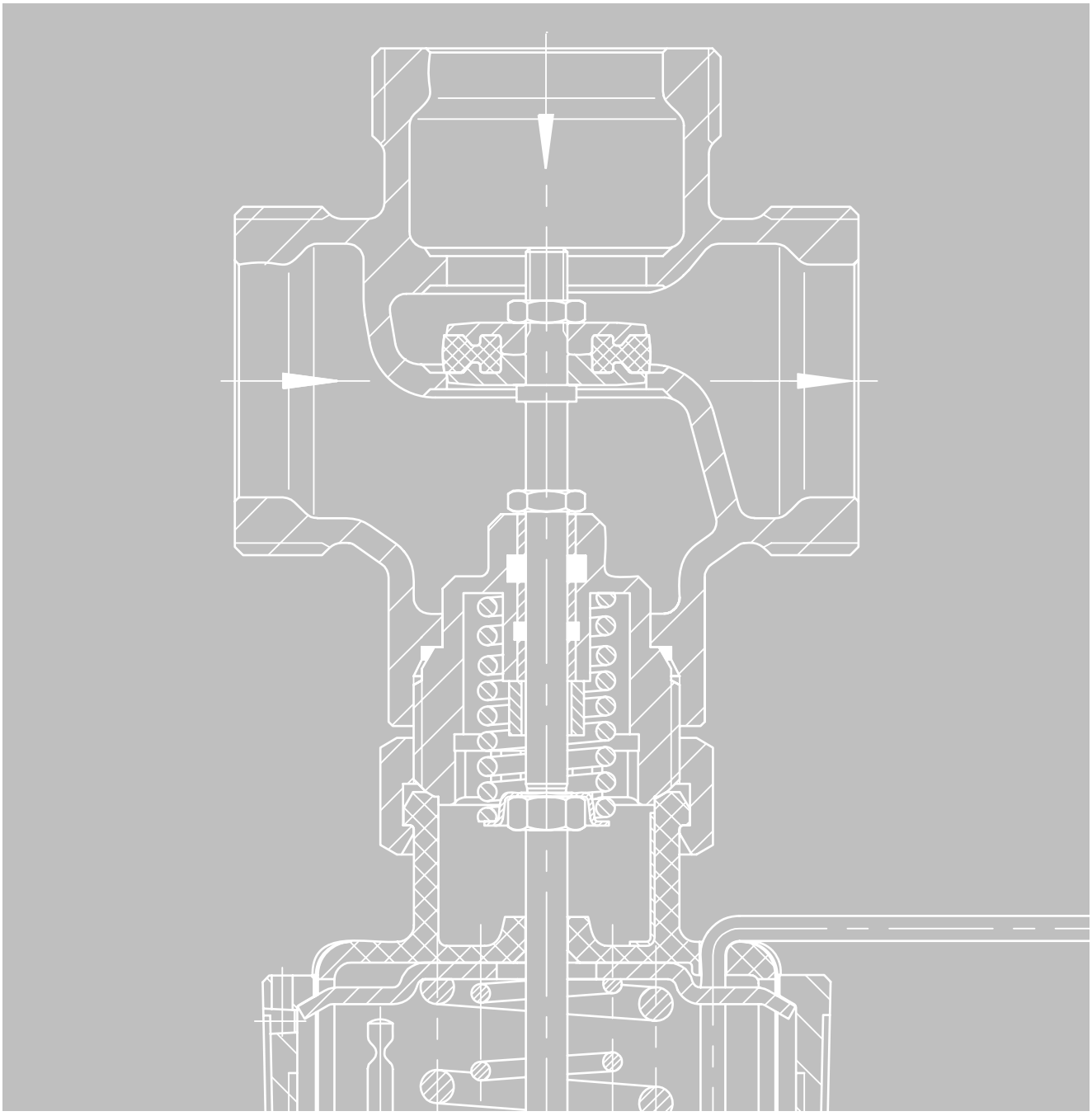
Self-operated Temperature Regulators

Series 43

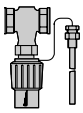
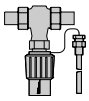
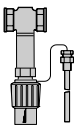
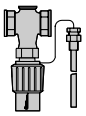
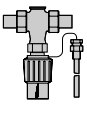
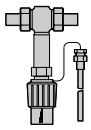
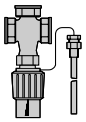
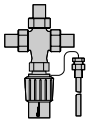
PN 25 · Class 250
DN 15 to DN 50 · ½" to 2"
G ½ to G 1 · ½ NPT to 1 NPT
Up to 200 °C · Up to 390 °F



