

# Richter Certified Chemical Safety Valves



Certified for vapours,  
gases and liquids

Corrosion-resistant  
PTFE/PFA

TFM-PTFE bellows sealed

Special design for  
chlorine plants



**RICHTER**  
Process Pumps & Valves

# Safety in corrosive and high purity applications

Only one certification for vapours, gases and liquids. Your advantages: increased flexibility, no mix-ups of single components, reduced storage requirement

## Range of application

- Protection of pressure vessels and plants against excessive pressure, set pressures of 0.1 to 13 bar (1.45-188 psig)
- Operating temperature up to 180 °C (360 °F)
- Corrosive media where metallic materials cannot attain an adequate service life or special metals cause high costs
- Chlorine electrolysis
- Pure and high-purity media
- Metal-reactive media, e.g. H<sub>2</sub>O<sub>2</sub>, electronic chemicals
- Thermal expansion

## Design

- Direct-acting, spring-loaded, bellows safety valve with angle-type valve body
- Normal safety valve, design and performance in acc. with German AD 2000 Code „Technical rules for pressure vessels“.
- Opening characteristic similar to full lift and streamlined flow parts result in high discharge coefficients  $\alpha_v$  and therefore a high discharge capacity (see page 5).
- Almost proportional performance at low set pressures < 1 bar (< 14.5 psi)
- **New: ASME/Sect. VIII, Div. 1 certified safety valve KSEA**, see separate publication

## Type code:

PFA/PTFE lining	KSE/F ...
Antistatic lining	KSE/F-L ...
DN inlet/outlet	... /_

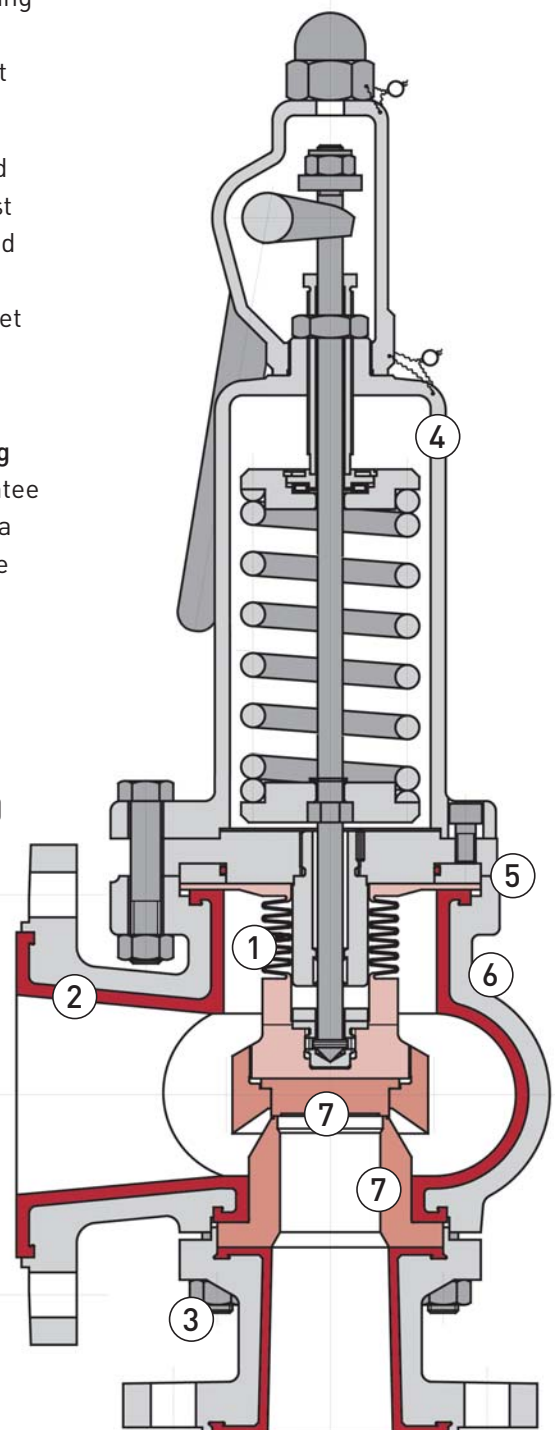
- ① Bellows of modified TFM-PTFE**
  - Hermetic seal to valve bonnet and protection of spindle against corrosion
  - Much better permeation resistant than standard PTFE
  - Flow-protected arrangement
  - Specially designed: back pressure on discharge side does not affect set pressure, thus valve also suitable for variable back pressures
  - Axial needle bearing in upper spring plate: no twisting of the bellows when adjusting screw is being set
- ② Thick-walled PFA/PTFE lining of the complete valve body**
  - Universal corrosion resistance
  - Vacuum-proof
  - Antistatic lining optional
  - Inlet nozzle optionally lined with highly permeation resistant Richter PFA-P lining

