High Efficiency

Pilot Operated Safety Valves

Series 810 – Pop Action
Series 820 – Modulate Action

CATALOG

LESER

The-Safety-Valve.com

Product Range

LESER

LESER Safety Valves for every industrial application

High Efficiency

Series 810 – Pop Action

Type 811

Series 820 – Modulate Action

Type 821

High Performance

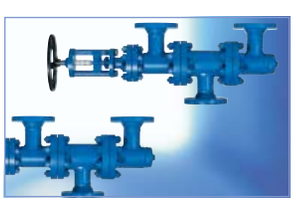
Compact Performance

API

Clean Service

Critical Service

Modulate Action



Best Availability

Product Range

TYPE 811

LESER Type 811 Pop Action pilot-operated safety valves are non-flowing, which minimizes the flow of media through the pilot for decreased emissions and extended valve life. Set pressure is not affected by back pressure.

Features:

- Set pressures: 36 – 1480 psig, 2.5 – 63 bar_g
- Sizes: 1" x 2" up to 8" x 10" (DN 25 – DN 200) with API Standard Orifices and Extra (full-bore) Orifices
- Adjustable blowdown of 3 – 7%
- Complete stainless steel construction of pilot valve
- Certified for air / gas service (ASME Section VIII, DIN EN ISO 4126, AD 2000-Merkblatt)

Soft seal sealings or metal-to-metal sealing

TYPE 821

LESER Type 821 Modulate Action pilot-operated safety valves open in proportion to system overpressure to decrease product loss, reduce emissions and limit noise. Set pressure is not affected by back pressure.
The modulate action pilot control can be vented to the outlet of the main valve for additional safety.

Features:

- Set pressures: 36 – 1480 psig, 2.5 – 63 bar_g
- Sizes: 1" x 2" up to 8" x 10" (DN 25 – DN 200) with API Standard Orifices and Extra (full-bore) Orifices
- Typical blowdown max. 7%
- Complete stainless steel construction of pilot valve
- Certified for air, gas and liquid service (ASME Section VIII) and air, gas, steam and liquid service (DIN EN ISO 4126, AD 2000-Merkblatt)

Soft seal sealings or metal-to-metal sealings





Options

Valve Finder

LESER

How to Find the Right Product Group

High operating to set pressure ratio, high backpressure or low total height?
Yes → **High Efficiency**
No

Clean Service application?
Yes → **Clean Service**
No

Critical Service / highly corrosive application?
Yes → **Critical Service**
No

API specified application?
Yes → **API**
No

Steam, gas and liquid application with low capacity in relation to valve size?
Yes → **Modulate Action**
No

Required Orifice letter?
Orifice ≥ F → **High Performance**
Orifice ≤ F → **Compact Performance**
No

Additional components beyond safety valves
Yes → **Best Availability**

Medium-controlled

Spring loaded

Safety Valves

Change-over valve

Bursting disc

Contents

Pilot-operated safety valve

Series 810 – Pop Action pilot valve

Series 820 – Modulate Action pilot valve

Product Description

Series 810 and 820 Overview

LESER Pilot Operated Safety Valve (POSV)

LESER Pilot Operated Safety Valves (POSVs) are designed according to the API 526 standard. The full range of sizes from 1" x 2" up to 8" x 10" (DN 25 – DN 200) with all orifices from D – T is available for pressure ratings up to pressure class 600 x 150.

Beyond API 526, LESER offers so-called Extra Orifices (also known als Full Port or Full Bore nozzles, see page 01/09). The Extra Orifices provide maximum capacity in relation to valve size. In addition, LESER POSVs come in two different functional designs, i.e. Pop Action (Series 810) and Modulate Action (Series 820). These designs determine the POSVs operating characteristics.

Depending on their design, LESER POSVs open rapidly (Series 810 – Pop Action) or gradually in proportion to system pressure (Series 820 – Modulate Action). Details are shown on page 01/23 – 01/28.

POSV-Main Valve and Pilot Valve Series 810

Series 810 – Pop Action

LESER POSVs Series 810 with rapid opening (Pop Action)

- are used for applications where the certified discharge capacity needs to be reached quickly
- are used for gas applications only
- have an adjustable blowdown of 2 – 7% of set pressure conforming to ASME VIII which can be adjusted beyond API standard up to -15%

Series 810 – Pop Action Pilot

Series 820 – Modulate Action

LESER POSVs Series 820 with proportional opening (Modulate Action)

- are used to minimize medium loss
- are used if medium must not discharge to atmosphere
- open in proportion to the overpressure to ensure that only as much mass flow is discharged from the safety valve as is necessary to prevent further pressure increase

Series 820 – Modulate Action Pilot

Product Description

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Series 810 and 820 Specifications and Approvals

The LESER Pilot Operated Safety Valve (POSV) comprises the POSV main valve and a pilot valve based on either the Pop Action (Series 810) or the Modulate Action (Series 820) designs. The table below shows their common and their specific features.

Specification at a glance

LESER Pilot Operated Safety Valve (Main Valve and Pilot Valve)			
		Common features for Series 810 and 820	
Flange pressure rating[1)]	acc. to ASME B16.5	CL150 – CL 600	
	acc. to DIN EN 1092-1	PN 10 – PN 63	
Materials	acc. to ASME B16.5	WCB, LCB, CF8M	
	acc. to DIN EN 1092-1	1.0619, 1.4408	
Pressure range	acc. to ASME B16.5	36 – 1480 psig	
	acc. to DIN EN 1092-1	2.5 – 63 bar	
Size	acc. to ASME B16.5	1" to 8"	
	acc. to DIN EN 1092-1	DN 25 – DN 200	
Temperature	acc. to ASME B16.5	-49 °F – 392 °F	
	acc. to DIN EN 1092-1	-45 °C – 200 °C	
Orifice system	API Standard Orifice	1 D 2 – 8 T 10	
	Extra Orifice	1 G 2 – 8 T+ 10	
		Specific features of Series 810 and Series 820	
Series		810	820
Type		811	821
Pilot action type		Pop Action	Modulate Action
Full Open (overpressure)		1%	max. 10%
Blowdown		3 to 7% adjustable (adjustable also beyond API standard from 2 up to -15%)	max. 7% fixed
Application		Gas	Steam, gases and liquids

[1)] The possible flange pressure ratings depend on the size of the valve. Refer to page 02/11 to verify the correct option codes and availability of DIN EN and JIS flange ratings.

POSV Approvals

LESER Pilot Operated Safety Valves can be used world-wide, as they comply with the following international codes and standards:

- **USA:** UV-Stamp acc. to ASME Section VIII Division 1, National Board certified capacities for gases and liquids
- **European Community:** CE marking as per Pressure Equipment Directive 97/23/EC and EN ISO 4126-4
- **Germany:** VdTUEV approval as per Pressure Equipment Directive, EN ISO 4126-4, VdTUEV – Merkblatt SV 100/1

The design, manufacture and marking of LESER's Pilot Operated Safety Valves also complies with the following regulations:

ASME PTC 25, ASME-Code Sec. II, ASME B16.34 and ASME B16.5, API Std. 527, API RP 576, EN ISO 4126-7, EN 12266-1/-2, EN 1092 part I and II

Additional Approval Information for Series 810 and 820 POSVs

			Series 810	Series 820
USA			Coefficient of discharge K	
ASME Sec. VIII Div. 1	Gas	Approval No.	M37280	
		Coefficient of discharge K	0.82	0.82
	Liquid	Approval No.	Not approved	M37268
		Coefficient of discharge K	Not approved	0.689
European Community			Coefficient of discharge K_{dr}	
DIN EN ISO 4126-4		Approval No.	07 202 1321 Z 0038/9/01	
		S/G	G: 0.82	S/G: 0.82
		L	Not approved	0.690
Germany			Coefficient of discharge α_w	
AD 2000-Merkblatt A2		Approval No.	TÜV SV 10-1126	
		S/G	G: 0.82	S/G: 0.82
		L	Not approved	0.69

Approvals for Canada, China and Russia will follow in 2011, as well as classifications from Bureau Veritas, Lloyd's Register of Shipping, Det Norske Veritas and Germanischer Lloyd.

Product Description

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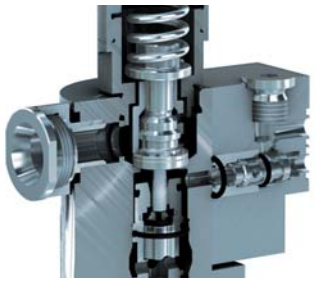
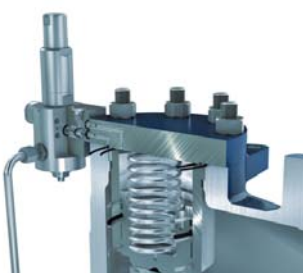
Good Reasons for the LESER Pilot Operated Safety Valve

Pilot operated safety valves have been a proven technology for many decades especially in ASME oriented regions. However, some of the older designs show potential for improvement in areas like external tubing, capacity and delivery times. Based on customer feedback and extended research and using Computational Fluid Dynamics (CFD), Rapid Prototyping and one of the most modern factories for safety valves, LESER has developed the latest POSV on the market. The new LESER POSV offers unique benefits for both users and assemblers / maintenance personnel that are listed below.

	Feature	Benefit for user	Benefit for assembler / maintenance
Design			
	Tubing between pilot valve and main valve integrated into top plate	• Less risk of damage to tubing • Resistant against vibration • No freezing	• Less tubing for easy removal of top plate • Tubing between inlet and pilot remains accessible for easy cleaning
	Backflow preventer integrated into manifold block as a standard component	• Easy ordering, no extra cost • Less risk of damage to backflow preventer	• No need for machining to retrofit backflow preventer
	Integral cast support brackets	• Compensation of reactive forces (high pressures) • Easy handling during installation	
NACE INTERNATIONAL	Pilot valve manufactured completely from stainless steel	Less corrosion for higher operation reliability	NACE conversion only requires exchange of spring
	All medium-wetted parts in tubing and pilot valve are either stainless steel or nickel-coated	Corrosion resistance	

Product Description

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	Feature	Benefit for user	Benefit for assembler / maintenance
High capacity / small size			
EXTRA ORIFICE	Higher capacity for same valve size with Extra Orifice types. For details see page 01/09	Smaller valve sizes possible	Small footprint in system
	20% less space requirement than typical competitive designs	Space-saving system designs possible	Small footprint in system
Modular system			
	Pop Action and Modulate Action pilot valves can be exchanged without tubing modification	Easy later upgrade	Less spare parts stock required. Easy conversion between Pop Action and Modulate Action pilot valve
LESER service			
	Sizing with VALVESTAR	Comprehensive documentation in multiple languages	
4 weeks delivery time	Four weeks delivery ex works for most types	Quick availability	
	Manufactured in Germany	Consistently high manufacturing quality	

Product Description

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Applications – Functional Areas

Across applications, there are four main functional requirements covered by the LESER Pilot Operated Safety Valve (POSV).

High Back Pressure Applications

- LESER POSVs can be operated in applications with a back pressure ratio (i.e. a ratio of back pressure / set pressure) of up to 70 %. Spring loaded safety valves can be typically used up to 50 % of back pressure.
- The absolute maximum back pressure is determined by the pressure class of the main valve outlet. Typically, LESER POSVs can be used for much higher back pressures than spring loaded safety valves.

Applications Requiring Set Pressure Independence of Back Pressure

The LESER POSVs open and operate independently of back pressure (within back pressure operating limits, see previous). The set pressure of the POSV is not affected by back pressure of any kind, i.e. superimposed, constant or variable.

Applications with High Inlet Pressure Losses (above 3%)

In these applications, POSVs with remote sensing should be utilized (refer to API 520 Part 2).

Applications with Increased Tightness Requirements

Since closing forces increase when approaching set pressure (see chart on right), LESER POSVs are particularly suitable for applications with high tightness requirements. Tightness is ensured up to 97% of set pressure because the closing forces increase approaching set pressure. Together with the defined blowdown, this allows operating the sytem close to the set pressure of the valve.

In a POSV, the system pressure acts on the main valve piston trying to push it open. It is, however, opposed by the same pressure because system pressure is also redirected to the dome area above the piston.

Since the area of the piston exposed to pressure is larger in the dome than on the system side, this creates a greater net closing force on the main valve disc / nozzle. Approaching set pressure, closing forces increase. Comparison see page 04/01.

Product Description

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Applications – Examples

Because of their suitability for high back pressure and high tightness applications, LESER Pilot Operated Safety Valves (POSVs) are used in a number of industrial areas including the following:

Compressors in Gas Main Systems
Pressure relief devices in these applications must allow for high operating pressures in relation to set pressure, which are required for efficient gas transport. Additionally, compressor vibrations put through requirements on the tightness of the safety valve.

LESER Series 810 and 820 POSVs offer an ideal solution for these conditions because:

- they enable highest possible operating pressure to set pressure ratios facilitating maximum energy density of transport medium
- they are not susceptible to leakage caused by compressor vibration as are spring loaded safety valvess

Downstream Oil and Gas Industry
Long pipings to the flare systems and common blowdown are frequently used in refineries. Both conditions lead to high back pressure of 50% of set pressure or more.

LESER Series 810 and 820 POSVs are used in these applications because:

- they offer high back pressure to set pressure ratios
- they operate reliably independent of back pressure

Upstream Oil and Gas Industry
Offshore platforms have especially high tightness requirements to avoid leakage. Furthermore, the weight and size of the safety valves should be minimized due to space limitations on the platform.

LESER Series 810 and 820 POSVs are ideal for the upstream oil and gas industry because of:

- their high tightness up to set pressure
- their bonnetless design which allows lower weight and lower valve height

Pumps in All Industries
Systems with positive displacement pumps are protected by safety valves. The medium is often discharged to the suction side of the pump which creates back pressure.

LESER Series 810 and 820 POSVs are used because:

- they operate independently of back pressure
- they allow high back pressure to set pressure ratios

Product Description

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Sour Gas Applications (NACE)

LESER Pilot Operated Safety Valves (POSVs) are available for sour gas (H_2S) service.

Regulatory Requirements

The material requirements for hydrogen sulfide (H_2S) service (sour gas service) are specified in the NACE standards, MR0175/ISO 15156 (Upstream processes), and MR0103 (Downstream processes). Since the body of the pilot valve is manufactured from stainless steel, only the spring in the pilot valve of the Series 810 Pop Action POSV and the dome spring in the main valve need to be replaced for compliance with these NACE standards.

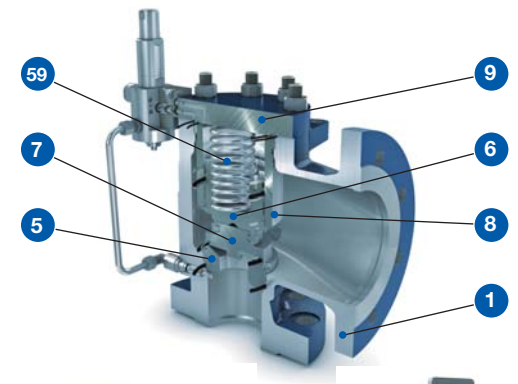
Standard	MR0175/ISO 15156	MR0103
Application	Upstream processes	Downstream processes (Refineries)
Content	Petroleum and natural gas industries – Materials for use in H_2S-containing environments in oil and gas production	Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining environments
	– Rigid requirements for materials resistant to SSC for petroleum production, drilling, gathering, flow line equipment and field processing facilities to be used in H_2S bearing hydrocarbon service	– Provides a standard set of requirements for materials used in sour petroleum refinery equipment
	– Applies to upstream processes (gas production and treatment)	– Applies to downstream (e.g. refining and gas processing) environments (broader range of sour environments)
Material		
Carbon Steel	22 HRC max. and more stringent welding requirement	No base metal hardness requirements on P-No. 1 Group 1 or 2 (WCB, A105 forgings, LCB)
Austenitic Stainless Steel (316 SS)	Maximum hardness of 22 HRC	Maximum hardness of 22 HRC No temperature limitations

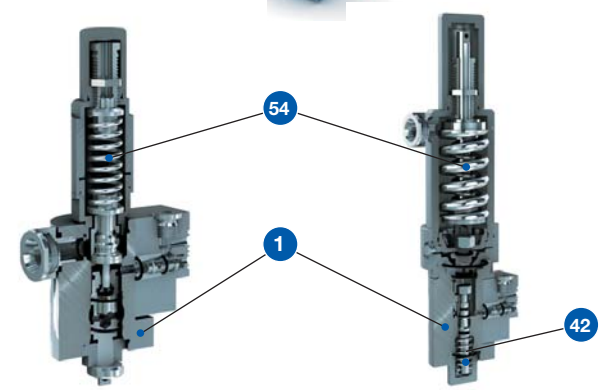
The following parts of the LESER POSV are affected by NACE sour gas standards requirements. Parts with a check mark are compliant with the relevant standard (Option code R70).

Main Valve		NACE-compliant materials
1	Body	✓
5	Nozzle	✓
6	Piston	✓
7	Disc	✓
8	Piston guide	✓
9	Top plate	✓
59	Dome spring	✓

Pilot Valve		Series 810	Series 820
1	Pilot body	✓	✓
42	Return spring	N/A	✓
54	Spring	Inconel®	Not affected

To achieve NACE International conformity for Series 810, only the spring needs to be manufactured in Inconel® material. Spring (**54**) of Series 820 is not affected by the medium and therefore does not need to be exchanged. Return spring (**42**) is manufactured in Inconel® material as a standard material. To order the NACE compliant LESER POSV, please select option code R70.





Pilot Series 810 Pilot Series 820

Product Description

Design Features

The following sections discuss the specific design and functional features of LESER's Pilot Operated Safety Valves (POSV) Series 810 und 820 which enable their application benefits. These benefits include:

- API 526 design ensuring standard valve sizes, dimensions and capacities for easy exchangeability in plants designed according to API standards
- API 526 product range with valve sizes from 1" to 8", orifice D to T, and pressure ratings up to Class 600
- Additional Extra Orifices allowing to use a smaller valve size for a given orifice letter or capacity
- Flange connections according to ASME, EN and JIS available, which guarantee worldwide suitability
- Tubing between main valve and pilot valve integrated into top plate
- One design and spring (single trim) for gas and liquid applications reduces the number of spare parts and ensures low cost maintenance
- Body materials WCB, CF8M, LCB, 1.069, 1.4408 available from stock. Further materials on request.
- Back pressure independent design allows external back pressure up to 70% of set pressure in most applications
- Metal discs or o-ring discs for a wide spectrum of applications
- NACE compliant materials enable NACE applications with minimal need for parts exchange as well as short delivery times
- Backflow preventer included as a standard feature – for details see page 01/10
- Easy-to-repair “top loader” design. This means the valve seat is a single part and can be installed from the top without the need to remove the entire POSV from the plant.

