Si 2321

Engineering
GREAT *Solutions*

Safety valves for pressure relief in accordance to PED, DIN/EN and ASME

IMI Critical Engineering

Si 2321

Features

The regular safety valve for low pressures:

> Cost-effective body design with seat bushing

> Smooth and stable behaviour thanks to comparatively low lift

> Cast iron body with inner parts mainly out of stainless steel

Inlet sizes
DN 20 to DN 150

Pressure rating
PN 10 to PN 16

Set pressures
0.45 bar g to 16 bar g
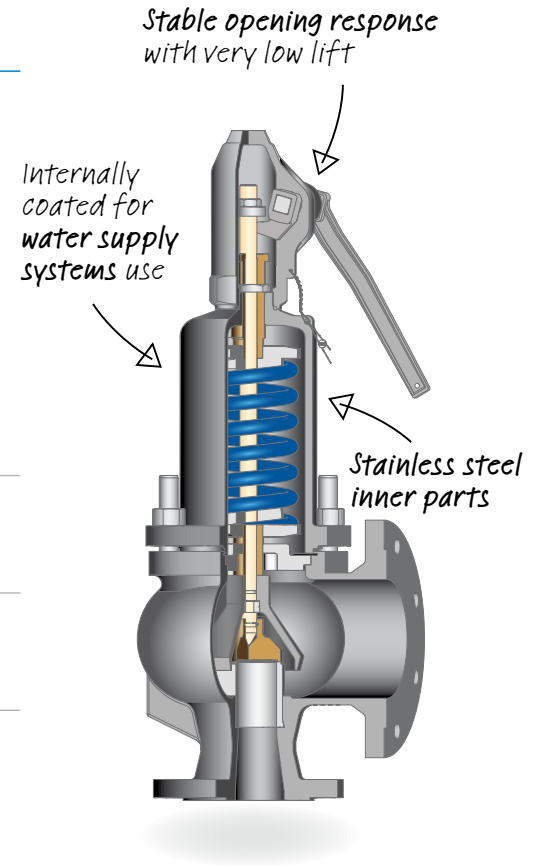
Temperature range
-10 °C to +300 °C

Overpressure
Vapours/gases	10%
Liquids	10%

Blowdown
Vapours/gases	10%
Liquids	20%

Allowable built-up back pressure
15% of set pressure

Stable opening response with very low lift

Internally coated for water supply systems use

Stainless steel inner parts

Applications

> For vapours, gases and liquids

> Protecting the systems downstream of control valves

> Water supply up to PN 16

> Approved for drinking water

Approvals and standards

EC type examination

- Pressure Equipment Directive 97/23/EC
- DIN EN ISO 4126-1
- AD2000-Merkblatt A2
- VdTÜV Merkblatt "Sicherheitsventil 100"

VdTÜV type approval acc. to

TÜV.SV.12-209.d_0.D / G / F.α_w.p

IMI Bopp & Reuther will not renew the existing VdTÜV type approvals. The requirements by VdTÜV and applicable standards are completely considered by the EC type examination.

The design, manufacture, testing and labelling meet the requirements of DIN EN ISO 4126-1, DIN EN 12266-1/-2 (insofar as applicable for safety valves), EN 1092-1, EN 1759-1, AD 2000-Merk-blätter A2 and HP0, ASME B16.5, ASME VIII

Si 2321

Type code

Type code				Ordering example		
1	**Series**	Si 2	DIN/EN regular safety valve	Si 2		
2	**Design**	3	Conventional, closed bonnet	3		
3	**Characteristic**	2	Regular Flow	2		
4	**Pressure class**	1	Up to PN 16	1		
5	**Cap**	A	Packed lifting lever	A		
		AB	Packed lifting lever with test gag			
6	**Material code**	05	EN-GJL-250/5.1301 GG25/0.6025/EN-JL 1040	05		
7	**Options**	.09	Locking sleeve (government ring)	.11a .41		
		.11a	Disc with soft seal EPDM			
		.35	With lift restriction ring			
		.41	Luperpox[1] coated internal and external			

[1] Luperpox is a coating for potable water and approved in accordance with the "UBA-Leitlinie" (federal environment agency guideline) for contact with potable water and in accordance with DVGW worksheet W 270 with KTW approval.

