

Pneumatic Steam Converter Type 3284-1

Steam-converting Valve Type 3284

Application

Final control element with globe valve for use in process engineering applications and thermal plants.

Nominal size DN 100 to 400
Nominal pressure PN 16 to 160
Temperatures Up to 500 °C

Steam converters reduce the pressure and temperature to the set point adjusted on the pressure and temperature controller (Fig. 1).

They consist of a Type 3284 Steam-converting Valve with:

- Type 3271 Pneumatic Actuator (Type 3284-1 Steam Converter).

The steam-converting valve largely corresponds to a single-seate Type 3254 Globe Valve (see Data Sheet T 8060 EN) equipped with a Flow Divider St III.

Valve body material

- Cast steel or
- High-temperature cast steel

Low-noise valve plug

- Metal-sealing or
- Lapped-in metal
- Balanced for handling high differential pressures
- Additional plug stem guide in the lower body flange

Water supply via the Flow Divider St III ensures

- Full utilization of the kinetic energy of the steam for mixing and splitting up the spray water
- Fast evaporation independent of the steam flow rate
- Homogenous condition of the reduced, desuperheated steam
- No thermal shock or erosion by the supplied spray water because it has no contact with the valve body
- Low-vibration and low-noise operation

The steam converters are based on the modular principle and can be equipped with the following accessories:

Positioners, limit switches, solenoid valves and other accessories according to IEC 60534-6 and NAMUR recommendation (see Information Sheet T 8350 EN).

Versions

Standard version with PTFE packing for temperatures up to 220 °C, or with an adjustable high-temperature packing up to 350 °C; nominal pressure PN 16 to 160; with Type 3271 Pneumatic Actuator (effective diaphragm area 350 to 2800 cm², see T 8310-1 EN and T 8310-2 EN).

- **Type 3284-1** (Fig. 2) · DN 100 to 400

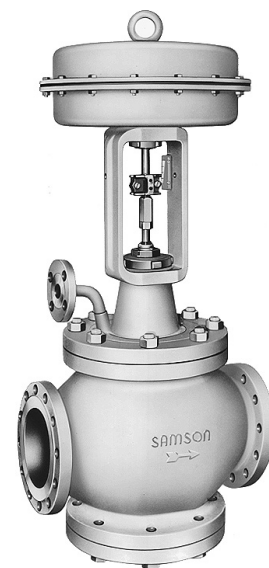
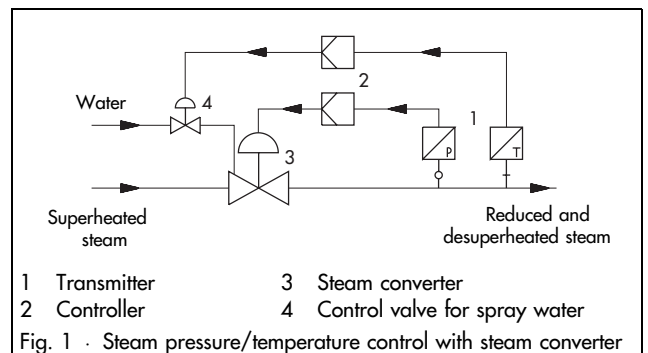


Fig. 2 · Type 3284-1 Steam Converter

Additional versions

- **Nominal pressure PN >160 to 400** · On request
- **Welding ends** according to DIN EN 12 627
- **Insulating section** for temperatures up to 500 °C
- **Additional handwheel** · See Data Sheet T 8310-1/-2 EN
- **ANSI version** · NPS 4 to 16, ANSI Class 300 to 2500, details on request.

Principle of operation (Figs. 3 and 4)

The process medium flows through the valve in the direction indicated by the arrow. The position of the valve plug determines the cross-sectional area of flow between the valve seat (2) and the plug (3).

The spray water does not have contact with the valve body. It is piped to the Flow Divider St III (13) through the connecting pipe (5.5) and the annular chamber formed by the cage element (13.1).

After having passed the throttling point between the valve seat and the plug, the steam flow reaches its maximum velocity and contacts the supplied water at the inner wall of the flow divider (13). The steam and the entrained water are split up and mixed in the close-mesh wire fabric of the flow divider. At the same time, the steam velocity is reduced, giving up heat which is transferred to the spray water across the large surface of the wire mesh coil, leading to quick evaporation. The steam-water mixture leaves the flow divider as mist with a high steam content. Evaporation is completed a short distance downstream of the steam-converting valve. Water atomization as described above is ensured over the entire load range, because the steam velocity at the throttling point is independent of flow.