In addition, the Series 820 – Modulate Action POSV is available in a diaphragm or piston design depending on the operating pressure range. For details on these designs, see “Diaphragm or Piston Design” in the section on the Series 820 – Modulate Action POSV see page 01/25.

Product Description

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Seat Designs: API Standard Orifices and Extra Orifices

The main valve of the LESER POSV Series 810 and 820 comes in a variety of orifices. These orifices are obtained by varying the diameter of the main valve nozzle (see illustrations below). For each nominal valve size, LESER offers several orifices which are in accordance with the API orifice system. These are termed API Standard Orifices. In addition, for each nominal valve size a full bore nozzle is also available where the orifice is beyond the API orifice system. LESER refers to this orifice as an Extra Orifice. With an Extra Orifice, the customer often has the choice to use a smaller valve size for a required orifice and capacity (for details see page 03/09). See below for design details and illustrations regarding the Standard and Extra Orifices.

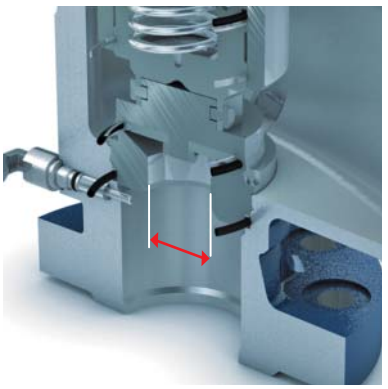
In the POSV, nominal valve sizes correspond to standard API and Extra Orifices as shown in the following table. Extra Orifice letters followed by a plus (+) sign, e.g. “K+”, mean that these valves offer at least 25% more capacity than specified in API 526. For capacity values for Standard and Extra Orifices see the capacity tables on page 03/09.

DN_{i+o}	25 x 50				40 x 50					40 x 80			50 x 80				80 x 100				100 x 150					150 x 200			200 x 250	
Valve size	1" x 2"				$1^1/_2$" x 2"					$1^1/_2$" x 3"			2" x 3"				3" x 4"				4" x 6"					6" x 8"			8" x 10"	
API Standard Orifice acc. to API 526	D	E	F		D	E	F	G		G	H		G	H	J		J	K	L		L	M	N	P		Q	R		T	
Extra Orifice				G					H			J				K+				N+					P+			R+		T+

Below are the details of the different nozzle designs for API Standard and Extra Orifices:

API Standard Orifice

The API Standard Orifice ensures that the safety valve is in accordance with the API 526 orifice system.

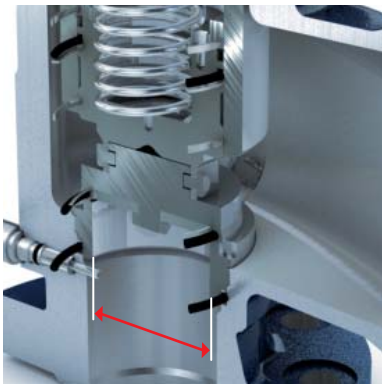


API Standard Orifice

Extra Orifice

The maximum drilling of the main valve seat (full bore) allows to discharge the maximum capacity in relation to the nominal valve size.

Full bore safety valves comply with API 526 except for their orifice, so their orifice is identified by a Extra Orifice letter.



Extra Orifice

Product Description

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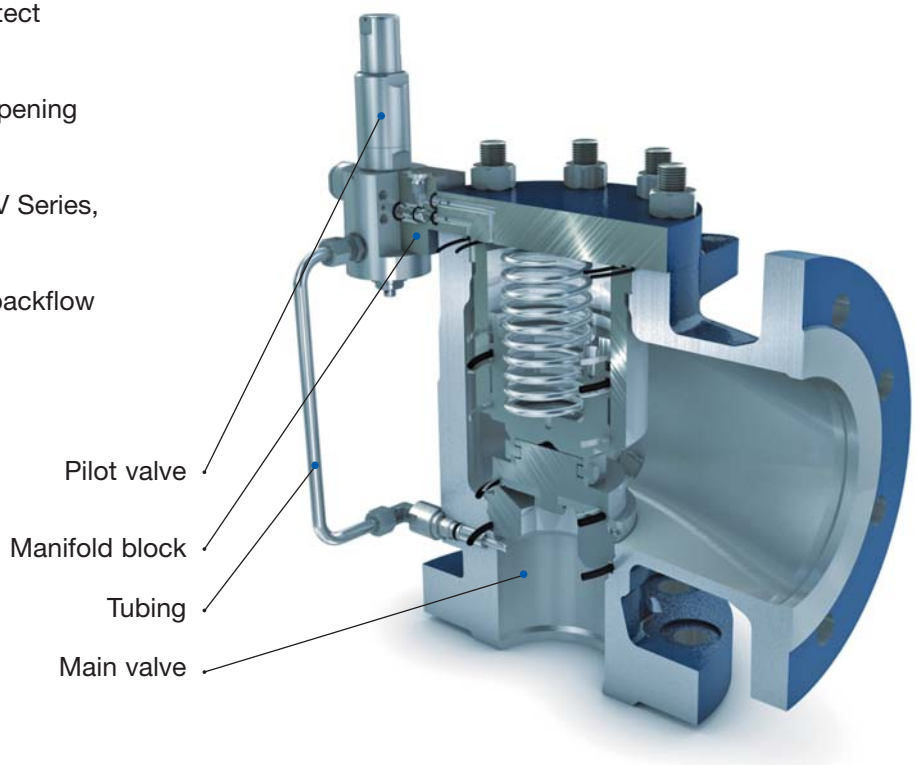
Components

POSV — Main valve, pilot valve, tubing and manifold block

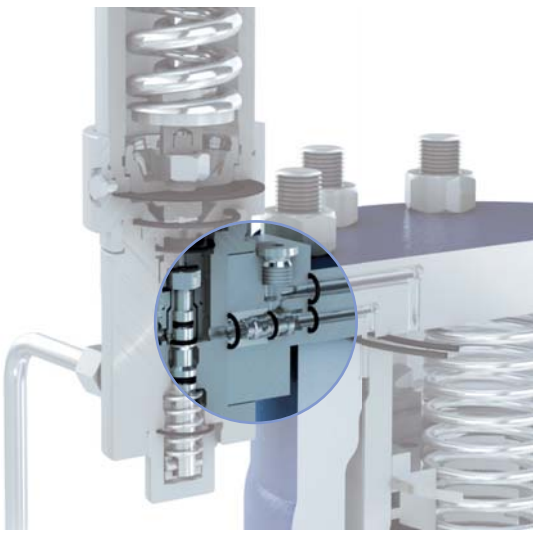
The LESER Pilot Operated Safety Valve (POSV) consists of four main components in its standard configuration:

- the main valve, which serves to protect the pressurized equipment
- the pilot valve, which controls the opening and closing of the main valve
- the tubing is identical for both POSV Series, i.e. 810 and 820
- the manifold block with integrated backflow preventer (standard feature)



Backflow Preventer — Included in standard configuration

The backflow preventer prevents an unwanted opening of the main valve, which would cause backflow of medium from the outlet into the protected system. This problem can occur when there is back pressure that exceeds the inlet pressure (or insufficient pressure at the inlet), resulting in a net force acting on the valve piston in the opening direction, such as e.g. in a process running under vacuum.



Product Description

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Accessories

For both series of the LESER Pilot Operated Safety Valve (POSV) the following accessories are available.
The accessories allow the adaptation of your safety valve to various special operating conditions.

Overview | **Maximum configuration**

Product Description

LESER

Accessories

The available accessories for Series 810 and 820 provide solutions for the following special operating conditions:

1 – Field Test Connector Option code: R26

Operating condition:
The pilot setting shall be tested without system shutdown and without increasing the system pressure.

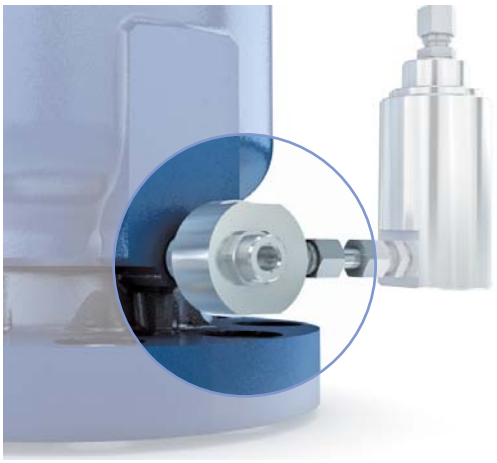
Solution provided:
A field test connector is recommended when set pressure shall be tested. This allows a quick and simple verification of set pressure while the valve remains in service.

To use the field test connector, the following additional equipment is required and must be provided by the customer:

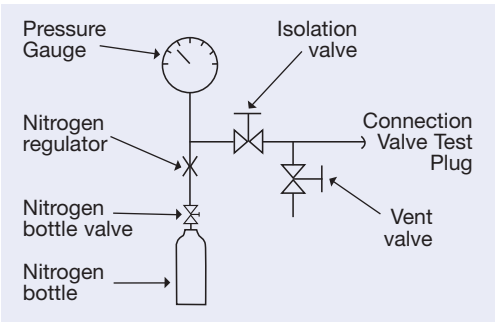
– external pressure supply, e.g. by a pressure cylinder
– pressure gauge

Customer benefit:
No plant shutdown necessary for set pressure testing
No dismounting of valve necessary.

Technical data:
Material: 316L / 1.4404
Connection size: G $^1/_2$ male and NPT $^1/_4$" female



Regular Testing of the Pilot Valve Setting required



2 – Pilot Supply Filter Option code: R30

Operating condition:
The POSV is used for applications involving “dirty” medium which require shorter maintenance intervals. These are undesirable.

Solution provided:
For dirty medium service, a pilot supply filter is available to prevent plugging of the pilot valve and tubing. The filter is suitable for liquid and gaseous media. With the filter added, the filter area is enlarged by a multiple in comparison to the standard pilot valve filter that is integrated into the inlet piping to the pilot valve. The maintenance cycles depend on the following conditions:
1) frequency of operation of the POSV
2) how “dirty” the medium is

Customer benefit:
Extended maintenance intervals of the POSV.

Technical data:
Housing material: 316L / 1.4404
Mesh size: 25µm

Dirty Medium Service

Product Description

LESER

Accessories

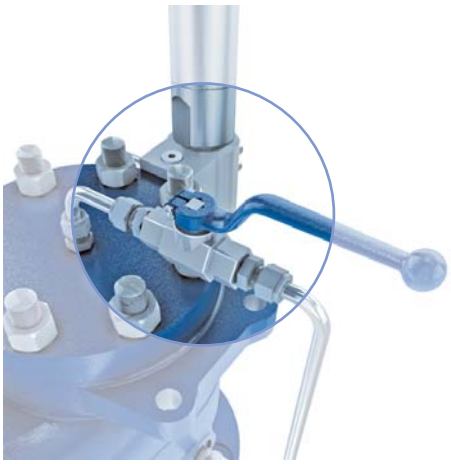
3 – Manual Blowdown

Option code: R27 (blowdown to atmosphere), R24 (blowdown to main valve outlet)

Operating condition:
The lifting of the piston shall be tested without switching of the pilot valve. To achieve a piston lift the dome volume must be released manually and refilling of the dome must be avoided. The testing of the piston may be required when the medium tends to block the piston. Manual blowdown cannot be used for set pressure testing.

Solution provided:
The manual blowdown allows lifting of the main valve by bypassing the pilot valve. Thus, the piston dome pressure can be discharged:
1) to atmosphere (Option Code R27) or
2) to the main valve outlet (Option Code R24)

Customer benefit:
No plant shutdown necessary to test valve lifting
No dismounting of the safety valve necessary for testing purposes



Valve Lifting Test **without** Actuation of Pilot Valve required

4 – Remote Sensing

Option code: R28

Operating condition:
Due to an unfavourable position or length of the inlet pipe excessive pressure loss may occur. This can lead to chattering of the safety valve especially with Pop Action POSVs and the safety valve cannot discharge as much medium as required. This may also damage the safety valve.

Solution provided:
The pilot valve pressure pick up is piped to a location which is remote from the main valve. The pilot will operate independently of a possible pressure loss in the inlet pipe. The tapping point must be chosen so as to avoid pressure loss resulting from flow influences.

LESER supplies the plug at the main valve and the fitting (NPT $^{3}/_{8}$") for the customer remote sensing pipe to the pilot.

The pipe itself and its welding to the system must be provided by the customer. Parameters determining the maximum length of the inlet pipe are the pipe diameter, the static height of the medium and the viscosity of the medium.

Customer benefit:
No reworking of inlet pipe necessary in case of high inlet pressure drop.

Inlet pressure drop

5 – Sealing Accessories

Option codes: see page 02/15

LESER offers two different types of discs for different applications to achieve optimum tightness:

O-Ring
Standard application

Metal disc
High tempertaure and high pressure

6 – NACE requirements

Option code: R70

For material details see page 01/24.

NACE INTERNATIONAL

Product Description

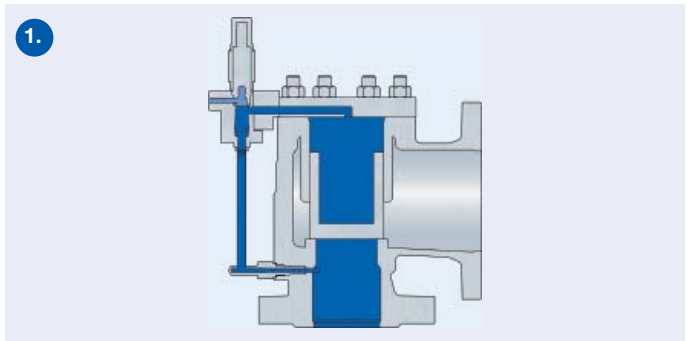
Operating Cycle

LESER Pilot Operated Safety Valve (POSV) is controlled by process medium. To achieve this, the system pressure is applied to the pilot valve (= control component for the main valve) via the pressure pickup. The pilot valve then uses the dome above the main valve piston to control the opening and closing of the main valve.

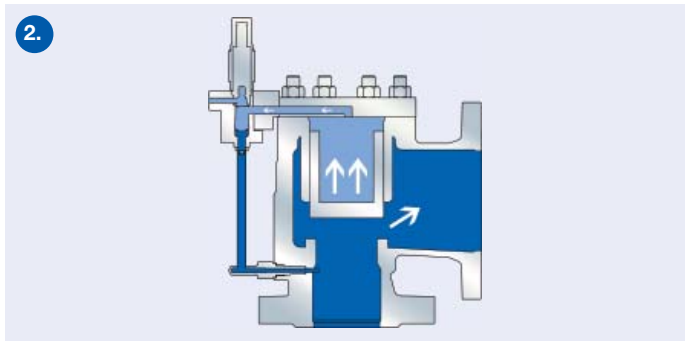
While there are specific differences between the Series 810 – Pop Action POSV and the Series 820 – Modulate Action POSV, the basic operation of a LESER POSV can be described as follows. During operation, the POSV goes through these basic operating states:

Operating states of the POSV

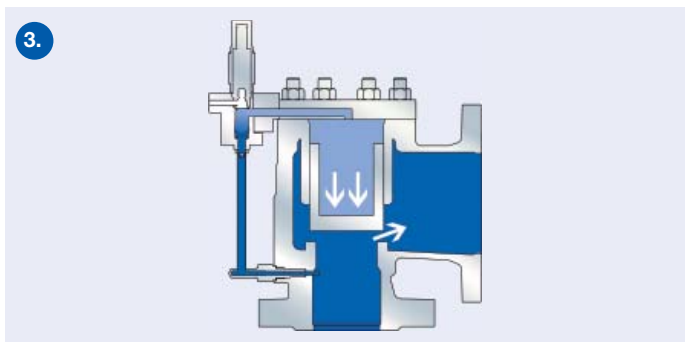
1. Below set pressure: normal operation
During normal operation, the system pressure is picked up at the main valve inlet and routed to the dome (see illustration). Since the dome area is larger than the area of the main valve seat, the closing force is greater than the opening force. This keeps the main valve tightly closed.



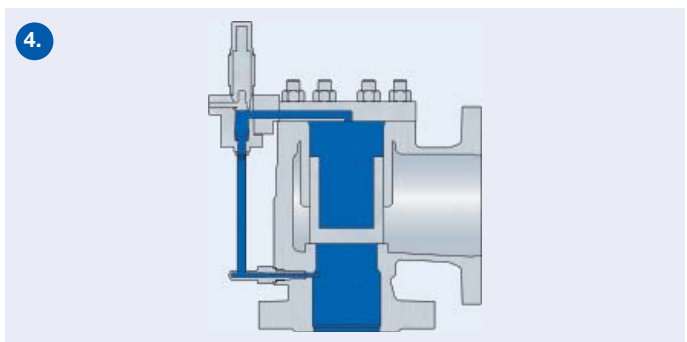
2. At set pressure: actuating state
At set pressure, the pilot valve actuates. The medium is no longer routed to the dome (see illustration). This prevents a further rise in dome pressure. Also, the dome is vented. As a result, the closing force ceases as a pre-condition for the system overpressure to push the main valve open.



3. Main valve opening
The main valve opens. Depending on the design of the pilot valve, this opening is either rapid and complete (Pop Action) or gradual and partial following system pressure (Modulate Action).



4. At closing pressure: refilling the dome
If system pressure drops to closing pressure, the pilot valve actuates and again routes the medium to the dome. The pressure in the dome builds up and the main valve recloses either rapid and complete (Pop Action) or gradual and partial following system pressure (Modulate Action).



