

Pneumatic Steam Converter Type 3281-1 and Type 3286-1 Steam-converting Valve Type 3281 and Type 3286

Application

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

Nominal size DN 50 to 200
Nominal pressure PN 16 to 160
Temperatures up to 500 °C

Conversion of valve sizing coefficients:

C_v (in U.S. gallons/min) = $1.17 \cdot K_{vs}$ (in m^3/h)
 K_{vs} (in m^3/h) = $0.86 \cdot C_v$ (in U.S. gallons/min)



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

They consist of a Type 3281 or Type 3286 Steam-converting Valve with:

- Type 3271 Pneumatic Actuator (Type 3281-1 or Type 3286-1 Steam Converters).

The steam-converting valve largely corresponds to a Type 3251 Globe Valve (see Data Sheet T 8051 EN) or a Type 3256 Angle Valve (see Data Sheet T 8065 EN) equipped with a Flow Divider St III.

Valve body material

- Cast steel or
- High-temperature cast steel.

Low-noise valve plug

- Metal sealing
- Lapped-in metal or
- Pressure balanced to handle high differential pressures.

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
- Homogenous condition of the reduced and 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 combined with various 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 3281-1** (Fig. 2) · DN 50 to 200
- **Type 3286-1** · DN 50 to 200 · DN 250/300 on request

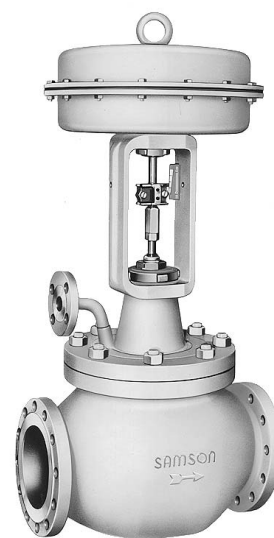
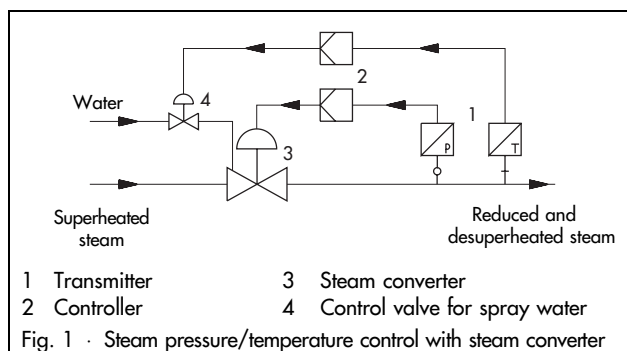


Fig. 2 · Type 3281-1 Pneumatic Steam Converter

Further 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
- **Type 3277 Pneumatic Actuator** · Effective diaphragm area 350 or 700 cm² on request (see T 8310-1 EN)
- **Additional handwheel** · See Data Sheet T 8310-1 EN and T 8310-2 EN
- **ANSI version** · NPS 2 to 8, Class 300 to 2500

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 has no contact with the valve body. It is piped to the Flow Divider St III (13) via the connecting pipe (5.5) and the annular chamber formed by the cage element (13.1).

Having passed the throttling area between the valve seat and the plug, the steam flow reaches its maximum velocity and contacts the supplied spray 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 area 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 valve. The water atomization described 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 Data Sheets T 8310-1 EN and T 8310-2 EN), the steam converter provides two different fail-safe positions which become effective upon air supply decrease or failure.

"Actuator stem extends"

Whenever the air supply fails, the valve closes.

"Actuator stem retracts"

Whenever the 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 | Water connection | | |

