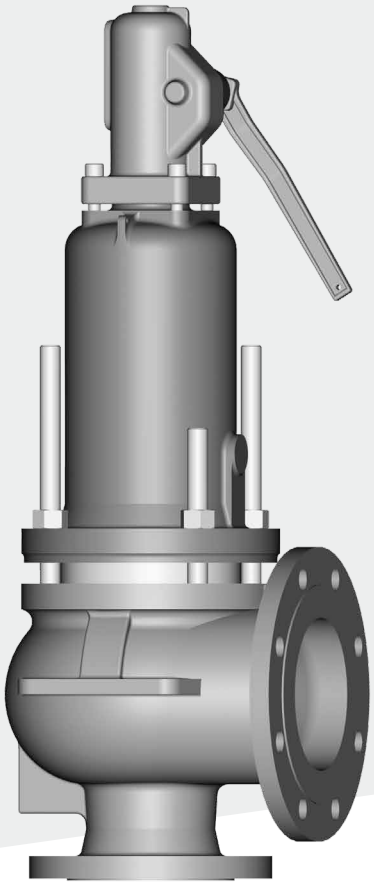
IMI BOPP & REUTHER

Si 4302



Engineering
GREAT Solutions

Process and steam safety valves to PED and DIN/EN standards

IMI Critical Engineering

Si 4302

Features

The state-of-the-art IMI Bopp & Reuther medium-pressure safety valve:

- Cost-effective semi nozzle body design with seat bushing
- Developed in modular design with other series
- Reliable function with ideal capacity
- Inner parts made from stainless steel (except for spring and spring washer)

Inlet sizes
DN 20 to DN 200

Inlet pressure rating
PN 10 to PN 40

Set pressures
0.1 bar g to 40 bar g

Temperature range
-270 °C to + 450 °C

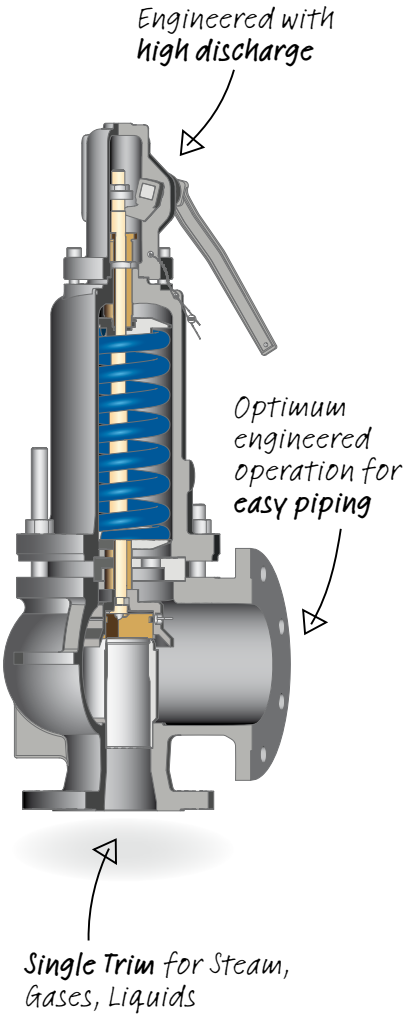
Overpressure

Vapours / gases	5%
Liquids	10%

Blow down

Vapours / gases	10%
Liquids	20%

Allowable built-up back pressure without bellows
20% of the set pressure



Applications

- For vapours, gases and liquids
- Protection of pressure vessels
- Protection of heat exchangers
- Protection of system components
- Suitable for all industrial applications
- Chemical industry
- Petrochemical industry
- Technical gases
- Cooling and oxygen applications
- Power generation and power supply
- Steam boiler up to PN 40

Approvals and standards

EC type examination

- Pressure Equipment Directive 97 / 23 / EC
- DIN EN ISO 4126-1
- AD 2000-Merkblatt A2
- VdTÜV Merkblatt “Sicherheitsventil 100”