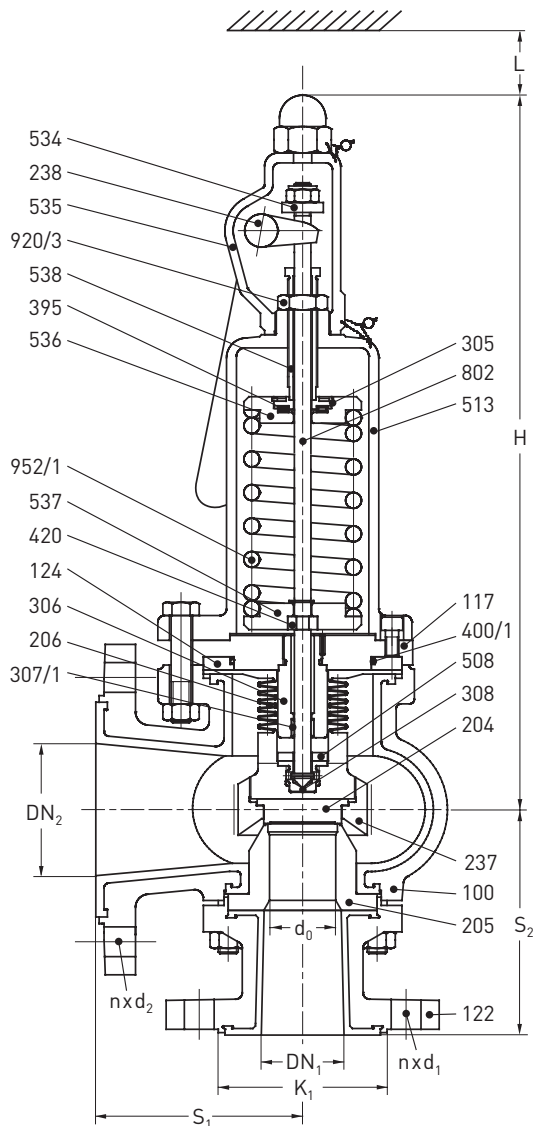
- ④ Lifting cap**

Lifting cap, lifting lever and bonnet made of ductile cast iron. Lifting lever positioned to prevent accidental actuation. Lifting cap and bonnet lead-sealed, gas-tight on request.
- ⑤ Metallic stop and centering of bonnet and body** guarantee exact guidance of spindle, a constant lift and repeatable performance.
  - Pressure ring adjustable from outside.

- ⑥ Pressure-bearing body**
  - Made of ductile cast iron EN-JS 1049 (ASTM A395)
  - Divergent outlet drains condensate or medium residues.

- ⑦ Seat and plug**
  - Individually exchangeable
  - Pressure-resistant PTFE/carbon compound (no glass, no ceramic)
  - Optional of pure TFM-PTFE, Hastelloy etc.
  - Positive-locking connection of spindle and plug, therefore can also be lifted without admission pressure.



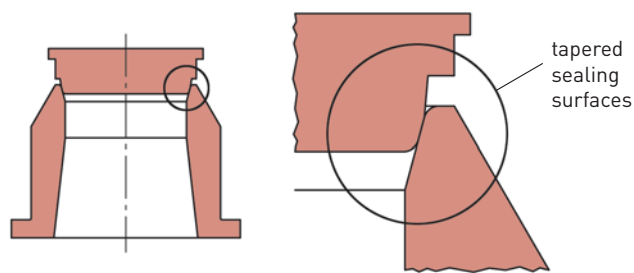


## Version KSE-C for low pressures, e.g. in chlorine electrolysis

**Advantage:** tight also at set pressures in the 250 mbar (0.36 psi) range and with working pressure differences in the < 50 mbar (0.07 psi) range

The tapered sealing surfaces have a three times higher surface pressure than flat sealing surfaces.