Edition June 2006

Information Sheet **T 2170 EN**

Series 43 Self-operated Temperature Regulators

Valve	Suitable for	Steam			•			•			
		Water, liquids	•	•	•	•	•	•	•	•	•
		Oil	•	•		•	•		•	•	
		Air, non-flamm. gases	•	•	•	•	•	•			
		Heating	•	•	•			•	•	•	•
		Cooling				•	•		•	•	
		Mixing							•	•	
	Globe valve		•	•	•	•	•	•			•
	Three-way valve								•	•	
	Pressure-balanced		•	•	•	•	•	•			
	Not pressure-balanced								•	•	•
	Connection	Screwed flange		•			•	•		•	
		Female thread	•		•	•			•		
		Weld-on fittings		•			•	•		•	• 1)
		Threaded ends		•			•	•		•	• 1)
	Nominal size G/DN		G ½ to 1	DN15 to 50	G ½ to 1	G ½ to 1	DN32 to 50	DN15 to 50	G ½ to 1	DN15 to 50	DN 15
	Nominal pressure		PN 25								PN 16
	Permissible temperature		150 °C	150 °C	200 °C	150 °C	150 °C	200 °C	150 °C	150 °C	120 °C
	Body material	Red brass	•	•	•	•	•	•	•	•	•
Thermostat	With thermostat	Type	2430 K								
	Set point		0 to 35 °C · 25 to 70 °C · 40 to 100 °C · 50 to 120 °C · 70 to 150 °C								0 to 100 °C
	Double adapter/adjuster		•	•	•	•	•	•	•	•	•
	Sensor material		Copper								
	Thermowell		Optionally copper or stainless steel								
Type			43-1	43-2 3)	43-5	43-6	43-6 3)	43-7 3)	43-3	43-3 2)	43-2 N
Data Sheet			T 2171 EN		T 2172 EN				T 2173 EN		T 2186 EN
Type 2040 Safety Temperature Monitor for cryogenic applications available on request											

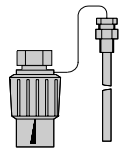
1) Connecting thread G ¾ B for attachment of soldering ends, weld-on fittings or threaded ends
2) Version with male thread for weld-on fittings, threaded ends or flanges also available as diverting valve

Control thermostats

Thermostats and temperature sensors

The Series 43 Temperature Regulators are equipped with Type 2430 K Thermostats. The temperature sensors can be used for operating pressures up to 40 bar (580 psi) and set points up to 150 °C (300 °F).

For details refer to the corresponding data sheets.



Temperature sensor with thermowell

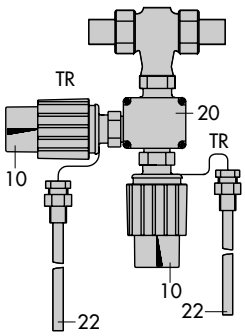
With screw gland

Fig. 1 · Thermostat with different sensor versions

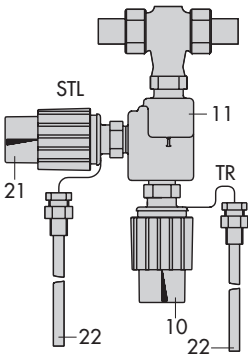
Combined regulators

To attach further thermostats and control equipment, a double adapter can be installed between valve and control thermostat (see Data Sheet T 2176 EN).

The regulators can also be combined with flow and differential pressure regulators.



Temperature regulator with Do3 K Double Adapter



Temperature regulator with safety temperature limiter (STL)

Fig. 2 · Combined regulators

10 Control thermostat
11 Housing with spring mechanism
20 Double adapter (housing)
21 Type 2439 K Safety Thermostat (STL)
22 Temperature sensor with thermowell

