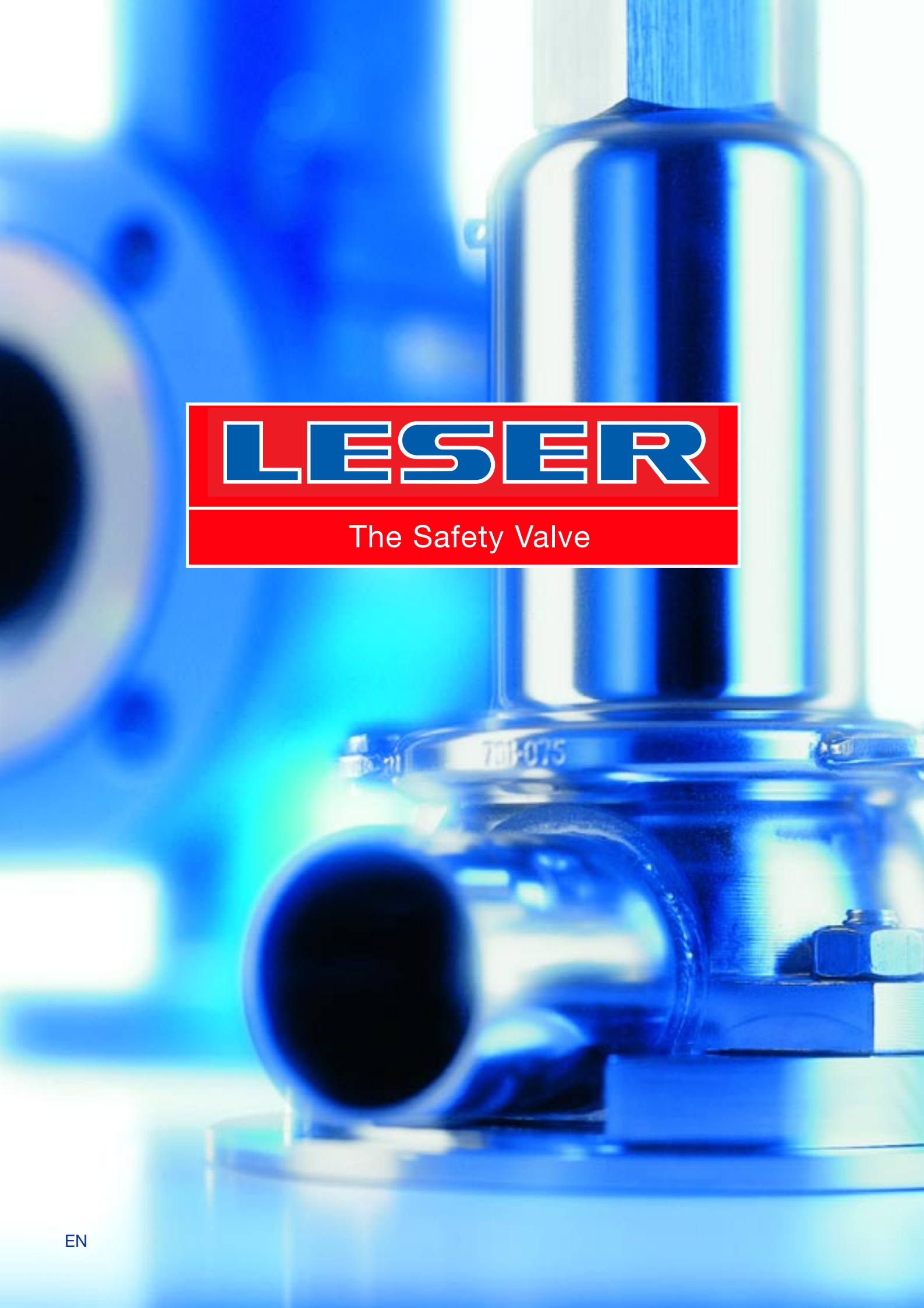
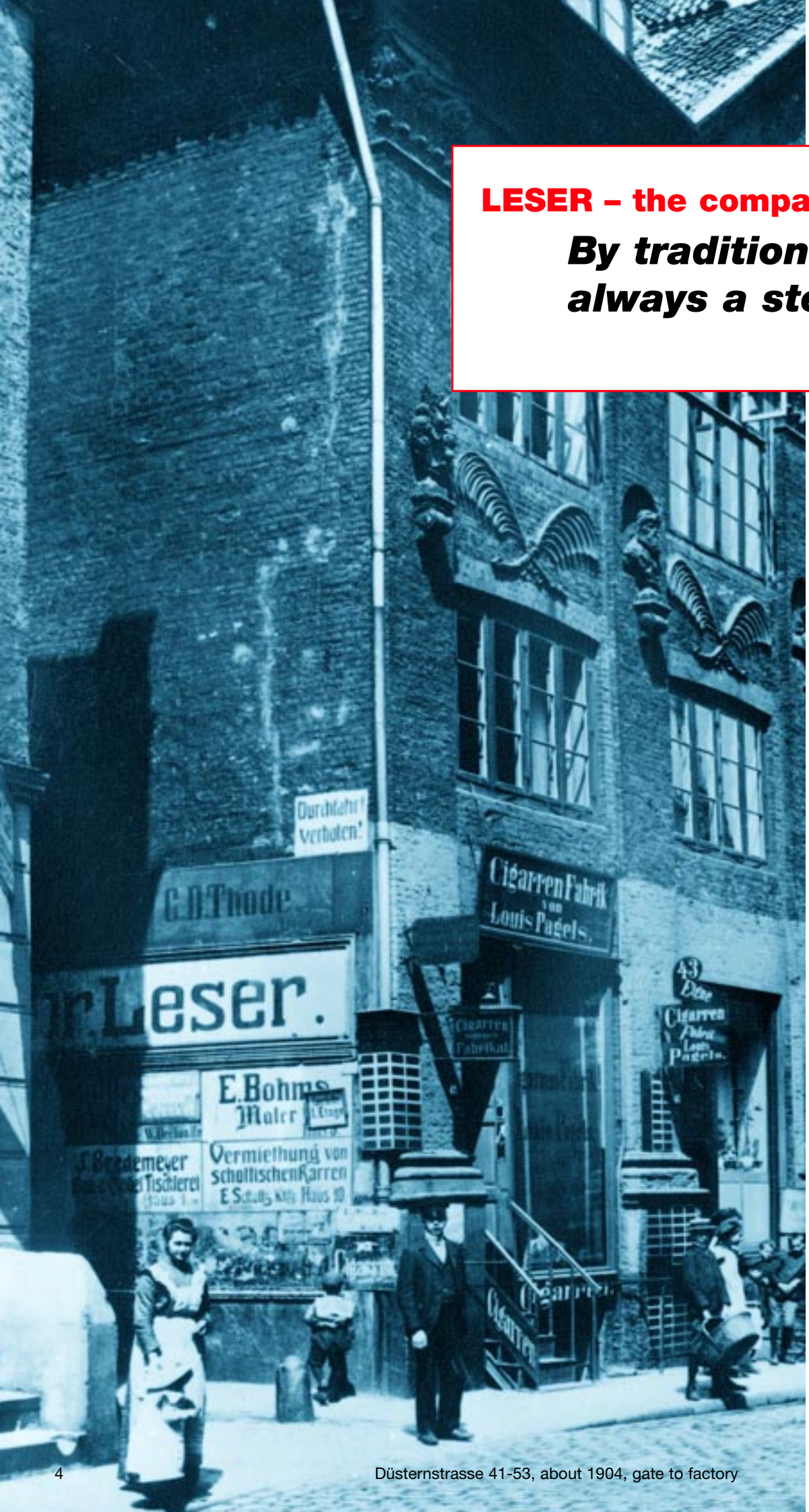


EN

LESER

The Safety Valve

Contents



LESER – the company

By tradition – always a step ahead

Düsternstrasse 41-53, about 1904, gate to factory


1

“Loyalty by change”. With almost **200 years of experience** LESER ranks among the pioneers of mechanical engineering in Germany. The company, founded as a brass foundry in 1818, developed its first safety valves for the protection of steam boilers. Even at those days LESER products were designed to protect man and environment.

As industrial development has been progressing very rapidly demands for safety valves have increased continuously too. Step by step LESER has developed its safety valves to reflect the state-of-the-art. The company has extended its product range to provide solutions for all sectors of this industry. Investment in research and development is therefore an important impetus for new developments at LESER and in this industry as a whole. LESER sets standards – now and in the future.

With its 280 employees in **Hamburg** [1] and **Hohenwestedt** (Northern Germany) [2] LESER belongs to the leading manufacturers of safety valves worldwide. The product range comprises a total of **23 valve series** (nominal diameter range DN 10 ...400 - NPS 1/2ᴵᴵ...16ᴵᴵ) for applications in all branches of the industry. The annual production currently amounts to 60,000 safety valves.

LESER is a member of VDMA, ASME and TÜV-Nord.

History

1818	Founded as a brass foundry in Hamburg-Neustadt
1833	First site with workshop at the same location
1884	Complete range of steam fittings, including safety valves
1914	Expansion with the purchase of the „Wendenstrasse“ site
1943	Destruction of the plant in Hamburg, relocation of production to Hohenwestedt
1948	Reconstruction at Wendenstrasse
1957	First test lab for safety valves
1959	First type test approval
1970	Specialisation in safety valves
1990	First American approval
Now:	5th generation family business. Market leader for safety valves in Germany and Europe


2

GEBR. LESER, G. WITTMANN NACHF.
ARMATURENFABRIK UND METALLGIESSEREI
GEGRÜNDET 1818.

GEBR. LESER K.G. · ARMATURENFABRIK

Gebr. Leser
ARMATURENFABRIK UND METALLGIESSEREI

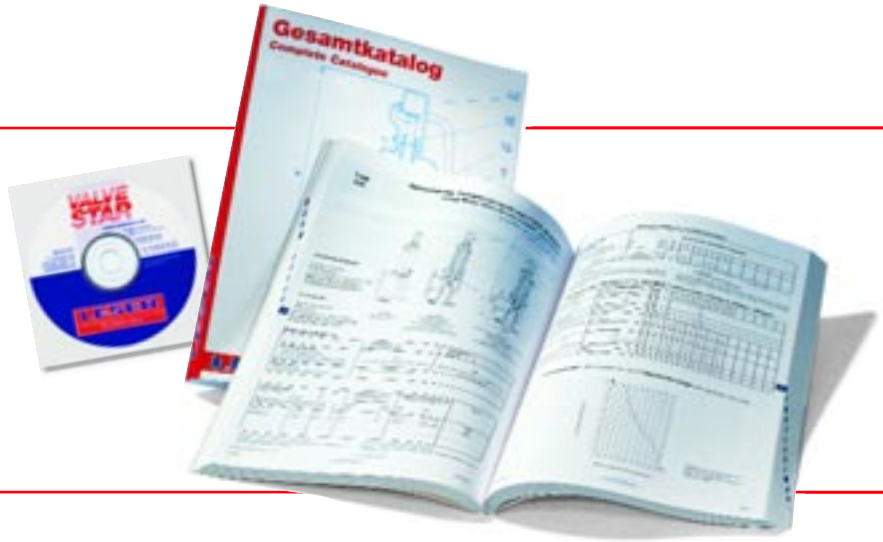
GEBR. Leser GmbH Armaturenfabrik Hamburg

LESER – your partner

Expert advice and professional products for satisfied customers

LESER worldwide

The **company's representatives** and **subsidiaries** can be found in Germany and **over 40 countries**. LESER and its partners provide you with delivery service and technical consultancy. A network of authorised **workshops in Germany and abroad** guarantees a professional repair service. Email, Internet and voice mail ensure that our customers can reach us 24 hours a day. **Stocks** were set up close to customers, e.g., in the US, Brazil, South Africa, Australia, Malaysia and in Europe.