- Gas-tight
- No lapping required
- Optimal against solids sedimentation
- DN 100/150 (4"/6") with 40 % higher discharge capacity than with the standard seat
- Exchangeable, other components identical to those of the KSE standard version
- DN 80/100 (3"/4") and 100/150 (4"/6") available with certification, DN 50/80 (2"/3") without.



KSE-C seat and plug for low set pressures

### Selection table for materials and accessories

Item	Designation	Standard design	Available on request
100	Valve body	Ductile cast iron EN-JS 1049 (ASTM A395)/PTFE	Lining antistatic PTFE-L
117	Thrust flange	1.0038 [steel R-St 37]	1.4301 (stainless steel)
122	Inlet nozzle	Ductile cast iron EN-JS 1049 (ASTM A395)/PFA	Lining highly permeation-resistant PFA-P, antistatic PFA-L
124	Pressure ring	1.4301 (stainless steel)	
204	Plug		TFM-PTFE, PTFE/glass compound, Hastelloy C, titanium etc.
205	Seat	PTFE/carbon compound	
206	Bellows	TFM-PTFE	
237	Lifting aid	PTFE/carbon compound	TFM-PTFE, PTFE/glass compound
238	Lifting lever	Ductile cast iron EN-JS 1049 (ASTM A395)	Without lever
305	Bearing guide	1.4104 (stainless steel)	Hastelloy C
306	Spindle guide	1.4301 (stainless steel)	Hastelloy C
307/1	Guide bush	PTFE/carbon compound	
308	Insert sleeve	1.4301 (stainless steel)	Hastelloy C
395	Axial needle bearing		
400/1	O-ring	FKM (Viton® or equivalent)	
420	Thrust ring, split	1.0038 [steel R-St 37]	1.4301 (stainless steel), Hastelloy C
508	Travel stop	1.4301 (stainless steel)	
513	Spring bonnet	Ductile cast iron EN-JS 1049 (ASTM A395)	
534	Spindle nut	1.0570 [steel R-St 52]	1.4301 (stainless steel)
535	Lifting cap	Ductile cast iron EN-JS 1049 (ASTM A395)	Gas-tight
536	Upper spring plate	1.0038 [steel R-St 37]	1.4301 (stainless steel)
537	Lower spring plate	1.0038 [steel R-St 37]	1.4301 (stainless steel)
538	Adjusting screw	1.4301 (stainless steel)	Hastelloy C
539/x	Locking plate (not illus.)	Ductile cast iron EN-JS 1049 (ASTM A395)	
802	Spindle	1.4104 (stainless steel)	Hastelloy C
920/3	Hex. nut, plain	1.0111 [steel]	
952/1	Pressure spring	EN 10270-1-SH, galvanised	1.4301 (stainless steel)

## Large operating range: $p_e$ 0.1-13 bar (1.45-188 psig), -60 to +180 °C (-75 to 360 °F)

### Flanges

to DIN EN 1092-2 shape B, PN 16, on request drilled to ANSI, BS etc. and groove to DIN 2512

- ASME-certified series KSEA with flanges to ASME (ANSI) B16.5 Cl. 150, optional with inlet flange Cl. 300, see separate publication

### Protection against corrosive atmosphere

- Body with external epoxy coating
- External nuts and bolts of stainless steel

### Identification

AD 2000 data sheet A4, DIN EN 19

### Back pressures $p_{a0}$ in valve outlet

for vapours/gases max. 30 %, for liquids max. 50 % of set pressure, but observe the following:

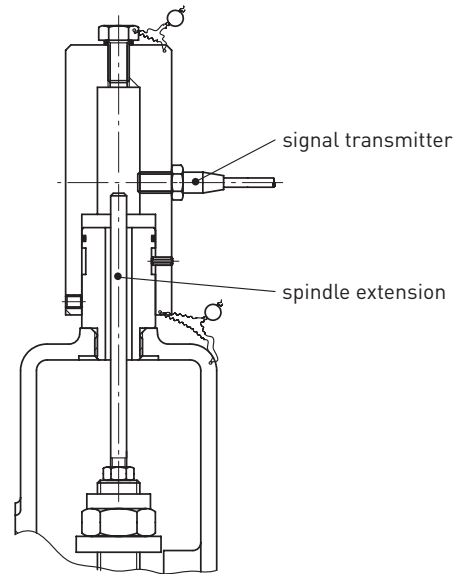
- when set pressure  $\leq$  4 bar (58 psi),  
 $p_{a0 \text{ max.}} = 1$  bar (14.5 psi)
- when set pressure  $>$  4 bar (58 psi),  
 $p_{a0 \text{ max.}} = 3$  bar (43.5 psi)

### Older KSE valves

can be retrofitted for the extended operating range of the current KSE technology. Details on request.

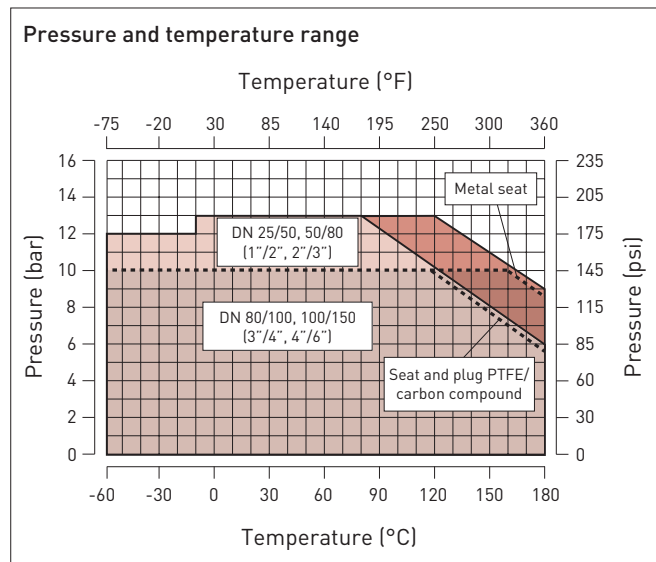
### Special designs

- Individual acceptance tests for special designs
- Remote monitoring by electric signal transmitter:



### Pressure and temperature range

- Body PN 16
- From -60 to +180 °C (-75 to 360 °F) as a function of set pressure and seat/plug materials in acc. with following diagram (higher pressures on request)



### Set pressures/Test certification

The set pressure range indicated is spread over various springs within which all intermediate set pressures are possible.

One common certification test No. covering vapours, gases and liquids universally!

Valve size (DN)		Set pressure		Certification test No.
mm	inch	bar	psi	
25/50	1"/2"	0.4-13	5.8-188	TÜV-SV...871-D/G/F
50/80	2"/3"	0.1-13	1.45-188	
80/100	3"/4"	0.1-10	1.45-145	
100/150	4"/6"	0.15-10	2.18-145	

### Connecting and installation dimensions to ISO/DIN, weights\*

Valve size (DN)		Inlet flange (mm)			Outlet flange (mm)			Seat and overall dimensions (mm)				Approx. weight (kg)	
mm	inch	DN <sub>1</sub>	K <sub>1</sub>	n x d <sub>1</sub>	DN <sub>2</sub>	K <sub>2</sub>	n x d <sub>2</sub>	d <sub>0</sub>	S <sub>1</sub>	S <sub>2</sub>	H		L
25/50	1"/2"	25	85	4 x 14	50	125	4 x 18	22	100	100	355	120	15
50/80	2"/3"	50	125	4 x 18	80	160	8 x 18	40	125	125	435	120	25
80/100	3"/4"	80	160	8 x 18	100	180	8 x 18	50	155	155	525	140	40
100/150	4"/6"	100	180	8 x 18	150	240	8 x 22	80	200	220	710	180	85

\* Data for ASME/ANSI series KSEA: see separate publication  
Connecting dimensions for ASME (ANSI) drilled flanges on request

# High discharge coefficients $\alpha_d$ for high discharge capacities

Certified discharge coefficients  $\alpha_d$  as a function of  $h/d_0$  and  $p_{a0}/p_0$