Fail-safe action

Depending on how the compression springs are arranged in the actuator (see T 8310-1 EN and T 8310-2 EN), the steam converter provides two different fail-safe positions which become effective when the air supply decreases or fails.

"Actuator stem extends"

Whenever air supply fails, the valve closes.

"Actuator stem retracts"

Whenever air supply fails, the valve opens.

Legend of Figs. 3 and 4

- | | |
|---------------------|------------------------|
| 2 Seat | 13 Flow Divider St III |
| 3 Plug | 13.1 Cage element |
| 5.5 Connecting pipe | |

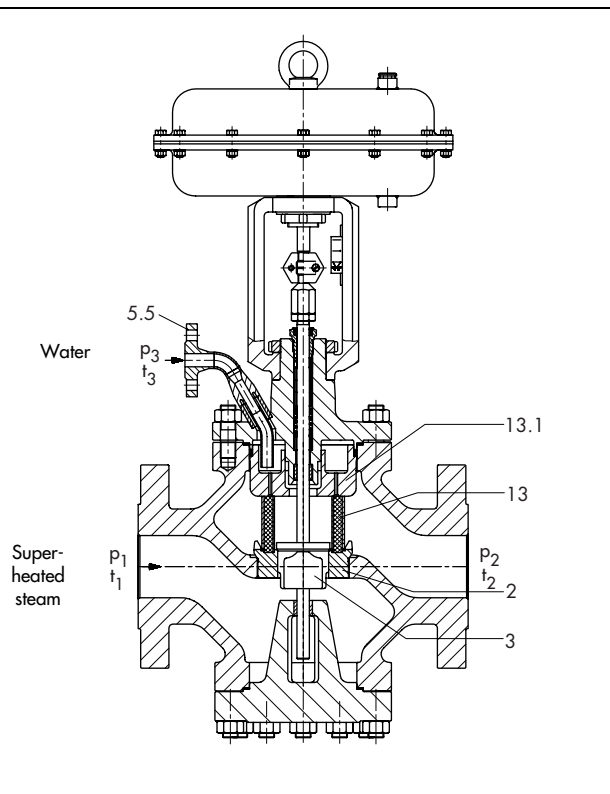


Fig. 3 · Type 3284-1 Pneumatic Steam Converter with flanges, standard plug and Type 3271 Actuator