	ANSI versions							
			•			•		
•	•	•	•	•	•	•	•	•
	•	•		•	•			
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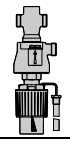
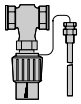
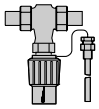
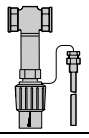
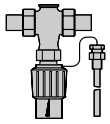
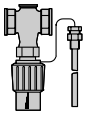
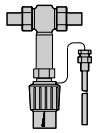
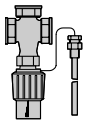
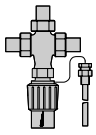
		•		•		•		•
DN 15	NPT ½ to 1	½″ to 2″	NPT ½ to 1	1¼″ to 2″	NPT ½ to 1	½″ to 2″	NPT ½ to 1	½″ to 2″
PN 25/16	Class 250							
150/120 °C [1]	300 °F	300 °F	390 °F	300 °F	300 °F	390 °F	300 °F	300 °F
•	•	•	•	•	•	•	•	•
2430 K								
45 to 65 °C	30 to 95 °F · 75 to 160 °F · 105 to 210 °F · 125 to 250 °F · 160 to 300 °F							
•	•	•	•	•	•	•	•	•
CrNiMo	Copper							
Without	Optionally copper or stainless steel							
43-8	43-1	43-2	43-5	43-6	43-6	43-7	43-3	43-3
T 2178 EN	T 2175 EN		T 2174 EN				T 2177 EN	
								

[1] Maximum permissible temperature of the valve

Safety thermostats

The **Type 2403 K Safety Thermostat** for safety temperature monitors (STM) comprises a temperature sensor without thermowell, a limit value adjuster, capillary tube and connecting element.

The **Type 2439 K Safety Thermostat** for safety temperature limiters (STL) comprises a housing with spring mechanism and thermostat with capillary tube, as well as a bulb sensor and a thermowell.

In addition, this thermostat may be equipped ex factory with an **electric signal transmitter** for remote transmission of faults.

Time response of thermostats

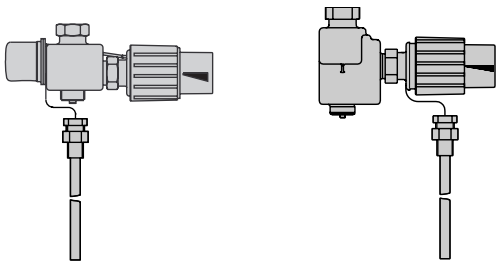
The regulator's dynamics is largely determined by the sensor's response behavior and its typical time constant.

Table 1 shows the time constants of SAMSON thermostats for Series 43 Regulators measured in water for different principles.

Table1 · Time response of some SAMSON thermostats

Principle	Type	Without thermowell		With thermowell	
Adsorption	2430 K	15 s [1]	30 s [2]	40 s [1]	80 s [2]
	2439 K	– [3]		40 s	
Vapor pressure	2403 K	3 s		– [3]	

[1] DN 15 to 25 [2] DN 32 to 50 [3] Not permissible



Type 2403 K Type 2439 K

Fig. 3 · Safety thermostats

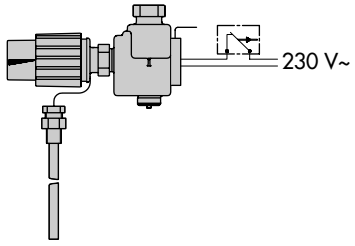
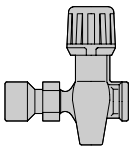
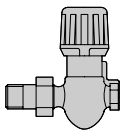
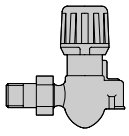


Fig. 4 · Type 2439 K Safety Thermostat with electric signal transmitter

Return Flow Temperature Limiters

Valve	Suitable for	Steam			
		Water	•	•	•
		Oil			
		Air and other non-flammable gases			
		Heating			
		Cooling			
		Mixing			
	Globe valve		•	•	Angle valve
	Three-way valve				
	Pressure-balanced				
	Not pressure-balanced		•	•	•
	Connection	Screwed flange			
		Female thread	•	Outlet	Outlet
		Screw joints with weld-on fittings	•	•	
		Screw joints with threaded ends		•	Inlet
	Nominal size G		G ½ to G 1	G ⅜ to G1½	G ⅜ to G1½
	Nominal pressure		PN 25	PN 16	PN 16
	Permissible temperature		120	120	120
	Body material	Brass	•	•	•
		Red brass (bronze)			
Thermostat	With thermostat	Type	Built-in		
	Set point		20 to 70 °C	10 to 60 °C	
	Double adapter/manual adjuster possible				
	Sensor material		Brass		
	Thermowell				
Type			3D	4D	4E
Data Sheet			T 2080 EN		
					

Conversion factors

The conversion factors commonly used for sizing, calculating and selecting valves are given below.