Product Description

Series 810 – Pop Action Features

The Series 810 – Pop Action Pilot Operated Safety Valve (POSV) is characterized by rapid opening, or pop action. When set pressure is reached, the dome of the main valve is vented quickly and completely and the main valve opens just as quickly and completely. The medium from the dome is discharged to atmosphere. The Pop Action POSV is used mainly for gas applications.

Product Features

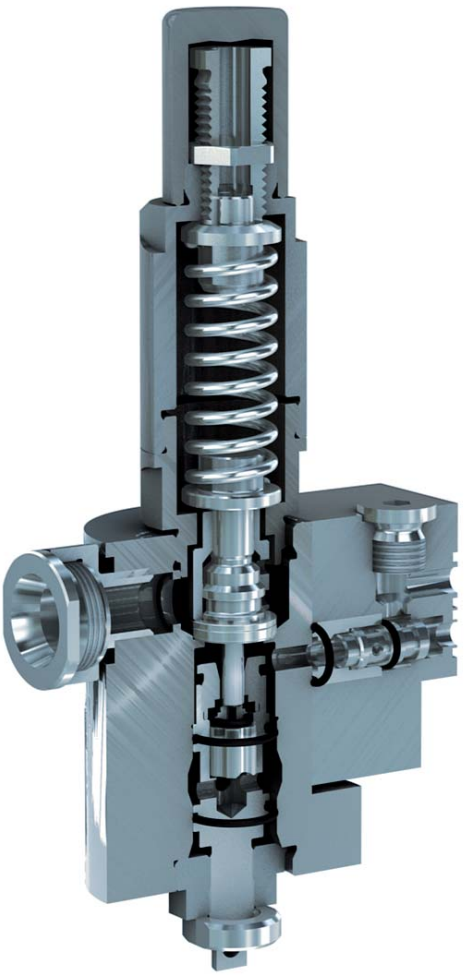
Robust and insensitive to vibrations. The robust connection of the pilot valve (= control valve for the main valve) to the main valve and the reduced exposed piping guarantee safe operation even if there are vibrations in the system.

Easy spring replacement. The spring is easily accessible. This allows simple replacement of the spring, saving time and costs. In order to replace the spring only the top section of the bonnet needs to be removed. Other functional parts or soft goods do not have to be disassembled and therefore do not need to be replaced.

Easy blowdown setting within the requirements of codes and standards. LESER sets the blowdown in the range of 3 – 7%, which conforms to codes and standards. This setting can easily be adjusted. Other testing devices are not required.

A large pressure range of 2.5 – 102 bar (36 – 1480 psig) ensures that the Series 810 Pop Action POSV can be used for a wide variety of applications.

Easy material replacement. The complete pilot valve is machined from bar material in 1.4404 / 316L. Hence, the pop action pilot valve can be made from customized materials easily within short lead time. Materials see page 01/23.



Series 810
Pop Action Pilot Valve

Product Description

Series 810 – Pop Action Operating Cycle

1. Below set pressure:
normal operation – feeding seat open, exhaust seat closed

The system pressure is routed to the top side of the main valve piston via the pressure pickup, the pilot valve and the dome of the main valve (see illustration). Since the pressure contact surface is larger on the top side than on the underside of the piston, there is always a stronger net force acting on the top side. The main valve is kept tightly closed.

2. At set pressure:
feeding seat opening, exhaust seat closing

When set pressure is reached, the pilot valve opens the exhaust seat and closes the feeding seat. This releases the dome pressure. The release of dome pressure is a pre-condition for the opening of the main valve by system pressure.

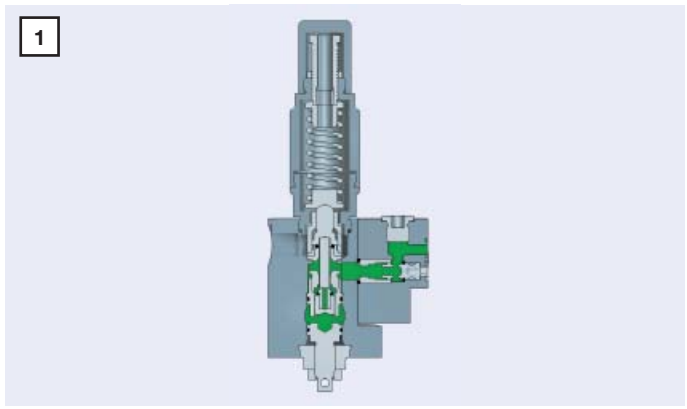
3. At and above set pressure (+ max. 1%):
pop opening

At set pressure, the main valve opens abruptly and completely feeding seat closed, exhaust seat open (Pop Action) (see bottom chart). The medium is channelled from the dome to atmosphere (see illustration on right).

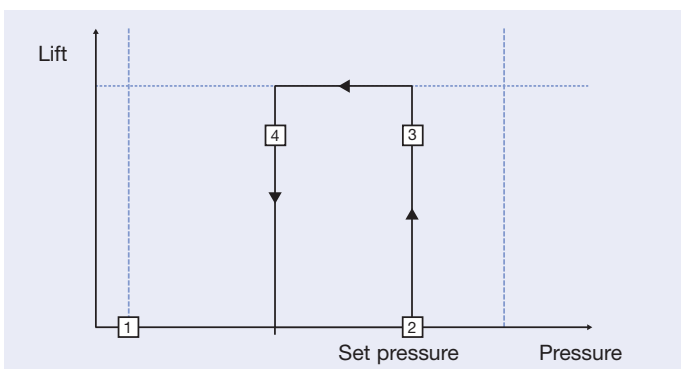
4. At closing pressure:
feeding seat open, exhaust seat closed

When the system pressure drops to closing pressure, the pilot valve actuates and again channels the system pressure to the dome of the main valve. Here, the system pressure builds up, the main valve recloses. The closing stage (blowdown) can be adjusted from at least 3% (when pressure loss at the inlet is low) to max. 15% blowdown difference.

Operating states Series 810



Opening Characteristic with Overpressure and Blowdown Difference:
Series 810 Pop Action vs. Spring Loaded Safety Valve



1 – Below set pressure: normal operation
2 – At set pressure
3 – Pop opening
4 – At closing pressure – blowdown

Product Description

Series 820 – Modulate Action Features

The pilot valve in the Series 820 – Modulate Action Pilot Operated Safety Valve (POSV) does not open the main valve abruptly after reaching set pressure (pop action), but in modulating to the system overpressure (modulate action). Above set pressure, only as much mass flow is discharged as is needed to prevent a further pressure increase. This avoids an unnecessary loss of medium.

The LESER Modulate Action POSV is suitable for liquid as well as for steam and gas applications.

Product Features

The LESER Series 820 – Modulate Action POSV has the same design related benefits as the Series 810 – Pop Action POSV. This means that it can be manufactured and delivered without any problems in special materials. It is robust, spare replacement is uncomplicated and it has a large pressure range of 2.5 – 102 bar (36 – 1480 psig). Furthermore, it offers the following specific benefits:

Suitability for media that are harmful to health / environment. The Series 820 – Modulate Action POSV releases the medium from the dome into the main valve outlet and not into the atmosphere like the Pop Action POSV. Since back pressure can occur here, the Modulate Action pilot valve has a back pressure compensating design.

Same performance, full lift. The LESER Series 820 – Modulate Action POSV has the same discharge capacity and the same lift when completely open as the Series 810 – Pop Action POSV.

Series 820
Modulate Action Pilot Valve
(Diaphragm design)

Product Description

Series 820 – Modulate Action: Diaphragm or Piston design

Depending on the set pressure, Series 820 – Modulate Action Pilot Operated Safety Valves (POSVs) are equipped with

– a diaphragm for set pressures of 2.5 – 30 bar (36 – 435 psig)
– a piston for set pressures of 30.01 – 102 bar (> 435 – 1480 psig)

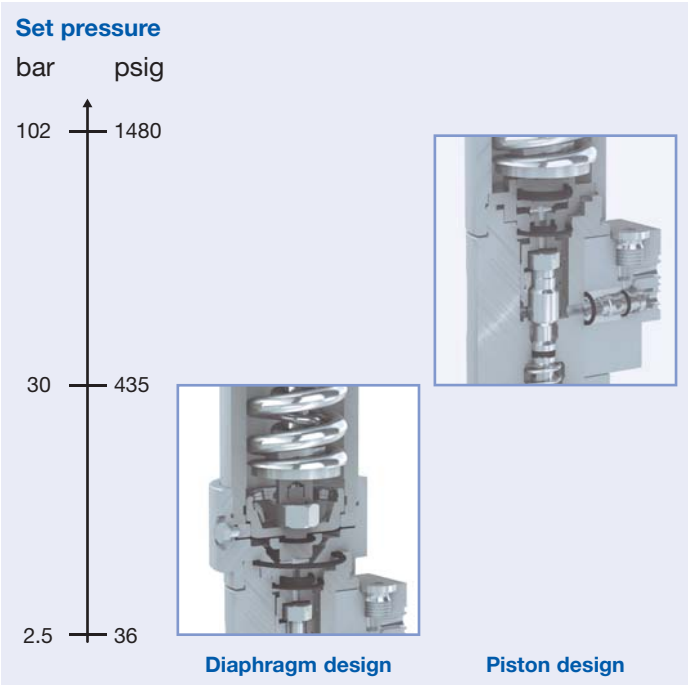
The pilot valve uses the same springs in both designs.

2.5 – 30 bar (36 – 435 psig) – Diaphragm
In the lower pressure range a frictionless diaphragm in the pilot valve accurately transmits system pressure. Approaching set pressure, system pressure builds up underneath the diaphragm. This upward force is opposed by the greater force of the spring pushing downwards. The spring force can be adjusted within the designated pressure range using an adjustment screw. On reaching set pressure, the diaphragm triggers the opening mechanism in the pilot valve. The diaphragm lift is restricted to 1.5 mm by design to protect against tearing.

30.01 – 102 bar (> 435 – 1480 psig) – Piston
In the range of 30.01 – 102 bar (> 435 – 1480 psig) a piston is used to transmit the system pressure to the pilot valve and to trigger the main valve's opening when set pressure is reached.

Depending on the diaphragm or piston designs, specific parts and dimensions (e.g. the mounting of the diaphragm or piston dimensions) in the pilot may differ. Materials see page 01/25.

Pressure ranges for Diaphragm and Piston designs



Product Description

LESER

Series 820 – Modulate Action Operating Cycle

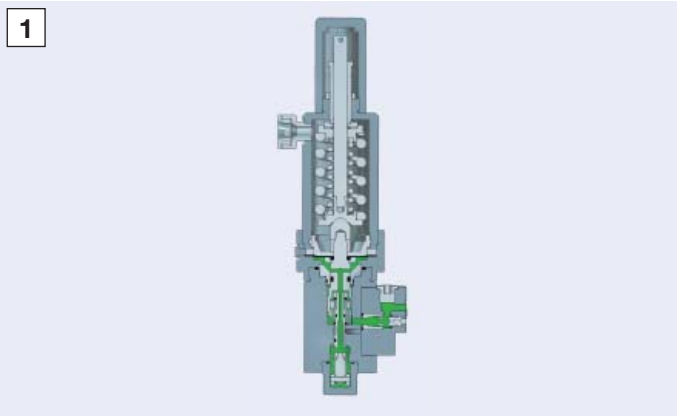
The operating cycles of the Series 820 – Modulate Action and the Series 810 – Pop Action POSV differ at two points: shortly before set pressure is reached (see below, 1a) and after reaching set pressure. At this second point actual modulation takes place in the Series 820 – Modulate Action POSV. Modulation means that above set pressure the pilot valve will open the main valve in proportion to overpressure. Thus, there may only be a partial lift of the main valve This ensures that only as much medium is discharged as is required for pressure reduction. Any unnecessary medium loss is avoided.

1. Below set pressure:
normal operation – feeding seat open, exhaust seat closed
The system pressure is routed to the dome, keeping the main valve tightly closed (see illustration).

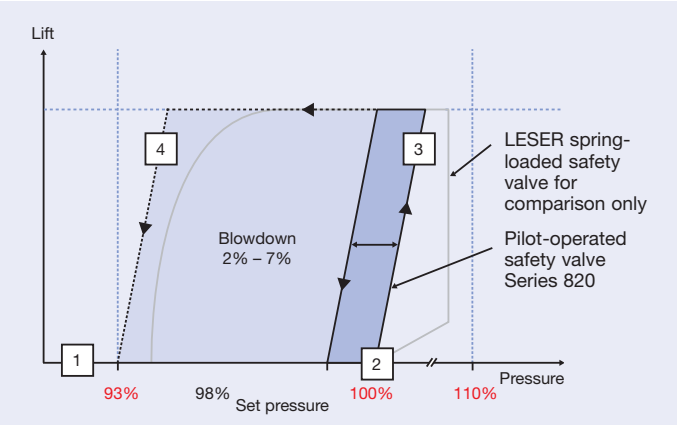
1a. Near set pressure:
feeding seat closed, exhaust seat closed (not shown)
Shortly before set pressure is reached, the pilot valve closes the dome feeding seat. This keeps the dome pressure stable. A stable dome volume is the pre-condition which allows the rising system pressure to push the main valve open at set pressure.

2. At set pressure (+ max. 1%):
feeding seat closed, exhaust seat open
With a further slight pressure increase, set pressure is reached and the pilot valve opens the dome exhaust seat. The dome volume is discharged and the main valve opens.

Operating states Series 820



Opening Characteristic with Overpressure and Blowdown Difference:
Series 820 – Modulate Action vs. Spring Loaded Safety Valve



1 – Below set pressure: normal operation
2 – At set pressure
3 – Pop opening
4 – At closing pressure – blowdown

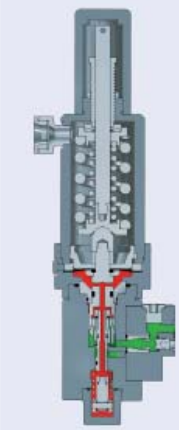
Product Description

Series 820 – Modulate Action Operating Cycle

3. Modulate opening:
feeding seat closed or open,
exhaust seat closed or open

At this point, modulation takes place. This means that if overpressure remains within the modulating range of 93 – 110% of set pressure, the pilot valve will again close the dome exhaust seat. This stops discharge from the dome and keeps the main valve piston unchanged at the achieved lift. The achieved lift will always be enough to ensure pressure reduction, but not more than is required. During blow-off this intermediate state with a stable dome volume and main valve lift can occur repeatedly and at different pressure levels. To change the lift, there can also be partial opening movements with the exhaust seat opened, or closing movements with the feeding seat opened. Modulation ensures that only as much medium is discharged as is necessary to prevent the overpressure from exceeding the modulating range (see chart page 01/19).

3



4. At closing pressure:
full closing – feeding seat open,
exhaust seat closed

When system pressure drops below the modulating range to reach blowdown pressure , the pilot returns to its first state (with feeding seat open and exhaust seat closed). The main valve closes completely.

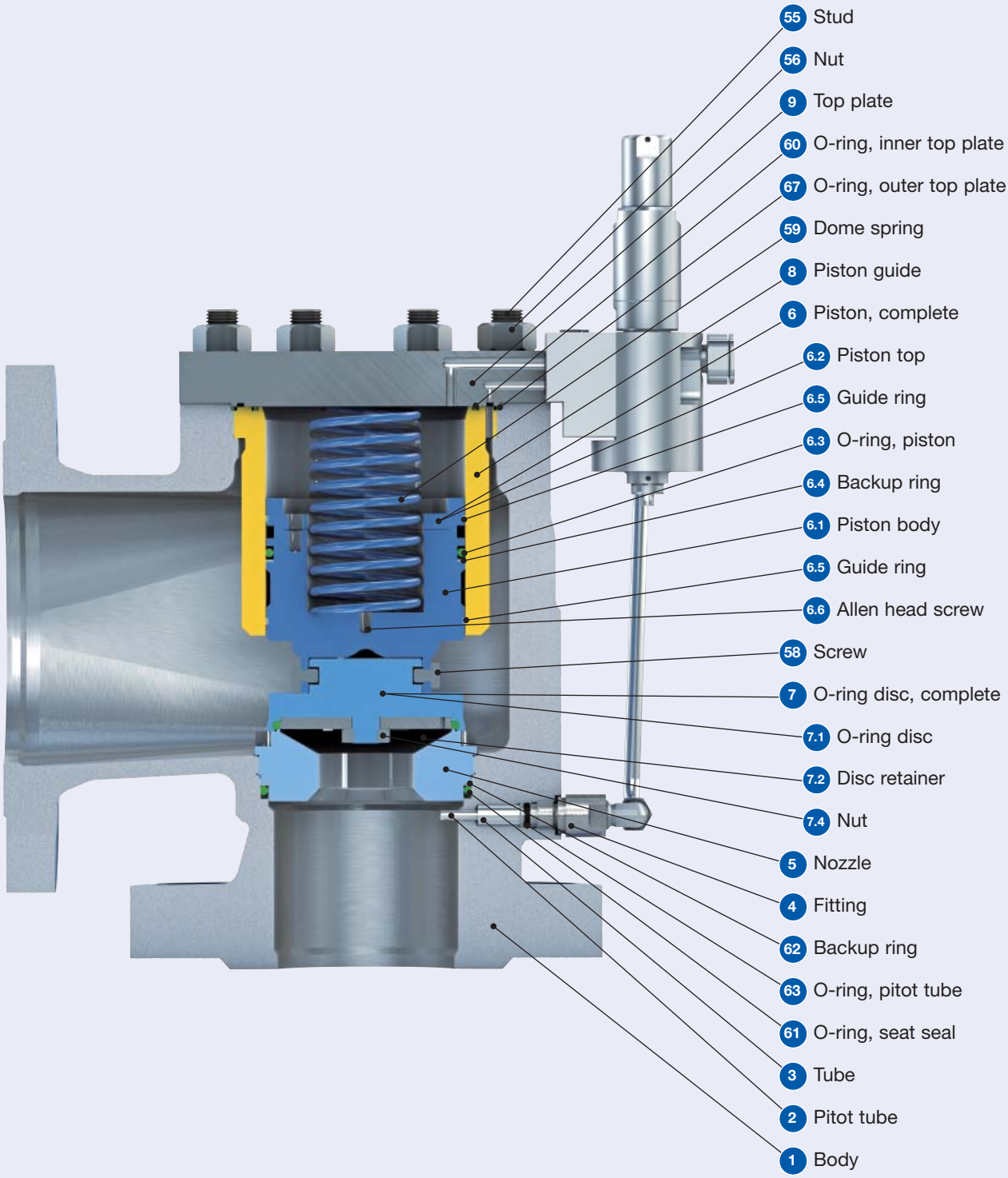
4

Product Description

LESER

Materials Series 810, 820
Main Valve

Below is a schematic drawing of the parts layout for the LESER POSV main valve including both the Standard and Extra Orifice designs. For the related parts listing, see opposite page.