VdTÜV type approval acc. to

TÜV.SV.13 -1094.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 4126-7, DIN EN 12266-1 / -2 (insofar as applicable to safety valves), DIN EN 1092 parts I and II Flanges, AD 2000-Merkblatt A4, AD 2000-Merkblatt HP0, technical rules for steam boiler TRD 110, TRD 421

Si 4302

Type code

Type code				Order example
1	**Series**	Si 4	Safety valve for high capacities	Si 4
2	**Design**	1	Conventional, open bonnet	4
		3	Conventional, closed bonnet	
		4	Bellows, closed bonnet	
		5	Bellows, open bonnet	
3	**Characteristic**	0	High capacity "High Flow"	0
4	**Pressure class**	2	Up to PN 40	2
5	**Cap**	G	Gastight cap	A
		GB	Gastight cap with test gag	
		A	Packed lifting lever	
		AB	Packed lifting lever with test gag	
		AK	Pneumatic actuator	
6	**Material code**	00	GP240GH / 1.0619	04
		04	GX5CrNiMo19-11-2 / 1.4408	
7	**Options**	.09	Locking sleeve (government ring)	.59
		.11t	Disc with soft seal PTFE	
		.14a	Lift indication with inductive proximity switch in the cap	
		.14b	Lift indication with inductive proximity switch in the auxiliary housing	
		.14c	Lift indication with inductive proximity switch for exposed spindle with actuator AK	
		.15	Bonnet spacer for high and low temperatures	
		.18	Heating jacket	
		.25	Block body design	
		.28	Oil and grease free	
		.32	Purge connection	
		.35	Lift restriction ring	
		.38	Vibration damper	
		.57	Weight loading	
		.59	Stellited disc	
		.60	Stellited seat	

Type ►	**Si 4402 A 04 .59**
Please state ►	
Set pressure	18 bar g
Fluid temp.	20 °C
Fluid and State	Air, Gas
Inlet	DN 50, PN 40, B1
Outlet	DN 80, PN 16, B1
Flow diameter	42 mm
Approval	97 / 23 / EG (CE)