K_{VS} and C_V value

Exact calculation is to be made according to DIN EN 60534 Part 2-1. In addition, the ISA-S75.01-1-1985 standard and the VDI/VDE guideline 2173 apply. Calculating the K_V value according to this guideline is sufficiently accurate in most cases. The necessary equations are listed in SAMSON Calculation Sheet AB 04 EN.

K_{VS}	=	0.86 C_V	K_{VS}	[m^3/h]
C_V	=	1.17 K_{VS}	C_V	[U.S. gallons/min]

Pressure

1 pound/square inch [lbs/in^2 = psi] = 0.06895 bar
1 bar = 14.5 psi

Area

1 square inch [sq. in; in^2] = 6.452 cm^2
1 cm^2 = 0.155 in^2

Mass

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

Mass flow rate

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 m^3/h
1 m^3/h = 4.4 US gal/min

Temperature

°F = 9/5 °C + 32
°C = 5/9 (°F – 32)

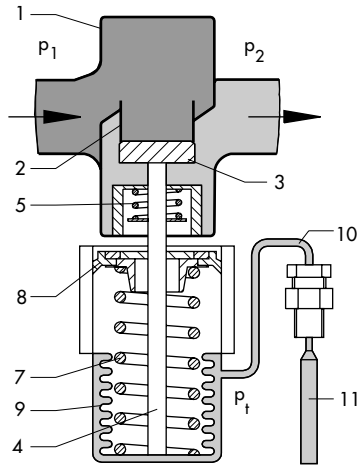
Principle of operation

- Series 43 Temperature Regulators -

The measuring unit of self-operated temperature regulators withdraws the energy it requires from the process medium and releases enough force to move the valve stem.

The regulators illustrated in the figures consist of a valve (1) and a control thermostat with set point adjuster (8), capillary tube (10) and a temperature sensor (11) which operates according to the adsorption principle [1].

The medium temperature generates a pressure p_t in the sensor (11) corresponding to the actual value. This pressure is transmitted to the bellows (9) through the capillary tube (10). The force $F_t = p_t \cdot A$ is created at the effective area A of the metal bellows. This force corresponds to the controlled variable x. At the bottom of the metal bellows, it is compared to the spring force F_s (= set point w), which depends on the set point adjustment. When the temperature changes, the plug (3) is moved until $F_t = F_s$.

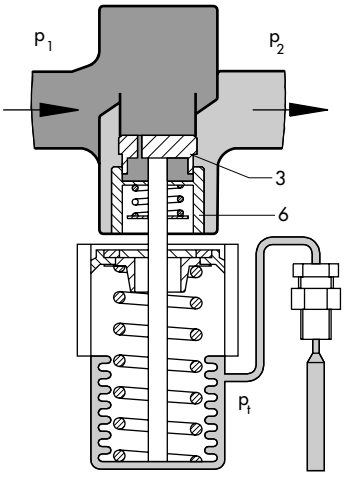


1 Valve body
2 Valve seat (exchangeable)
3 Plug
4 Plug stem
5 Valve spring
7 Adjustment spring(s)
8 Set point adjuster
9 Bellows
10 Capillary tube
11 Temperature sensor

Fig. 5.1 · Temperature regulator

Pressure-balanced plug

Control accuracy and stability depend on the disturbances that occur (e.g. changes in upstream pressure and flow). However, the regulators are designed to keep this impact low.

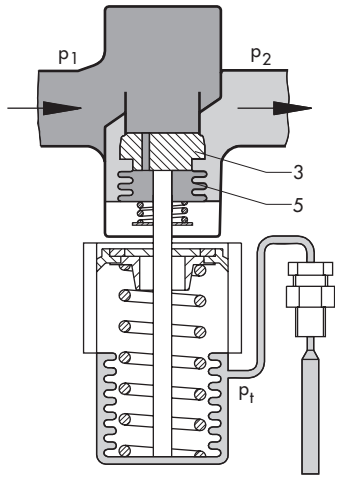


3 Piston plug
6 Bushing

Fig. 5.2 · Temperature regulator with balanced piston plug, valve **closes** when temperature increases

The force exerted by the upstream pressure on the valve plug, for example, may be eliminated by using a pressure-balanced plug. The balanced plug has a bore so that both the front and the back of the plug are pressurized. The downstream pressure is separated from the plug either via the bushing of a piston plug (Fig. 5.2) or a metal bellows (Fig. 5.3).