Product Description

LESER

Materials Series 810, 820
Main Valve

Materials

Item	Component	Type 8112 / 8212	Type 8114 / 8214	Type 8113 / 8213
1	Body	1.0619 SA 216 WCB	1.4408 SA 351 CF8M	 SA 352 LCB
2	Pitot tube	1.4404 316L	1.4404 316L	1.4404 316L
3	Tube	1.4404 316L	1.4404 316L	1.4404 316L
4	Fitting	1.4404 316L	1.4404 316L	1.4404 316L
5	Nozzle	1.4404 316L	1.4404 316L	1.4404 316L
6	Piston, complete	1.4404 316L	1.4404 316L	1.4404 316L
6.1	Piston body	1.4404 316L	1.4404 316L	1.4404 316L
6.2	Piston top	1.4404 316L	1.4404 316L	1.4404 316L
6.4	Backup ring	PTFE PTFE	PTFE PTFE	PTFE PTFE
6.5	Guide ring	PTFE with carbon PTFE with carbon	PTFE with carbon PTFE with carbon	PTFE with carbon PTFE with carbon
6.6	Allen head screw	A4-70 Stainless steel	A4-70 Stainless steel	A4-70 Stainless steel
7	O-ring disc, complete	1.4404 316L	1.4404 316L	1.4404 316L
7.1	O-ring disc	1.4404 316L	1.4404 316L	1.4404 316L
7.2	Disc retainer	1.4404 316L	1.4404 316L	1.4404 316L
7.4	Nut	A4-70 Stainless steel	A4-70 Stainless steel	A4-70 Stainless steel
8	Piston guide	1.4404 316L	1.4404 316L	1.4404 316L
9	Top plate	1.0460 SA 105	1.4404 316L	1.406 SA105
55	Stud	1.7225 B7M	1.4401 B8M	1.7225 B7M
56	Nut	1.7225 2H	1.4401 8M	1.7225 2HM
58	Screw	A4-70 Stainless steel	A4-70 Stainless steel	A4-70 Stainless steel
59	Dome spring	1.4310 Stainless steel	1.4310 Stainless steel	1.4310 Stainless steel
62	Backup ring	PTFE PTFE	PTFE PTFE	PTFE PTFE

		Option code	
6.3, 6.4, 7.3, 60, 61, 63, 67	O-ring[1)]	*	Viton® (FKM – Fluorocarbon)
		R05	Buna-EP® (EPDM – Ethylene-Propylene-Dine)
		R06	Kalrez® (FFKM – Perfluo)

Please notice:

- Modifications reserved by LESER.
- LESER can upgrade materials without notice.
- Every part can be replaced by other material acc. to customer specification.

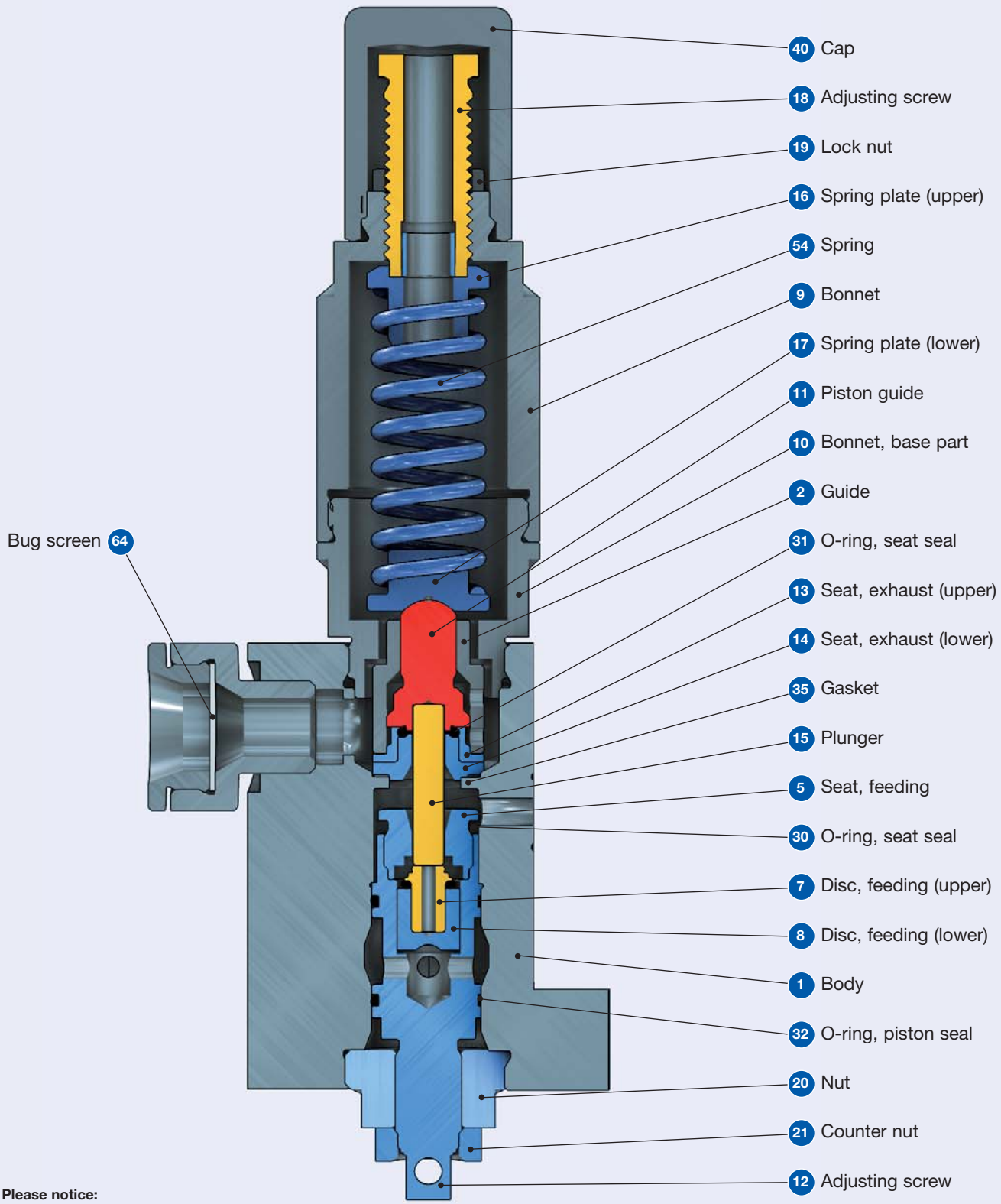
[1)] For further soft seal materials refer to page 02/15

Product Description

LESER

Materials Series 810
Pop Action Pilot Valve

Below is a schematic drawing of the parts layout for the LESER Series 810 – Pop Action pilot valve.
For the related parts listing, see opposite page.



Please notice:

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- Every part can be replaced by other material acc. to customer specification.

Product Description

LESER

Materials Series 810
Pop Action Pilot Valve

Materials

Item	Component	Standard	NACE
1	Body	1.4404 SA 479 316L	1.4404 SA 479 316L
2	Guide	1.4404 316L	1.4404 316L
5	Seat, feeding	1.4404 316L	1.4404 316L
7	Disc, feeding (upper)	1.4404 316L	1.4404 316L
8	Disc, feeding (lower)	1.4404 316L	1.4404 316L
9	Bonnet	1.4404 SA 479 316L	1.4404 SA 479 316L
10	Bonnet, base part	1.4404 SA 479 316L	1.4404 SA 479 316L
11	Piston guide	1.4404 316L	1.4404 316L
12	Adjusting screw	1.4404 316L	1.4404 316L
13	Seat, exhaust (upper)	1.4404 316L	1.4404 316L
14	Seat, exhaust (lower)	1.4404 316L	1.4404 316L
15	Plunger	1.4404 316L	1.4404 316L
16	Spring plate (upper)	1.4404 316L	1.4404 316L
17	Spring plate (lower)	1.4404 316L	1.4404 316L
18	Adjusting screw	1.4404 316L	1.4404 316L
19	Lock nut	1.4404 316L	1.4404 316L
20	Nut	1.4404 316L	1.4404 316L
21	Counter nut	1.4404 316L	1.4404 316L
26	Piston	1.4404 316L	1.4404 316L
35	Gasket	PTFE	PTFE
40	Cap	1.4404 316L	1.4404 316L
54	Spring	1.4310 Stainless steel	2.4669 INCONEL X750
64	Bug screen	Plastic Plastic	Plastic Plastic
Option code			
30, 31, 32	O-ring[1)]	*	Viton® (FKM – Fluorocarbon)
		R05	Buna-EP® (EPDM – Ethylene-Propylene-Dine)
		R06	Kalrez® (FFKM – Perfluo)

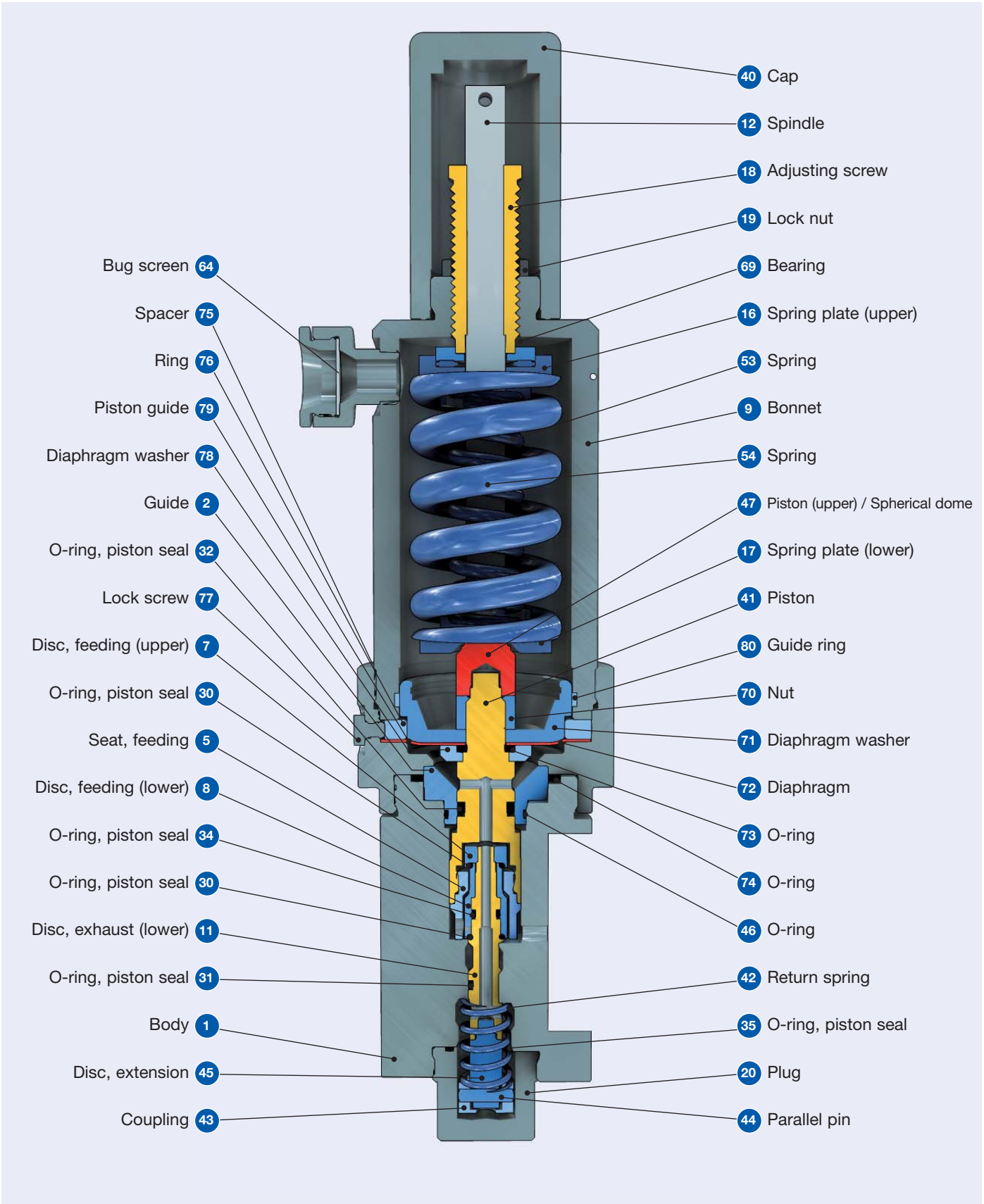
[1)] For further soft seal materials refer to page 02/15

Product Description

LESER

Materials Series 820
Modulate Action Pilot Valve

Below is a schematic drawing of the parts layout for the LESER Series 820 – Modulate Action pilot valve.
For the related parts listing, see opposite page.



Product Description

LESER

Materials Series 820
Modulate Action Pilot Valve

Materials			
Item	Component	Piston	Diaphragm
1	Body	1.4404 SA 479 316L	1.4404 SA 479 316L
2	Guide	1.4404 316L	1.4404 316L
5	Seat, feeding	1.4404 316L	1.4404 316L
7	Disc, feeding (upper)	1.4404 316L	1.4404 316L
8	Disc, feeding (lower)	1.4404 316L	1.4404 316L
9	Bonnet	1.4404 SA 479 316L	1.4404 SA 479 316L
11	Disc, exhaust (lower)	1.4404 316L	1.4404 316L
12	Spindle	1.4404 316L	1.4404 316L
16	Spring plate (upper)	1.4122 Hardened stainless steel	1.4122 Hardened stainless steel
17	Spring plate (lower)	1.4122 Hardened stainless steel	1.4122 Hardened stainless steel
18	Adjusting screw	1.4404 316L	1.4404 316L
19	Lock nut	1.4404 316L	1.4404 316L
20	Plug	1.4404 316L	1.4404 316L
40	Cap	1.4404 316L	1.4404 316L
41	Piston	1.4404 316L	1.4404 316L
42	Return spring	2.4669 INCONEL X750	2.4669 INCONEL X750
43	Coupling	1.4404 316L	1.4404 316L

Materials			
Item	Component	Piston	Diaphragm
44	Parallel pin	Stainless steel Stainless steel	Stainless steel Stainless steel
45	Disc, extension	1.4404 316L	1.4404 316L
47	Piston (upper)	1.4404 316L	– –
	Spherical dome	– –	1.4404 316L
54	Spring	1.4310 Stainless steel	1.4310 Stainless steel
64	Bug screen	Plastic Plastic	Plastic Plastic
69	Bearing	1.4404 316L	1.4404 316L
70	Nut	– –	1.4401 Stainless steel
71	Diaphragm washer	– –	1.4404 316L
72	Diaphragm	– –	FKM
75	Spacer	– –	1.4404 316L
76	Ring	– –	1.4404 316L
77	Lock screw	– –	1.4401 Stainless steel
78	Diaphragm washer	– –	1.4404 316L
80	Guide ring	– –	1.4404 316L
81	Backup ring	PTFE –	– –
82	Backup ring	PTFE –	– –

Materials			
Item	Component	Option code	
30, 31, 32, 34, 35, 46, 73, 74	O-ring[1)]	*	Viton® (FKM – Fluorocarbon)
		R05	Buna-EP® (EPDM – Ethylene-Propylene-Dine)
		R06	Kalrez® (FFKM – Perfluo)

Please notice:

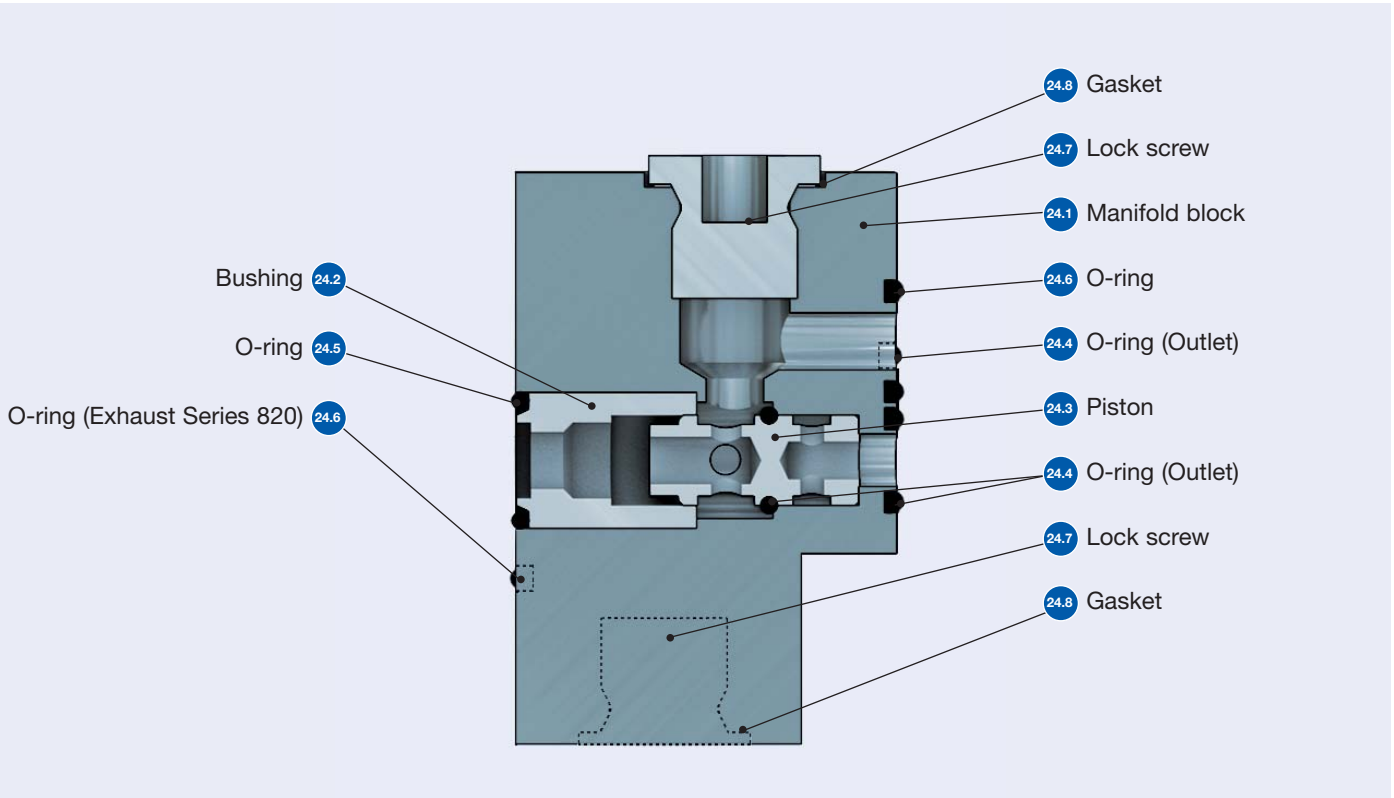
- Modifications reserved by LESER.
- LESER can upgrade materials without notice.
- Every part can be replaced by other material acc. to customer specification.