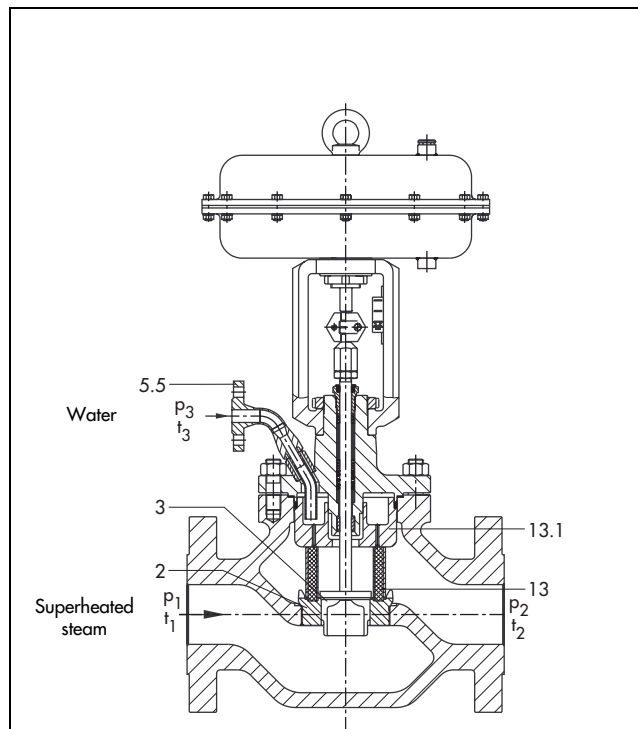


Fig. 3 · Type 3281-1 Pneumatic Steam Converter with flanges and Type 3271 Actuator

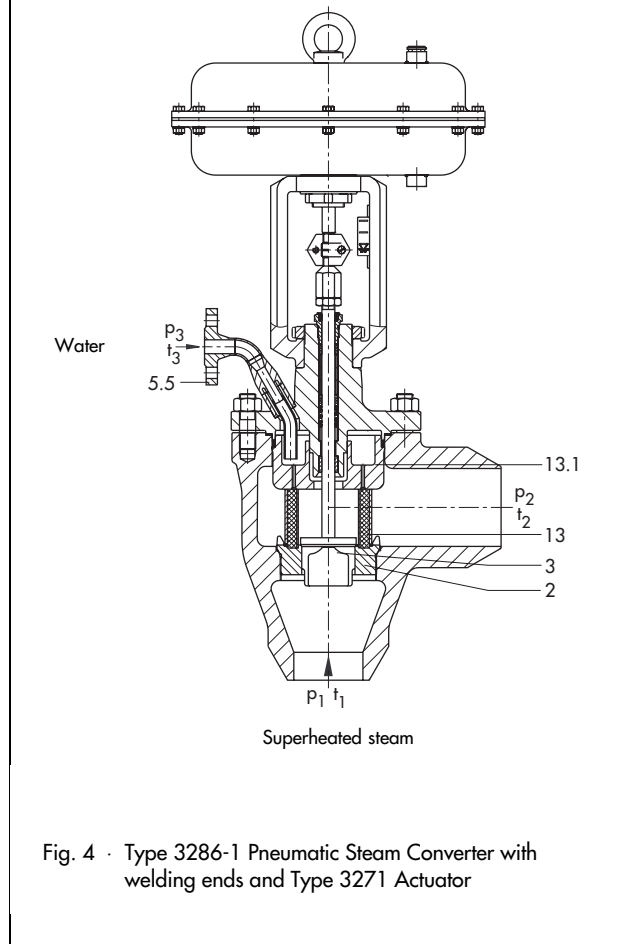


Fig. 4 · Type 3286-1 Pneumatic Steam Converter with welding ends and Type 3271 Actuator

Table 1 · Technical data of the Type 3281 and Type 3286

Material		Cast steel GS-C25 1.0619	Cast steel GS-17 CrMo 55 1.7357
Nominal size	DN	50 to 200 ²⁾	
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 sealing		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 with graphite ring	220 to 500	
Leakage class acc. to DIN EN 1349			
Valve plug	Standard Metal sealing	IV	
	Balanced	Lapped-in metal	IV-S2 · DN 100 and larger: IV-S1
		Metal sealing	With graphite ring: III

1) Up to PN 400 on request

2) DN 200 in PN 40 to 100

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		V-ring packing PTFE with carbon; spring: 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 above 500 °C: GS-12 CrMo 910 (1.7380).