Regulators for heated plants



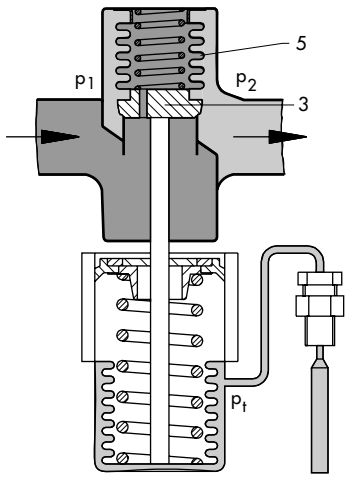
3 Bellows plug
5 Metal bellows

Fig. 5.3 · Temperature regulator with balanced bellows plug, valve **closes** when temperature increases

Regulators illustrated in Figures 5.2 and 5.3 are suitable for application in heated plants.

The valve **closes** when the temperature at the sensor increases.

Regulators for cooled plants



3 Bellows plug
5 Metal bellows

Fig. 5.4 · Temperature regulator with balanced bellows plug, valve **opens** when temperature increases

Regulators illustrated in Fig. 5.4 are suitable for application in cooled plants.

The valve **opens** when the temperature at the sensor increases.

[1] Special versions with small time constant, which operate according to the vapor pressure principle, are available.

Series 43 Temperature Regulators

- Low-maintenance P regulator requiring no auxiliary energy
- Temperature sensor for any desired mounting position and high permissible ambient temperatures
- Suitable for liquids, gases and vapors at operating pressures up to 40 bar
- Especially suited for district heating systems

Versions with globe valve

Type 43-1 · Type 43-2 Temperature Regulators

For heated plants. With pressure-balanced piston plug [1]. Valve closes when temperature increases.

Technical data	Data Sheets T 2171 EN · T 2175 EN
Set point ranges	0 to 150 °C · 30 to 300 °F
Nominal size	DN 15 to 50 / ½" to 2" G½ to G1/NPT½ to 1
Nominal pressure	PN 25 · Class 250
Temperature ranges	
Liquids	Up to 150 °C · Up to 300 °F
Non-flammable gases	Up to 80 °C · Up to 175 °F

Series 43- ... N

- Low-maintenance P regulator requiring no auxiliary energy
- Temperature sensor for any desired mounting position
- For treated water up to 120 °C at operating pressures up to 16 bar
- Especially suited for local heat supply and large heating networks

Type 43-2 N Temperature Regulator

For heated plants. Valve closes when temperature increases.

Technical data	Data Sheet T 2186 EN
Set point range	0 to 100 °C
Nominal size	DN 15
Nominal pressure	PN 16
Temperature range	
Treated water	Up to 120 °C

Type 43-5 · Type 43-7 Temperature Regulators

For heated plants. With pressure-balanced bellows plug [1]. Valve closes when temperature increases.

Technical data	Data Sheets T 2172 EN · T 2174 EN
Set point ranges	0 to 150 °C · 30 to 300 °F
Nominal size	DN 15 to 50 / ½" to 2" G½ to G1/NPT½ to 1
Nominal pressure	PN 25 · Class 250
Temperature ranges	
Liquids and vapor	Up to 200 °C · Up to 390 °F
Non-flammable gases	Up to 80 °C · Up to 175 °F

Type 43-6 Temperature Regulator

For cooled plants. With pressure-balanced bellows plug [1]. Valve opens when temperature increases.

Technical data	Data Sheets T 2172 EN · T 2174 EN
Set point ranges	0 to 150 °C · 30 to 300 °F
Nominal size	DN 32 to 50 / ½" to 2" G½ to G1/NPT½ to 1
Nominal pressure	PN 25 · Class 250
Temperature ranges	
Liquids	Up to 150 °C · Up to 300 °F
Gases	Up to 80 °C · Up to 175 °F

