Type 2373 Type 2375	Data Sheet ▶ T 2534 Data Sheet ▶ T 2536
Set point ranges	0.8 to 16 bar
Valve size	DN 15 to 50
Pressure rating	PN 40
Temperature range	
Gases and liquids	Up to 80 °C

Pressure regulators for small set point ranges

Type 2405 · Pressure reducing valve

Type 2406 · Excess pressure valve

Pressure regulators for gases and for the control of inert gases

- Suitable for vacuum
- Meets strict fugitive emission requirements
- Minimum leakage class IV
- Flanges

Technical data

Type 2405 Type 2406	Data Sheet ▶ T 2520 · ▶ T 2521 Data Sheet ▶ T 2522 · ▶ T 2523
Set point ranges	0.005 to 10 bar · 0.075 to 150 psi
Valve size	DN 15 to 50 · NPS ½ to 2
Pressure rating	PN 16 to 40 · Class 125 to 300
Temperature range	
Gases	–20 to 60 °C (150 °C) [1] –5 to 140 °F (300 °F) [1]

[1] For unbalanced version with FKM diaphragm and FKM soft seal

Type 2373 Pressure Reducing Valve for corrosive media

Type 2405 Pressure Reducing Valve

Fig. 17: *Pressure regulators for special applications*

Pressure limiters (PL)

They consist of a valve and a Type 2401 Pressure Element.

The spring mechanism of the pressure element closes and locks the valve when the pressure reaches the adjusted limit between 1 and 10 bar. The valve can only be put back into service manually after the fault has been remedied.

Pressure limiters (PL) with Type 2401 Pressure Element
Type 2111/2422/2119 Valve with Type 2401 Pressure Element

Type 2111/2401 · Type 2111 Globe Valve, DN 15 to 50

Type 2422/2401 · Type 2422 Globe Valve, DN 15 to 150

Type 2119/2401 · Type 2119 Three-way Valve, DN 15 to 150

Technical data

Type 2111/2422/2119/2401	**Data Sheet ▶ T 2519**
Set point ranges	1 to 10 bar
Pressure rating	PN 16 to 40
Temperature range	Up to 350 °C

Type 2111/2422/2119/2401 Pressure Limiter
Connecting element with spring mechanism and Type 2401 Pressure Element