[1)] For further soft seal materials refer to page 02/15

Product Description

Materials Series 810, 820
Manifold block

Below is a schematic drawing of the parts layout for the Manifold block.
For the related parts listing, see opposite page.



Product Description

Materials Series 810, 820
Manifold block

Materials

Item	Component		Standard
24.1	Manifold block		1.4404
			316L
24.2	Bushing		1.4404
			316L
24.3	Piston		1.4404
			316L
24.7	Lock screw		1.4101
			Stainless steel
24.8	Gasket		1.4101
			Stainless steel
		Option code	
24.4, 24.5, 24.6	O-ring[1)]	*	Viton® (FKM – Fluorocarbon)
		R05	Buna-EP® (EPDM – Ethylene-Propylene-Dine)
		R06	Kalrez® (FFKM – Perfluo)

Please notice:

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- LESER can upgrade materials without notice.
- Every part can be replaced by other material acc. to customer specification.

[1)] For further soft seal materials refer to page 02/15

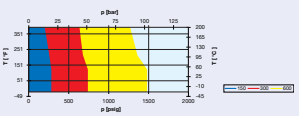
Sizing and Selection

How to Construct the Article Number

LESER combines the steps of Sizing and Selection into one process. This means when you make the technical specifications for your LESER product you construct the order code for your order at the same time. The sizing also can be done with VALVESTAR®.

The article number is the most important part of the order code. The steps you follow in order to construct the article number for your LESER POSV are summarized.

On the following page, the steps for constructing the remainder of the order code are outlined. Note that these two overview pages only show sample data. The actual data for sizing and selection of your LESER POSV can be found on the pages indicated below under “Reference”.

	Step	Selectable Code / Explanation	Reference	Example
1	**Type**	**811 – Pop Action** **821 – Modulate Action**	See page 01/08	**811**
2	**Material code**	**2 – WCB / 1.0619** **3 – LCB** **4 – CF8M / 1.4408**		**2**
3	**Flange pressure rating**	As a prerequisite, you need to know the operating pressure and operating temperature of the application. Then select the flange pressure rating from the selection chart indicated on the right.	For selection charts see page 02/03 	
4	**Valve code**	As a prerequisite, you need to know the connection sizes and the required orifice letter of your application. Alternatively, you can identify your orifice using LESER's VALVESTAR® software program or by using the discharge capacity tables indicated on the right. Based on the flange pressure rating, the connection size and the orifice you select the last three digits of your order code from the selection charts indicated on the right.	For discharge capacities see page 03/09 This example: Flange pressure range 150 x 150 Connection size: 1" x 2" Orifice: D	**.0010**

Valve size		1 x 2			
Standard Orifice acc. to API 526		D	E	F	
Extra Orifice					G
Body material: WCB 1.0619					
Flange class	Art.-No.				
150 x 150	8112.	0010	0020	0030	1820
300 x 150	8112.	0220	0230	0240	1900
600 x 150	8112.	0640	0650	0660	2060

Article number

Type	Material code	Valve code
811	2	.0010

How to Construct the Order Code

Following the steps below, the remaining order code is constructed using the same basic procedure as for the article number.

5	**Set Pressure**	Here you indicate the pressure in gauge units	Application range	**5 bar_g**
6	**Connections**	Option codes for dimensions and facings.	See page 02/11 and 02/13	**H45 H51**
7	**Options**	Accessories for main valve and pilot valve	For accessories see page 02/14 For the standard configuration see page 01/11	**R27**
8	**Documentation**	Select your required documentation, e.g. LESER Certificate for Global Application or material test certificates for individual parts	For required documentation see page 04/16	**H01 L23**
9	**Code and Medium**	1 2 3 . 1 **1 Code** 1. ASME Section VIII 2. CE / VdTUEV 3. ASME Section VIII + CE / VdTUEV **2 Medium** .1 Gases .2 Liquids .3 Steam (valid only for CE / VdTUEV) .0 Steam / Gases / Liquids (valid only for CE / VdTUEV) Serie 810 certified only for gases	See page 02/16	**3.1**

Order code

Set pressure	Connections		Options	Documentation		Code und Medium
5 bar_g	H45	H51	R27	H01	L23	3.1

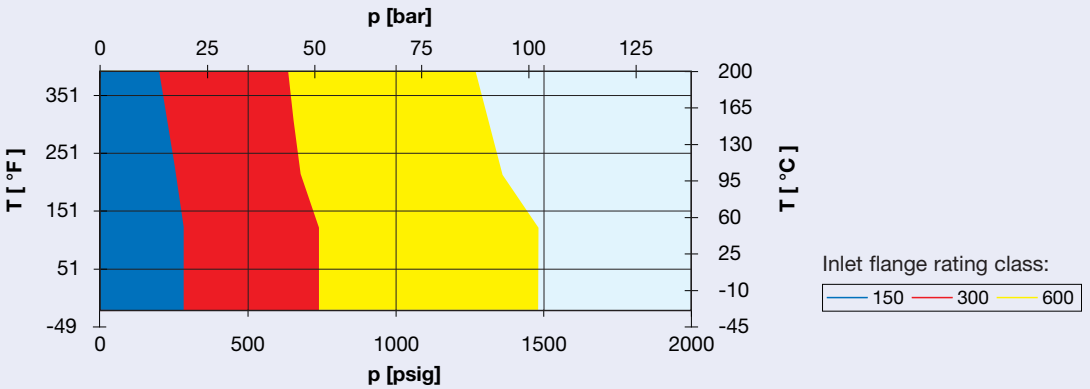
Sizing and Selection

3 Reference: Identifying the Flange Pressure Rating (ASME)

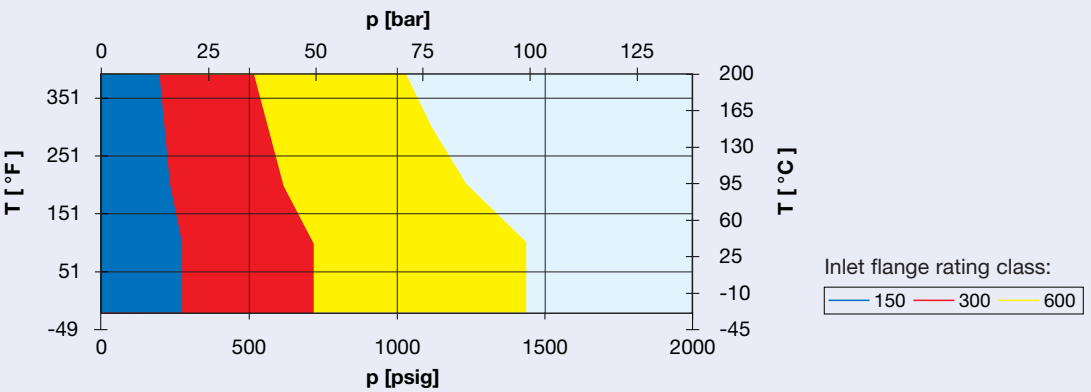
The following selection charts help you identify the flange pressure rating of your LESER safety valve based on the operating pressure and operating temperature of your plant depending on the required body material.

The flange pressure rating is shown inside the color-coded fields of each chart. For the numerical selection tables see opposite page.

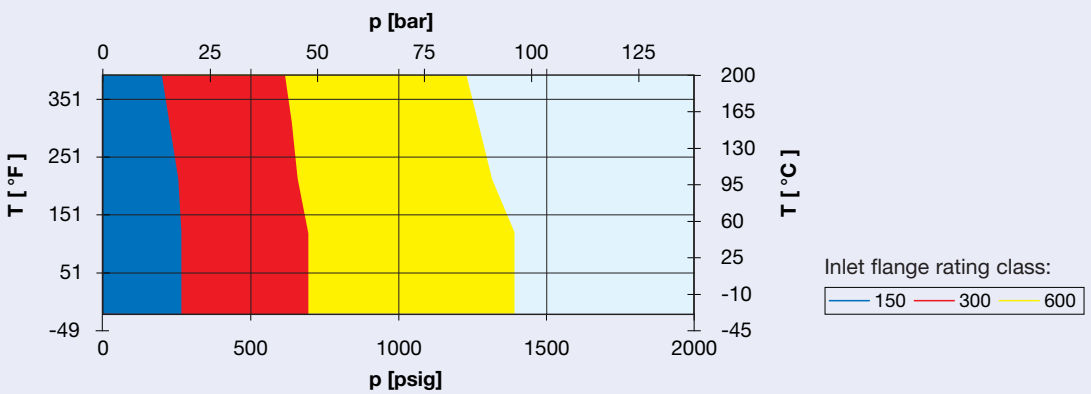
Body material: WCB



Body material: CF8M



Body material: LCB



3 Reference: Identifying the Flange Pressure Rating (ASME)

Body material: WCB

	Temperature range				
T [°C]	-29	38	93	149	204
T [°F]	-20	100	200	300	400
Inlet flange rating class					
	Pressure range [psig]				
150	285	285	260	230	200
300	740	740	680	655	635
600	1480	1480	1360	1310	1265

Body material: CF8M

	Temperature range				
T [°C]	-29	38	93	149	204
T [°F]	-20	100	200	300	400
Inlet flange rating class					
	Pressure range [psig]				
150	275	275	235	215	195
300	720	720	620	560	515
600	1440	1440	1240	1120	1025

Body material: LCB

	Temperature range				
T [°C]	-29	38	93	149	204
T [°F]	-20	100	200	300	400
Inlet flange rating class					
	Pressure range [psig]				
150	265	265	255	230	200
300	695	695	660	640	615
600	1395	1395	1320	1275	1230

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4 Reference: Identifying the Valve Code, Series 810, Orifice D – K+

In the selection charts below you identify the article number based on your flange pressure rating ("flange class"), connection size ("valve size") and orifice. If you specified the Extra Orifice (or "Full bore" orifice) for your nozzle design, refer to row "Extra Orifice", otherwise use row "API Standard Orifice acc. to API 526".

Series 810 – Pop Action, API Standard Orifice and Extra Orifice
All Connection Sizes, Orifice D – K+, by Flange Pressure Rating

DN I+O		25 x 50				40 x 50				40 x 80			50 x 80			
Valve size		1" x 2"				1½" x 2"				1½" x 3"			2" x 3"			
API Standard Orifice acc. to API 526		D	E	F		D	E	F		G	H		G	H	J	
Extra Orifice					G				H			J				K+
Body material: WCB 1.0619																
Flange class	Art.-No.															
150 x 150	**8112.**	**0010**	**0020**	**0030**	**1820**	**0040**	**0050**	**0060**	**1830**	**0070**	**0080**	**1840**	**0090**	**0100**	**0110**	**1850**
300 x 150	**8112.**	**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
600 x 150	**8112.**	**0640**	**0650**	**0660**	**2060**	**0670**	**0680**	**0690**	**2070**	**0700**	**0710**	**2080**	**0720**	**0730**	**0740**	**2090**
Body material: CF8M 1.4408																
Flange class	Art.-No.															
150 x 150	**8114.**	**0010**	**0020**	**0030**	**1820**	**0040**	**0050**	**0060**	**1830**	**0070**	**0080**	**1840**	**0090**	**0100**	**0110**	**1850**
300 x 150	**8114.**	**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
600 x 150	**8114.**	**0640**	**0650**	**0660**	**2060**	**0670**	**0680**	**0690**	**2070**	**0700**	**0710**	**2080**	**0720**	**0730**	**0740**	**2090**
Body material: LCB																
Flange class	Art.-No.															
150 x 150	**8113.**	**0010**	**0020**	**0030**	**1820**	**0040**	**0050**	**0060**	**1830**	**0070**	**0080**	**1840**	**0090**	**0100**	**0110**	**1850**
300 x 150	**8113.**	**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
600 x 150	**8113.**	**0640**	**0650**	**0660**	**2060**	**0670**	**0680**	**0690**	**2070**	**0700**	**0710**	**2080**	**0720**	**0730**	**0740**	**2090**

4 Reference: Identifying the Valve Code, Series 810, Orifice J – T+

In the selection charts below you identify the article number based on your flange pressure rating ("flange class"), connection size ("valve size") and orifice. If you specified the Extra Orifice (or "Full bore" orifice) for your nozzle design, refer to row "Extra Orifice", otherwise use row "API Standard Orifice acc. to API 526".

Series 810 – Pop Action, API Standard Orifice and Extra Orifice
All Connection Sizes, Orifice J – T+, by Flange Pressure Rating

DN I+O		80 x 100				100 x 150					150 x 200			200 x 250	
Valve size		3" x 4"				4" x 6"					6" x 8"			8" x 10"	
API Standard Orifice acc. to API 526		J	K	L		L	M	N	P		Q	R		T	
Extra Orifice					N+					P+			R+		T+
Body material: WCB 1.0619															
Flange class	Art.-No.														
150 x 150	**8112.**	**0120**	**0130**	**0140**	**1860**	**0150**	**0160**	**0170**	**0180**	**1870**	**0190**	**0200**	**1880**	**0210**	**1890**
300 x 150	**8112.**	**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
600 x 150	**8112.**	**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**
Body material: CF8M 1.4408															
Flange class	Art.-No.														
150 x 150	**8114.**	**0120**	**0130**	**0140**	**1860**	**0150**	**0160**	**0170**	**0180**	**1870**	**0190**	**0200**	**1880**	**0210**	**1890**
300 x 150	**8114.**	**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
600 x 150	**8114.**	**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**
Body material: LCB															
Flange class	Art.-No.														
150 x 150	**8113.**	**0120**	**0130**	**0140**	**1860**	**0150**	**0160**	**0170**	**0180**	**1870**	**0190**	**0200**	**1880**	**0210**	**1890**
300 x 150	**8113.**	**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
600 x 150	**8113.**	**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**

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4 Reference: Identifying the Valve Code, Series 820, Orifice D – K+

In the selection charts below you identify the article number based on your flange pressure rating ("flange class"), connection size ("valve size") and orifice. If you specified the Extra Orifice (or "Full bore" orifice) for your nozzle design, refer to row "Extra Orifice", otherwise use row "API Standard Orifice acc. to API 526".

Series 820 – Modulate Action, API Standard Orifice and Extra Orifice
All Connection Sizes, Orifice D – K+, by Flange Pressure Rating

DN I+O		25 x 50				40 x 50				40 x 80			50 x 80			
Valve size		1" x 2"				1½" x 2"				1½" x 3"			2" x 3"			
API Standard Orifice acc. to API 526		D	E	F		D	E	F		G	H		G	H	J	
Extra Orifice					G				H			J				K+
Body material: WCB 1.0619																
Flange class	Art.-No.															
150 x 150	**8212.**	**0010**	**0020**	**0030**	**1820**	**0040**	**0050**	**0060**	**1830**	**0070**	**0080**	**1840**	**0090**	**0100**	**0110**	**1850**
300 x 150	**8212.**	**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
600 x 150	**8212.**	**0640**	**0650**	**0660**	**2060**	**0670**	**0680**	**0690**	**2070**	**0700**	**0710**	**2080**	**0720**	**0730**	**0740**	**2090**
Body material: CF8M 1.4408																
Flange class	Art.-No.															
150 x 150	**8214.**	**0010**	**0020**	**0030**	**1820**	**0040**	**0050**	**0060**	**1830**	**0070**	**0080**	**1840**	**0090**	**0100**	**0110**	**1850**
300 x 150	**8214.**	**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
600 x 150	**8214.**	**0640**	**0650**	**0660**	**2060**	**0670**	**0680**	**0690**	**2070**	**0700**	**0710**	**2080**	**0720**	**0730**	**0740**	**2090**
Body material: LCB																
Flange class	Art.-No.															
150 x 150	**8213.**	**0010**	**0020**	**0030**	**1820**	**0040**	**0050**	**0060**	**1830**	**0070**	**0080**	**1840**	**0090**	**0100**	**0110**	**1850**
300 x 150	**8213.**	**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
600 x 150	**8213.**	**0640**	**0650**	**0660**	**2060**	**0670**	**0680**	**0690**	**2070**	**0700**	**0710**	**2080**	**0720**	**0730**	**0740**	**2090**

4 Reference: Identifying the Valve Code, Series 820, Orifice J – T+

In the selection charts below you identify the article number based on your flange pressure rating (“flange class”), connection size (“valve size”) and orifice. If you specified the Extra Orifice (or “Full bore” orifice) for your nozzle design, refer to row “Extra Orifice”, otherwise use row “API Standard Orifice acc. to API 526”.