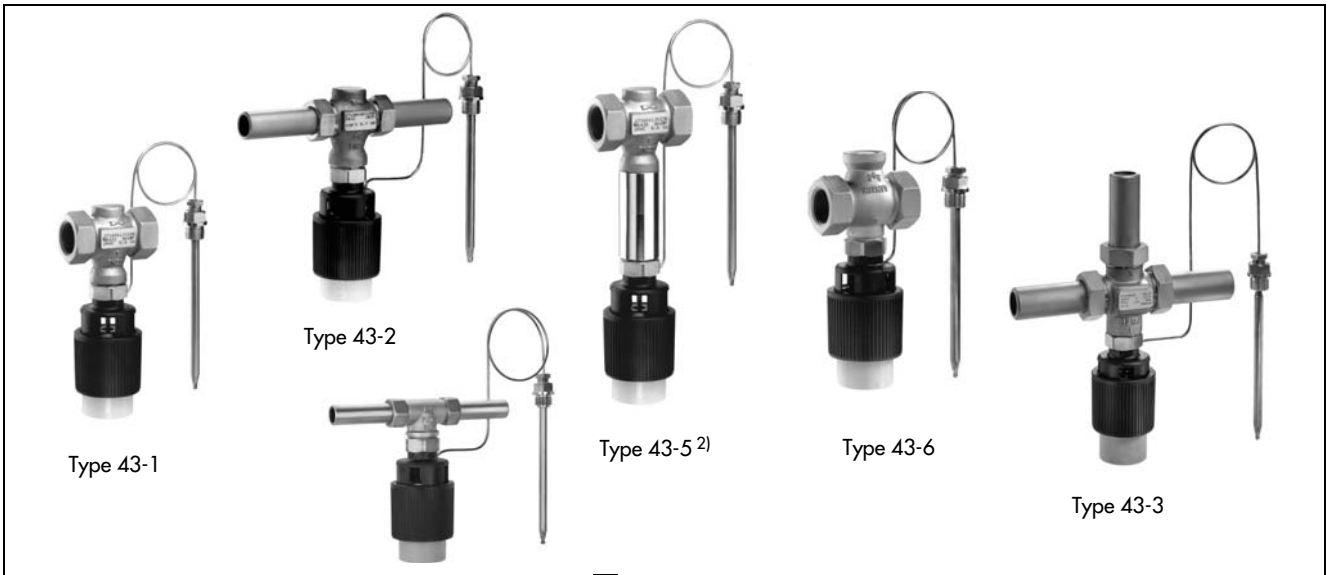
Versions with three-way valves

Type 43-3 Temperature Regulator

For mixing or diverting in heated or cooled plants.

Technical data	Data Sheets T 2173 EN · T 2177 EN
Set point ranges	0 to 150 °C · 30 to 300 °F
Nominal size	DN 15 to 50 / ½" to 2" G½ to G1/NPT½ to 1
Nominal pressure	PN 25 · Class 250
Temperature ranges	
Water, oil	Up to 150 °C · Up to 300 °F

[1] For versions with reduced K_{VS} values and small seat bores, the plugs do not need to be pressure-balanced.



2) Type 43-5 and Type 43-7 are constructed identically, except that Type 43-7 provides union nuts on both sides for connection of threaded ends or weld-on fittings (DN 15 to 50).

Fig. 6 · Series 43 Temperature Regulators

Type 43-8/43-8N Regulators with Hydraulic Controller

Temperature regulation in small district heating systems, especially in one-family or two-family houses.

- Regulation of small instantaneous water heaters
- Compact design, easy operation and installation
- Stable regulation even at tapped amounts of 3 l/min
- Temperature regulation when water is not tapped
- Thermostats operating according to the vapor pressure principle with small time constant

Technical data	Data Sheet T 2178 EN
Valve	Type 2432 K
Nominal pressure	PN 25 / PN 16 [1]
Nominal size	DN 15
Max. perm. temperature	150 °C / 120 °C [1]
Control thermostat	Type 2430 K
Set point range	45 to 65 °C
Perm. pressure at the sensor	PN 40
Perm. temp. at the set point adjuster	35 °C
Hydraulic controller	Type 2438 K
Nominal pressure	PN 16
Perm. ambient temperature	80 °C

[1] Type 43-8 N

Type 3D · Type 4D · Type 4E Return Flow Temperature Limiter

Limiters for the return flow temperature in district heating and other heating systems. Valve closes when temperature increases.

Technical data	Data Sheet T 2080 EN
Set point range	+10 to +70 °C
Nominal size	G½ to G1 or G⅜ to G½
Nominal pressure	PN 25/PN 16
Max. perm. temperature	120 °C

Type 2040 Temperature Regulator for Special Applications

Type 2040 Safety Temperature Monitors are used to provide safety in consumer systems - particularly in cryogenic systems. The regulators with integrated temperature sensor and set point adjuster close the valve when the temperature is too low or the sensor is defective (safety function).

For cryogenic gases and liquids as well as other liquids, gases and vapors.