Sizing and selection

Great care is needed when sizing and selecting safety valves. Therefore LESER and its partners give you support in different ways.

The **Complete Catalogue** with its 350 pages provides a comprehensive survey of LESER's product range. You will also find all relevant international standards concerning safety valves as well as a summary of the installation and maintenance instructions for our safety valves.

Even the layman is able to select the required safety valve rapidly and reliably by using our sizing program **VALVESTAR®**. We constantly improve this program and issue updated versions.

We can assist you in your systems planning by processing 2D and 3D CAD data.

Through **seminars** LESER provides operators, planners and workshop personnel with information on the function and the design of safety valves. We will also arrange seminars at your premises if required.

Prompt and fast delivery

During the last years LESER has constantly shortened its delivery periods. **Now every safety valve is delivered within 4 days** including the required inspections and documentation **– even overnight if necessary.**

TÜV Nord and other classification and inspection organisations perform daily **inspections** at LESER. The **documentation** comprises data sheets, material quality certificates as well as operating and maintenance instructions. A new service LESER offers is the additional supply of **material certificates** (certificate@leser.com).

ONTIME – Information about your order

Our **ONTIME service** (ontime@leser.com) gives you information about your order on: delivery dates, partial deliveries, consignment and delivery records, reducing delivery times.

LESER – the performance test labs

Proving reliability

Only comprehensive tests and trials can ensure that safety valves will always **function perfectly**, even under extreme service conditions. LESER performs these tests not only in the development and design phases, but throughout the whole service life of a product.

For over 40 years LESER has been operating **performance test labs for the media of steam, gases and liquids.** Performance test labs are currently in operation at Wendenstrasse [1] and MV Rugenberger Damm [2].

LESER safety valves are approved by a large number of authorities and classification societies (e.g., TÜV, ASME/NB, Stoomwezen, Lloyd's Register, I.S.P.E.S.L., CBPVI-China, DNV, GL). This ensures their suitability for service worldwide.

In addition the LESER test labs are accepted as a "Prüfstelle" of the TÜV for **type tests** and as a "testing laboratory" of ASME/NB (the first one outside the USA).

Test lab data Maximum rate	Air	Water	Steam	
Location	Wendenstrasse		MV Rugenberger Damm	
Year of construction	1984, Extention: 1997		2001	
Storage volume	83 m³ at 100 bar 8300 Nm³	50 m³	Large steam generator (powerstation)	
DN_{max}/NPS	400/16[II]	400/16[II]	400/16[II]	
p_{max}	100 bar/1450 psig	42 bar/610 psig	45 bar/652 psig	18 bar/261 psig
Operating temperature T	Environment temperature		Superheated steam 425 °C/797 °F Saturated steam p_{max} 35 bar 240 °C/464 °F	Superheated steam 280 °C/536 °F Saturated steam 210 °C/410 °F
Mass flow continuous	75 t/h - 35625 scfm	280 t/h - 1240 gpm	Sup.S: 30 t/h - 66140 pph Sat.S: 15t/h - 33070 pph	Sup.S: 25 t/h - 55116 pph Sat.S: 25 t/h - 55116 pph
Mass flow short time	190 t/h - 90250 scfm	> 430 t/h - 1900 gpm (function test)	30 t/h/66140 pph	-
TÜV-Approval	since 1983		2003	
ASME-Approval	since 1994	since 1994	approx. 2004	
rated capacities	24964 scfm/ 1450 psig	1057 gpm/ 610 psig	-	-

Tests and trials

Capacity
Determination of the coefficient of discharge and the capacities

Function
Determination of reseating and opening pressure, determination of the opening characteristic

Type test approvals
Type tests to the relevant standards

Application
Simulation of operating conditions to ensure safe function even in special situations

Two phase flow
Design guidelines for special media

Back pressure
Functional behaviour in special installations

Bursting discs and change-over valves
Design guidelines for combination with safety valves

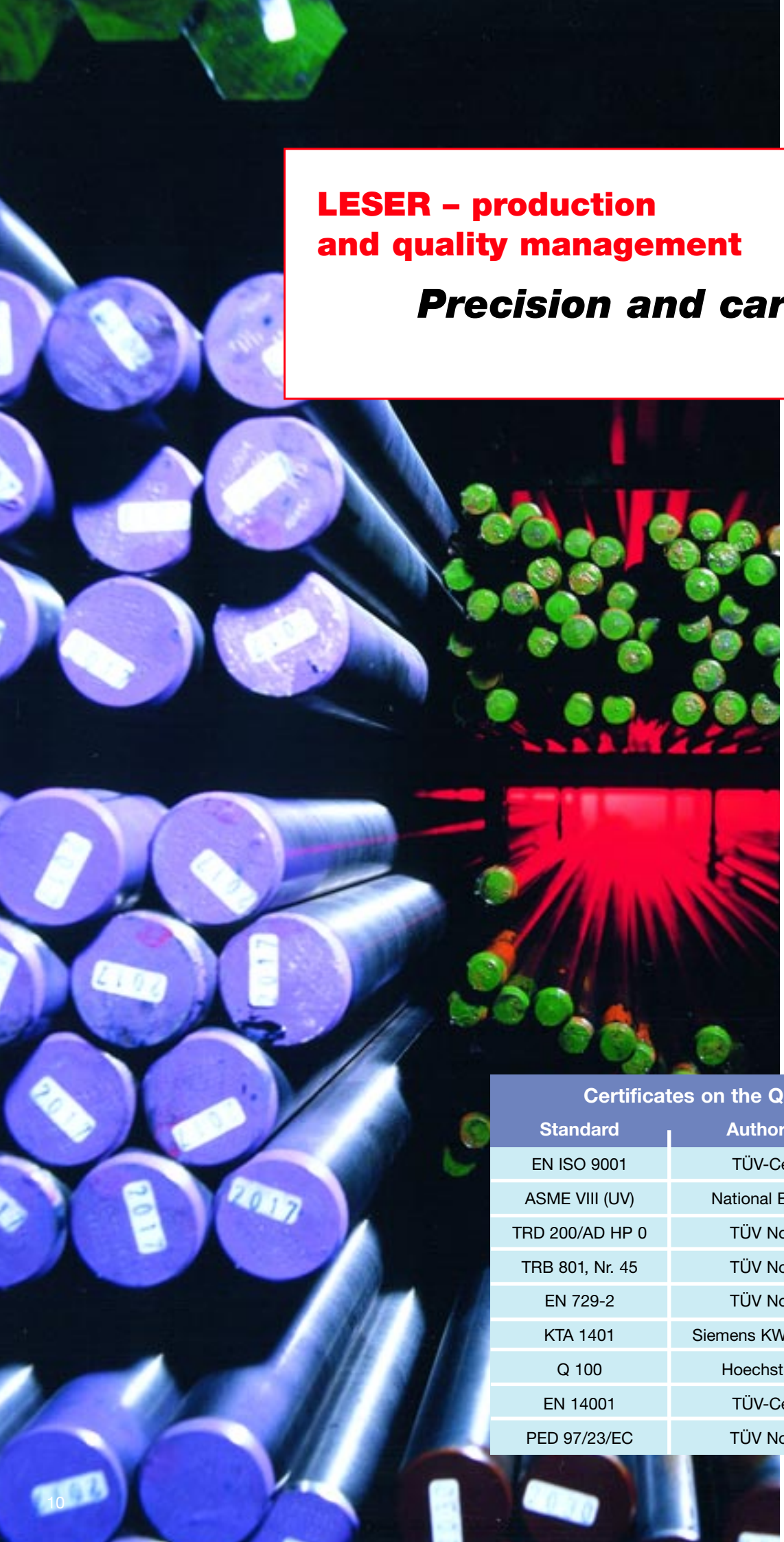
Damping
Stable functional behaviour under all installation conditions

Fatigue
Mechanical stability of the components under high numbers of load cycles

Joukowski
Stability when subjected to shock wave

Heat
Mechanical stability of the components and functional leak tightness under the influence of high temperatures

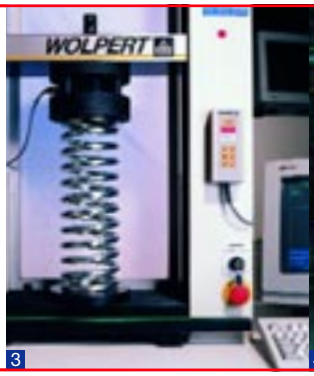
2



LESER – production and quality management

Precision and care

Certificates on the QM-System		
Standard	**Authority**	**since**
EN ISO 9001	TÜV-Cert	1991
ASME VIII (UV)	National Board	1994
TRD 200/AD HP 0	TÜV Nord	1991
TRB 801, Nr. 45	TÜV Nord	1995
EN 729-2	TÜV Nord	1997
KTA 1401	Siemens KWU/RWE	1990
Q 100	Hoechst AG	1997
EN 14001	TÜV-Cert	03/2001
PED 97/23/EC	TÜV Nord	07/2000



3

4


5

Safety valves protect all kinds of plants from impermissible overpressure. They prevent persons, the environment and investments from being damaged. As they form the last link in the safety chain their perfect function must be ensured. The requirements for development, design, production, and quality management are correspondingly high.

The quality management which is certified by many organisations accompanies all stages of development, design and production.

The quality of the castings fulfils the requirements of DIN 1690 Part 10. In cooperation with the foundry each pattern is optimised before series release in order to prevent defects reliably [1] [2]. Solidification simulations are performed with the aid of 3D CAD design data. There is a prototype file for every pattern.

The welded seams are tested to the applicable standard (AD, TRD, ASME). Welding work is performed by TÜV and ASME approved welders.

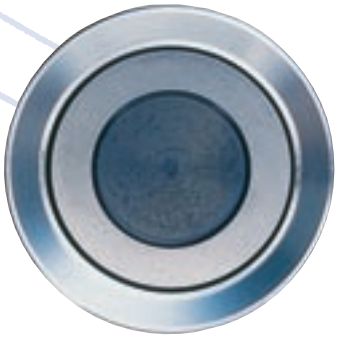
The spring [3] is the key component ensuring the correct function of the safety valve. All relevant international standards are observed in its design and dimensioning.

Production: All individual parts are manufactured on modern machining centres and CNC lathes [4]. This ensures dimensional conformity and a high surface quality.

The valve assembly [5] is order-driven, in accordance with the customer's wishes. The safety valves are free of non-ferrous metals, asbestos and silicone; "oil and grease free" versions are available if required.