Valve size (DN)		Flow area $A_0$ (mm <sup>2</sup> )	Vapours/Gases		Liquids
mm	inch		$\alpha_d$ for $h/d_0 \geq 0.32$ and $p_{a0}/p_0 \leq 0.2$		$\alpha_d$ for $h/d_0 \geq 0.32$
25/50	1"/2"	380	0,75		0,55
50/80	2"/3"	1257	0,82		0,55
80/100	3"/4"	1964	0,85		0,55
100/150	4"/6"	5027	0,82		0,53

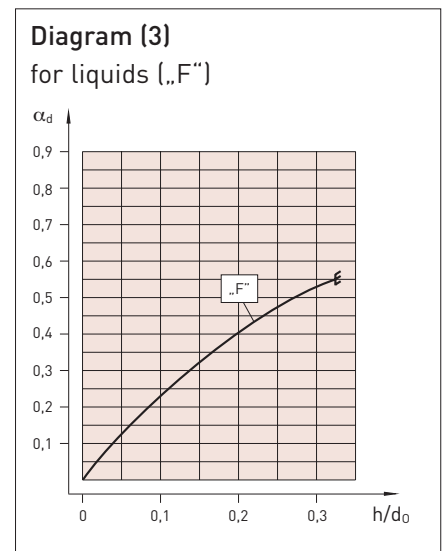
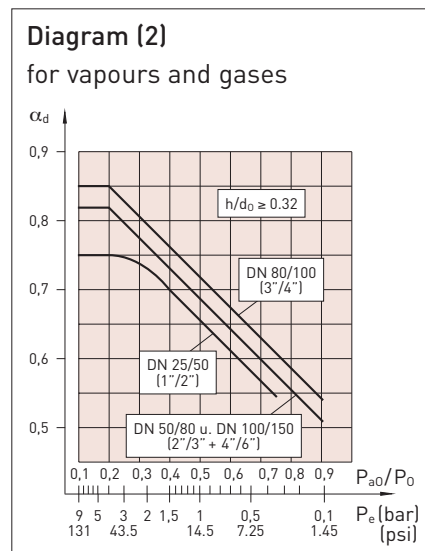
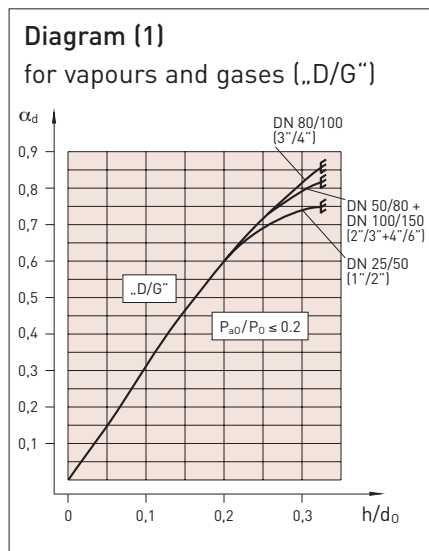
**Advantage:** The KSE safety valves can be adapted to the discharge mass flow by means of a lift reduction (details on request) in the event of possible oversizing.

**Vapours and gases:** With pressure conditions  $p_{a0}/p_0 > 0.2$  the discharge coefficients  $\alpha_d$  are to be taken from diagram (2) and applied.

For safety valves which are to be adapted to the discharge mass flow by means of a lift reduction, the discharge coefficients  $\alpha_d$  can be taken from diagram (1); with pressure conditions  $p_{a0}/p_0 > 0.2$  a deduction in accordance with diagram (2) is to be made. This deduction is derived from the difference between the certified discharge

coefficients  $\alpha_d$  (see above table) and the value taken from diagram (2) for the relevant pressure condition  $p_{a0}/p_0$ .

**Liquids:** For safety valves which are to be adapted to the mass flow by means of a lift reduction, the discharge coefficients can be taken from diagram (3).