Series 820 – Modulate Action, API Standard Orifice and Extra Orifice
All Connection Sizes, Orifice J – T+, by Flange Pressure Rating

DN I+O		80 x 100				100 x 150					150 x 200			200 x 250	
Valve size		3" x 4"				4" x 6"					6" x 8"			8" x 10"	
API Standard Orifice acc. to API 526		J	K	L		L	M	N	P		Q	R		T	
Extra Orifice					N+					P+			R+		T+
Body material: WCB 1.0619															
Flange class	Art.-No.														
150 x 150	**8212.**	**0120**	**0130**	**0140**	**1860**	**0150**	**0160**	**0170**	**0180**	**1870**	**0190**	**0200**	**1880**	**0210**	**1890**
300 x 150	**8212.**	**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
600 x 150	**8212.**	**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**
Body material: CF8M 1.4408															
Flange class	Art.-No.														
150 x 150	**8214.**	**0120**	**0130**	**0140**	**1860**	**0150**	**0160**	**0170**	**0180**	**1870**	**0190**	**0200**	**1880**	**0210**	**1890**
300 x 150	**8214.**	**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
600 x 150	**8214.**	**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**
Body material: LCB															
Flange class	Art.-No.														
150 x 150	**8213.**	**0120**	**0130**	**0140**	**1860**	**0150**	**0160**	**0170**	**0180**	**1870**	**0190**	**0200**	**1880**	**0210**	**1890**
300 x 150	**8213.**	**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
600 x 150	**8213.**	**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**

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5 Reference: Application range of soft seal disc and metal to metal disc at ambient temperature

Different sealing designs are used for different pressure ranges to ensure maximum tightness. Generally, at lower pressures, soft sealings are used, at higher pressures metal-to-metal sealings are used. The following chart shows which sealing is used as a standard.

Application range

DN $_{I+O}$			25 x 50				40 x 50				40 x 80			50 x 80			
Valve size			1" x 2"				$1^1/_2$" x 2"				$1^1/_2$" x 3"			2" x 3"			
API Standard Orifice acc. to API 526			D	E	F		D	E	F		G	H		G	H	J	
Extra Orifice						G				H			J				K+
Set pressure																	
p	**[bar]**	**[psig]**															
from	**2.5**	**36**															
to	**19.7**	**286**					**Soft seal disc**										
to	**27.6**	**387**															
to	**41.3**	**599**															
to	**102**	**1480**					**Metal to metal disc**										

For soft seal material options, please refer to page 02/12.
The chart above refers to ambient temperature conditions.
For sealing materials at other temperatures, please ask LESER.

5 Reference: Application range of soft seal disc and metal to metal disc at ambient temperature

Different sealing designs are used for different pressure ranges to ensure maximum tightness. Generally, at lower pressures, soft sealings are used, at higher pressures metal-to-metal sealings are used. The following chart shows which sealing is used as a standard.

Application range

DN I+O			80 x 100				100 x 150					150 x 200			200 x 250	
Valve size			3" x 4"				4" x 6"					6" x 8"			8" x 10"	
API Standard Orifice acc. to API 526			J	K	L		L	M	N	P		Q	R		T	
Extra Orifice						N+					P+			R+		T+
p	[bar]	[psig]														
from	2.5	36					Soft seal disc									
to	19.7	286														
to	27.6	387														
to	41.3	599					Metal to metal disc									
to	102	1480														

For soft seal material options, please refer to page 02/12.
The chart above refers to ambient temperature conditions.
For sealing materials at other temperatures, please ask LESER.

6 Reference: Option Codes for Connections acc. to DIN EN 1092

As a standard, the Types 811 and 821 are equipped with flanges according to ASME B 16.5. Flanges according to DIN EN 1092 can be specified with the option codes below. Use the right half of the selection table to determine if an article number exists for your required combination of pressure classes. Then use the left half of the same table to establish the two option codes (inlet/outlet) for that combination.

Option Codes for Inlet/Outlet DIN Connections with DIN EN 1092-1 Flange Facings (through PN Pressure Class 63 and Orifice K+)

		DN I+O	25 x 50				40 x 50				40 x 80			50 x 80			
		Valve size	1" x 2"				1 1/2" x 2"				1 1/2" x 3"			2" x 3"			
		API Standard Orifice acc. to API 526	D	E	F		D	E	F		G	H		G	H	J	
		Extra Orifice				G				H			J				K+
Inlet		**Outlet**															
Flange rating class	**Option code**	**Flange rating class**	**Option code**	**Art.-No.**																
PN 10	H44	PN 10	H50	**8112. 8212. 8114. 8214. 8113. 8213.**	**0220**	**0230**	**0240**	**1900**	**0040**	**0050**	**0060**	**1830**	**0070**	**0080**	**1840**	**0090**	**0100**	**0110**	**1850**
PN 16	H45	PN 16	H51		**0220**	**0230**	**0240**	**1900**	**0040**	**0050**	**0060**	**1830**	**0070**	**0080**	**1840**	**0090**	**0100**	**0110**	**1850**
PN 25	H46	PN 10	H50		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
		PN 16	H51		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
PN 40	H47	PN 10	H50		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
		PN 16	H51		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
PN 63	H10	PN 10	H50		–	–	–	–	–	–	–	–	–	–	–	**0720**	**0730**	**0740**	**2090**
		PN 16	H51		–	–	–	–	–	–	–	–	–	–	–	**0720**	**0730**	**0740**	**2090**

		DN I+O	80 x 100				100 x 150					150 x 200			200 x 250		
		Valve size	3" x 4"				4" x 6"					6" x 8"			8" x 10"		
		API Standard Orifice acc. to API 526	J	K	L		L	M	N	P		Q	R		T		
		Extra Orifice				N+					P+			R+			T+
Inlet		**Outlet**															
Flange rating class	**Option code**	**Flange rating class**	**Option code**	**Art.-No.**																
PN 10	H44	PN 10	H50	**8112. 8212. 8114. 8214. 8113. 8213.**	**0120**	**0130**	**0140**	**1860**	**0150**	**0160**	**0170**	**0180**	**1870**	**0190**	**0200**	**1880**	**0210**	**1890**		
PN 16	H45	PN 16	H51		**0120**	**0130**	**0140**	**1860**	**0150**	**0160**	**0170**	**0180**	**1870**	**0190**	**0200**	**1880**	**0210**	**1890**		
PN 25	H46	PN 10	H50		**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**		
		PN 16	H51		**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**		
PN 40	H47	PN 10	H50		**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**		
		PN 16	H51		**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**		
PN 63	H10	PN 10	H50		**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**		
		PN 16	H51		**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**		

Flange dimensions of LESER Type 811, 821 may exceed flange dimensions as mentioned in ASME / ANSI B 16.5, DIN EN 1092 and JIS B 2220. The exceedance is in accordance e.g. with API Standard 526 Sec. 2.4.

For flange facings, please see page 02/13.

6 Reference: Option Codes for Connections acc. to JIS B2220

As a standard, the Types 811 and 821 are equipped with flanges according to ASME B 16.5. Flanges according to JIS can be specified with the option codes below. Use the right half of the selection table to determine if an article number exists for your required combination of pressure classes. Then use the left half of the same table to establish the two option codes (inlet/outlet) for that combination.

Option Codes for Inlet/Outlet JIS Connections with JIS Flange Facings (through 63K and Orifice K+)

					DN i+o	25 x 50				40 x 50				40 x 80			50 x 80			
					Valve size	1" x 2"				1 1/2" x 2"				1 1/2" x 3"			2" x 3"			
					API Standard Orifice acc. to API 526	D	E	F		D	E	F		G	H		G	H	J	
					Extra Orifice				G				H			J				K+
Inlet		**Outlet**		**Art.-No.**																
Flange rating class	**Option code**	**Flange rating class**	**Option code**																	
10K	R53	10K	R49	**8112. 8212. 8114. 8214. 8113. 8213.**	**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
16K	R54	16K	R50		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
20K	R55	10K	R49		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
		16K	R50		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
30K	R56	10K	R49		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
		16K	R50		**0220**	**0230**	**0240**	**1900**	**0250**	**0260**	**0270**	**1910**	**0280**	**0290**	**1920**	**0300**	**0310**	**0320**	**1930**
40K	R57	10K	R49		**0640**	**0650**	**0660**	**2060**	**0670**	**0680**	**0690**	**2070**	**0700**	**0710**	**2080**	**0720**	**0730**	**0740**	**2090**
63K	R60	16K	R50		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

					DN i+o	80 x 100				100 x 150					150 x 200			200 x 250	
					Valve size	3" x 4"				4" x 6"					6" x 8"			8" x 10"	
					API Standard Orifice acc. to API 526	J	K	L		L	M	N	P		Q	R		T	
					Extra Orifice				N+					P+			R+		T+
Inlet		**Outlet**		**Art.-No.**															
Flange rating class	**Option code**	**Flange rating class**	**Option code**																
10K	R53	10K	R49	**8112. 8212. 8114. 8214. 8113. 8213.**	**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
16K	R54	16K	R50		**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
20K	R55	10K	R49		**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
		16K	R50		**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
30K	R56	10K	R49		**0330**	**0340**	**0350**	**1940**	**0360**	**0370**	**0380**	**0390**	**1950**	**0400**	**0410**	**1960**	**0420**	**1970**
		16K	R50		**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**
40K	R57	10K	R49		**0750**	**0760**	**0770**	**2100**	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**
63K	R60	16K	R50		–	–	–	–	**0780**	**0790**	**0800**	**0810**	**2110**	**0820**	**0830**	**2120**	**0840**	**2130**

Flange dimensions of LESER Type 811, 821 may exceed flange dimensions as mentioned in ASME / ANSI B 16.5, DIN EN 1092 and JIS B 2220. The exceedance is in accordance e.g. with API Standard 526 Sec. 2.4.

For flange facings, please see page 02/13.

6 Reference: Option Codes for Flange Facings

The following table shows the various specifications for flange facings according to ASME B16.5 or DIN EN.

Flange facings

Acc. to ASME B16.5

			Smooth Finish[2]		Serrated Finish		RTJ-groove			
			Inlet	Outlet	Inlet	Outlet	Inlet			Outlet
	DN / NPS						CL150	CL300	CL600	CL150
Type	Inlet	Outlet	Option code		Option code		Option code			
811, 821	All	All	L52	L53	*	*	H62			H63

Acc. to DIN EN 1092

Flange facing		Inlet	Outlet	Note	
		PN 10 – PN 40	PN 10 – PN 40	(Rz-data according to DIN EN 1092 in µm)	
Raised face	Form B1	*	*	Groove: Rz = 12.5 – 50	
	Form B2	L36	L38	Groove: Rz = 3.2 – 12.5	Steel flanges only
Tongue face C[1]		H94	H92		
Groove face D[1]		H93	H91		
Male face E		H96	H98		
Female face F		H97	H99		
O-ring male face G		J01	J02		
O-ring female face H		J03	J04		

[1] LESER manufactures the groove at flanged valves by milling. If you require a turned surface in the bottom of the groove according to DIN 2512 and/or DIN EN 1092-1 an additional option code is necessary: “S01: bottom of the groove turned.” Groove and tongue for PN160 flanges refer to DIN2512/LWN 313.32.
[2] Smooth finish is not defined in the effective standards.

Note: Flange drillings and facings meet always the requirements of mentioned flange standards.
Flange thickness and outer diameter may vary from flange standard.

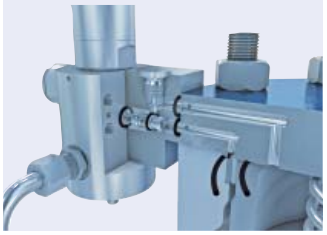
7 Reference: Available Accessories

Specify one or more of the following option codes to order the required accessories for your LESER POSV.

Field test connection
R26

Set pressure testing with external test medium

Backflow preventer
(Standard)



Prevents return flow of the medium from the discharge into the system to be secured

Pilot supply filter
R30

Filter to prevent plugging of the pilot

Manual blowdown
R27 to atmosphere
R24 into main valve outlet

Functional test of main valve piston

NACE sour gas application
R70
MR0175/ISO 15156
MR0103

Remote Sensing
R28

Actual operating pressure sensed to pilot.
No influence of inlet pressure losses, stable function of POSV

Soft sealing
POSV complete
O-ring disc, Piston guide, Seat, Tubing, Cover
R05: EPDM
R06: FFKM
R04: FKM (Standard = *)

Main valve disc
R71 metal sealing

Drain hole
J19: G 1/2
R48: NPT 1/2"

Pilot lifting device
R25

Mechanical lifting of pilot for verification of POSV operation

Pilot test gag
R33

Blocking of operation in case of required hydrostatic testing of vessel

Blowdown
adjusted to fixed value
(for type 811 only)
R44

Blowdown adjusted:
Closing pressure difference as a fixed value between 2 – 15%.
Standard adjustment between 3 – 7%

7 Reference: Selecting Soft Seal Material – Main Valve and Pilot

Use the option codes in this table to order the required soft sealing material for your LESER POSV main valve.

Soft seal (Complete valve)

ASTM 1418 Abbrevation		Commercial name	Code letter[1]	Option code	T_{min} [°C]	T_{min} [°F]	T_{max} [°C]	T_{max} [°F]	Application[2]
Soft Seal Disc (O-Ring), Main Valve									
FKM	FDA	Viton® (Fluorocarbon)	L	*	-15	5	200	392	High temperature service (no superheated steam), mineral oil and grease, silicone oil and grease, vegetable and animal grease and oil, ozone, FDA compliant compound available on request
EPDM	FDA USP VI	Buna-EP (Ethylene-Propylene-Dine)	D	R05	-40	-40	150	302	Hot water and superheated steam up to 150 °C, 302 °F, some organic and inorganic acids, silicone oil and grease, FDA compliant
FFKM	FDA USP VI	Kalrez® (Perfluo)	C	R06	0	32	200	392	Nearly all chemicals, standard compound is Kalrez® 6375 with steam resistance, FDA compliant compound available on request
Other than listed			X	For other materials please contact your local representive or **sales@leser.com**					

[1] The code letters will be stamped on the disc.
[2] Pressure and temperature service must be considered in any case.
Chemical resistance and the temperature limits ddepend on O-ring manufacturer information.
LESER can not take any warranty.

* Standard

8 Reference: Option Codes for Documentation

The option codes you specify here are used by LESER in order to supply the documentation you need on your product (step 8) and for manufacturing and marking purposes, e.g. for markings on the product (step 9).

Inspections, Tests

	Option code
DIN EN 10204-3.2: TUEV-Nord TUEV-Nord Certificate for test pressure	M33
LESER CGA (Certificate for Global Application) – Inspection certificate 3.1 acc. to DIN EN 10204 – Declaration of conformity acc. to PED 97/23/EC	H03

Material Test Certificate

Component	Option code
Main valve	
Body	H01
Disc	L23
Nozzle/Seat	L59
Studs	N07
Nuts	N08
Piston	R75
Cover	R76
Piston Guide	R77
Pilot valve	
Spring	L60
Pilot Body	R78
Pilot Bonnet	R79
Manifold	R84

9 Reference: Selection of Code and Medium

Option Codes Applicable

Applicable Code	Code	Medium	Code
ASME Section VIII	1	Gases	1
CE / VdTUEV	2	Liquids	2
ASME Section VIII	3	Steam (applies only to CE / VdTUEV)	3
		Steam / Gases / Liquids (applies only to CE / VdTUEV)	0

This code is specified as a combination of two digits separated by a dot, e.g. “1.1” for ASME as a code and gas as a medium.

Dimensions and Weights – Series 810 and 820

Metric Units — Orifice D – K+

DN $_{I+O}$	25 x 50				40 x 50				40 x 80			50 x 80			
Valve size	1" x 2"				1½" x 2"				1½" x 3"			2" x 3"			
API Standard orifice acc. to API 526	D	E	F		D	E	F		G	H		G	H	J	
Extra Orifice				G				H			J				K+
d_0 [mm]	11	14.7	18.4	23	11	14.7	18.4	29	23.6	29.4	35.7	23.6	29.4	38	48
A_0 [mm²]	95.0	169.7	265.9	415.5	95.0	169.7	265.9	660.5	437.4	678.9	1001	437.4	678.9	1134.1	1809.6
Flange class 150 x 150															
a	105	105	105	105	124	124	124	124	130	130	130	137	137	137	137
b	114	114	114	114	121	121	121	121	124	124	124	124	124	124	124
H Series 810	330	330	330	330	359	359	359	359	370	370	370	386	386	386	386
H Series 820	456	456	456	456	485	485	485	485	496	496	496	512	512	512	512
S_1	20	20	20	20	31	31	31	31	31	31	31	36	36	36	36
S_2	24	24	24	24	24	24	24	24	29	29	29	29	29	29	29
A	143	143	143	143	152	152	152	152	160	160	160	179	179	179	179
B	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
D	182	182	182	182	186	186	186	186	200	200	200	209	209	209	209
E	283	283	283	283	296	296	296	296	304	304	304	311	311	311	311
m	22,5	22,5	22,5	22,5	27	27	27	27	31	31	31	37	37	37	37
Flange class 300 x 150															
a	111	111	111	111	124	124	124	124	130	130	130	137	137	137	137
b	114	114	114	114	121	121	121	121	124	124	124	124	124	124	124
H Series 810	336	336	336	336	359	359	359	359	370	370	370	386	386	386	386
H Series 820	462	462	462	462	485	485	485	485	496	496	496	512	512	512	512
S_1	26	26	26	26	31	31	31	31	31	31	31	36	36	36	36
S_2	24	24	24	24	24	24	24	24	29	29	29	29	29	29	29
A	143	143	143	143	152	152	152	152	160	160	160	179	179	179	179
B	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
D	182	182	182	182	186	186	186	186	200	200	200	209	209	209	209
E	283	283	283	283	296	296	296	296	304	304	304	311	311	311	311
m	19,5	19,5	19,5	19,5	24	24	24	24	28	28	28	34	34	34	34
Flange class 600 x 150															
a	111	111	111	111	124	124	124	124	130	130	130	137	137	137	137
b	114	114	114	114	121	121	121	121	124	124	124	124	124	124	124
H Series 810	336	336	336	336	359	359	359	359	370	370	370	386	386	386	386
H Series 820	462	462	462	462	485	485	485	485	496	496	496	512	512	512	512
S_1	26	26	26	26	31	31	31	31	31	31	31	36	36	36	36
S_2	24	24	24	24	24	24	24	24	29	29	29	29	29	29	29
A	143	143	143	143	152	152	152	152	160	160	160	179	179	179	179
B	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
D	182	182	182	182	186	186	186	186	200	200	200	209	209	209	209
E	283	283	283	283	296	296	296	296	304	304	304	311	311	311	311
m	22,5	22,5	22,5	22,5	27	27	27	27	31	31	31	37	37	37	37