Type ▶ **Si 2321 A 05 .11a .41**

Please state: ▶

Set pressure	6 bar g
Fluid temperature	20 °C
Fluid and state	Water Liquid
Inlet	DN 50, PN 16, B1
Outlet	DN 50, PN 10, B1
Flow diameter	32 mm
Approval	97/23/EG (CE)

Si 2321

Coefficient of discharge

Fluid group	Inlet size	Flow diameter	$h/d_0 \geq$	Pressure $p_0 \geq$ [bar g]	$p_b/p_0 \leq$	α_w
Vapours/gases (D/G)	DN 20 to DN 150	12 mm to 93 mm	0.1	0.6	0.62	0.25
Liquids (F)	DN 20 to DN 150	12 mm to 93 mm	0.1	0.45	-	0.25

The coefficient of discharge for gases/vapours in a pressure ratio of $p_b/p_0 > 0.62$ is shown in the diagram below.

The capacity of the safety valve can be adjusted to the required capacity by reducing the lift, thus reducing an undesirable extra performance.

The following applies $\alpha_{w(reduced)} = \alpha_w \times q_m/q_{mc}$. The required ratio h/d_0 is shown in the diagram below, and the reduced lift calculated with $h_{(reduced)} = d_0 \times (h/d_0)$.

The coefficients of discharge K_{dr} acc. to DIN EN ISO 4126-1 for this valve series are identical to the above coefficients of discharge α_w and the values in the diagrams.

h	=	Lift [mm]
d_0	=	Flow diameter of the selected safety valve [mm]
h/d_0	=	Lift/flow diameter ratio
p_b	=	Absolute back pressure [bar a]
p_0	=	Absolute relieving pressure [bar a]

p_b/p_0	=	Absolute back pressure/absolute relieving pressure ratio
α_w	=	Coefficient of discharge acc. to AD 2000-Merkblatt A2
q_m	=	Required mass flow [kg/hr]
q_{mc}	=	Certified mass flow [kg/hr]
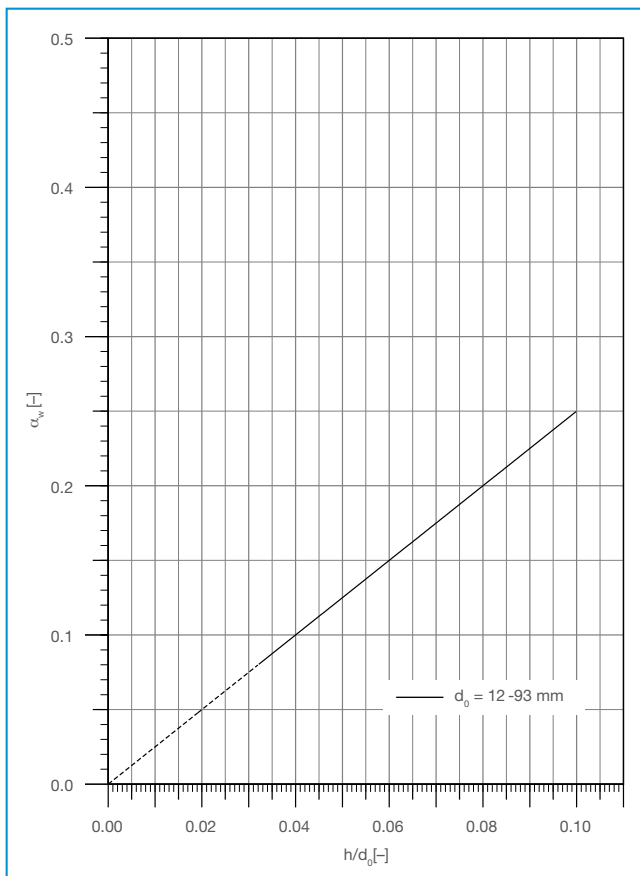
Si 2321 coefficient of discharge α_w depending on h/d_0 for gases and vapours, liquids
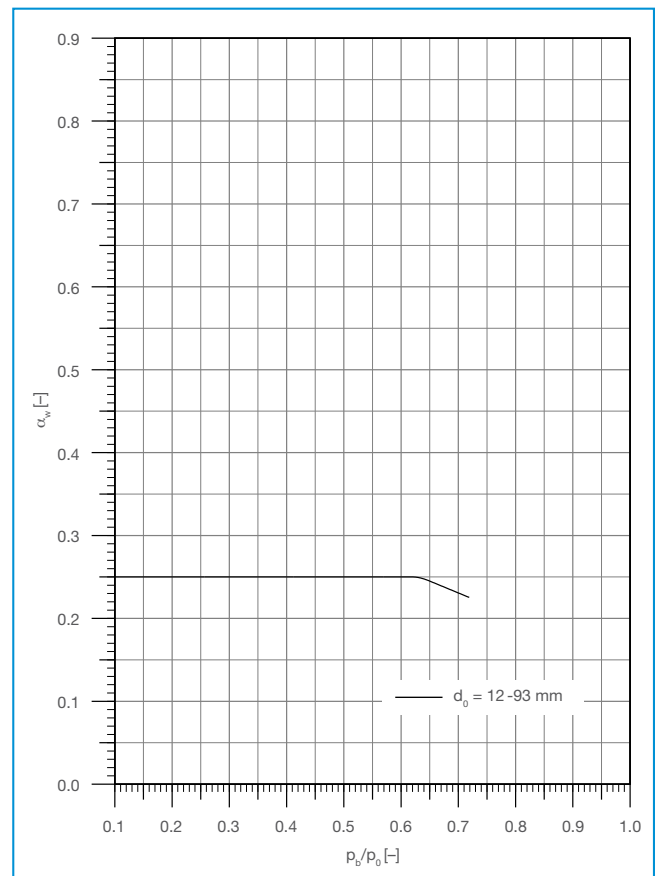
Si 2321 coefficient of discharge α_w depending on p_b/p_0 for gases and vapours