Technical data	Data Sheet T 2090 EN
Set point range	–30 to 70 °C
Connection	Conical joint G1¼ A
Operating pressure	Max. 40 bar
Temperature range	–60 to +60 °C

Temperature regulator with double adapter or manual adjuster Do3 K Double Adapter

A **Do3 K Double Adapter** can be installed between valve and control thermostat for the attachment of further thermostats to apply additional controlled variables. The adapter is suited to attach max. two control thermostats or control units. One of the connections may be used to attach a manual adjuster.

Manual adjuster

For manual operation of the control valve. The **manual adjuster** can be attached either directly to the valve (instead of a control thermostat) or to the Do3 K at connection b.

Technical data	Data Sheet T 2176 EN
Attachment to ...	Series 43 Globe and Three-way Valves
Nominal size	G½ to G1 / DN 15 to 50
Nominal pressure	PN 25

Typetested temperature regulators

Typetested temperature regulators (TR), safety temperature monitors (STM), safety temperature limiters (STL) and pressure limiters (PL) as well as combined regulators (e.g. TR/PL) with limit values up to 170 °C are part of the safety equipment used in heat generating installations.

DIN Geprüft These versions are DIN-tested and approved. Register no. and test mark are available on request.

For details refer to the corresponding data sheets and Information Sheet T 2181 EN.