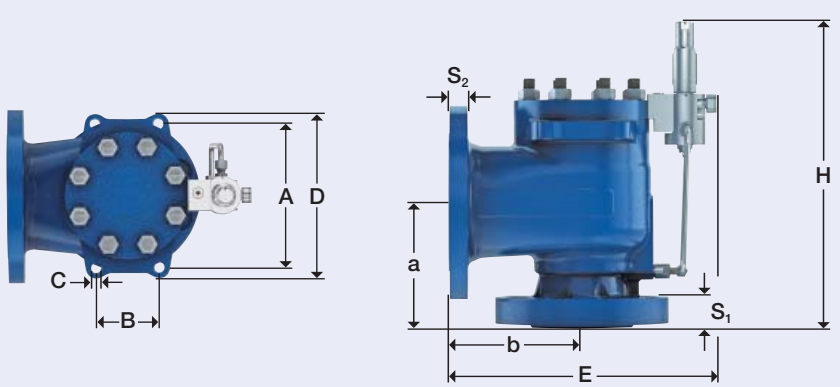
d_0 = Actual discharge diameter [mm]
A_0 = Actual discharge area [mm²]
a = Center to face [mm]
b = Center to face [mm]
H = Heights [mm]
S_1 = Inlet flange thicknes [mm]
S_2 = Outlet flange thickness [mm]

A = Bracket [mm]
B = Bracket [mm]
C = Hole diameter [mm]
D = Total width [mm]
E = Total length [mm]
m = Weight [kg]

Dimensions and Weights – Series 810 and 820

Metric Units — **Orifice J – T+**

DN I+O	80 x 100				100 x 150					150 x 200			200 x 250	
Valve size	3" x 4"				4" x 6"					6" x 8"			8" x 10"	
API Standard orifice acc. to API 526	J	K	L		L	M	N	P		Q	R		T	
Extra Orifice				N+					P+			R+		T+
d_0 [mm]	38	45	56	75	56	63	69	83	95	110	133	142	168	180
A_0 [mm²]	1134.1	1590.4	2463.0	4417.9	2463.0	3117.3	3739.3	5410.6	7088.2	9503.3	13892.9	15836.8	22167.0	25446.9
Flange class 150 x 150														
a	156	156	156	156	197	197	197	197	197	240	240	240	276	276
b	162	162	162	162	210	210	210	210	210	241	241	241	279	279
H Series 810	428	428	428	428	481	481	481	481	481	580	580	580	683	683
H Series 820	554	554	554	554	607	607	607	607	607	706	706	706	809	809
S_1	36	36	36	36	49	49	49	49	49	52	52	52	45	45
S_2	29	29	29	29	30	30	30	30	30	47	47	47	35	35
A	223	223	223	223	249	249	249	249	249	320	320	320	356	356
B	110	110	110	110	110	110	110	110	110	160	160	160	160	160
C	18	18	18	18	18	18	18	18	18	18	18	18	18	18
D	259	259	259	259	305	305	305	305	305	381	381	381	430	430
E	370	370	370	370	432	432	432	432	432	528	528	528	561	561
m	59	59	59	59	89	89	89	89	89	195	195	195	263	263
Flange class 300 x 150														
a	156	156	156	156	197	197	197	197	197	240	240	240	276	276
b	162	162	162	162	210	210	210	210	210	241	241	241	279	279
H Series 810	428	428	428	428	481	481	481	481	481	580	580	580	683	683
H Series 820	554	554	554	554	607	607	607	607	607	706	706	706	809	809
S_1	36	36	36	36	49	49	49	49	49	52	52	52	45	45
S_2	29	29	29	29	30	30	30	30	30	47	47	47	35	35
A	223	223	223	223	249	249	249	249	249	320	320	320	356	356
B	110	110	110	110	110	110	110	110	110	160	160	160	160	160
C	18	18	18	18	18	18	18	18	18	18	18	18	18	18
D	259	259	259	259	305	305	305	305	305	381	381	381	430	430
E	370	370	370	370	432	432	432	432	432	528	528	528	561	561
m	59	59	59	59	89	89	89	89	89	195	195	195	263	263
Flange class 600 x 150														
a	162	162	162	162	197	197	197	197	197	246	246	246	297	297
b	162	162	162	162	210	210	210	210	210	241	241	241	279	279
H Series 810	434	434	434	434	481	481	481	481	481	586	586	586	689	689
H Series 820	560	560	560	560	607	607	607	607	607	712	712	712	815	815
S_1	42	42	42	42	49	49	49	49	49	58	58	58	66	66
S_2	29	29	29	29	30	30	30	30	30	47	47	47	35	35
A	223	223	223	223	249	249	249	249	249	320	320	320	356	356
B	110	110	110	110	110	110	110	110	110	160	160	160	160	160
C	18	18	18	18	18	18	18	18	18	18	18	18	18	18
D	259	259	259	259	305	305	305	305	305	381	381	381	430	430
E	370	370	370	370	432	432	432	432	432	528	528	528	561	561
m	59	59	59	59	89	89	89	89	89	195	195	195	263	263



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Dimensions and Weights – Series 810 and 820

US Units	Orifice D – K+														
DN $_{I+O}$	25 x 50				40 x 50				40 x 80			50 x 80			
Valve size	1" x 2"				1 1/2" x 2"				1 1/2" x 3"			2" x 3"			
API Standard orifice acc. to API 526	D	E	F		D	E	F		G	H		G	H	J	
Extra Orifice				G				H			J				K+
d_0 [inch]	0.433	0.579	0.724	0.906	0.433	0.579	0.724	1.142	0.929	1.157	1.406	0.929	1.157	1.496	1.890
A_0 [inch²]	0.147	0.264	0.412	0.643	0.147	0.264	0.412	1.025	0.677	1.052	1.552	0.677	1.052	1.758	2.806
Flange class 150 x 150															
a	4 1/8	4 1/8	4 1/8	4 1/8	4 7/8	4 7/8	4 7/8	4 7/8	5 1/8	5 1/8	5 1/8	5 3/8	5 3/8	5 3/8	5 3/8
b	4 1/2	4 1/2	4 1/2	4 1/2	4 3/4	4 3/4	4 3/4	4 3/4	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8
H Series 810	13	13	13	13	14 4/32	14 4/32	14 4/32	14 4/32	14 5/8	14 5/8	14 5/8	15 6/32	15 6/32	15 6/32	15 6/32
H Series 820	18	18	18	18	19 1/8	19 1/8	19 1/8	19 1/8	19 5/8	19 5/8	19 5/8	20 6/32	20 6/32	20 6/32	20 6/32
S_1	25/32	25/32	25/32	25/32	17/32	17/32	17/32	17/32	17/32	17/32	17/32	1 13/32	1 13/32	1 13/32	1 13/32
S_2	30/32	30/32	30/32	30/32	30/32	30/32	30/32	30/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32
A	5 5/8	5 5/8	5 5/8	5 5/8	6	6	6	6	6 5/16	6 5/16	6 5/16	7 1/16	7 1/16	7 1/16	7 1/16
B	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16
D	7 3/16	7 3/16	7 3/16	7 3/16	7 5/16	7 5/16	7 5/16	7 5/16	7 14/16	7 14/16	7 14/16	8 4/16	8 4/16	8 4/16	8 4/16
E	11 5/32	11 5/32	11 5/32	11 5/32	11 21/32	11 21/32	11 21/32	11 21/32	11 31/32	11 31/32	11 31/32	12 1/4	12 1/4	12 1/4	12 1/4
m	49.6	49.6	49.6	49.6	59.5	59.5	59.5	59.5	68.3	68.3	68.3	81.6	81.6	81.6	81.6
Flange class 300 x 150															
a	4 3/8	4 3/8	4 3/8	4 3/8	4 7/8	4 7/8	4 7/8	4 7/8	5 1/8	5 1/8	5 1/8	5 3/8	5 3/8	5 3/8	5 3/8
b	4 1/2	4 1/2	4 1/2	4 1/2	4 3/4	4 3/4	4 3/4	4 3/4	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8
H Series 810	13 7/32	13 7/32	13 7/32	13 7/32	14 4/32	14 4/32	14 4/32	14 4/32	14 5/8	14 5/8	14 5/8	15 6/32	15 6/32	15 6/32	15 6/32
H Series 820	18 2/8	18 2/8	18 2/8	18 2/8	19 1/8	19 1/8	19 1/8	19 1/8	19 5/8	19 5/8	19 5/8	20 6/32	20 6/32	20 6/32	20 6/32
S_1	1 1/32	1 1/32	1 1/32	1 1/32	17/32	17/32	17/32	17/32	17/32	17/32	17/32	1 13/32	1 13/32	1 13/32	1 13/32
S_2	30/32	30/32	30/32	30/32	30/32	30/32	30/32	30/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32
A	5 5/8	5 5/8	5 5/8	5 5/8	6	6	6	6	6 5/16	6 5/16	6 5/16	7 1/16	7 1/16	7 1/16	7 1/16
B	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16
D	7 3/16	7 3/16	7 3/16	7 3/16	7 5/16	7 5/16	7 5/16	7 5/16	7 14/16	7 14/16	7 14/16	8 4/16	8 4/16	8 4/16	8 4/16
E	11 5/32	11 5/32	11 5/32	11 5/32	11 21/32	11 21/32	11 21/32	11 21/32	11 31/32	11 31/32	11 31/32	12 1/4	12 1/4	12 1/4	12 1/4
m	49.6	49.6	49.6	49.6	59.5	59.5	59.5	59.5	68.3	68.3	68.3	81.6	81.6	81.6	81.6
Flange class 600 x 150															
a	4 3/8	4 3/8	4 3/8	4 3/8	4 7/8	4 7/8	4 7/8	4 7/8	5 1/8	5 1/8	5 1/8	5 3/8	5 3/8	5 3/8	5 3/8
b	4 1/2	4 1/2	4 1/2	4 1/2	4 3/4	4 3/4	4 3/4	4 3/4	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8	4 7/8
H Series 810	13 7/32	13 7/32	13 7/32	13 7/32	14 4/32	14 4/32	14 4/32	14 4/32	14 5/8	14 5/8	14 5/8	15 6/32	15 6/32	15 6/32	15 6/32
H Series 820	18 2/8	18 2/8	18 2/8	18 2/8	19 1/8	19 1/8	19 1/8	19 1/8	19 5/8	19 5/8	19 5/8	20 6/32	20 6/32	20 6/32	20 6/32
S_1	1 1/32	1 1/32	1 1/32	1 1/32	17/32	17/32	17/32	17/32	17/32	17/32	17/32	1 13/32	1 13/32	1 13/32	1 13/32
S_2	30/32	30/32	30/32	30/32	30/32	30/32	30/32	30/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32	1 5/32
A	5 5/8	5 5/8	5 5/8	5 5/8	6	6	6	6	6 5/16	6 5/16	6 5/16	7 1/16	7 1/16	7 1/16	7 1/16
B	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16	9/16
D	7 3/16	7 3/16	7 3/16	7 3/16	7 5/16	7 5/16	7 5/16	7 5/16	7 14/16	7 14/16	7 14/16	8 4/16	8 4/16	8 4/16	8 4/16
E	11 5/32	11 5/32	11 5/32	11 5/32	11 21/32	11 21/32	11 21/32	11 21/32	11 31/32	11 31/32	11 31/32	12 1/4	12 1/4	12 1/4	12 1/4
m	49.6	49.6	49.6	49.6	59.5	59.5	59.5	59.5	68.3	68.3	68.3	81.6	81.6	81.6	81.6

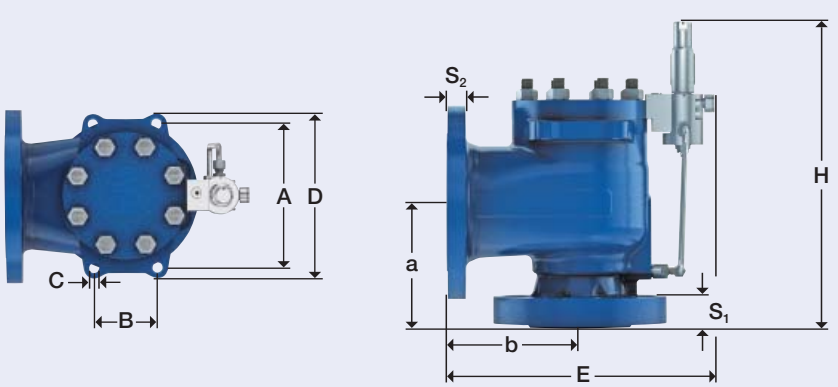
d_0 = Actual discharge diameter [inch]
A_0 = Actual discharge area [inch²]
a = Center to face [inch]
b = Center to face [inch]
H = Heights [inch]
S_1 = Inlet flange thicknes [inch]
S_2 = Outlet flange thickness [inch]

A = Bracket [inch]
B = Bracket [inch]
C = Hole diameter [inch]
D = Total width [inch]
E = Total length [inch]
m = Weight [lb]

Dimensions and Weights – Series 810 and 820

US Units — **Orifice J – T+**

DN I+O	80 x 100				100 x 150					150 x 200			200 x 250	
Valve size	3" x 4"				4" x 6"					6" x 8"			8" x 10"	
API Standard orifice acc. to API 526	J	K	L		L	M	N	P		Q	R		T	
Extra Orifice				N+					P+			R+		T+
d_0 [inch²]	1.496	1.772	2.205	2.953	2.205	2.480	2.717	3.268	3.740	4.331	5.236	5.591	6.614	7.087
A_0 [inch²]	1.758	2.465	3.818	6.848	3.818	4.832	5.796	8.386	10.987	14.730	21.534	24.547	34.359	39.443
Flange class 150 x 150														
a	6 1/8	6 1/8	6 1/8	6 1/8	7 3/4	7 3/4	7 3/4	7 3/4	7 3/4	9 7/16	9 7/16	9 7/16	10 7/8	10 7/8
b	6 3/8	6 3/8	6 3/8	6 3/8	8 1/4	8 1/4	8 1/4	8 1/4	8 1/4	9 1/2	9 1/2	9 1/2	11	11
H Series 810	16 27/32	16 27/32	16 27/32	16 27/32	18 15/16	18 15/16	18 15/16	18 15/16	18 15/16	22 27/32	22 27/32	22 27/32	26 2/8	26 2/8
H Series 820	21 14/16	21 14/16	21 14/16	21 14/16	23 15/16	23 15/16	23 15/16	23 15/16	23 15/16	27 13/16	27 13/16	27 13/16	31 5/16	31 5/16
S_1	1 7/16	1 7/16	1 7/16	1 7/16	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16	2 2/32	2 2/32	2 2/32	1 12/16	1 12/16
S_2	1 2/16	1 2/16	1 2/16	1 2/16	1 3/16	1 3/16	1 3/16	1 3/16	1 3/16	1 27/32	1 27/32	1 27/32	1 6/16	1 6/16
A	8 25/32	8 25/32	8 25/32	8 25/32	9 13/16	9 13/16	9 13/16	9 13/16	9 13/16	12 19/32	12 19/32	12 19/32	14 1/32	14 1/32
B	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	6 5/16	6 5/16	6 5/16	6 5/16	6 5/16
C	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32
D	10 6/32	10 6/32	10 6/32	10 6/32	12	12	12	12	12	15	15	15	16 30/32	16 30/32
E	14 9/16	14 9/16	14 9/16	14 9/16	17	17	17	17	17	20 25/32	20 25/32	20 25/32	22 3/32	22 3/32
m	130.1	130.1	130.1	130.1	196.2	196.2	196.2	196.2	196.2	429.9	429.9	429.9	579.8	579.8
Flange class 300 x 150														
a	6 1/8	6 1/8	6 1/8	6 1/8	7 3/4	7 3/4	7 3/4	7 3/4	7 3/4	9 7/16	9 7/16	9 7/16	10 7/8	10 7/8
b	6 3/8	6 3/8	6 3/8	6 3/8	8 1/4	8 1/4	8 1/4	8 1/4	8 1/4	9 1/2	9 1/2	9 1/2	11	11
H Series 810	16 27/32	16 27/32	16 27/32	16 27/32	18 15/16	18 15/16	18 15/16	18 15/16	18 15/16	22 27/32	22 27/32	22 27/32	26 7/8	26 7/8
H Series 820	21 14/16	21 14/16	21 14/16	21 14/16	23 15/16	23 15/16	23 15/16	23 15/16	23 15/16	27 13/16	27 13/16	27 13/16	31 14/16	31 14/16
S_1	1 7/16	1 7/16	1 7/16	1 7/16	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16	2 2/32	2 2/32	2 2/32	1 12/16	1 12/16
S_2	1 2/16	1 2/16	1 2/16	1 2/16	1 3/16	1 3/16	1 3/16	1 3/16	1 3/16	1 27/32	1 27/32	1 27/32	1 6/16	1 6/16
A	8 25/32	8 25/32	8 25/32	8 25/32	9 13/16	9 13/16	9 13/16	9 13/16	9 13/16	12 19/32	12 19/32	12 19/32	14 1/32	14 1/32
B	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	6 5/16	6 5/16	6 5/16	6 5/16	6 5/16
C	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32
D	10 6/32	10 6/32	10 6/32	10 6/32	12	12	12	12	12	15	15	15	16 30/32	16 30/32
E	14 9/16	14 9/16	14 9/16	14 9/16	17	17	17	17	17	20 25/32	20 25/32	20 25/32	22 3/32	22 3/32
m	130.1	130.1	130.1	130.1	196.2	196.2	196.2	196.2	196.2	429.9	429.9	429.9	579.8	579.8
Flange class 600 x 150														
a	6 3/8	6 3/8	6 3/8	6 3/8	7 3/4	7 3/4	7 3/4	7 3/4	7 3/4	9 11/16	9 11/16	9 11/16	11 11/16	11 11/16
b	6 3/8	6 3/8	6 3/8	6 3/8	8 1/4	8 1/4	8 1/4	8 1/4	8 1/4	9 1/2	9 1/2	9 1/2	11	11
H Series 810	17 3/32	17 3/32	17 3/32	17 3/32	18 15/16	18 15/16	18 15/16	18 15/16	18 15/16	23 2/32	23 2/32	23 2/32	27 1/8	27 1/8
H Series 820	22 1/16	22 1/16	22 1/16	22 1/16	23 15/16	23 15/16	23 15/16	23 15/16	23 15/16	28 1/16	28 1/16	28 1/16	32 2/16	32 2/16
S_1	1 10/16	1 10/16	1 10/16	1 10/16	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16	2 9/32	2 9/32	2 9/32	2 10/16	2 10/16
S_2	1 2/16	1 2/16	1 2/16	1 2/16	1 3/16	1 3/16	1 3/16	1 3/16	1 3/16	1 27/32	1 27/32	1 27/32	1 6/16	1 6/16
A	8 25/32	8 25/32	8 25/32	8 25/32	9 13/16	9 13/16	9 13/16	9 13/16	9 13/16	12 19/32	12 19/32	12 19/32	14 1/32	14 1/32
B	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	4 11/32	6 5/16	6 5/16	6 5/16	6 5/16	6 5/16
C	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32	23/32
D	10 6/32	10 6/32	10 6/32	10 6/32	12	12	12	12	12	15	15	15	16 30/32	16 30/32
E	14 9/16	14 9/16	14 9/16	14 9/16	17	17	17	17	17	20 25/32	20 25/32	20 25/32	22 3/32	22 3/32
m	130.1	130.1	130.1	130.1	196.2	196.2	196.2	196.2	196.2	429.9	429.9	429.9	579.8	579.8