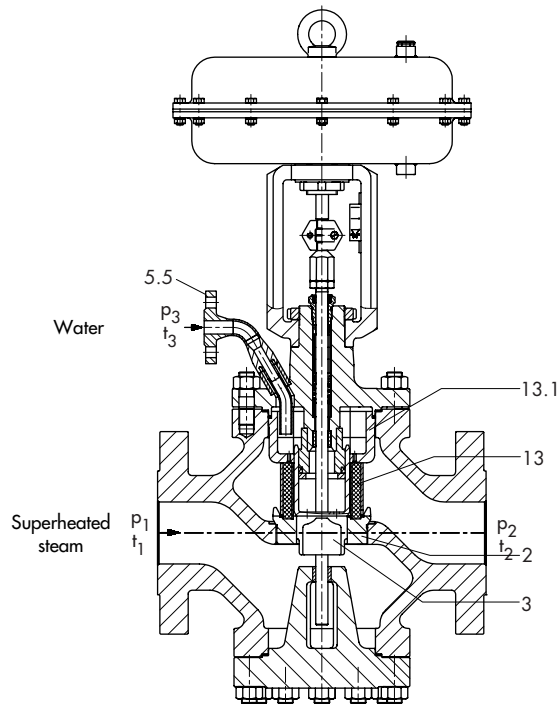


Fig. 4 · Type 3284-1 Pneumatic Steam Converter with flanges and balanced plug

Table 1 · Technical data for Type 3284

Material		Cast steel GS-C25 1.0619	Cast steel GS-17 CrMo 55 1.7357
Nominal size	DN	100 to 400	
Nominal pressure ¹⁾	PN	16 to 160	16 to 160
Type of connection	Flanges	All DIN versions	
	Welding ends	According to DIN 3239 Part 1 with edge form acc. to DIN 2559	
Seat-plug seal		Metal-sealing or lapped-in metal	
Characteristic		Equal percentage or linear	
Rangeability		50 : 1	
Temperature ranges in °C · Permissible operating pressures acc. to pressure-temperature diagrams (see Information Sheet T 8000-2 EN)			
Body without insulating section		-10 to 220 · Up to 350 °C with high-temperature packing	
Body with	Insulating section	-10 to 400	-10 to 500
	Bellows seal	-10 to 400	-10 to 500
Valve plug	Standard Metal sealing	-200 to 500	
	Balanced Graphite ring	220 to 500	
Leakage class acc. to DIN EN 1349			
Valve plug	Standard	Metal-sealing	IV
		Lapped-in metal	IV-S2 · DN 100 and larger: IV-S1
		Metal-sealing	With graphite ring: III

¹⁾ Up to PN 400 on request

Table 2 · Materials

Standard version Body and flanges ¹⁾		Cast steel GS-C25 1.0619	Cast steel GS-17 CrMo 55 1.7357
Seat and plug ²⁾	Metal-sealing	1.4006/1.4008	
	Sealing ring when Balanced	Graphite	
Guide bushings		1.4112	
Packing		PTFE V-ring packing with carbon, spring of 1.4310, or high-temperature packing	
Body gasket		Metal	
Insulating section		13 CrMo 44	

¹⁾ See also pressure-temperature diagrams in T 8000-2 EN, materials for temperatures up to 500 °C: GS-17 CrMo V511 (1.7706).

²⁾ Seats and plugs also stellite, or plug of solid Stellite

Table 3 · Available K_v coefficients · Versions highlighted in gray also available with balanced plug

K _v		47	75	120	190	270	480	750	1100
Seat Ø	mm	63	80	100	125	150	200	250	300
Travel	mm	30			60			120	
DN	100	•							
	150	•	•	•					
	200			•	•	•			
	250			•	•	•	•		
	300				•	•	•	•	
	400					•	•	•	•

**Table 4a · Permissible differential pressures Δp for valves with unbalanced, metal-seated plug
Without metal bellows seal; fail-safe position "Valve CLOSED"**

Values specified in the grey shaded columns apply to standard operation, i.e. at rated travel · Values specified in the white columns apply to maximum pretensioned springs · Values in parentheses apply to half travel