Fig. 18: *Safety equipment*

Sample applications

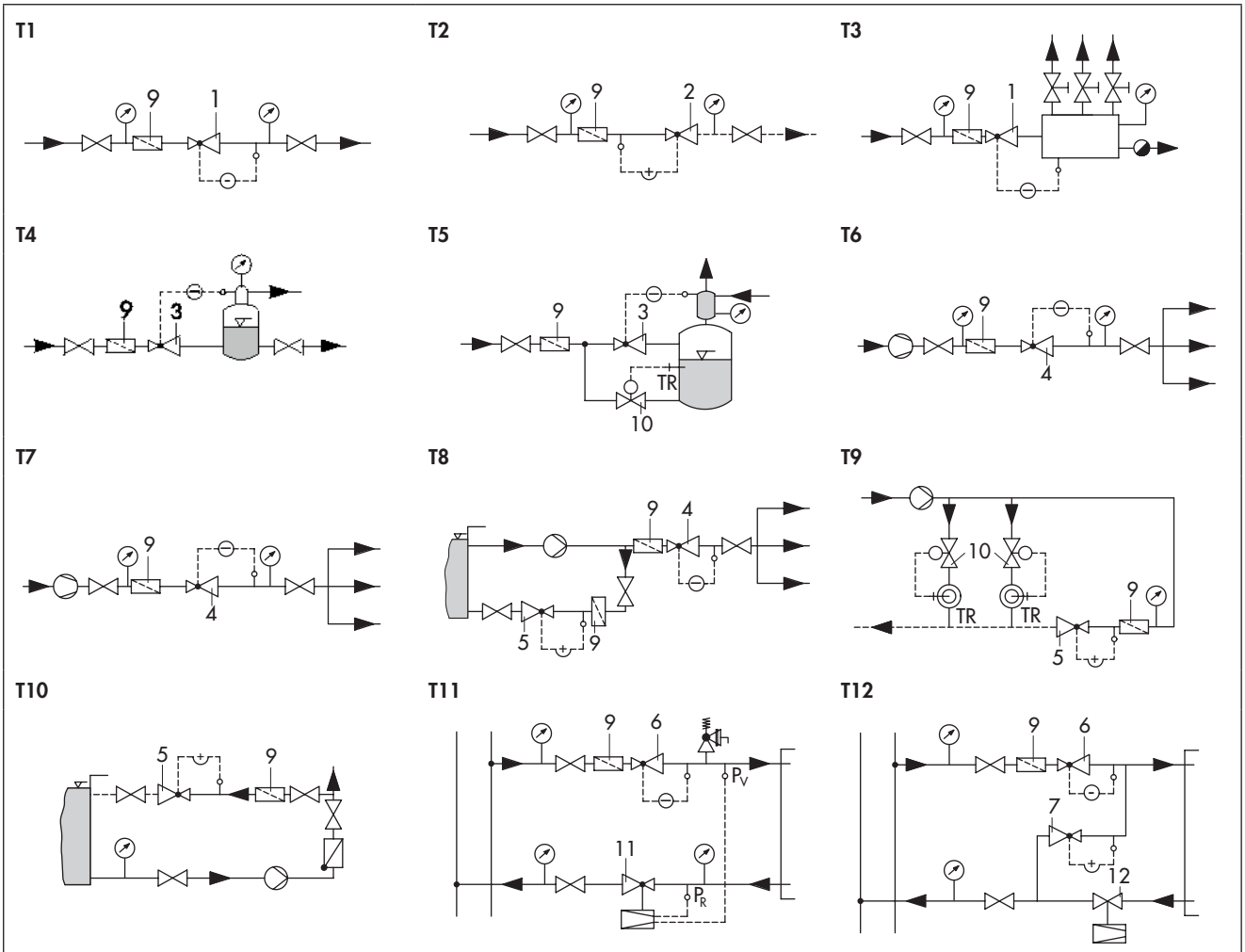


Fig. 19: *Sample applications*

Steam pressure control

T1 Pressure reduction in a pipeline

T2 Excess pressure control in a pipeline

T3 Steam pressure reduction upstream of a manifold

T4 Pressure control in a water-heated steam generator

T5 Pressure control in a steam-heated gasifying plant

Pressure control systems for liquids and non-flammable gases

T6 Pressure reduction downstream of a compressor

T7 Pressure reduction upstream of water outlets

T8 Piping system with pressure reduction (4) and excess pressure control (5)

T9 Excess pressure control in piping systems

T10 Excess pressure control in a constant pressure system

Pressure control at heat transfer stations

House substation in district heating supply networks or corresponding piping system

T11 With safety shut-off valve (SSV) (6), safety valve and differential pressure regulator (11)

T12 With safety shut-off valve (SSV) (6), safety excess pressure valve (SEV) (7) and flow regulator (12)

Legend for typical applications

1	Type 41-23, Type 2422/2424, Type 44-0 B Pressure Reducing Valves
2	Type 41-73, Type 2422/2425 Excess Pressure Valve
3	Type 41-23, Type 2422/2424 Pressure Reducing Valve
4	Type 41-23, Type 2422/2424, Type 33-1, Type 36-4, Series 44, Type 2371-11 Pressure Reducing Valve
5	Type 41-73, Type 2422/2425, Type 33-7, Type 36-8 or Type 44-6 B/-7/-8, Type 2371-00/-01 Excess Pressure Valve
6	Type 33-1, Type 36-4 or Type 44-3, 44-9 Safety Shut-off Valve
7	Type 33-7, 36-8 or 44-4 Safety Excess Pressure Valve
9	SAMSON strainer
10	SAMSON temperature regulator
11	SAMSON differential pressure and flow regulator
12	SAMSON flow regulator