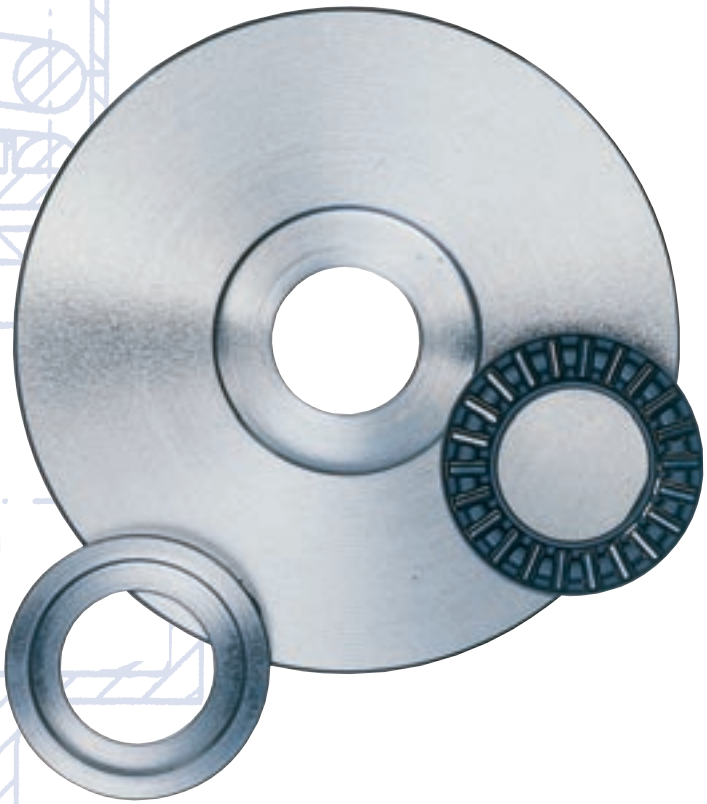

1


2



LESER – the design features

One concept for all series



Bonnet

You have the choice between a closed or an open bonnet:

- The **closed bonnet** – in conjunction with a gas-tight cap or lifting device – prevents the process medium from getting into the atmosphere.
- The **open bonnet** protects the spring from high temperatures and prevents the formation or collection of condensation, e.g., if used for the protection of steam boilers.

Universal design

The universal design permits safe operation independently of the medium, the accessories and the field of application. No conversion is necessary.

- **Single trim:** The same internal components (seat, disc and spindle) for the application with steam, gases and liquid media.
- Identical **spring tables** for all media and valve accessories, each with large pressure setting ranges. For the pressure range from 1 to 40 bar (15 - 580 psig), for example, only 11 springs are used.
- Double certifications of the material quality are available for all **body materials.** The body materials thus fulfil the requirements of both **AD 2000-Merkblatt Reihe W, AD 2000-Merkblatt A4, TRD-Reihe 100 and ASME Code Section II.**

Pressure setting

- The **spring material** is only stressed to a maximum of 60% at maximum initial tension. A 40% reserve ensures minimum relaxation, even in operation at high temperatures. The set pressure does not change during the service life of the safety valve.
- **Low friction:** A flat, play-free needle bearing is used to reduce the friction between the adjusting screw and the spring plate.

Compact and reliable

- **Good guidance:** The spindle is a single piece and is guided at points spaced far apart in the spindle guide (metal guide bush) and in the adjusting screw (PTFE bush). This design together with the ball bearings of the disc ensures a reproducible precise response.
- A **low overall height** is achieved by the integrated cover flange on the body and the short distance between the spindle guide and the spring.

Lifting devices/Caps

Various lifting devices can be selected:

Gas-tight cap H2:
Not liftable - for safety valves which should not or must not be lifted for operational reasons.

Open lifting device H3:
Not gas-tight.

Gas-tight lifting device H4:
The medium does not get into the atmosphere.

Pneumatic lifting device H8:
For cleaning processes in plant with special hygienic requirements (CIP/SIP).

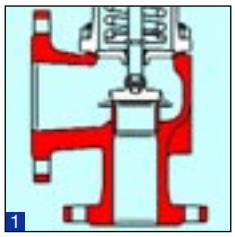
Type 441/442

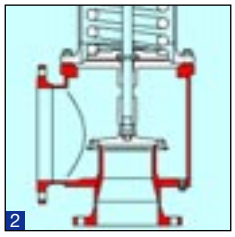
Full Lift Safety Valves with flanged connections

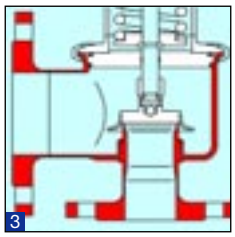
up to PN 40/PR #300

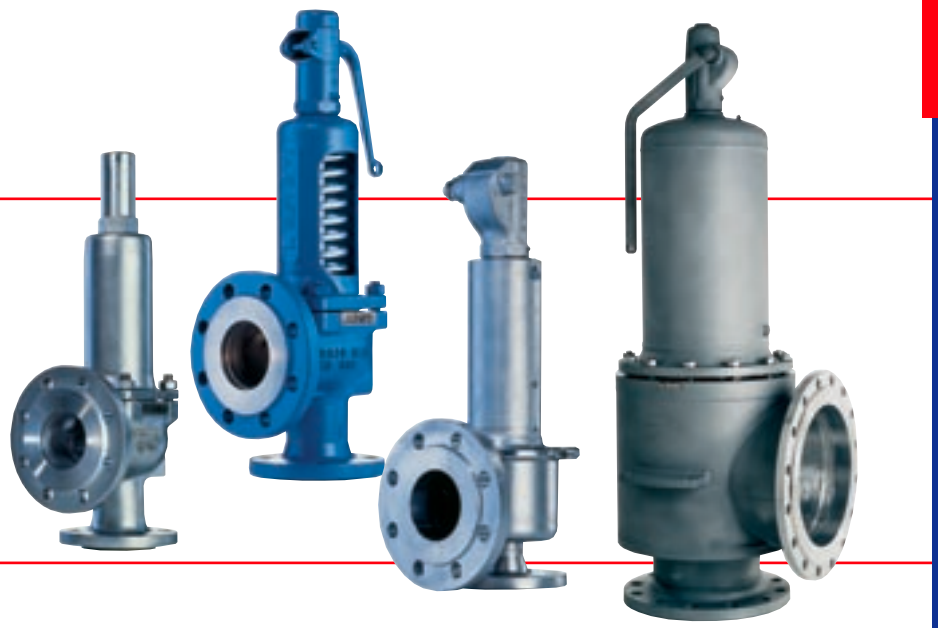
DESIGN FEATURES

- High discharge capacity in relation to the inlet nominal diameter
- Suitability for the relevant service conditions is ensured by:
  - Six body materials (stainless steel, carbon steel, stainless steel and carbon steel castings, nodular and cast iron)
  - A large variety of accessories
  - Closely graded flow ratings with a wide range of nominal diameters in 14 steps
    (DN 20...400, NPS 3/4"...16")









Full lift safety valves open rapidly within an overpressure of 5% to the full design lift. They are used in particular for vapours and gases, in applications where the maximum mass flow has to be discharged rapidly. LESER types 441/442 are suitable for almost any industrial application and belong to the best selling spring-loaded flange types of safety valves up to a pressure rating of PN 40/PR #300 worldwide. There are four series available:

Type 441/442 DIN:

Cast construction with DIN flanges [1];
four body materials: stainless steel, carbon steel, nodular and cast iron

Type 441/442 ANSI:

Cast construction with ANSI flanges[1];
two body materials: stainless steel and cast steel
Centre to face length in accordance with API 526,
greater discharge capacity than standard API valves

Type 441/442 “XXL”:

Robust welded construction [2] with DIN or ANSI flanges;
welding procedures to EN and ASME standards;
two body materials: stainless steel and carbon steel

Applications:

Chemical industry
– Process protection (e.g., columns)
– Equipment
– Heat exchangers
– Works supply

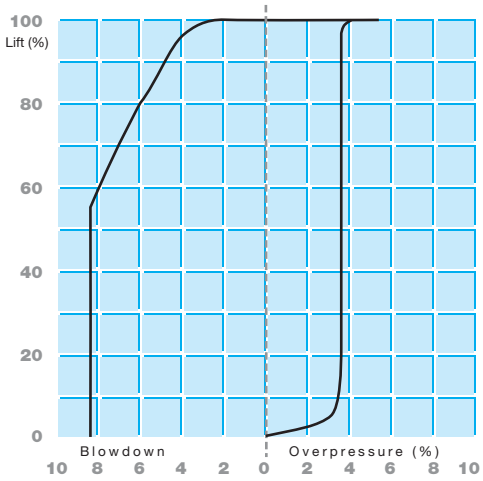
Steam generators in industry
– Water space
– Steam drum

Compressors
– Blowers
– Turbo compressors

Pumps

Mechanical engineering (OEM)
– Dying machines
– Filter construction

Power stations
– Low and medium pressure steam
– Condensers



Type	Bonnet	Flange DIN 2501 PN	Flange DIN 2501 DN	Flange ASME B 16.5 PR	Flange ASME B 16.5 NPS	Main characteristic
441 DIN 442 DIN	closed open	16...40	20...200	–	–	Cast construction, semi nozzle
441 ANSI 442 ANSI	closed open	–	–	#150...#300	1"...8"	
441 “XXL“ 442 “XXL“	closed open	10...25	200...400	#150...#300	8"...16"	Welded construction, full nozzle

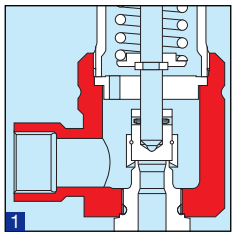
Type 455/456 457/458 459M

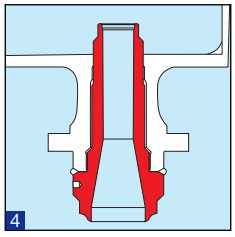
Safety Valves for high operating pressures

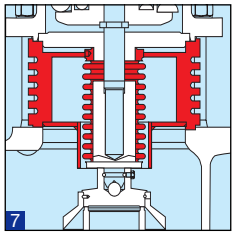
≥ PN 63/PR # 600

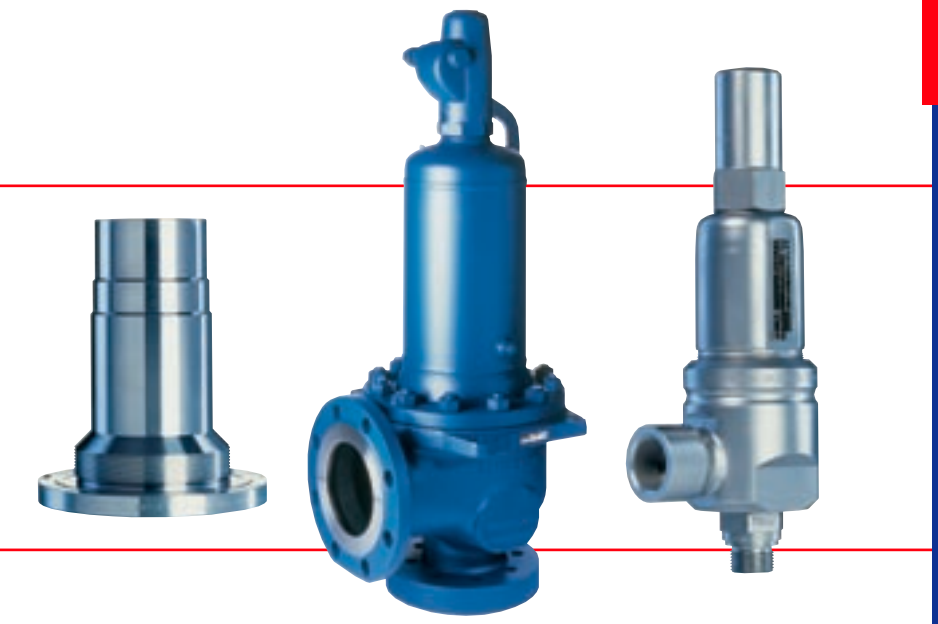
DESIGN FEATURES

- Valve body with brackets resp. ring grooves to provide fixing means to help support the valve and reduce the effect of reaction forces
- Torque free adjustment of set pressure with play-free flat needle roller bearing
- Bull race disc with lift aid which is detachable for ease of maintenance [5]
- Discs with soft seals available up to 100 bar/1450 psig
- Stellited, precision machined metal sealing surfaces [6]