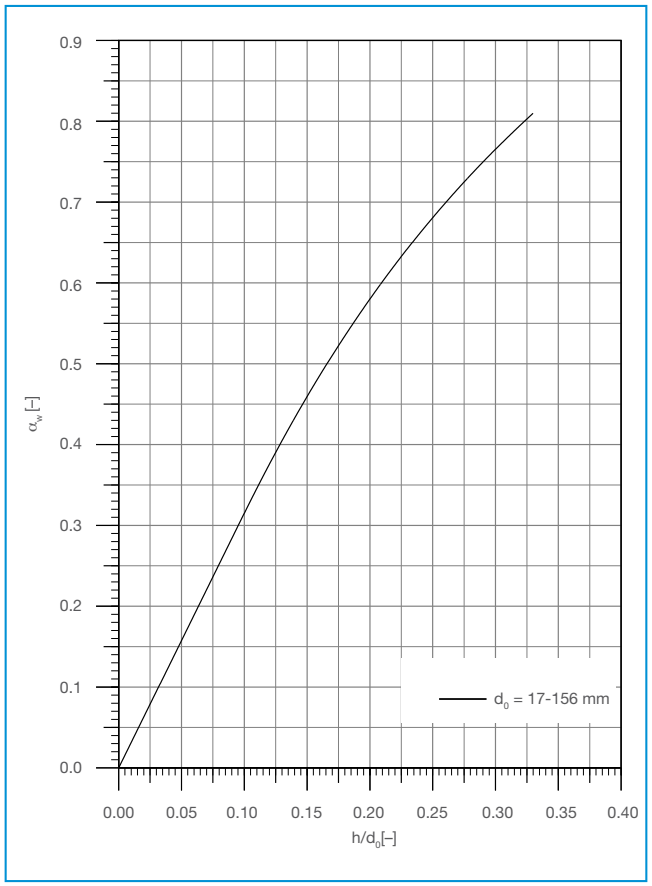
Si 4302

Coefficients of discharge

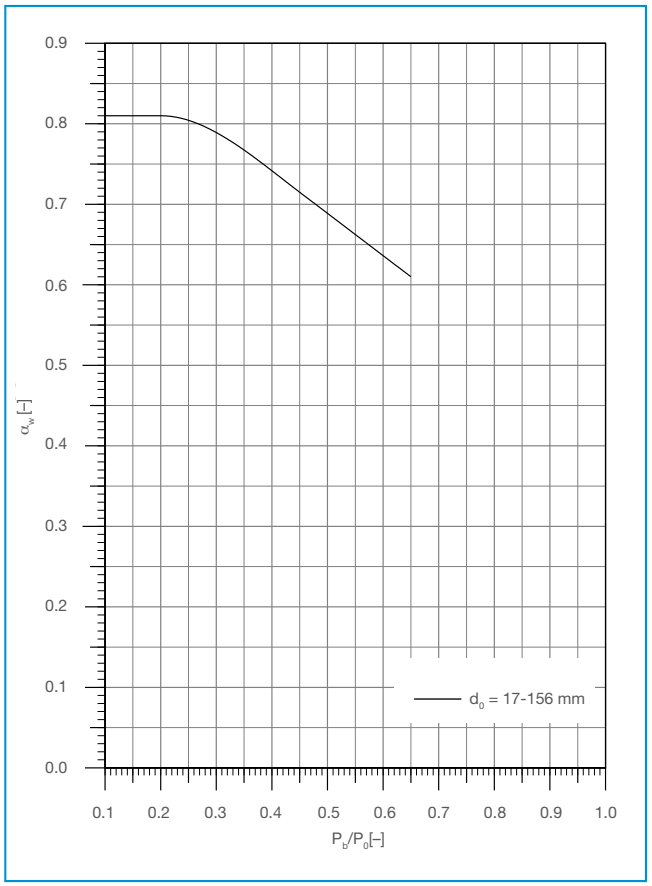
Fluid group	Inlet size	Flow diameter	$h/d_0 \geq$	$p_b/p_0 \leq$	α_w
Vapours / gases (D / G)	DN 20 to DN 200	17 mm to 156 mm	0.33	0.2	0.81
Liquids (F)	DN 20 to DN 200	17 mm to 156 mm	0.33	-	0.57

The coefficient of discharge for gases / vapours in a pressure ratio of $p_b / p_0 > 0.2$ is shown in the diagram below.

The capacity of the selected safety valves can be adjusted to the required capacity by reducing the lift, thus reducing 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 $h_{(reduced)} = d_0 \times (h/d_0)$.



Si 4302 coefficient of discharge α_w depending on h/d_0 for gases and vapours



Si 4302 coefficient of discharge α_w depending on p_b/p_0 for gases and vapours

Si 4302

Sample size calculation for a safety valve in gas service acc. to DIN EN ISO 4126-7:

Fluid
air

Temperature T_0
20 °C = 293.15 K

Isentropic exponent k
1.4

Molar mass M
29.0 kg / kmol

Compressibility factor Z
1.0

Set pressure
1.5 bar g

Relieving pressure p_0 at 10% accumulation
(1.5 x 1.1) + 1 = 2.65 bar a

Back pressure p_b
atmospheric

Required capacity q_m
6.000 kg / hr

p_b/p_0 = 0.377 can be used to derive the coefficient of discharge K_{dr} = 0.757 from the diagram “Si 4302 coefficient of discharge α_w depending on p_b/p_0 for gases and vapours”. (α_w is equal K_{dr})