## Discharge capacities

for air at 20 °C and 1013 mbar (68 °F and 14.7 psi) and water 20 °C (68 °F) at 0 bar (0 psi) back pressure

Set pressure		DN 25/50 (1"/2")		DN 50/80 (2"/3")		DN 80/100 (3"/4")		DN 100/150 (4"/6")	
bar	psi	Air (m <sup>3</sup> /h)	Water (kg/h)	Air (m <sup>3</sup> /h)	Water (kg/h)	Air (m <sup>3</sup> /h)	Water (kg/h)	Air (m <sup>3</sup> /h)	Water (kg/h)
0.1	1.45			310	11128	485	17387	1198	44511
1	14.5	334	10645	1154	35189	1908	54983	4684	140757
2	29	547	15054	1932	49765	3137	77758	7830	199061
3	43.5	749	18437	2676	60950	4339	95234	10841	243799
4	58	936	21289	3430	70378	5554	109966	13719	281514
5	72.5	1139	23802	4116	78686	666	122946	16463	314743
6	87	1329	26074	4802	86196	7776	134681	19207	344784
7	101.5	1519	28163	5487	93102	8888	145472	21950	372409
8	116	1708	30108	6173	99530	10000	155516	24694	398122
9	130.5	1899	31934	6859	105568	11110	164950	27438	422272
10	145	2088	33662	7545	111278	12221	173872	30182	445114
11	159.5	2279	35305	8231	116710				
12	174	2468	36875	8917	121899				
13	188.5	2657	38380	9603	126877				

# Valve sizing, formula notation, specification

## Formulas for valve sizing

(in acc. with AD 2000 data sheet A 2 and DIN 3320)

### • for vapours and gases

$$A_0 = 0,1791 \cdot \frac{q_m}{\psi \cdot \alpha_d \cdot p_0} \cdot \sqrt{\frac{T \cdot Z}{M}}$$

### • for liquids

$$A_0 = 0,6211 \cdot \frac{q_m}{\alpha_d \cdot \sqrt{\Delta p \cdot \rho}}$$

## Further information

- VdTÜV data sheet 871
- Richter data sheets with discharge coefficients  $\alpha_d$  as function of  $h/d_0$  and  $p_0-p_{a0}$

## Please state in inquiries/orders

(other dimensions acceptable, too):

- valve type, DN size, PN
- mass flow to be discharged (kg/h)
- set pressure (bar)
- back pressure (bar)
- operating pressure of the system to be protected (bar)
- medium (gas, vapour, liquid)
- temperature of medium (°C)

## Additional details required for vapours and gases

- molecular mass (kg/kmol)
- isentropic exponent  $k$  of the medium in the pressure chamber
- compressibility factor  $Z$  of the medium in the pressure chamber

## Additional details required for liquids

- density (kg/m<sup>3</sup>)
- specify solids if any

## Formelzeichen

$$A_0 = \frac{\pi \cdot d_0^2}{4} = \text{flow area (mm}^2\text{)}$$

$q_m$  = mass flow to be discharged (kg/h)

$\alpha_d$  = certified discharge coefficients

$p_0$  = absolute pressure in pressure chamber (bar abs)

$p_e$  = set pressure (bar)

$p_{a0}$  = back pressure in outlet nozzle (bar)

$\Delta p$  =  $p_0-p_{a0}$  pressure difference (bar)

$\psi$  = flow coefficient

$T$  = absolute temperature of medium in pressure chamber (K)

$Z$  = compressibility factor of medium in pressure chamber

$M$  = molecular mass (kg/kmol)

$\rho$  = density (kg/m<sup>3</sup>)

$d_0$  = minimum flow  $\emptyset$  (mm) of the safety valve

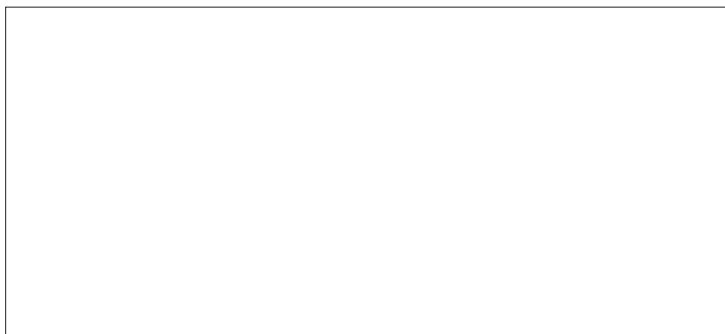
$h$  = valve lift (mm)

## Overflow and pressure relief valve GU series

- Lining PFA
- Hermetically sealed by bellows
- DN 25 - 80 (1" - 3")
- PN 16, max. 180 °C (360 °F)



Presented by:



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