The **LESER high pressure safety valves** are full lift spring loaded safety valves which are used at high operating pressures (≥ 40 bar/≥ 580 psig), often in conjunction with high operating temperatures (≥ 400 °C/≥ 752 °F). The high pressure safety valves are designed to withstand these extreme service conditions through their robust construction, selection of materials, fit matching for the sliding parts, and the use of high temperature fittings. There are three series available:

Type 455-456 “semi nozzle” [2]:

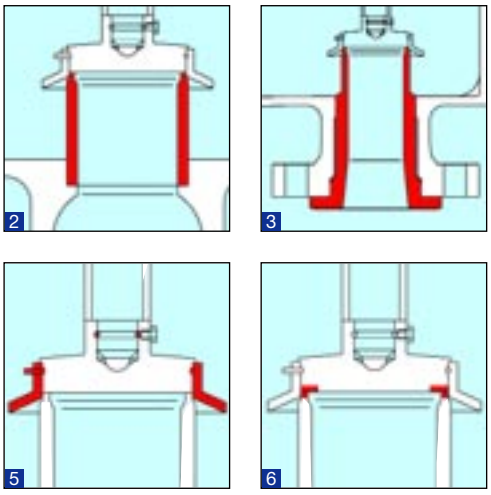
Medium to large mass flows, high operating pressures (up to 100 bar/1450 psig), flanged connection

Type 457-458 “full nozzle” [3]:

Medium to very high mass flows, very high operating pressures (up to 400 bar/5800 psig), flanged connection or welding stubs [4]

Type 459M [1]:

Small mass flows, very high operating pressures (250 ... 700 bar/3625...10150 psig), threaded, flanged or special connection (e.g., IG flange)



Type	Bonnet	Max. set pressure (bar)	Max. set pressure (psig)	Flange DIN 2501 PN	Flange DIN 2501 DN	Flange ASME B 16.5 PR	Flange ASME B 16.5 NPS	Main characteristic
455 456	open closed	100	1450	63...160	25...100	#300... #1500	1"...4"	Cast construction semi nozzle
457 458	open closed	400	5800	63...400	25...150	#300... #2500	1"...6"	Cast construction full nozzle
459 M	closed	700	10150	63...700	10	...#2500	½"	Machined from solid full nozzle

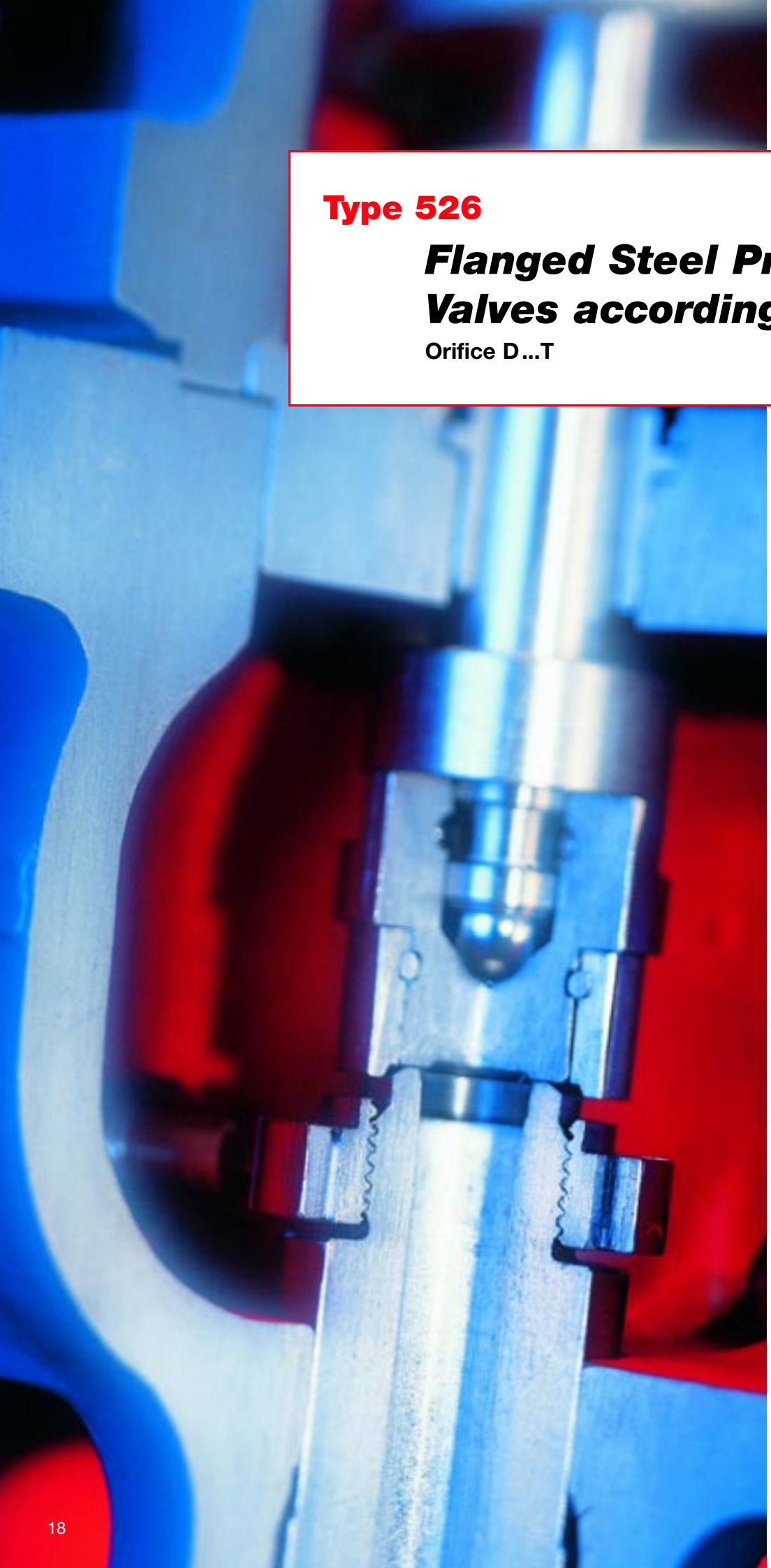
Applications:

- **Power stations and industrial superheated steam generation**
  - Drums
  - Superheaters
  - Economisers
- **Petrochemical industry**
  - Protection of reactors and columns
  - Natural gas extraction and processing
- **Chemical plant**
  - Process protection (e.g., NH_3 synthesis, CO_2 extraction)
  - Protection of pump stations and high pressure water systems
- **Compressor systems**
  - Protection of compressors with high pressures and capacities
- **Desalination plants**
  - Full nozzle in special materials

Type 526

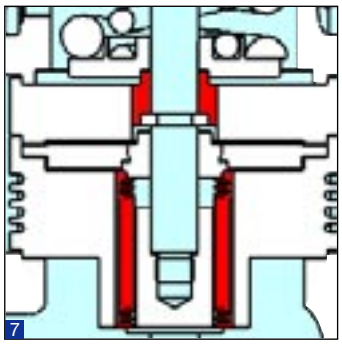
Flanged Steel Pressure Relief Valves according to API 526

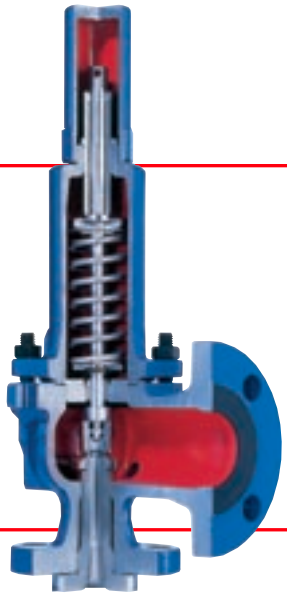
Orifice D...T

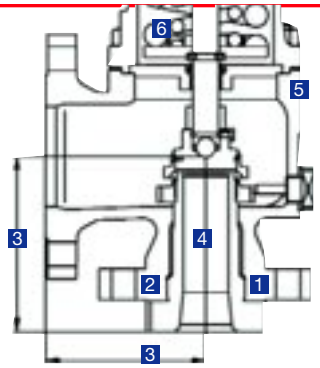


DESIGN FEATURES

- ASME-NB certified capacities
- “Single trim” for steam/gases/liquids
- Versions with open and closed bonnets
- Single part spindle, large guide spacings
- Adjusting ring to alter the opening and reseating pressure differential (“blow-down-ring”)
- Back pressure compensating stainless steel ballanced bellows available from 1 bar/15 psig [7]







Applications:

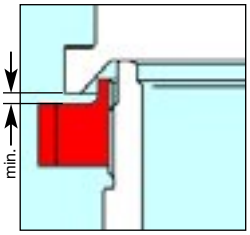
- **Large scale chemical plant**
  – Tank protection
  – Blow-down systems
- **Oil extraction, transport and processing**
  – Drilling platforms
  – Oilfields (“Christmas trees”)
  – Storage tank facilities
  – Refineries

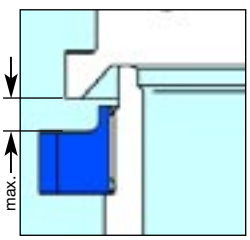
API 526 is a purchase specification in which nominal diameters [1], flange pressure ratings [2], centre to face dimensions [3], flow areas [4], body [5] and spring materials [6], and their service limits are stipulated for “API safety valves”.

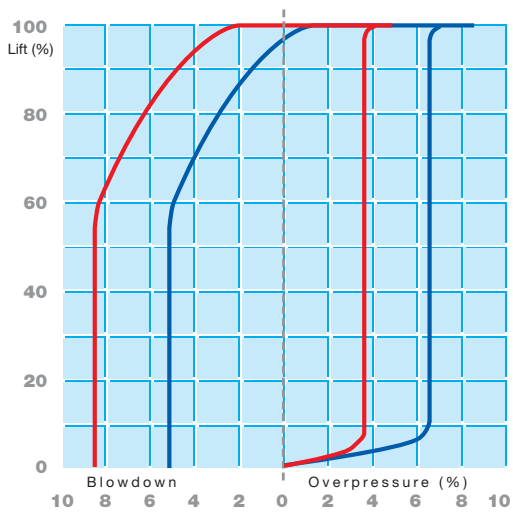
API safety valves are used worldwide in the petrochemical industry, both on- and off-shore. These applications are characterised by standardised plants, blow-down systems and long pipework sections. The capacities of API safety valves are relatively low in relation to their nominal diameters.

The LESER type 526 combines the requirements of the API standards and the ASME Code with the tried and tested service reliability of the LESER product range.