Table 4a · Fail-safe position "Valve CLOSED" (FA)												
Bench range (bar) for actuator (cm ²)		700	0.2 to 1.0	0.4 to 1.2 (0.8 to 1.2)	0.4 to 2.0	0.8 to 2.4 (1.6 to 2.4)	0.6 to 3.0	1.2 to 3.6 (2.4 to 3.6)	1.4 to 2.3 (1.85 to 2.3)	2.1 to 3.3 (2.7 to 3.3)	2.35 to 3.8 (3.05 to 3.8)	2.6 to 4.3 (3.45 to 4.3)
		1400		0.4 to 1.2 (0.8 to 1.2)	0.8 to 2.4 (1.6 to 2.4)	1.0 to 3.0 (2.0 to 3.0)	1.2 to 3.6 (2.4 to 3.6)	0.9 to 1.6	1.1 to 1.8 (1.25 to 1.6)	1.0 to 2.1	1.4 to 2.7 (2.05 to 2.7)	1.3 to 2.8
		2800	0.4 to 1.2 (0.8 to 1.2)	0.8 to 2.4 (1.6 to 2.4)	1.0 to 3.0 (2.0 to 3.0)	1.2 to 3.6 (2.4 to 3.6)	0.9 to 1.6	1.1 to 1.8 (1.25 to 1.6)	1.0 to 2.1	1.25 to 2.35 (1.55 to 2.1)	1.1 to 2.6	1.5 to 3.0 (1.85 to 2.6)
		2x2800	0.4 to 1.2 (0.8 to 1.2)	0.8 to 2.4 (1.6 to 2.4)	1.0 to 3.0 (2.0 to 3.0)	1.2 to 3.6 (2.4 to 3.6)	0.9 to 1.6	1.1 to 1.8 (1.25 to 1.6)	1.0 to 2.1	1.25 to 2.35 (1.55 to 2.1)	1.1 to 2.6	1.5 to 3.0 (1.85 to 2.6)
Required supply pressure		Upper spring range value + 0.2 bar										
DN	K _{vs}	Actuator cm ²	Δp when p ₂ = 0									
100	47	700	–	6.5	6.5	14.5	10.5	22.6	26.7	40.8	45.9	50.9
		1400	–	(30.7)	–	(63)	–	(79.2)	–	(81.2)	–	(97.4)
150	47	700	–	6.2	6.2	14.3	10.2	22.4	26.4	40.6	45.6	50.7
		1400	–	(30.4)	–	(62.8)	–	(78.9)	–	(81)	–	(97.1)
150	75	700	–	–	–	8.6	6.2	13.7	16.2	24.9	28.1	31.2
		1400	–	(18.7)	–	(38.7)	–	(48.8)	–	(50)	–	(60)
150 to 250	120	700	–	–	–	5.2	–	8.4	10	15.6	17.7	19.7
		1400	–	(11.6)	–	(24.5)	–	(30.9)	–	(31.7)	–	(38.1)
200 to 300	190	1400	–	–	–	7.3	4.2	9.4	10.4	13.5	12.5	16.6
		2800	(15.5)	(32)	(40.2)	(48.4)	–	(24.7)	–	(30.9)	–	(37.1)
		2x2800	(33)	(64)	(80.2)	(96.8)	–	(49.4)	–	(61.8)	–	(74.2)
200 to 400	270	1400	–	–	–	5	–	6.4	7.1	9.3	8.6	11.4
		2800	(10.7)	(22.1)	(27.8)	(33.5)	–	(17.1)	–	(21.4)	–	(25.7)
		2x2800	(21.4)	(44.2)	(55.6)	(67)	–	(34.2)	–	(42.8)	–	(51.4)
250 to 400	480	1400	–	–	–	–	–	–	–	5.1	4.7	6.3
		2800	(5.9)	(12.3)	(15.5)	(18.8)	–	(9.5)	–	(11.9)	–	(14.3)
		2x2800	(11.8)	(24.6)	(31)	(37.6)	–	(19)	–	(23.8)	–	(28.6)
300 to 400	750	2800	–	–	4.8	5.8	4.2	5.3	4.8	6	5.3	7.3
		2x2800	–	7.4	9.6	11.6	8.4	10.6	9.6	12	10.6	14.6
400	1100	2800	–	–	–	4	–	–	–	4.1	–	5
		2x2800	–	5	6.6	8	5.8	7.2	6.6	8.2	7.2	10

Table 4b · Permissible differential pressures Δp for valves with unbalanced, metal-seated plug Without metal bellows seal Fail-safe position "Valve OPEN"

Table 4b · Fail-safe position "Valve OPEN" (FE)						
Bench range (bar) for actuator (cm ²)		700	0.2 to 1.0 (0.2 to 0.6)			
		1400				
		2800				
		2x2800				
Required supply pressure		1.4	2.4	4.0	6.0	
DN	K _{vs}	Actuator (cm ²)	Δp when p ₂ = 0			
100	47	700	6.5	26.7	59	99.4
		1400	(30.7)	(71)	(136)	–
150	47	700	6.2	26.4	58.7	99.2
		1400	(30.6)	(71)	(136)	(216)
150	75	700	–	16.2	36.2	61.3
		1400	(18.7)	(43.7)	(83.8)	(134)
150 250	120	700	–	10.2	23	39.1
		1400	(11.8)	(27.8)	(53.5)	(85.6)
200 to 300	190	1400	–	13.5	29.9	50.4
		2800	(15.5)	(36.1)	(68.9)	–
		2x2800	(31)	(72)	(138)	–
200 to 400	270	1400	–	9.3	20.7	34.9
		2800	(10.7)	(25)	(47.8)	–
		2x2800	(21.4)	(50)	(95.6)	–
250 to 400	480	1400	–	5.1	11.5	19.6
		2800	(5.9)	(13.9)	(26.8)	(42.8)
		2x2800	(11.8)	(27.8)	(53.6)	–
300 to 400	750	2800	–	6.8	15	25.3
		2x2800	–	13.6	30	50.6
400	1100	2800	–	4.7	10.4	17.5
		2x2800	–	9.4	20.8	35

Limits of application

The Type 3284 Steam-converting Valve has a broad range of application. However, optimum operation can only be guaranteed when the following operational conditions are provided (with absolute pressures p_{abs} in bar):

Pressure ratio $X = \Delta p / p_1 \geq 0.1$

Water pressure (p₃) at the connecting flange (5.5):
 $p_3 \geq p_2 + 0.15 \cdot p_1$

The water pressure upstream of the control valve (4) illustrated in Fig. 1 must be higher than p₃. The pressure must be selected carefully so that efficient control of the supplied water is ensured over the entire operating range.