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

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

Kvs	3.0	4.8	7.5	12	20	30	47	75	120	190 ¹⁾	270 ¹⁾
Seat Ø	24			31	38	50	63	80	100	125	150
Travel	15					30			60		
DN											
50	•	•	•								
80	•	•	•	•	•	•					
100				•	•	•	•				
150							•	•	•		
200									•	•	•

**Table 4a · Permissible differential pressures Δp for valves with unbalanced, metal-seated plug
Without metal bellows seal**

Values specified in the grey shaded columns apply to standard operation, i.e. 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)			0.4 to 1.2		0.8 to 2.4		0.6 to 3.0		1.2 to 3.6		1.4 to 2.3		2.1 to 3.3		-		-					
			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)		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)			
350			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)	
700			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)		0.5 to 2.5		1.0 to 3.0 (2.0 to 3.0)		1.1 to 2.4		1.4 to 2.7 (2.05 to 2.7)		1.3 to 2.8		1.7 to 3.2 (2.45 to 3.2)	
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		1.25 to 2.35 (1.55 to 2.1)		1.1 to 2.6		1.5 to 3.0 (1.85 to 2.6)	
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																			
50 80	3 to 7.5	350	8.1	22	22	49.9	35.9	77.7	91.7	140	-	-										
		700	-	(105)	-	(217)	-	(328)	(252)	(370)	(400)	-	-									
80 100	12	350	4.3	12.7	12.7	29.4	21	45.1	54.4	83.6	-	-										
		700	-	(62.7)	-	(129)	-	(196)	(150)	(221)	(250)	(284)	-	-								
80 100	20	350	-	8.1	8.1	19.2	13.6	30.3	35.8	55.3	-	-										
		700	-	(41.4)	-	(85.8)	-	(130)	(99.7)	(147)	(166)	(188)	-	-								
80 100	30	700	4.3	10.7	10.7	23.6	17.1	36.4	42.8	65.3	73.3	81.3										
		1400	-	(49.2)	-	(100)	-	(126)	-	(129)	-	(155)	-	-								
100 150	47	700	-	6.3	6.3	14.4	10.4	22.5	26.5	40.7	45.7	50.8										
		1400	-	(30.6)	-	(62.9)	-	(79.1)	-	(81.1)	-	(97.3)	-	-								
150	75	700	-	-	-	8.7	6.2	13.7	16.3	25	28.2	31.3										
		1400	-	(18.8)	-	(38.8)	-	(48.8)	-	(50.1)	-	(60.1)	-	-								
150	120	700	-	-	-	5.4	-	8.7	10.3	15.9	17.9	19.9										
		1400	-	(11.9)	-	(24.7)	-	(31.1)	-	(31.9)	-	(38.3)	-	-								
200	120	700	-	-	-	5.4	-	8.6	10.2	15.8	17.8	19.8										
		1400	-	(11.8)	-	(24.6)	-	(31)	-	(31.8)	-	(38.2)	-	-								
200	190	1400	-	-	-	7.4	4.3	9.5	10.5	13.6	12.5	16.6										
		2800	(15.6)	(32)	(40.3)	(48.5)	-	(24.9)	-	(31)	-	(37.2)	-	-								
		2x2800	(31.2)	(64)	(80.6)	(97)	-	(49.8)	-	(62)	-	(74.4)	-	-								
200	270	1400	-	-	-	5.1	-	6.5	7.2	9.3	8.6	11.5										
		2800	(10.7)	(22.2)	(27.9)	(33.6)	-	(17.2)	-	(21.5)	-	(25.7)	-	-								
		2x2800	(21.4)	(44.4)	(55.8)	(67.2)	-	(34.4)	-	43	-	(51.4)	-	-								

Table 4b · Permissible differential pressures Δp for valves with unbalanced, metal-seated plug Without metal bellows seal

Table 4b · Fail-safe position "Valve OPEN" (FE)						
Bench range (bar) for actuator (cm ²)	350		0.2 to 1.0 (0.2 to 0.6)			
	700					
	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			
50 80	3 to 7.5	350	21.6	91.3	203	342
		700	(105)	(244)	(400)	-
80 100	12	350	12.4	54.2	121	204
		700	(62.5)	(146)	(280)	-
80 100	20	350	7.9	35.7	80.1	136
		700	(41)	(97)	(185)	-
80 100	30	700	10.6	42.7	94.1	158
		1400	(49)	(113)	(216)	-
100 150	47	700	6.2	26.4	58.7	99.2
		1400	(30.4)	(71)	(135)	-
150	75	700	-	16.2	36.2	61.3
		1400	(18.7)	(43.7)	(84)	(134)
150	120	700	-	10.2	23	39.1
		1400	(11.8)	(27.8)	(53.5)	(85)
200 ¹⁾	120	700	-	10.0	22.9	38.9
		1400	(11.6)	(27.7)	(53.3)	(85)
200 ¹⁾	190	1400	-	13.5	29.9	50.4
		2800	(15.5)	(36.1)	(69)	-
		2x2800	(31)	(72)	(138)	-
200 ¹⁾	270	1400	-	9.3	20.7	34.9
		2800	(10.7)	(25)	(47.8)	-
		2x2800	(21.4)	(50)	(95.6)	-