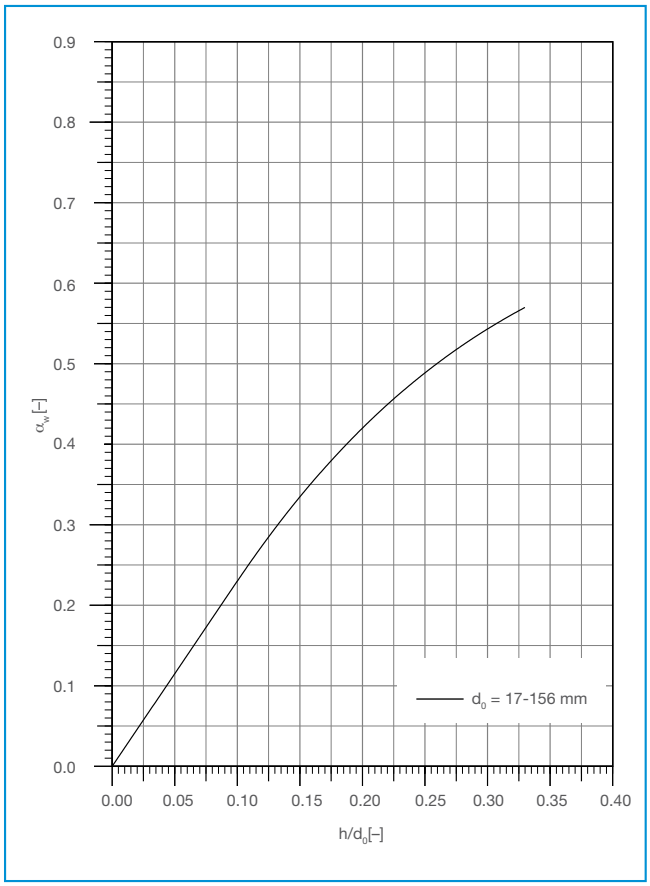
As the condition for critical flow

$$\frac{p_b}{p_0} \leq \left(\frac{2}{k+1}\right)^{\frac{k}{k-1}}$$ is met in the example, the following applies: $$A = \frac{q_m}{p_0 C K_{dr} \sqrt{\frac{M}{Z T_0}}}$$

With $$C = 3.948\sqrt{k\left(\frac{2}{k+1}\right)^{\frac{k+1}{k-1}}} = 2.703,$$ is

$$A = \frac{6000}{2.65 \times 2.703 \times 0.757 \sqrt{\frac{29}{1 \times 293.15}}} = 3{,}518.1 \text{ mm}^2,$$ is the required flow area.

With a flow area of A_0 = 4902 mm², the safety valve Si 4302 A 00, DN 100 x 150, PN 10 x 10, d_0 79.0 mm is suitable for this application (see page 8 for size range).