The steam converter can only be used when the superheated steam and the spray water contain no or only small-sized suspended matter.

For further details, refer to the Information Sheet T 8250 EN.

Selection and sizing of the steam converter

The steam converters require particularly careful sizing. SAMSON therefore assumes the final sizing of the valves.

1. The ideal K_v coefficient is calculated acc. to IEC 60534.
2. The nominal size and K_{vs} coefficient are selected acc. to Table 3.
3. The permissible differential pressure Δp is determined and the suitable actuator selected acc. to Tables 4a to 5b.
4. The steam converters are selected considering material, pressure and temperature acc. to Tables 1 and 2, and also acc. to the associated pressure-temperature diagram (see T 8000-2 EN).

**Table 5 · Permissible differential pressures Δp for valves with metal-seated plug balanced by PTFE ring
Without metal bellows seal**

Values specified in the grey shaded columns apply to standard operation, i.e. at rated travel · Values specified in the white columns apply to maximum pretensioned springs · Values in parentheses apply to half travel

Table 5a · Fail-safe position "Valve CLOSED"									5b · "Valve OPEN"		
Bench range (bar) with actuator (cm ²)	700	0.4 to 2.0	0.8 to 2.4	–	–	0.6 to 3.0	1.2 to 3.6	0.4 to 2.0 (0.4 to 1.2)	2.4	4.0	6.0
	1400		0.8 to 2.4 (1.6 to 2.4)	0.5 to 2.5	1.0 to 3.0 (2.0 to 3.0)	–	–				
	2800					0.6 to 3.0	1.2 to 3.6 (2.4 to 3.6)				
	2x2800										
Required supply pressure		Upper spring range value + 0.2 bar									
DN	K _{vs}	Actuator cm ²	Δp when p ₂ = 0								
100 150	47	700	57.4	155	–	–	106	252	57.4	400	400
		1400	–	(400)	–	(400)	–	–	(400)	(400)	(400)
150	75	700	18.4	58.3	–	–	38.4	98.3	18.4	178	378
		1400	–	(297)	–	(378)	–	–	(218)	(400)	(400)
150 250	120	700	13.9	53.9	–	–	33.9	93.8	13.9	173	373
		1400	–	(293)	–	(373)	–	–	(213)	(400)	(400)
200 to 300	190	1400	18	49.2	25.8	64.8	–	–	18	143	298
		2800	–	(236)	–	(298)	–	(361)	(174)	(400)	(400)
200 to 400	270	1400	15.8	47	23.6	62.6	–	–	15.8	140	296
		2800	–	(234)	–	(296)	–	(359)	(172)	(400)	(400)
		2x2800	–	(400)	–	(400)	–	(400)	(344)	(400)	(400)
250 to 400	480	1400	11.4	42.6	19.2	58.2	–	–	11.4	136	292
		2800	–	(230)	–	(292)	–	(355)	(167)	(400)	(400)
		2x2800	–	(400)	–	(400)	–	(400)	(334)	(400)	(400)
300 400	750	2800	38.3	100	53.9	132	69.4	163	38.3	288	400
		2x2800	76.6	200	107.8	264	138.8	326	76.6	400	400

Table 6 · Dimensions in mm for Type 3284-1 in standard version

Valve size	DN	100	150	200	250	300	400
Length L	PN 10 to 40	350	480	600	730	850	1100
	PN 63 to 160	430	550	650	775	900	1150
H1 with actuator	700 cm ²	482	732	805	–		
	1400 cm ²	537	732	805	860	–	
	2800 cm ²	722	817	890	1094	1290	1290
H2	PN 10 to 40	207	288	390	410	480	560
	PN 63 to 160	249	338	390	410	480	650

Actuator	cm ²	700	1400	2800	2 x 2800
Diaphragm \varnothing D		390	530	770	
H		196	287	617	1134
H3 ¹⁾		190	610	648	
Thread		M 30 x 1.5	M 60 x 1.5	M 100 x 2	
α (Type 3271 Actuator)		G 3/8 (NPT 3/8)	G 3/4 (NPT 3/4)	G 1 (NPT 1)	
$\alpha 2$ (Type 3277 Actuator)		G 3/8 (NPT 3/8)	–		

¹⁾ Minimum clearance for actuator disassembly



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