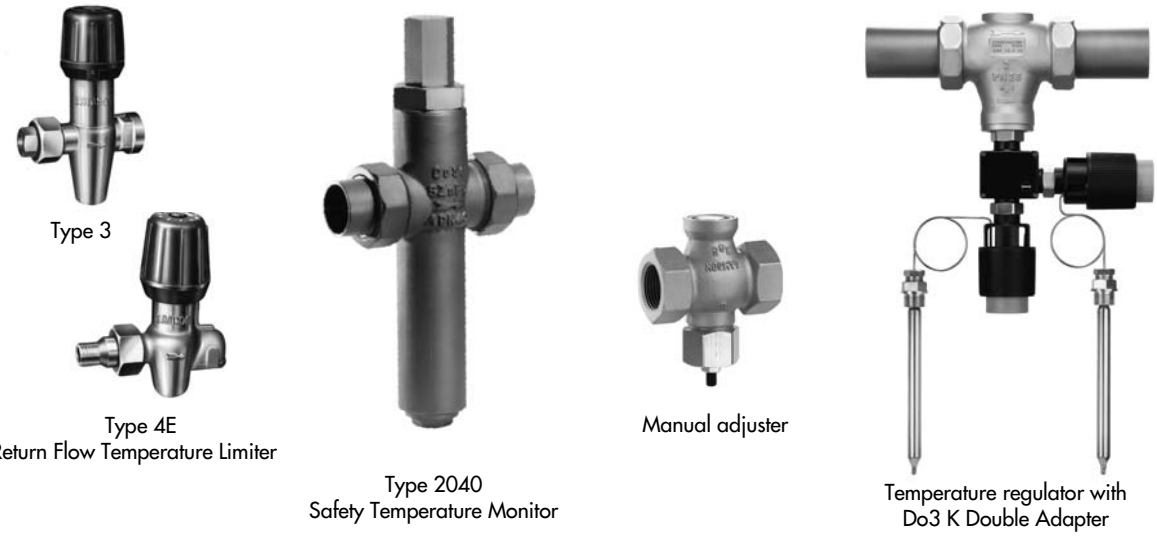


Fig. 7 · Temperature regulators, different versions

Examples of application

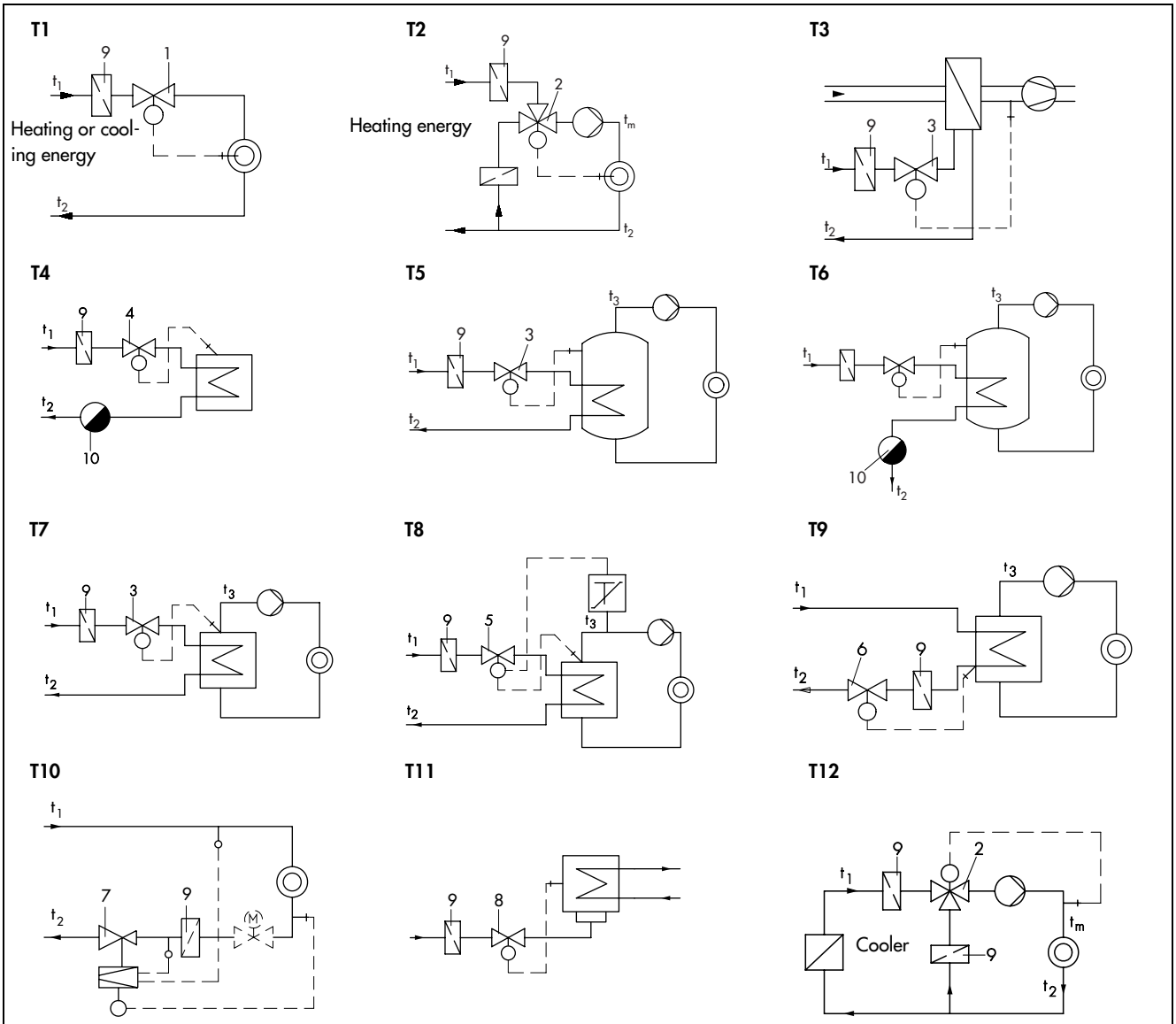


Fig. 8 · Examples of application

Temperature regulation for different consumers

T1 Heating or cooling with globe valve
T2 Heating with three-way valve (mixing service)
T3 Regulation of a water-heated air duct
T4 Regulation of a vapor-heated drying cabinet, drying chamber or storeroom

Temperature regulation of boilers, heat generators and heat exchangers

T5 Regulation of water-heated boilers
T6 Regulation of vapor-heated boilers
T7 Regulation of a heat generator or water-heated heat exchanger
T8 Temperature regulation and safety temperature limitation of a heat generator or water-heated heat exchanger

Temperature regulation in district heating systems and cooled plants

T9 Return flow temperature regulation
T10 Return flow temperature and differential pressure regulation of a directly connected building substation
T11 Temperature regulation of a condenser
T12 Regulation of the cooling water circuit of engines or compressors

Legend of the application examples:

1 Type 43-1, 43-2, 43-5, 43-6, 43-7, 43-2 N
2 Type 43-3
3 Type 43-1, 43-2, 43-2 N
4 Type 43-5, 43-7
5 Type 43-1, 43-2, 43-5, 43-7, 43-2 N with typetested safety equipment (TR/STL)
6 Type 43-1, 43-2, 43-5, 43-7, 43-2 N
7 Type 2468/2430
8 Type 43-6
9 SAMSON strainer
10 SAMSON steam trap

For further application examples of typetested regulators, refer to Information Sheet T 2181 EN.

Specifications subject to change without notice.

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main · Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
Internet: http://www.samson.de