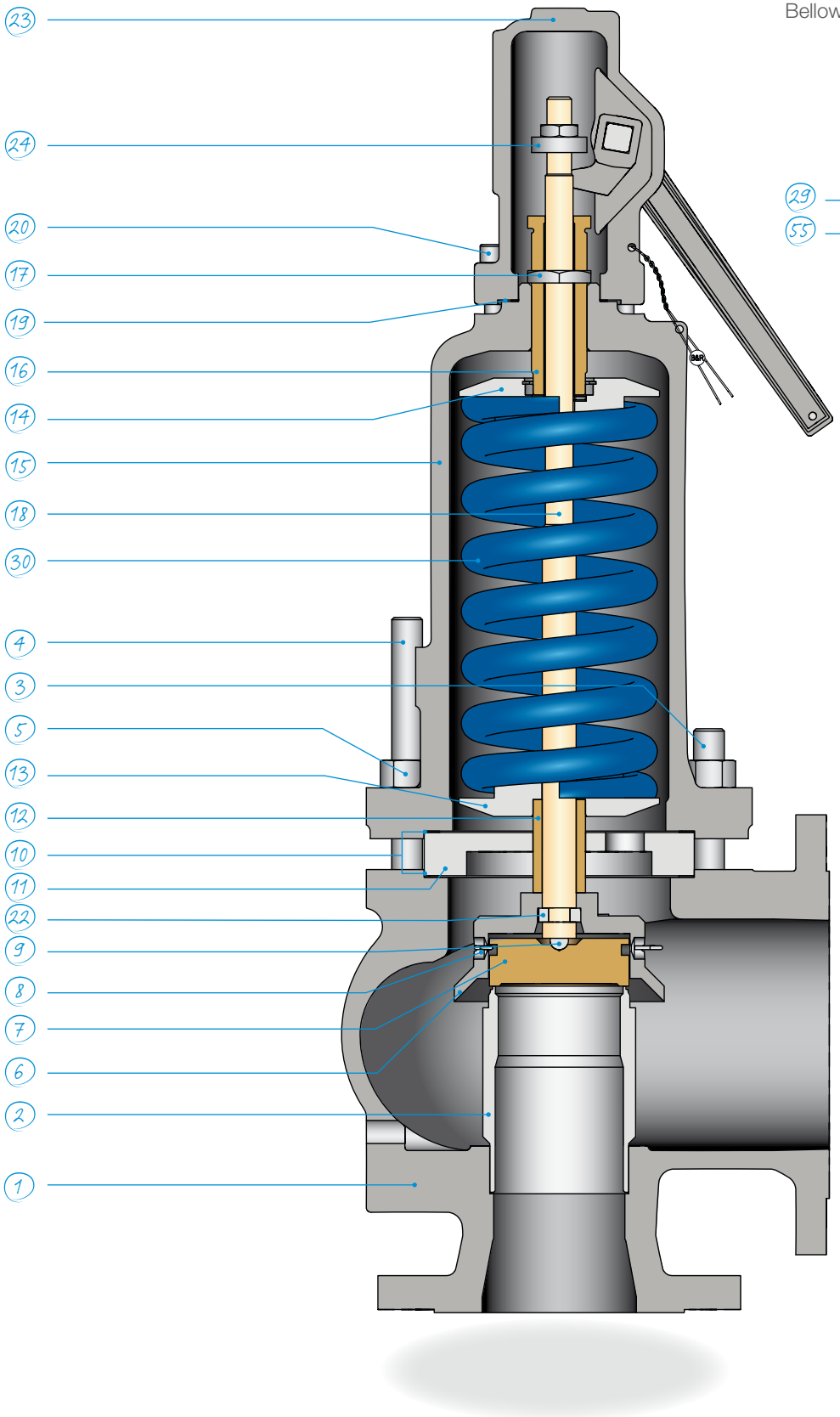
Si 4302 coefficient of discharge α_w depending on p_b/p_0 for liquid

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

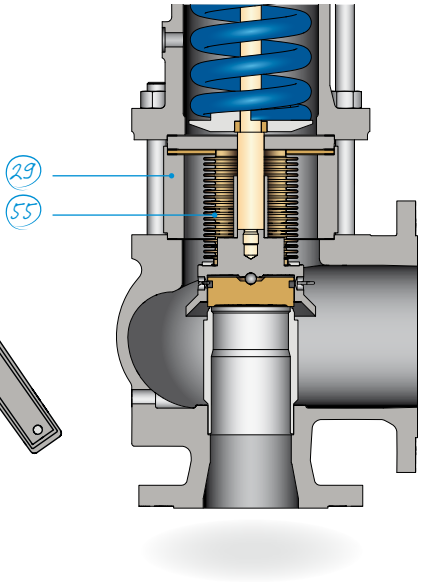
h	=	Lift [mm]
d_0	=	Flow diameter of the selected safety valve [mm]
h/d_0	=	Lift / Flow diameter ratio
p_b	=	Absolute back pressure [bar a]
p_0	=	Absolute relieving pressure [bar a]
p_b/p_0	=	Absolute back pressure / absolute relieving pressure ratio
α_w	=	Coefficient of discharge acc. to AD 2000-Merkblatt A2
q_m	=	Required mass flow [kg/hr]
q_{mc}	=	Certified mass flow [kg/hr]