ASME-Code	**Section VIII Div 1** - UG 125 – UG137 **Section II** - SA 216, 217, 351	Approval Materials	UV	ASME B 16.5 ASME B 16.34
API	RP 520 STD 526 STD 527	Sizing Nominal diameters Pressure ratings Orifice letters Materials Functional leak tightness		







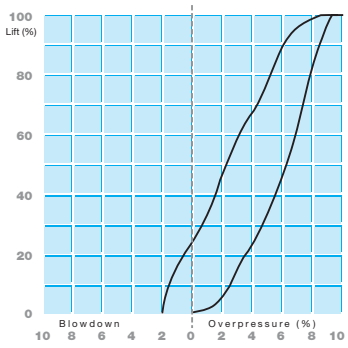
Orifice letter “Orifice”	Flow area according to API 526 mm²	sq.in	Flow diameter according to API 526 mm	inch
D	71,0	0,110	9,5	0,4
E	126	0,196	12,7	0,5
F	198	0,307	15,9	0,6
G	325	0,503	20,3	0,8
H	506	0,785	25,4	1,0
J	830	1,287	32,5	1,3
K	1 186	1,838	38,9	1,5
L	1 841	2,853	48,4	1,9
M	2 323	3,600	54,4	2,1
N	2 800	4,340	59,7	2,4
P	4 116	6,380	72,4	2,8
Q	7 129	11,05	95,3	3,8
R	10 323	16,00	114,6	4,5
T	16 774	26,008	146,1	5,8

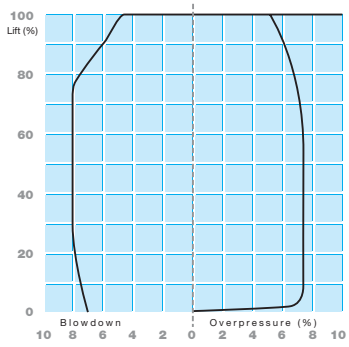
Type 427/429 431/433 532/534

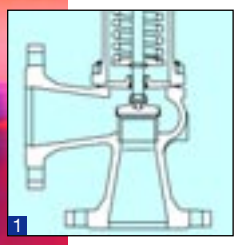
Relief and Safety Relief Valves with flanged connections

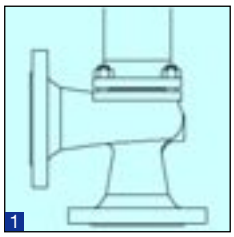
DESIGN FEATURES

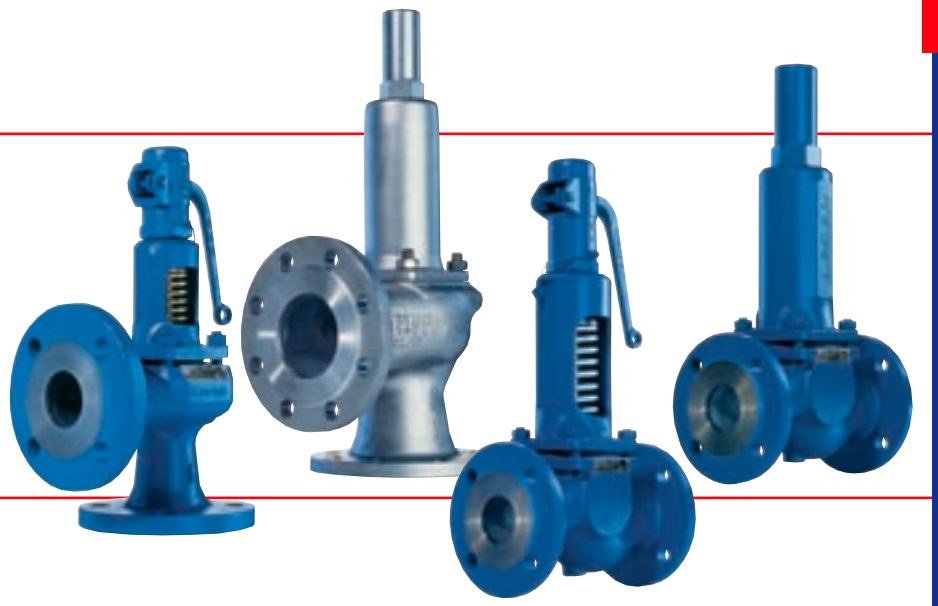
- Adaptation to the relevant service conditions is ensured by:
  - A large range of additional accessories
  - Closely graded flow ratings with a wide range of nominal diameters in 11 steps (DN 15 -150 / NPS 1/2"...6")
- Low overall height and low weight
- The inlet nominal size is equal to the outlet nominal size











Relief valves open in proportion to the pressure rise. They are used wherever normally expected mass flows are very small and the medium loss is to be kept as low as possible (e.g., thermal expansion).

Safety relief valves are ideal relief valves for medium mass flows. Their large proportional range leads to consistent functioning and relief of pressure peaks, particularly with liquids. Both proportional and safety relief valves are characterised by particularly stable operation.

There are four series available:

Type 431/433:

Safety relief valve spring loaded [1], cast construction
with flanged connections for nominal pressure ratings up to PN 40/PR #150;
three body materials: stainless steel, carbon steel and nodular cast iron

Safety relief valve spring loaded, cast construction
with flanged connections for nominal pressure ratings up to PN 160/PR #600;
two body materials: stainless steel and cast carbon steel

Type 427/429:

Relief valve spring loaded [1], cast construction
with flanged connections; three body materials:
stainless steel, carbon steel and nodular cast iron

Type 532/534:

In-line relief valve spring loaded, cast construction
with flanged connections and in-line design [2];
two body materials: carbon steel and cast iron

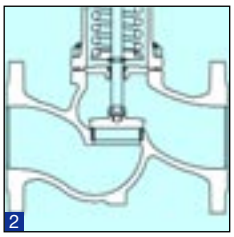
Applications:

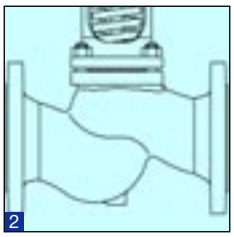
Type 431/433

- **Chemical industry**
  - Production plants: low medium losses
  - Long pipework systems
  - Two phase flow
  - Waste gas cleaning systems (on the outlet side)
- **Heat transfer oil systems**
- **Protection of liquids**
  - Dosing/metering pumps
  - Hydraulic systems
  - Pulsating operating pressures
- **Mechanical engineering (OEM)**
  - Reciprocating compressors of small and medium capacities

Type 427/429 532/534

- **Overflow functions**
- **Thermal expansion**
  - Protection of pipeline segments
  - Enclosed storage tanks





Type	Bonnet	Flange DIN 2501 PN	Flange DIN 2501 DN	Flange ASME B 16.5 PR	Flange ASME B 16.5 NPS	Form	Opening characteristic (S/G)
431 433	open closed	16...40	15...150	#150	½"...6"	Angle type	Safety relief
		63...160	15, 25	#300...#600	½"...1"		
427 429	open closed	16...40	15...150	#150	½"...6"		Relief
532 534	open closed	16...40	15...150	#150	½"...6"	In-line	

Type 437/438/439 459/462

Safety Valves with threaded connections

DESIGN FEATURES

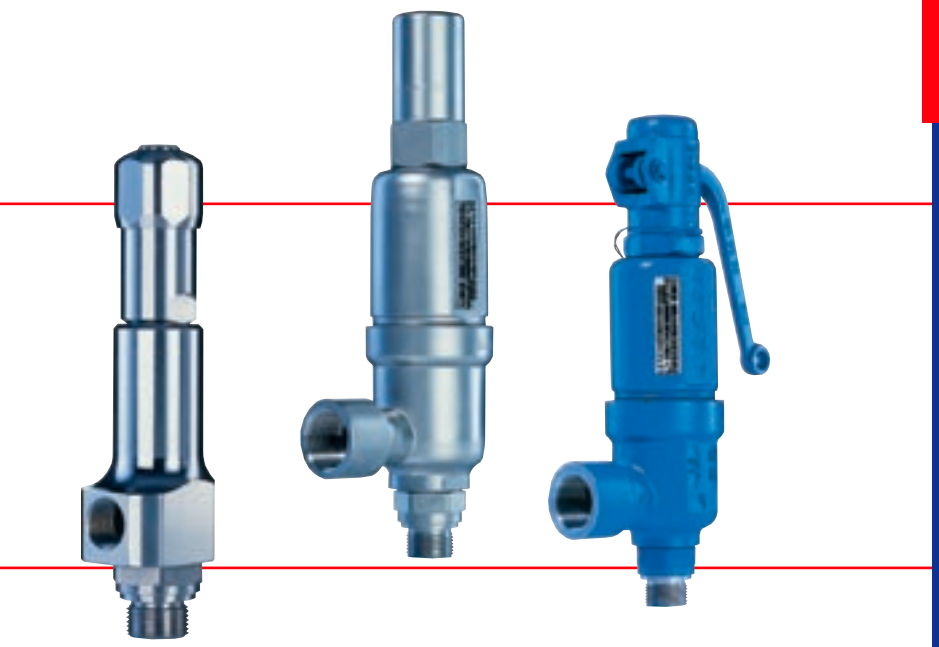
- Maintenance friendly with screwed in nozzle [1] [2] and detachable lifting aid [5]
- Universal application through metal sealing of all body parts
- Variety of connections through:
  – **Threaded connection**:
    • Connections according to DIN ISO 228, NPT or customer requests
    • Available as male or female thread in parallel or taper design
  – **Flanged connection**:
    • Flanges according to DIN, ANSI, IG or special design
    • Inlet: Slip on flange design [7]
- Complete draining of the valve chamber
- Short delivery times, even for special materials

Type 437/438/439

- Extremely compact design
- Disc with changeable sealing plate [3], materials: PTFE-carbon, PCTFE or on request
- Attractive design, machined on all sides
- Certified for horizontal fitting
- Type 438: Soft seal disc [6]
- Type 439: Rubber sealing surface, low pressure application [3]

Type 459/462

- Smallest available safety valve with bellows [4]
- Smooth surfaces, deep drawn body and bonnet
- For p >250 bar g/3625 psig stellited sealing surfaces (seat/disc)
- Type 462: Soft seal disc [6]



Safety valves with threaded connections are used for handling small and medium mass flows.

The LESER threaded connection safety valves are notable for their wide range of set pressures, compact overall dimensions and low weight.