¹⁾ Only for Type 3281

Limits of application

The Type 3281 and Type 3286 have a broad range of application. However, optimum operation can only be guaranteed when the following operational conditions are provided (for absolute pressures p_{abs} in bar):

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

Water pressure (p₃) at 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, please 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_v coefficient are selected acc. to Table 3.
3. The permissible differential pressure Δp is determined and the suitable actuator selected acc. to the Tables 4a to 5b.
4. The steam converters are selected considering material, pressures and temperatures acc. to Tables 1 and 2 and also acc. to the associated pressure-temperature diagram (see T 8000-2 EN).
5. Accessories are selected acc. to Tables 1 and 2.

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

Values specified in the grey shaded columns apply to standard operation, i.e. 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" (FA)								Table 5b · "Valve OPEN" (FE)			
Bench range (bar) for actuator (cm ²)	700	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	0.4 to 2.0 (0.4 to 1.2)			
	1400			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						2.4	4.0	6.0	
DN	K _{vs}	Actuator cm ²	Δp when p ₂ = 0								
150	75	700	18.4	58.3	–	–	38.4	98.3	18.4	178	378
		1400	–	(298)	–	(378)	–	–	(218)	(400)	–
150	120	700	13.9	53.8	–	–	33.9	93.8	13.9	174	373
		1400	–	(293)	–	(373)	–	–	(213)	(400)	–
200 ¹⁾	120	700	4.6	20.2	–	–	12.4	35.8	4.6	67	145
		1400	–	(114)	–	(145)	–	–	(82.6)	(207)	(363)
200 ¹⁾	190	1400	18	49.2	25.8	64.8	–	–	18	143	299
		2800	–	(236)	–	(298)	–	(361)	(174)	(400)	–
		2x2800	–	(400)	–	(400)	–	(400)	(348)	(400)	–
200 ¹⁾	270	1400	15.8	47	23.6	62.6	–	–	15.3	109	265
		2800	–	(234)	–	(296)	–	(359)	(172)	(400)	–
		2x2800	–	(400)	–	(400)	–	(400)	(344)	(400)	–

1) Only for Type 3281

Table 6 · Dimensions and weights for Type 3281-1 Globe Valve in standard version

Valve size	DN	50	80	100	150	200
Length L	PN 10 to 40	230	310	350	480	600
	PN 63 to 160	300	380	430	550	650
H1 with actuator	350 cm ²	457	462	482	–	
	700 cm ²	457	462	482	732	805
	1400 cm ²	–	517	537	732	805
	2800 cm ²	–		722	817	890
H2	PN 10 to 40	90	100	160	220	250
	PN 63 to 160	100	120	180	235	270
Weight without actuator (appx. kg)	PN 16 to 40	40	68	85	215	450
	PN 63 to 160	66	105	140	395	660

Table 7 · Dimensions and weights for Type 3286 Angle Valve in standard version

Valve size	DN	50	80	100	150	200
Length L2	PN 10 to 40	125	155	175	225	275
	PN 63 to 160	150	190	215	275	325
H1 with actuator	350 cm ²	415	400	410	–	–
	700 cm ²	415	400	410	628	965
	1400 cm ²	–	455	465	628	965
	2800 cm ²	–	–	650	713	1050
Weight without actuator (appx. kg)	PN 16 to 40	37	63	80	200	440
	PN 63 to 160	62	100	130	330	On request

Table 8 · Dimensions and weights for Type 3271 Pneumatic Actuator

Actuator size	cm ²	350	700	1400	2800	2 x 2800
Diaphragm Ø D		280	390	530	770	
H 1)		82	196	287	617	1134
H3 2)		110	190	610	648	
Thread	d	M 30 x 1.5		M 60 x 1.5	M 100 x 2	
Thread	a	G 3/8 (NPT 3/8)		G 3/4 (NPT 3/4)	G 1 (NPT 1)	
Weights (kg)	Without handwheel	8	22	70	450	950
	With handwheel	13	27	Only with side-mounted handwheel, see T 8310-2 EN.		