Si 4302

Material code



Bellows design Si 4402



Si 4302

Material code			00	04
Temperature application range			-10 °C to +450 °C [1]	-200 °C to +400 °C [2]
Part	**Name**	**Spare part**	**Material**	**Material**
1	Body		GP240GH / 1.0619	GX5CrNiMo19-11-2 / 1.4408
2	Seat bushing		1.4122	1.4571
3	Stud, short		1.1181	A4-70
4	Stud, long		1.1181	A4-70
5	Hexagon nut		04	04
6	Disc holder		1.4021	1.4571
7	Disc	*2, 3	1.4571	1.4571
8	Disc retainer		1.4571	1.4571
9	Ball		Stainless steel	Ceramic
10	Flat gasket	*1, 2, 3	1.4401 / graphite	1.4401 / graphite
11	Intermediate cover		1.4122	1.4571
12	Pressure sleeve		1.4122	1.4571
13	Spring washer, bottom		1.0460	1.4571
14	Spring washer, top		1.0460	1.4571
15	Bonnet		GP240GH / 1.0619	GX5CrNiMo19-11-2 / 1.4408
16	Adjusting screw		1.4021	1.4571
17	Lock nut		1.4122	1.4571
18	Spindle		1.4021	1.4571
19	Flat gasket	*1, 2, 3	1.4401 / graphite	1.4401 / graphite
20	Cylinder bolt		8.8	A4-70
22	Pressure ring		1.4571	1.4571
23	Packed lifting lever (cap)		1.0619	1.4408
24	Lifting nut		1.4021	1.4571
29	Bonnet spacer		1.0619	1.4408
30	Spring [3]	*3	1.1200 1.8159	1.4310 1.8159, chem. nickel plated
55	Bellows	*3	1.4571	1.4571

[1] Material may be used in temperatures down to -85 °C if the specification of AD 2000-Merkblatt W10 is complied with.

[2] Material may be used in temperatures down to -273 °C if the specification of AD 2000-Merkblatt W10 is complied with.

[3] The spring material selection depends on the valve size and set pressure as well as the temperature. Other spring materials are available for special operating conditions, e.g. temperatures > 400 °C or < -170 °C, and if the customer specifies this.

Spare Parts:
*1 For start-up
*2 For 2 years of operation
*3 After several years of operating

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 4302

Sizes, pressure ranges and dimensions

Size	**DN_E**	20	25	32	40	40	40	50	65 [3]	80	80	80	100	125	150	150	200	200
	DN_A	32	40	50	50	65 [3]	80	80	100	100	125	150	150	200	200	250	250	300
Flow diameter [mm] d_0		17	22	27.5	27.5	35	35	42	52	52	65	65	79	93	93	112	125	156
Flow area [mm²] A_0		227	380	594	594	962	962	1385	2124	2124	3318	3318	4902	6793	6793	9852	12272	19113
Min. set pressure [bar g]	**Si 41 / Si 43**	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
	Si 4302.57 [1]	0.25	0.2	0.1	0.1	0.13	0.13	0.13	0.16	0.16	0.11	0.11	0.13	0.15	0.18	0.15	0.16	0.15
	Si 44 / Si 45	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Max. set pressure [1] [bar g]		40	40	40	40	32	32	32	32	32	25	25	20	20	20	25	15	14
Max. back pressure [2] [bar g]		16	16	16	16	16	16	16	16	16	10	10	10	7	7	7	4	4
Inlet flange DIN EN [4]		PN 10 - 40 (with flange thickness as per PN 40)											PN 10/16 (DN 200 PN 16 with flange thickness as per PN 25)					
													PN 25/40				PN 25	
Outlet flange DIN EN [4]		PN 10 - 40		PN 10/16													PN 10	
Centre to face dimension S1 [mm]		85	95	100	100	115	115	125	140	140	155	155	175	215	215	225	240	265
Centre to face dimension S2 [mm]		95	105	110	110	130	130	145	150	150	170	170	180	220	220	245	270	290
Height H1 [mm]		410	425	435	435	522	522	576	690	690	740	740	840	1030	1030	1195	1225	1320
Height H2 [mm]		470	480	480	480	572	572	626	750	750	810	810	920	1135	1135	1325	1355	240
Additional height H3 f. actuator AK [mm]		222	222	222	222	310	310	310	267	267	267	267	267	394	394	240	240	240
Drain size E [5]		G¼	G¼	G¼	G¼	G¼	G¼	G¼	G⅜	G⅜	G⅜	G⅜	G⅜	G½	G½	G½	G¾	G¾
Weight Si 41/43 [kg]		9	12	14	14.5	19	21	27	40	43	55	58	84	104	108	148	183	240
Weight Si 44/45 and Si 41/43.15 [kg]		11	14	17	17.5	22	25	31	44	47	60	63	92	112	122	178	213	270
Additional weight actuator AK [kg]		12	12	12	12	37	37	37	37	37	37	37	37	76	76	80	80	80

[1] Set pressure if the direct weight load option .57 is used.