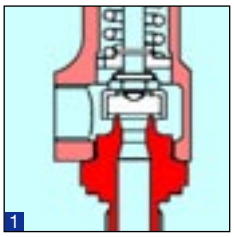
There are two series available:

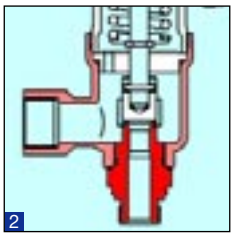
Type 437/438/439

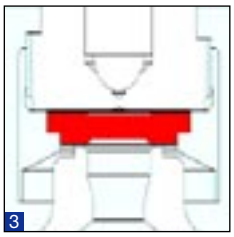
Safety relief valve spring loaded [1] for small mass flows (e.g., thermal expansion and overflow);
two body materials: chrome steel or stainless steel

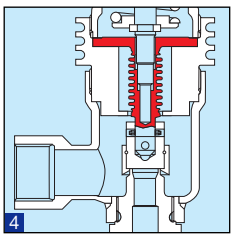
Type 459/462

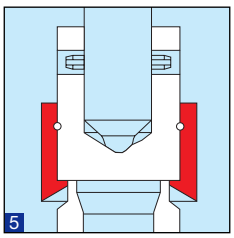
Full lift safety valve spring loaded [2] for the medium mass flow range (e.g., small scale or pilot plant);
two body materials: stainless steel or chrome steel/nodular cast iron

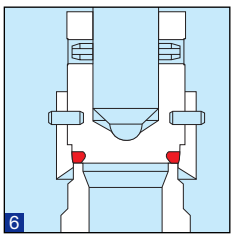


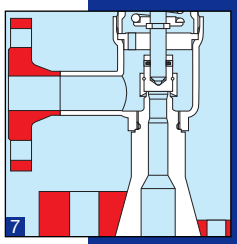












Type	Inlet male	Set pressure range (bar)	Set pressure range (psig)	Characteristic
437	½"	0,1...330	1,5...4785	Metal seal
438	½"	0,5...180	7,5...2610	Soft seal
439	½"	0,1...16	1,5...232	Rubber sealing surface
459	¾"...1"	0,1...250	1,5...3625	Metal seal
459 M	½"	250...700	3625...10150	machined from solid
462	¾"...1"	0,1...250	1,5...3625	Soft seal

Applications:

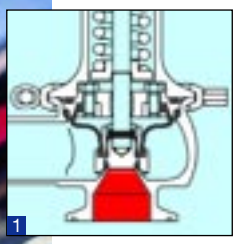
- **Carbon dioxide plants**
  – Manufacture
  – Vaporisation
  – Processing
- **Technical gases**
  – Air separation (cold box)
  – Cylinder filling
- **Refrigeration systems**
  – 3K helium systems
- **Compressors**
  – Diving air
  – Low, medium and high pressure systems
- **Steam generators**
  – Flash steam generators
  – Firetube boilers
- **LPG/LNG**
  – Terminals
  – Carriers
- **Pumps**
  – Dosing/metering pumps
  – Overflow protection
- **Pipework protection**
  – Pipelines
  – Chemical plants
- **Chemical installations**
  – Technical centres
  – Reactors

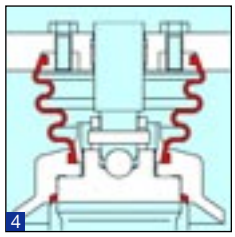
Type 481 483 484 485 486 488

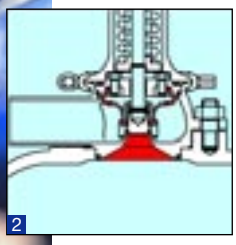
Safety Valves for "Clean Service"

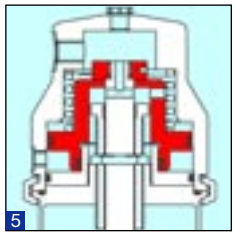
DESIGN FEATURES

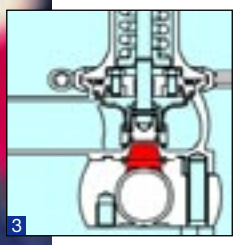
- Many aseptic connections possible (e.g., dairy industry coupling, sterile screw coupling, small flange, Tri-clamps)
- FDA-compliant elastomer materials
- Excellent cleanability and sterilization through:
  - Crevice free fastening of all elastomer parts [4]
  - Exposed, rinsed o-rings
  - Outlet chamber sealed from bonnet by EPDM bellows [4]
- Body and trim in material 1.4404/1.4435/316L; other materials on request
- Manual lifting device H4 or pneumatic lifting device H8 as options [5]
- Control of operating conditions open/closed via indicator

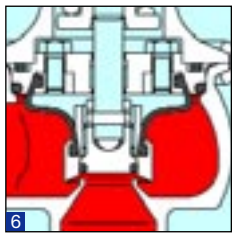


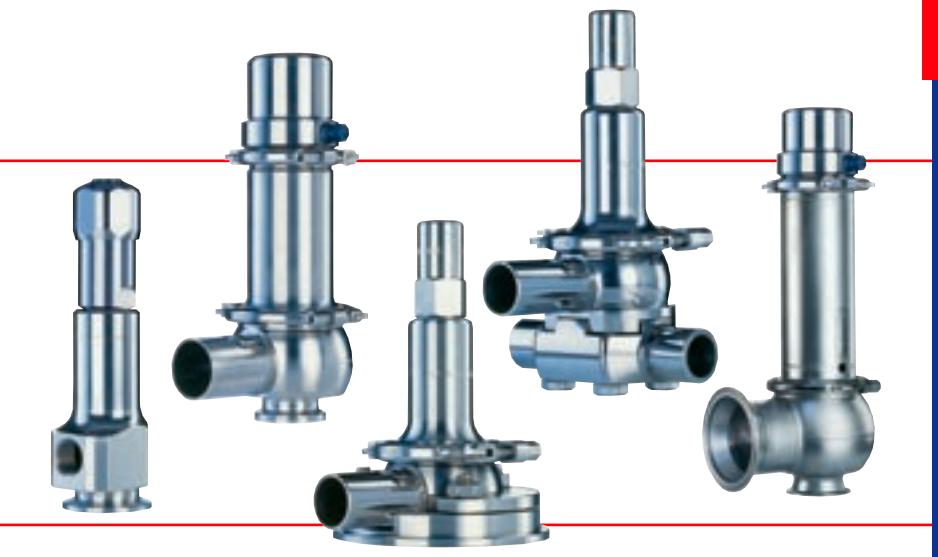












LESER has developed five safety valve types, known collectively as the "48x series", **for the protection of systems with special cleanliness requirements** ("clean service": systems for foodstuffs, beverages, pharmaceuticals and cosmetics). The properties common to the "48x series" are:

- Low dead space
- High surface quality
- Free of crevice
- CIP, SIP, and COP capability

The six types differ in capacities and opening characteristics:

Type 481: Safety relief valve for small capacity
Type 483: Safety relief valve for small and medium capacity [1]
Type 486: High capacity safety relief valve for liquids
Type 488: Full lift safety valve for large capacity for air, steam, liquid

For the very highest aseptic requirements, dead-space-free special designs for direct installation are also available:

Type 484: Safety relief valve with connection direct to vessel [2]
Type 485: Safety relief valve with integrated pipework connection [3]

The safety valves of the "48x" series can be fitted with manually lockable lifting devices H4 to hold open at a small lift, and with pneumatic lifting devices H8 for automated systems (CIP process) [6].

Applications:

Type 481

- **Pipelines**
- **Stainless steel reactors /vessels**

Type 483, 486, 488

- **Autoclaves**
- **Laboratory facilities**
- **Beverage industry**
  – Bottling plants (mixers, fillers)
  – Storage tanks
- **Food industry**
- **Breweries**

Type 484

- **Fermenters**
- **Bio-reactors**

Type 485

- **Pipework protection if direct vessel protection is impossible or not desired**

Type	DN NPS	Set pressure range (bar)	Set pressure range (psig)	Output "Orifice"	Aseptic properties Inlet	Aseptic properties Outlet
481	25 1"	0,1...68	1,5...986	low (D – E)	Low dead space, crevice free	Free discharge
483	25, 40 1", 1 1/2"	0,1...16	1,5...232	medium (F – J)	Low dead space, crevice free	Free discharge, crevice free, no dome
484	25, 40 1", 1 1/2"	0,1...16	1,5...232	medium (F – J)	Dead space free, crevice free	Free discharge, crevice free, no dome
485	15, 25, 40, 50 1/2", 1", 1 1/2", 2"	0,1...16	1,5...232	medium (F – J)	Dead space free, crevice free	Free discharge, crevice free, no dome
486	25, 40, 50, 65, 80 1 1/2", 2, 2 1/2", 3", 4"	0,1...16	1,5...232	very high (G – P)	Reduced dead space, crevice free	Free discharge, crevice free, no dome
488	25...100 1"...4"	0,2...16	3,0...232	very high (K – P)	Reduced dead space, crevice free	Free discharge, crevice free, no dome

Type 447 546 449

Safety Valves for critical service conditions

DESIGN FEATURES

Type 546:

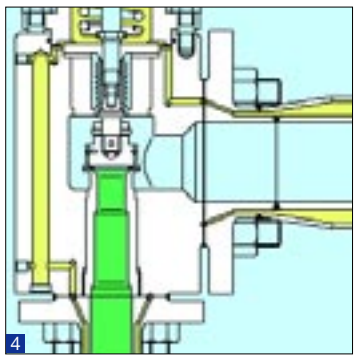
- Body:
  carbon steel or nodular cast iron
- Nozzle: stabilised by support ring [1], optionally in
  – PTFE
  – PTFE - carbon
- Bellows: optionally
  – PTFE bellows
  – Stainless steel bellows
- Sealing element: sealing disc in
  – Borofloat - glass
  (thermal shock resistant)
  – PTFE - carbon

Type 447:

- Body: cast steel, lined
- Lining: vacuum-proof, isostatic lining in virgin PTFE [2]
- Seat nozzle: PTFE/glass sintered under inert gas
- Nozzle, sealing disc and inlet body [3] can be replaced separately and are available in special materials for specific applications

Type 449:

- Block body: Manufactured from a single block, material 1.4571 or special materials such as Hastelloy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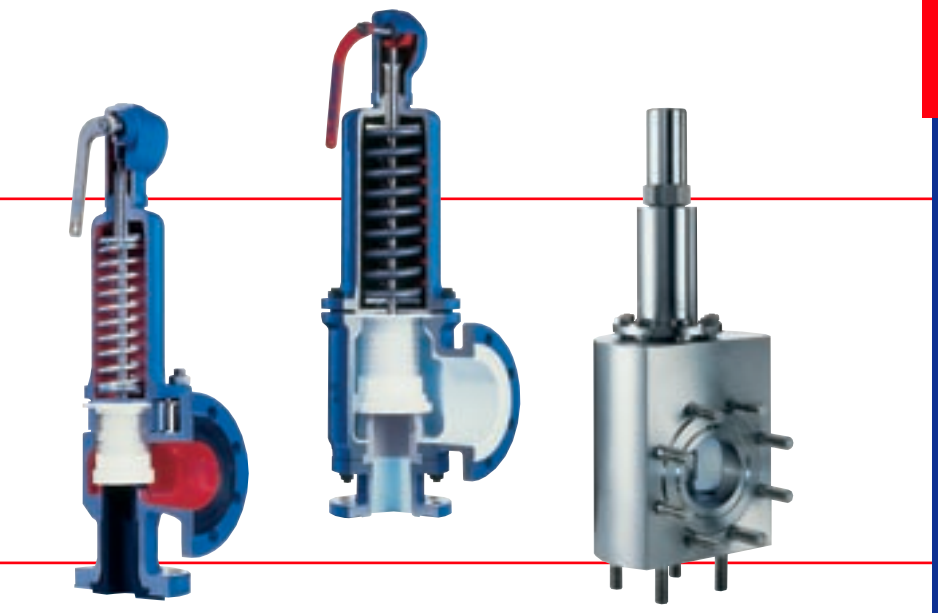


In chemical plants **critical service conditions** and media may occur which place special demands on the design of safety valves, e.g.,

• Highly corrosive media • Highly toxic media • High back pressures

LESER has developed three series of safety valves for these applications:

Type 546:

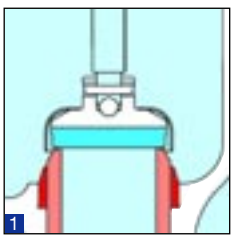
Safety valve with PTFE nozzle and protective coating in the outlet area for protection from highly corrosive media in systems with relatively rare activation of the safety valve. The PTFE nozzle avoids product contam-ination and adherence. By implementing stainless steel bellows operation with up to 50% back pressure is possible.