1) Actuator 350 cm² without lifting ring

2) Minimum clearance for actuator disassembly

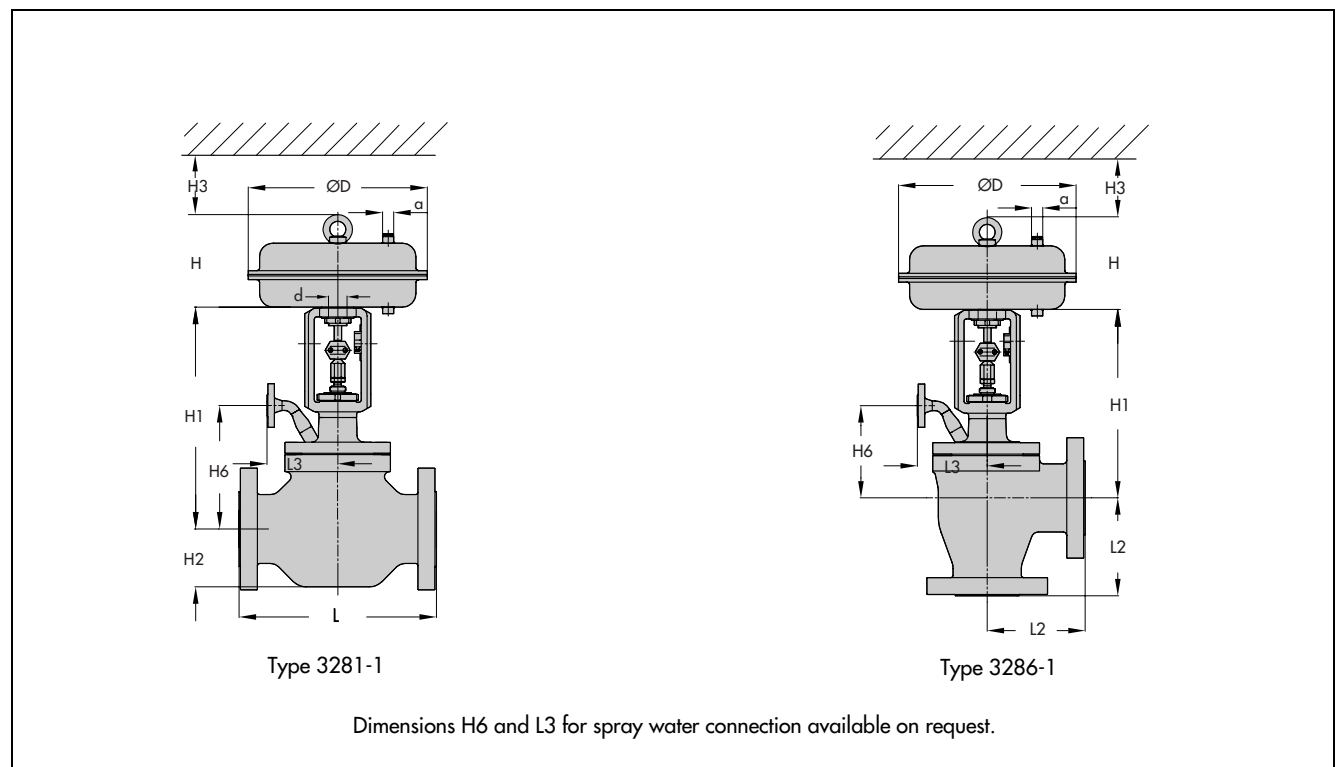
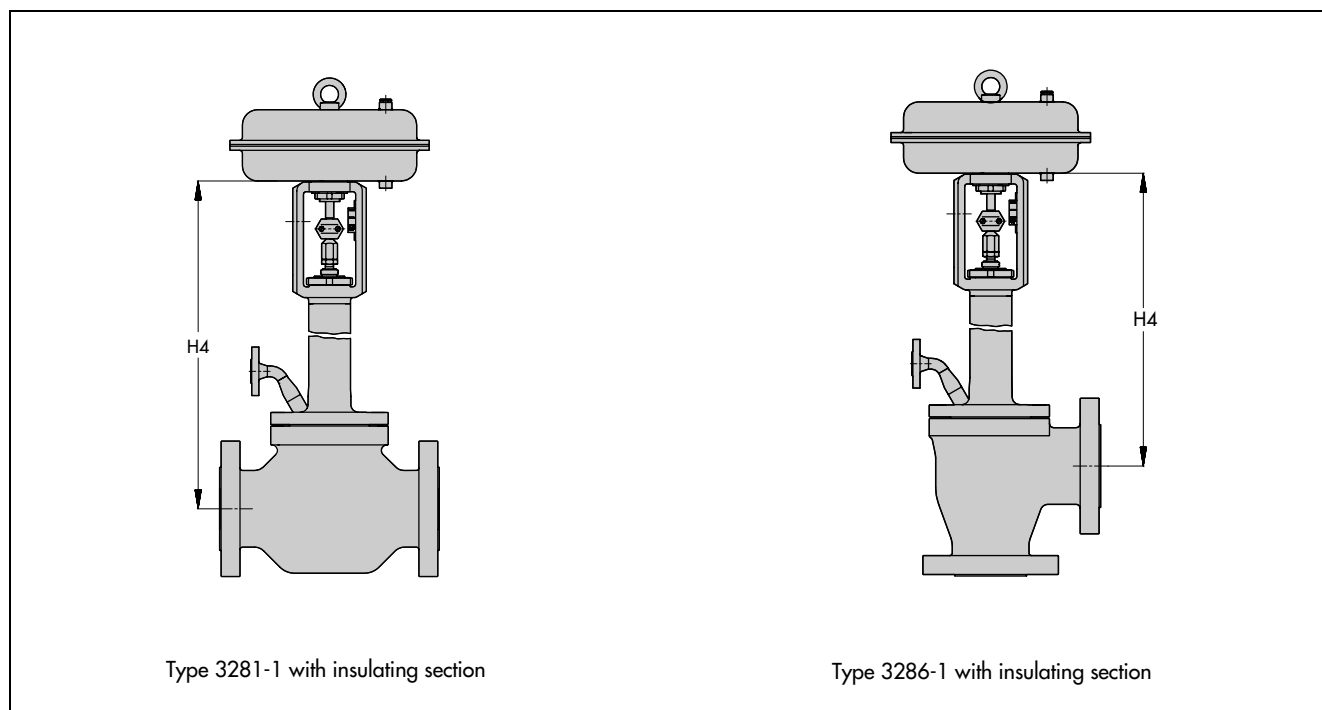