Si 2321

Sample calculation for a safety valve for use with liquid in accordance with AD 2000-Merkblatt A 2

Fluid
Water

Density ρ
998 kg/m³

Set pressure
7.5 bar g

Opening pressure p_0 at 10% accumulation
$(7.5 \times 1.1) + 1{,}01 = 9.26$ bar a

Back pressure p_b
1.01 bar a

Required mass flow q_m
12,300 kg/hr

The coefficient of discharge for all these pressures is $\alpha_w = 0.25$.

The required area is

$$A_0 = 0.6211 \cdot \frac{q_m}{\alpha_w \cdot \sqrt{(p_0 - p_b) \cdot \rho}}$$

$$= 0.6211 \cdot \frac{12300}{0.25 \cdot \sqrt{(9.26 - 1.01) \cdot 998}} = 337 \text{ mm}^2$$

With the flow area of $A_0 = 491$ mm² the safety valve Si 2321 A 05, DN 40 × DN 40, PN 16 × PN 16, d_0 25 mm is adequately dimensioned for the application. The certified capacity of the selected safety valve is 17,928 kg/hr.
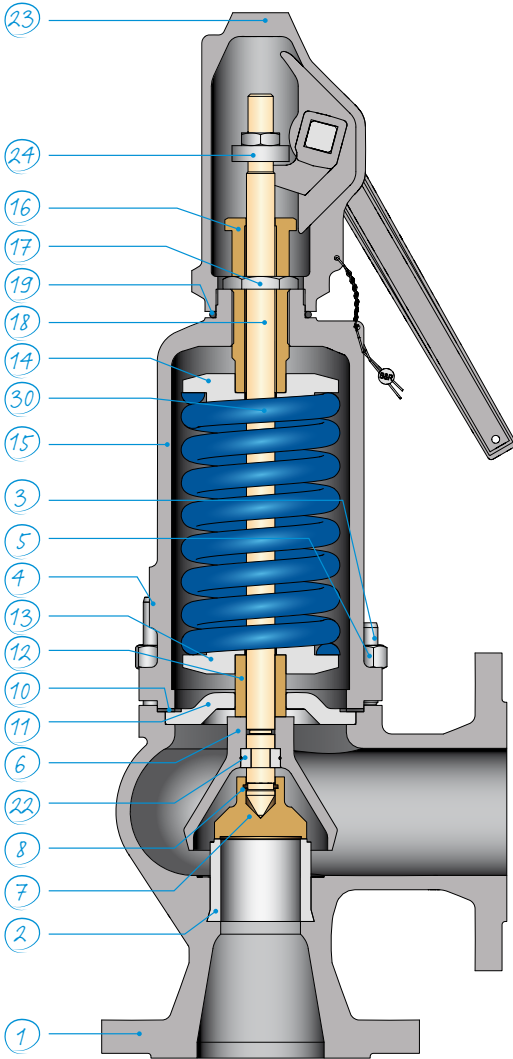
With the application data provided the following capacity table for water results in selecting the same flow area of $d_0 = 25$ mm. Interim values for the set pressure can be linearly interpolated.

Capacity data for water (20°C and 998 kg/m³) calculated according to AD-2000 Merkblatt A2 with 10% accumulation