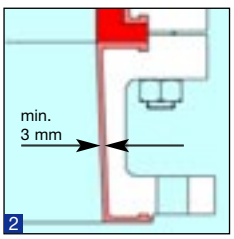
Type 447:

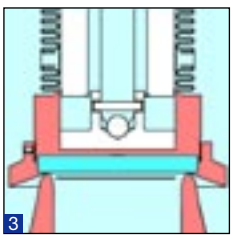
Safety valve with full PTFE lining for protection from highly corrosive media. The PTFE bellows is gastight and back-pressure compensated. Adherence is avoided by the smooth PTFE surfaces. (max. R_z 16 µm).

Type 449:

Safety valve in block form for protection from highly toxic media. A duct system for inert gas shrouding and analysis prevents the medium from getting into the atmosphere [4].







Type	Set pressure range (bar)	(psig)	Flange DIN 2501 PN	DN	Flange ASME B 16.5 PR	NPS
546	0,1...10	1,5...145	16...40	25...100	#150	1"...4"
447	0,1...16	1,5...232	16	25...100	#150	1"...4"
449	0,1...16	1,5...232	16...40	25, 50, 80	#150...#300	1", 2", 3"

Applications:

Type 546

- **Multiple product systems**

Type 447

- **Chlorine manufacture and processing**
- **Reducing acids**
  (e.g., hydrochloric acid, acetic acid)
- **Alkalis**
  (e.g., NaOH solution)

Type 449

- **Phosgene systems**
- **MDI systems**

Type 411 421 522 543/544 440 424 450 460

Safety Valves according to special standards and regulations

DESIGN FEATURES

Type 411 421 522:

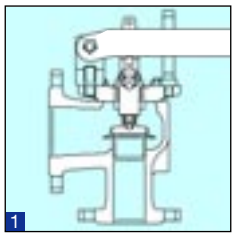
- Low overall height
- Direct lifting
- Simple adjustment of set pressure
- Hardened edge guides

Type 543 544:

- Two independently functioning safety valves
- Common vessel connector
- Common discharge pipe

Type 440 460 and 424 450:

- Fixed set pressure steps in the range of 0,5 .... 10 bar
- Elastomer bellows to protect the sliding parts
- Soft sealing o-ring disc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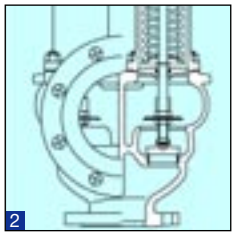
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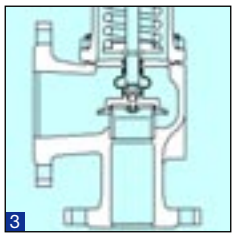
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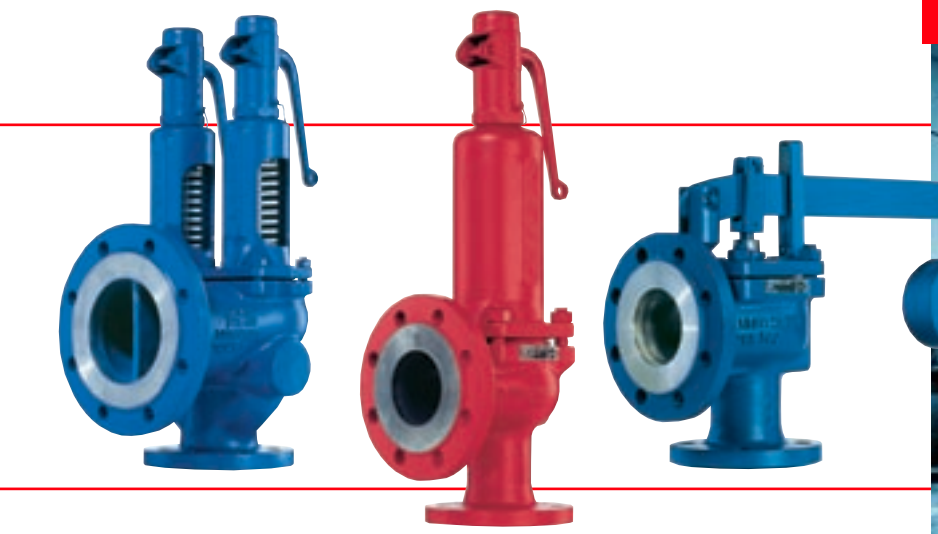


There are **special rules and regulations** in many countries for the protection of land-based steam boilers, marine steam boilers and heating systems. These specifications are fulfilled by LESER's special series:

Safety valves with lever and weight (Types 411 421 522) [1]:

The main application for safety valves with levers and weights is the protection of land-based steam boilers. Further applications result from their small overall height and the ease of set pressure adjustment.

Double safety valves (Types 543/544) [2]:

Two independent safety valves – in some cases with a government ring – are specified for the protection of ship's boilers. In the constricted space on ships double safety valves fulfil this requirement ideally with only one connector on the steam boiler.

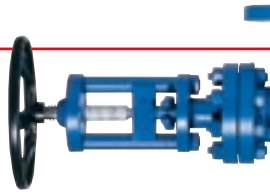
Safety valves for heating plants, low pressure steam boilers (Types 424 440 450 460) [3]:

For heating plants up to 120 °C and low pressure steam boilers up to 1 bar TRD 721 requires safety valves with soft sealing and elastomer bellows to protect the sliding parts.

Type	Bonnet	Flange DIN 2501		Flange ASME B 16.5		Main characteristic
		PN	DN	PR	NPS	
411	–	16...40	20...150	#150	3/4"...6"	Safety relief valve with lever
421	–	16...40	25...100	#150	1"...4"	Full lift safety valve with lever
522	–	40	50...100	#150	2"...4"	Double safety relief valve with lever
543 544	open closed	40	50...100	#150	2"...4"	Double safety relief valve spring loaded
440	closed with bore	16	20...150	–	–	Safety valve according to TRD 721 section 6
424	closed with bore	16	25...150	–	–	Safety valve according to TRD 721 section 5
460	closed with bore	–	15, 20	–	G 3/4", G1"	Safety valve according to TRD 721 section 6, threaded connections
450	closed with bore	–	15, 20	–	G 3/4", G1"	Safety valve according to TRD 721 section 5, threaded connections

Type 310 311

Change-over Valves



DESIGN FEATURES

- Compact, low weight design
- Full flow area on change-over
- Flow area designed in such a way that no flow constriction takes place, and drag coefficients of resistance are therefore low:
  – Type 310 ζ = 0.6...1.0
  – Type 311 ζ = 1.0...2.0
- Conical seal surfaces increase functional leak tightness
- Optionally available with stuffing box or stainless steel bellows with safety stuffing box

Type 310:

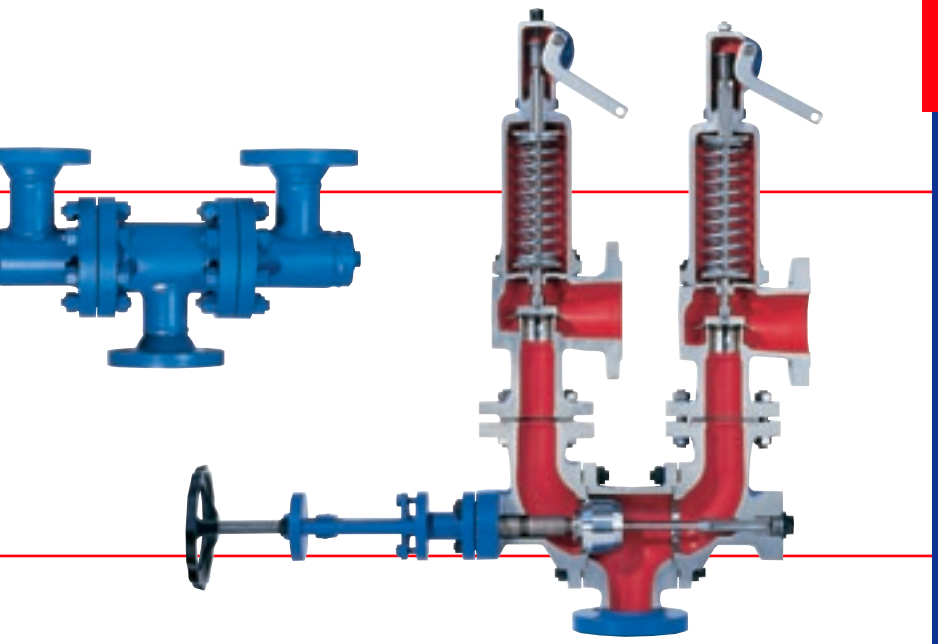
- Two body materials: cast steel and cast stainless steel
- Can be combined with safety valves of the same nominal diameter [2]

Type 311:

- Two body materials: steel and stainless steel
- Reducers can be directly welded on

Options:

– Pressure relief valve
– Bypass with non-return valves
– Limit switches



Change-over valves will be used if a plant shutdown is impossible or undesirable for process engineering or commercial reasons. With change-over valves it is possible to switch over between parallel safety valves without interrupting operation, so as, for example, to perform maintenance work.

The design of the change-over valves ensures:

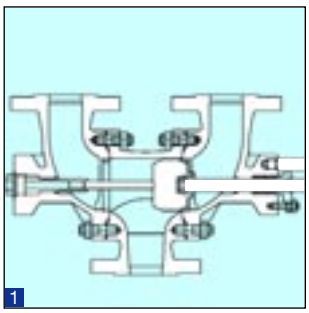
- Low pressure losses on discharge flow (3% criterion)
- Adequate open passage in any position during the change-over process
- Stable operation of the downstream safety valves

The combination [2] of LESER change-over valves and safety valves has been comprehensively tested on full flow test labs.

There are two series available:

Type 310: cast construction DN 25...150/NPS 1"...6" [1]

Type 311: welded construction DN 80...400/NPS 3"...16"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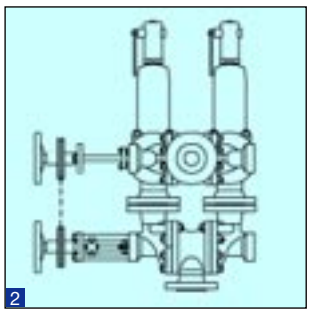

2

Type	Flange DIN 2501 PN	DN	Flange ASME B 16.5 PR	NPS	Main characteristic
310	40...160	25...150	#150...#600	1"...6"	Cast construction
311	10...160	80...400	#150...#600	3"...16"	Welded construction

Applications:

- **Continuously functioning plant**
  - Bitumen refineries
  - Oilfields
  - Ethylene plants
- **Non-drainable systems**
  - Natural gas caverns, large storage facilities
  - Storage tanks for technical gases (e.g., ethylene reservoirs)
- **Application required by national standards**
  - TRB 801 Nr. 14 for refrigeration systems
  - TRB 801 Nr. 26 for technical gases below -10°C
  - TRB 801 Nr. 27 for liquid gas systems

Type 700

“Supplementary Loading” System

DESIGN FEATURES

Control Unit

- Redundant design of the sensing and control systems
- Individual testing of the control systems during operation is possible
- Protection category IP 54 or 68
- Low control air consumption
- Remote activation from the control panel possible
- Service range from -30°C to +60°C (-30°C to +2°C additional heater required)
- Quick coupling measuring points for pressure diagnosis

Actuators

- Robust, simple design (in three sizes)
- Coupling design also suitable for safety valves of other manufacturers
- Non-interchangeable connections for loading air and lifting air