[2] Stated values are maximum values corresponding to the spring forces. The component strength may need to be reviewed, and a suitable pressure rating selected, depending on the material and temperature.

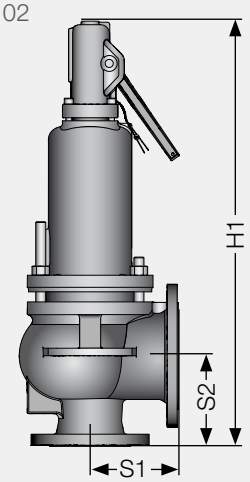
[3] 4-hole flange drilling with DN 65 PN 10/16

[4] Flanges PN 10 - 40 acc. to DIN EN 1092-2; facing type B1

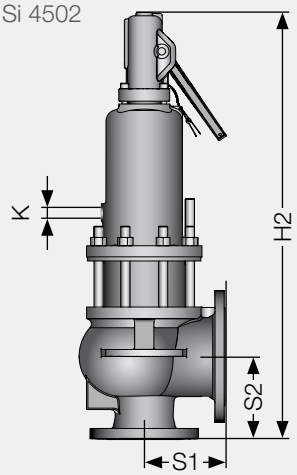
[5] Drain E is only drilled into the body if condensate formation is to be expected.

Si 4302

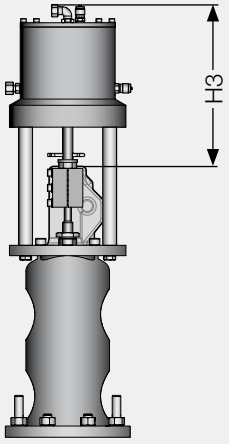
Si 4302
Si 4102



Si 4402
Si 4502



Actuator AK



Support brackets

Size $DN_E \times DN_A$	A	B	C	D	E	L	Support bracket thickness	Number of screws
40 x 65	180	84	134	60	150	14	10	4 x M 12
40 x 80	180	84	134	60	150	14	10	4 x M 12
50 x 80	210	93	160	65	175	14	12	4 x M 12
65 x 100	245	94	196	65	210	14	12	4 x M 12
80 x 100	245	94	196	65	210	14	12	4 x M 12
80 x 125	300	115	240	85	265	18	15	4 x M 16
80 x 150	320	150	280	125	290	18	15	4 x M 16
100 x 150	320	150	280	125	290	18	15	4 x M 16
125 x 200	365	120	300	85	325	18	15	4 x M 16
150 x 200	365	120	300	85	325	18	15	4 x M 16
150 x 250	415	150	360	115	375	18	15	4 x M 16
200 x 250	455	180	400	145	415	18	15	4 x M 16
200 x 300	510	180	450	145	465	22	20	4 x M 20

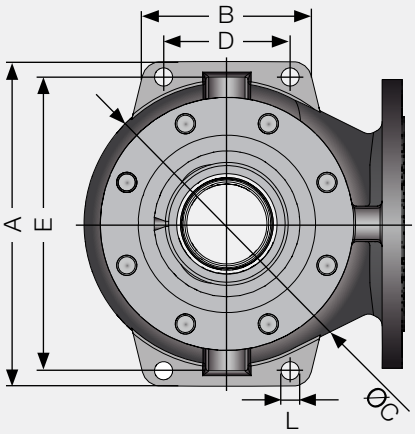
Dimensions in mm

The height from the inlet to the lower edge of the support bracket is identical with the centre to face dimension S2.

Support brackets will only be drilled if specified by the customer.

The bonnet for bellows seal design is provided with the test connection K.
K up to DN 50 x 80 – G¼", above G⅜".

Support brackets



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