$DN_E \times DN_A$	20 x 20	25 x 25	32 x 32	40 x 40	50 x 50	65 x 65	80 x 80	100 x 100	125 x 125	150 x 150
Flow diameter d_0 [mm]	12	16	20	25	32	40	50	63	77	93
Set pressure p [bar g]						10³ kg/h Water				
1	1.50	2.68	4.18	6.54	10.7	16.7	26.1	41.5	62.1	90.5
2	2.13	3.79	5.92	9.25	15.1	23.7	37.0	58.7	87.8	128
3	2.61	4.64	7.25	11.3	18.5	29.0	45.3	72.0	107	156
4	3.01	5.36	8.37	13.0	21.4	33.5	52.3	83.1	124	181
5	3.37	5.99	9.36	14.6	23.9	37.4	58.5	92.9	138	202
6	3.69	6.56	10.2	16.0	26.2	41.0	64.1	101	152	221
7	3.99	7.09	11.0	17.3	28.3	44.3	69.2	109	164	239
8	4.26	7.58	11.8	18.5	30.3	47.4	74.0	117	175	256
9	4.52	8.04	12.5	19.6	32.1	50.2	78.5	124	186	271
10	4.76	8.47	13.2	20.7	33.9	52.9	82.8	131	196	286
12	5.22	9.28	14.5	22.6	37.1	58.0	90.7	144	215	313
14	5.64	10.0	15.6	24.4	40.1	62.7	97.9	155	232	338
16	6.03	10.7	16.7	26.1	42.9	67.0	104	166	248	362

Si 2321

Material code

Materialcode		05
Temperature application range		-10 °C to +300 °C
Part	**Name**	**Material**
1	Body	EN-GJL-250 / 5.1301 GG25 / 0.6025 / EN-JL 1040
2	Seat bushing	1.4122
3	Stud, short	5.6
4	Stud, long	5.6
5	Hexagon nut	5
6	Disc holder	0.7040
7	Disc [3]	1.4122
8	Disc retainer	1.4571
10	Flat gasket	1.4401 / Graphite
11	Intermediate cover [1]	1.4122 1.4059
12	Pressure sleeve	1.4122
13	Spring washer, bottom	1.0038
14	Spring washer, top	1.0038
15	Bonnet	EN-GJL-250 / 5.1301 GG25 / 0.6025 / EN-JL 1040
16	Adjusting screw	1.4104
17	Locknut	5
18	Spindle	1.4021
19	Flat gasket	1.4401 / Graphite
22	Ring (two-parts)	1.4122
23	Lifting lever [2]	0.7040
24	Lifting nut	1.4021
30	Spring [4]	1.1200 1.8159

1) Intermediate cover to DN 80 made from 1.4122, above that made from 1.4059
2) Packed lifting lever (cap) from DN 150 flanged
3) Disc material may be upgraded to stellited 1.4571 upon request for safety valves in saturated steam service
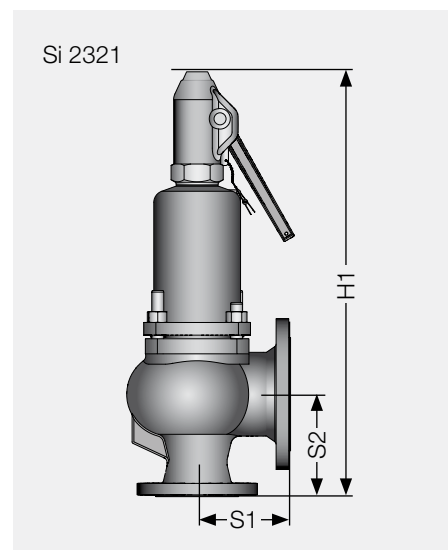4) The spring material selection depends on the valve size and set pressure

IMI Bopp & Reuther reserve the right to technical changes or application of higher quality materials without prior notice. The material design can be tailored to customer specifications at any time upon request.

Si 2321

Sizes, pressure ranges and dimensions

Size		20	25	32	40	50	65 [3]	80	100	125	150
	DN_E	20	25	32	40	50	65 [3]	80	100	125	150
	DN_A	20	25	32	40	50	65 [3]	80	100	125	150
Flow diameter [mm]		12	16	20	25	32	40	50	63	77	93
Flow area [mm²]		113	201	314	491	804	1257	1964	3117	4657	6793
Min. set pressure [bar g]		0.45									
Max. set pressure [bar g] [1]		16									
Max. back pressure [bar g]		4									
Inlet flange DIN EN [2]		PN 10									
		PN 16									
Outlet flange DIN EN [2]		PN 10									
		PN 16									
Centre to face dimension S1 [mm]		95	100	105	115	125	145	155	175	200	225
Centre to face dimension S2 [mm]											
Height H1 [mm]		335	350	390	420	495	550	655	705	810	850
Weight [kg]		8	9	11	13	18	26	38	52	80	90

[1] Stated pressures are maximum values corresponding to the spring forces. The component strength may need to be reviewed depending on the material and temperature.

[2] Flanges PN 10 / 16 acc. to DIN EN 1092-2; flange facing Type B1

[3] 4-hole flange drilling with DN 65 PN 10 / 16

Si 2321

IMI
Critical Engineering