Valve lift actuator

- Operation of up to 6 safety valves from one control unit possible

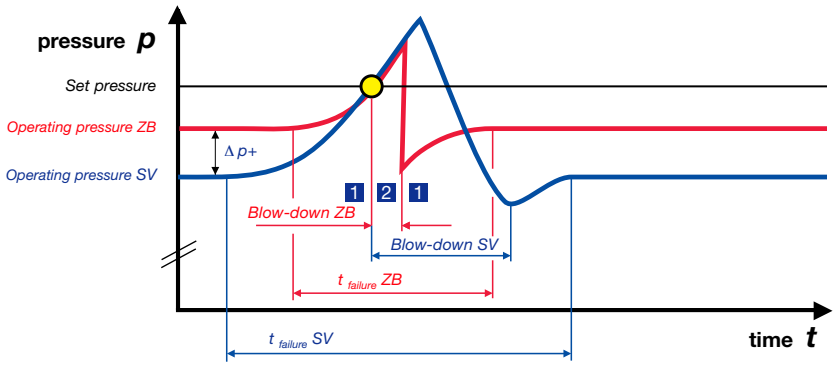
Applications:

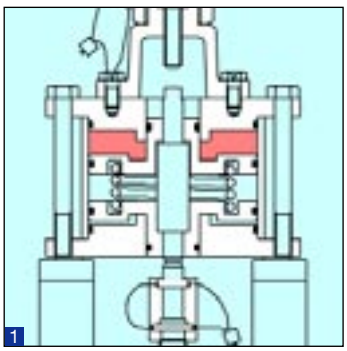
- **Large steam boilers in power stations**
- **Industrial heating boilers:**
  – High system availability and greatest possible use of the maximum allowable working pressure
  – Paper mills
  – Chemical industry
  – Sugar factories

LESER safety valves can be equipped with a supplementary loading system. **The supplementary loading system** consists of four components:

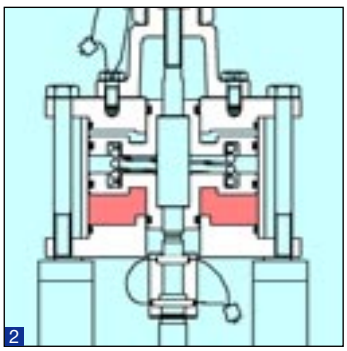
- Safety valve
- Actuator
- Control units (pneumatic, electric/pneumatic)
- Valve lift actuator

The supplementary loading system (ZB) allows the system operating pressure to be increased (Δp+) to just below the set pressure of the safety valve (SV). The functional leak tightness of the additionally loaded safety valve is ensured up to the set pressure (anti-simmer device). When the safety valve operates the supplementary loading device assists the opening [2] and closing [1] processes, thus returning the system to its original service condition more rapidly. As a result the blow-off process is shortened and the product losses are smaller.





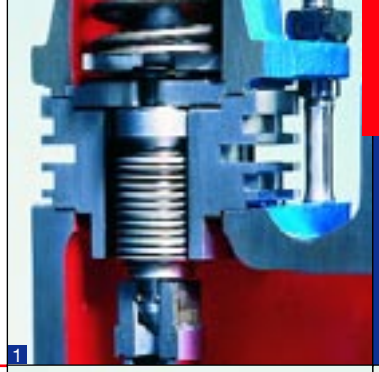
loaded

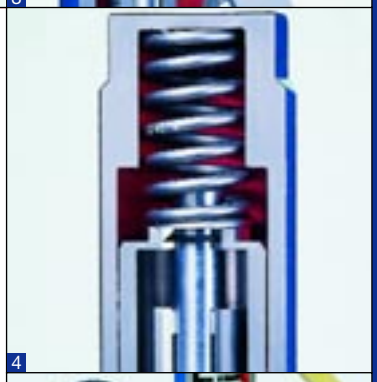


open

Options

Highest adaptation to all service conditions





The stainless steel bellows [1] have two functions:

- Compensation of applied or built-up back pressure on the outlet side of the valve. The full lift of the safety valve is thus ensured.
- Protection of the sliding parts and springs from temperature or cotamination.

The lift stop [2], e. g., by gag, serves to adjust the safety valve precisely to the mass flow to be discharged.

The Test Gag [3] allows the valve to be blocked for pressure tests on the system.

The vibration damper [4] suppresses vibrations on safety valves even under extremely adverse system conditions. A stable blow-off is ensured.

The safety valve/bursting disc combination [5] is used, where environmentally harmful, toxic or expensive media or media with a propensity to adhere are protected, and at the same time the highest demands are placed on freedom from leakage. The safety valve and bursting disc combination are type tested.

The drain hole [6] serves to drain the valve body, particularly in the presence of condensate in the case of steam plants.

Flanges, flange sealing faces, threaded or special connections can be supplied to European, American and other standards.

In systems which have to be heated (e.g., protection of freezing media or viscous media) the safety valve can be fitted with a **heating jacket** [7]. The heating jacket is heated either by low pressure steam or by heat transfer oils.

Safety valve seat and disc:

- Metal sealing: seat and hardened disc have precision machined sealing faces. For severe service conditions stelliting of the sealing faces is available.
- Soft sealing: discs with soft seals (o-rings) offer high degrees of leakproofness. A large number of elastomers are available for selection. The temperature limits of the elastomers must be observed (min. -45 °C/ max. 250 °C).

Type		Flanged connections Inlet				Max. set pressure	
		DIN 2501		ASME B16.5			
Bonnet open	Bonnet closed	DN	PN	NPS	PR	[bar g]	[psig]
Full Lift Safety Valves with flanged connections – up to PN 40/PR #300 (Page 14)							
442	441	20···200	16···40	–	–	40	580
442	441	–	–	1"···4"	#150 ···#300	50	740
442	441	200···400	10···25	8"···16"	#150···#300	25	362
Safety Valves for high operating pressures – ≥ PN 63/PR #600 (Page 16)							
455	456	25···100	63···160	–	–	100	1450
457	458	25···150	63···400	1"···6"	#300···#2500	400	5800
–	459M	10	63···700	1/2"	#300···#2500	700	10150
Flanged Steel Pressure Relief Valves according to API 526 Orifice D...T (Page 18)							
526	526	–	–	1"···6"	#150···#2500	414	6000
Relief and Safety Relief Valves with flanged connections (Page 20)							
427	429	15···150	16···40	1/2"···6"	#150	40	580
431	433	15···150	16···40	1/2"···6"	#150	40	580
431	433	15, 25	63···160	1/2"···1"	#300···#600	160	2320
532	534	15···150	16···40	1/2"···6"	#150	40	580
Safety Valves with threaded connections (Page 22)							
–	437	10, 15	–	1/2"	–	330	4785
–	438	10, 15	–	1/2"	–	180	2610
–	439	10, 15	–	1/2"	–	16	232
–	459	10···20	–	1/2"···1"	–	250	3625
–	459M	10	–	1/2"	–	700	10150
–	462	15, 20	–	1/2"···1"	–	250	3625
Safety Valves for "Clean Service" (Page 24)							
–	481	25	Aseptic connections on request	1"	Aseptic connections on request	68	986
–	483	25, 40		1", 1 1/2"		16	232
–	484	25, 40		1", 1 1/2"		16	232
–	485	15, 25, 40, 50		1/2", 1", 1 1/2", 2"		16	232
–	486	25, 40, 50 65, 80		1 1/2, 2", 2 1/2", 3", 4"		16	232
–	488	25···100		1"···4"		16	232
Safety Valves for critical service conditions (Page 26)							
–	546	25···100	16···40	1"···4"	#150	10	145
–	447	25···100	16	1"···4"	#150	16	232
–	449	25, 50, 80	16···40	1", 2", 3"	#150···#300	16	232
Safety Valves according to special standards and regulations (Page 28)							
411		20···150	16···40	3/4"···6"	#150	40	580
421		25···100	16···40	1"···4"	#150	40	580
522		50···100	40	2"···4"	#150	40	580
543	544	50···100	40	2"···4"	#150	40	580
–	440	20···150	16	–	–	10	–
–	424	25···150	16	–	–	0,5 + 1,0	–
–	450	15, 20	–	G3/4", G1[II]	–	10	–
–	460	15, 20	–	G3/4", G1[II]	–	0,5 + 1,0	–
Change-over Valves (Page 30)							
310		25···150	40···160	1"···6"	#150···#600	–	–
311		80···400	10···160	3"···16"	#150···#600	–	–
Pressure Reducing Valve for Steam							
612		15···100	16, 40	1/2"···4"	#150	25 Upstream pressure	362 Upstream pressure
"Supplementary Loading" System (Page 32)							
700		For detailed information on characteristics and function see complete catalogue section 14					

Footnotes

[1]) 1.4571/SA-240/SA-479 316Ti
[2]) 1.4581/SA-351 CF10M

Opening characteristic for Steam/Gas (D/G)
(according to AD-Merkblatt A2, TRD 421 and TRD 721)

Full Lift Safety Valve	V
Safety Relief Valve	N
Relief Valve	P
Safety Valve for Hot Water Heating plants up to 120 °C	H

Body materials								Main characteristic	Opening characteristic S/G	Complete catalogue
0.6025	0.7043/ SA-365 60-40-18	1.0619/ SA-216 WCB	1.7357/ SA-217 WC6	1.0460/ 1.0425	1.4104/ AISI 430F	1.4404/ SA240/ SA-479 316L	1.4408/ SA-351 CF8M			
CI	NCI	GS/carbon steel		Carbon steel		corrosion resistant/ low temperature ductile			see below	Page
x	x	x					x	Cast construction with DIN flanges	V	4/11
		x					x	Cast construction with ANSI-flanges	V	4/15
	x			x		x[1]		Welded construction	V	4/20
		x					x[2]	Semi nozzle	V	4/40
		x	x			x	x	Full nozzle	V	4/50
						x		Machined from solid	V	9/20
		x	x				x	Safety valves to API 526 Orifice D...T	V	5/10
x	x	x					x	Relief valve	P	7/10
x	x	x					x	Safety relief valve	N	6/10
		x					x	High pressure safety relief valve	N	6/20
x		x						In-line design	P	7/20
					x	x		Metal seal	N	9/10
					x	x		Soft seal, horizontal installation	N	9/12
						x	x	Rubber sealing surface	N	9/14
					x	x		Metal seal	V	9/20
						x		Machined from solid	V	9/25
					x	x		O-Ring soft seal	V	9/22
						x		Low dead space small valve	N	12/10
						x		Low dead space safety relief valve	N	12/20
						x		Dead space free, connection direct to vessel	N	12/40
						x		Dead space free, integrated pipework connection	N	12/50
						x		High capacity relief valve for liquids	N	12/60
						x		Low dead space full lift safety valve	V	12/30
	x	x						PTFE nozzle	N	11/10
		x						Fully PTFE lined	N	11/20
						x		Safety valve in block form with inert gas shrouding	N	11/30
x		x						Safety relief valve with lever	N	8/10
x		x						Full lift safety valve with lever	V	8/20
		x						Double safety relief valve with lever	N	8/30
		x						Double safety valve spring loaded	N	6/30
x								SV according to TRD 721 section 6, flanged connection	H	10/10
x								SV according to TRD 721 section 5, flanged connection	V	10/20
					x			SV according to TRD 721 section 6, threaded connection	H	10/40
					x			SV according to TRD 721 section 5, threaded connection	V	10/30
		x					x	Cast construction	–	16/10
				x		x[1]		Welded construction	–	16/30
x		x							–	17/10
								Redundant control unit	–	14/10

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