Table 9 · Dimensions and weights for Type 3281 Globe Valve in standard version with insulating section · Without actuator

Valve size	DN	50	80	100	150	200
Height H4 with actuator	350 cm ²	727	732	752	–	
	700 cm ²	727	732	752	1083	1365
	1400 cm ²	–	787	807	1083	1365
	2800 cm ²	–		992	1168	1450
Weight (kg) w/o actuator for	PN 16 to 40	50	78	105	250	475
	PN 63 to 160	75	115	160	380	685

Table 10 · Dimensions and weights for Type 3286 Angle Valve in standard version with insulating section · Without actuator

Valve size	DN	50	80	100	150	200
Height H4 with actuator	350 cm ²	685	670	680	–	–
	700 cm ²	685	670	680	978	–
	1400 cm ²	–	725	735	978	2015
	2800 cm ²	–		920	1063	2100
Weight (kg) w/o actuator for	PN 16 to 40	47	70	100	235	On request
	PN 63 to 160	70	105	150	365	



Please submit the following details on ordering:

Steam converter Type 3281 Globe Valve or
Type 3286 Angle Valve

Nominal size DN ...

Nominal pressure PN ...

Body material As indicated in Table 2

Type of connection Flanges or welding ends

Plug Standard or balanced

Characteristic Equal percentage or linear

Max. and min. flow rate
of the superheated and
desuperheated steam p₁ and t₁ as well as
p₂ and t₂
in kg/h or t/h

Steam temperature upstream
and downstream of the valve t₁
t₂

Pressure and temperature of p₃ and t₃
spray water upstream of the
valve

Actuator Type 3271

Effective actuator area ... cm²

Fail-safe position Valve CLOSED or
valve OPEN

Accessories Positioner and/or limit switch

Specifications subject to change without notice.