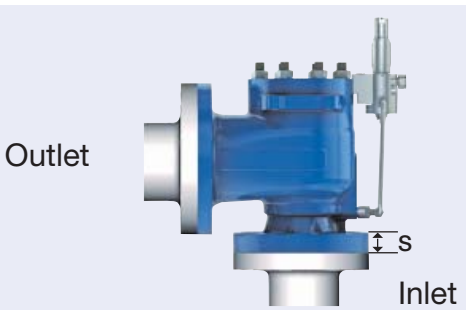


Screw Dimensions acc. to DIN EN 1092-1

The flange thickness of the inlet and outlet flanges of the Pilot Operated Safety Valve (POSV) may differ from the standard. Therefore stud-bolts for the flange connections may also be longer than stated in DIN EN 1092-1. To simplify the calculation of the correct bolt length, the quantity and sizes of the stud-bolts and nuts for the inlet and outlet flange connections are given below. The listed screw dimensions are rounded to standard dimensions. The connection flanges are based on the DIN EN 1092-1 standard.

Metric Units — **Orifice D – K+**

DN $_{I+O}$				25 x 50				40 x 50				40 x 80			50 x 80			
Size				1" x 2"				1½" x 2"				1½" x 3"			2" x 3"			
API Standard orifice acc. to API 526				D	E	F		D	E	F		G	H		G	H	J	
Extra Orifice							G				H			J				K+
d_0 [mm]				11	14,7	18,4	23	11	14,7	18,4	29	23,6	29,4	35,7	23,6	29,4	38	48
A_0 [mm²]				95	170	266	415	95	170	266	661	437	679	1001	437	679	1134	1810
Flange Class 150 x 150																		
Inlet	Qty	Hexagon screws	PN 10 – PN 16	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Nuts		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Hexagon screw diameter nut size [mm]			M12	M12	M12	M12	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16
	Screw dim	Raised face flange type [mm]		65	65	65	65	80	80	80	80	80	80	80	85	85	85	85
Outlet	Qty	Hexagon screws	PN 10 – PN 16	4	4	4	4	4	4	4	4	8	8	8	8	8	8	8
		Nuts		4	4	4	4	4	4	4	4	8	8	8	8	8	8	8
	Hexagon screw diameter nut size [mm]			M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16
	Screw dim	Raised face flange type [mm]		75	75	75	75	75	75	75	75	80	80	80	80	80	80	80
Flange class 300 x 150																		
Inlet	Qty	Hexagon screws	PN 25 – PN 40	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Nuts		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Hexagon screw diameter nut size [mm]			M12	M12	M12	M12	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16
	Screw dim	Raised face flange type [mm]		65	65	65	65	80	80	80	80	80	80	80	85	85	85	85
Outlet	Qty	Hexagon screws	PN 10 – PN 16	4	4	4	4	4	4	4	4	8	8	8	8	8	8	8
		Nuts		4	4	4	4	4	4	4	4	8	8	8	8	8	8	8
	Hexagon screw diameter nut size [mm]			M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16
	Screw dim	Raised face flange type [mm]		75	75	75	75	75	75	75	75	80	80	80	80	80	80	80
Flange class 600 x 150																		
Inlet	Qty	Hexagon screws	PN 36	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Nuts		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Hexagon screw diameter nut size [mm]			M12	M12	M16	M16	M16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20
	Screw dim	Raised face flange type [mm]		65	65	80	80	80	80	80	80	80	100	100	100	100	110	110
Outlet	Qty	Hexagon screws	PN 10 – PN 16	4	4	4	4	4	4	8	8	8	8	8	8	8	8	8
		Nuts		4	4	4	4	4	4	8	8	8	8	8	8	8	8	8
	Hexagon screw diameter nut size [mm]			M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16
	Screw dim	Raised face flange type [mm]		75	75	75	75	75	75	80	80	80	80	80	80	80	80	80



Screw Dimensions acc. to DIN EN 1092-1

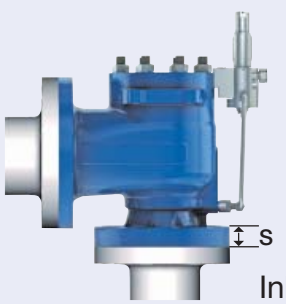
Metric Units				Orifice J – T+														
DN $_{I+O}$				80 x 100				100 x 150					150 x 200			200 x 250	
Size				3" x 4"				4" x 6"					6" x 8"			8" x 10"	
API Standard orifice acc. to API 526				J	K	L		L	M	N	P		Q	R		T	
Extra Orifice							N+					P+			R+		T+
d_0 [mm]				38	45	56	75	56	63	69	83	95	110	133	142	168	180
A_0 [mm²]				1134	1590	2463	4418	2463	3117	3739	5411	7088	9503	13893	15837	22167	25447
Flange Class 150 x 150																	
Inlet	Qty	Hexagon screws	PN 10 – PN 16	8	8	8	8	8	8	8	8	8	8	8	8	12	12
		Nuts		8	8	8	8	8	8	8	8	8	8	8	8	12	12
	Hexagon screw diameter nut size [mm]			M16	M16	M16	M16	M16	M16	M16	M16	M16	M20	M20	M20	M20	M20
	Screw dim	Raised face flange type [mm]		90	90	90	90	100	100	100	100	100	120	120	120	130	130
Outlet	Qty	Hexagon screws	PN 10 – PN 16	8	8	8	8	8	8	8	8	8	12	12	12	12	12
		Nuts		8	8	8	8	8	8	8	8	8	12	12	12	12	12
	Hexagon screw diameter nut size [mm]		PN 10	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	M20
			PN 16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M24	M24
	Screw dim	Raised face flange type [mm]	PN 10	80	80	80	80	90	90	90	90	90	110	110	110	100	100
			PN 16	80	80	80	80	90	90	90	90	90	110	110	110	110	110
Flange class 300 x 150																	
Inlet	Qty	Hexagon screws	PN 25 – PN 40	8	8	8	8	8	8	8	8	8	8	8	8	12	12
		Nuts		8	8	8	8	8	8	8	8	8	8	8	8	12	12
	Hexagon screw diameter nut size [mm]		PN 25	M16	M16	M16	M16	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24
			PN 40	M16	M16	M16	M16	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24
	Screw dim	Raised face flange type [mm]	PN 25	95	95	95	95	110	110	110	110	110	130	130	130	140	140
			PN 40	95	95	95	95	110	110	110	110	110	130	130	130	150	150
Outlet	Qty	Hexagon screws	PN 10 – PN 16	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		Nuts		8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Hexagon screw diameter nut size [mm]		PN 10	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	M20
			PN 16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M24	M24
	Screw dim	Raised face flange type [mm]	PN 10	80	80	80	80	90	90	90	90	90	110	110	110	100	100
			PN 16	80	80	80	80	90	90	90	90	90	110	110	110	110	110
Flange class 600 x 150																	
Inlet	Qty	Hexagon screws	PN 63	8	8	8	8	8	8	8	8	8	8	8	8	12	12
		Nuts		8	8	8	8	8	8	8	8	8	8	8	8	12	12
	Hexagon screw diameter nut size [mm]			M20	M20	M20	M20	M24	M24	M24	M24	M24	M30	M30	M30	M33	M33
	Screw dim	Raised face flange type [mm]		110	110	110	110	120	120	120	120	120	100	100	100	100	110
Outlet	Qty	Hexagon screws	PN 10 – PN 16	8	8	8	8	8	8	8	8	8	8	8	8	8	8
		Nuts		8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Hexagon screw diameter nut size [mm]		PN10	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	M20
			PN16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M24	M24
	Screw dim	Raised face flange type [mm]	PN10	80	80	80	80	90	90	90	90	90	110	110	110	100	100
			PN16	80	80	80	80	90	90	90	90	90	110	110	110	110	110

Screw Dimensions acc. to ASME B16.5

The flange thickness of the inlet and outlet flanges of the Pilot Operated Safety Valve (POSV) may differ from the standard. Therefore stud-bolts for the flange connections may also be longer than stated in ASME B16.5. To simplify the calculation of the correct bolt length, the quantity and sizes of the stud-bolts and nuts for the inlet and outlet flange connections are given below. The listed screw dimensions are rounded to standard dimensions. The connection flanges are based on the ASME B16.5 standard.

US Units — **Orifice D – K+**

			DN I+O	25 x 50				40 x 50				40 x 80			50 x 80			
			Size	1" x 2"				1 1/2" x 2"				1 1/2" x 3"			2" x 3"			
			API Standard orifice acc. to API 526	D	E	F		D	E	F		G	H		G	H	J	
			Extra Orifice				G				H			J				K+
			d_0 [inch]	0.433	0.579	0.724	0.906	0.433	0.579	0.724	1.142	0.929	1.157	1.406	0.929	1.157	1.496	1.890
			A_0 [inch²]	0.147	0.264	0.412	0.643	0.147	0.264	0.412	1.025	0.677	1.052	1.552	0.677	1.052	1.758	2.806
Flange class 150 x 150																		
Inlet	Qty		Stud bolts	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
			Nuts	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
			Stud bolt diameter nut size [inch]	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	5/8	5/8	5/8	5/8
	Bolt dim		Raised face flange type [inch]	3 1/4	3 1/4	3 1/4	3 1/4	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	4	4	4	4
			Ring type joint flange [inch]	3 1/4	3 1/4	3 1/4	3 1/4	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	4 1/4	4 1/4	4 1/4	4 1/4
Outlet	Qty		Stud bolts	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
			Nuts	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
			Bolt size [inch]	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8
	Bolt dim		Raised face flange type [inch]	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	4	4	4	4	4	4	4
			Ring type joint flange [inch]	4	4	4	4	4	4	4	4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4
Flange class 300 x 150																		
Inlet	Qty		Stud bolts	4	4	4	4	4	4	4	4	4	4	4	8	8	8	8
			Nuts	8	8	8	8	8	8	8	8	8	8	8	16	16	16	16
			Bolt size [inch]	5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	3/4	3/4	3/4	5/8	5/8	5/8	5/8
	Bolt dim		Raised face flange type [inch]	3 3/4	3 3/4	3 3/4	3 3/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4
			Ring joint flange [inch]	3 3/4	3 3/4	3 3/4	3 3/4	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/4	4 1/4	4 1/4	4 1/4
Outlet	Qty		Stud bolts	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
			Nuts	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
			Bolt size [inch]	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8
	Bolt dim		Raised face flange type [inch]	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	4	4	4	4	4	4	4
			Ring type joint flange [inch]	4	4	4	4	4	4	4	4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4
Flange class 600 x 150																		
Inlet	Qty		Stud bolts	4	4	4	4	4	4	4	4	4	4	4	8	8	8	8
			Nuts	8	8	8	8	8	8	8	8	8	8	8	16	16	16	16
			Bolt size [inch]	5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	3/4	3/4	3/4	5/8	5/8	5/8	5/8
	Bolt dim		Raised face flange type [inch]	4	4	4	4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 1/2	4 1/2	4 1/2	4 1/2
			Ring type joint flange [inch]	4	4	4	4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4
Outlet	Qty		Stud bolts	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
			Nuts	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
			Bolt size [inch]	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8
	Bolt dim		Raised face flange type [inch]	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	4	4	4	4	4	4	4
			Ring type joint flange [inch]	4	4	4	4	4	4	4	4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4	4 1/4



Screw Dimensions acc. to ASME B16.5

US Units			Orifice J – T+													
DN I+O			80 x 100				100 x 150					150 x 200			200 x 250	
Size			3" x 4"				4" x 6"					6" x 8"			8" x 10"	
API Standard orifice acc. to API 526			J	K	L		L	M	N	P		Q	R		T	
Extra Orifice						N+					P+			R+		T+
d_0 [inch]			1.496	1.772	2.205	2.953	2.205	2.480	2.717	3.268	3.740	4.331	5.236	5.591	6.614	7.087
A_0 [inch²]			1.758	2.465	3.818	6.848	3.818	4.832	5.796	8.386	10.987	14.730	21.534	24.547	34.359	39.443
Flange class 150 x 150																
Inlet	Qty	Stud bolts	4	4	4	4	8	8	8	8	8	8	8	8	8	8
		Nuts	8	8	8	8	16	16	16	16	16	16	16	16	16	16
	Stud bolt diameter nut size [inch]		5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	3/4
	Bolt dim	Raised face flange type [inch]	4 1/2	4 1/2	4 1/2	4 1/2	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	5 1/2	5 1/2	5 1/2	6	6
		Ring type joint flange [inch]	4 3/4	4 3/4	4 3/4	4 3/4	5	5	5	5	5	5 3/4	5 3/4	5 3/4	6 1/4	6 1/4
Outlet	Qty	Stud bolts	8	8	8	8	8	8	8	8	8	8	8	8	12	12
		Nuts	16	16	16	16	16	16	16	16	16	16	16	16	24	24
	Bolt size [inch]		5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	7/8	7/8
	Bolt dim	Raised face flange type [inch]	4	4	4	4	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	5 1/4	5 1/4	5 1/4	5 1/4	5 1/4
		Ring type joint flange [inch]	4 1/4	4 1/4	4 1/4	4 1/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2
Flange class 300 x 150																
Inlet	Qty	Stud bolts	8	8	8	8	8	8	8	8	8	12	12	12	12	12
		Nuts	16	16	16	16	16	16	16	16	16	24	24	24	24	24
	Bolt size [inch]		3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	7/8	7/8
	Bolt dim	Raised face flange type [inch]	5	5	5	5	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	6	6	6	7	7
		Ring type joint flange [inch]	5 1/2	5 1/2	5 1/2	5 1/2	5 3/4	5 3/4	5 3/4	5 3/4	5 3/4	6 1/4	6 1/4	6 1/4	7 1/4	7 1/4
Outlet	Qty	Stud bolts	8	8	8	8	8	8	8	8	8	8	8	8	12	12
		Nuts	16	16	16	16	16	16	16	16	16	16	16	16	24	24
	Bolt size [inch]		5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	7/8	7/8
	Bolt dim	Raised face flange type [inch]	4	4	4	4	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	5 1/4	5 1/4	5 1/4	5 1/4	5 1/4
		Ring type joint flange [inch]	4 1/4	4 1/4	4 1/4	4 1/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2
Flange class 600 x 150																
Inlet	Qty	Stud bolts	8	8	8	8	8	8	8	8	8	8	8	8	12	12
		Nuts	16	16	16	16	16	16	16	16	16	24	24	24	24	24
	Bolt size [inch]		3/4	3/4	3/4	3/4	7/8	7/8	7/8	7/8	7/8	1	1	1	1 1/8	1 1/8
	Bolt dim	Raised face flange type [inch]	5 1/2	5 1/2	5 1/2	5 1/2	6 1/4	6 1/4	6 1/4	6 1/4	6 1/4	7 1/2	7 1/2	7 1/2	8 1/2	8 1/2
		Ring type joint flange [inch]	5 1/2	5 1/2	5 1/2	5 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	7 1/2	7 1/2	7 1/2	8 1/2	8 1/2
Outlet	Qty	Stud bolts	8	8	8	8	8	8	8	8	8	8	8	8	12	12
		Nuts	16	16	16	16	16	16	16	16	16	16	16	16	24	24
	Bolt size [inch]		5/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	7/8	7/8
	Bolt dim	Raised face flange type [inch]	4	4	4	4	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	5 1/4	5 1/4	5 1/4	5 1/4	5 1/4
		Ring type joint flange [inch]	4 1/4	4 1/4	4 1/4	4 1/4	4 3/4	4 3/4	4 3/4	4 3/4	4 3/4	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2

Capacities – Steam (Metric Units)

Calculation of the capacity for saturated steamacc. to AD 2000-Merkblatt A2 based on set pressure plus 10% overpressure at 0° C and 1013 mbar. Capacities at 1 bar (14.5 psig) and lower are based on 0.1 bar (1.45 psig) overpressure.

Metric Units	**AD 2000-Merkblatt A2** [kg/h]										
API Standard Orifice acc. to API 526	D	E	F		G		H		J	K	
Extra Orifice				G		H		J			K+
d_0 [mm]	11	14.7	18.4	23	23.6	29	29.4	35.7	38	45	48
A_0 [mm²]	95.0	169.7	265.9	415.5	437.4	660.5	678.9	1001	1134.1	1590.4	1809.6
Set pressure [bar]	**Capacity** [kg/h]										
2.5	211	376	589	921	969	1459	1505	2211	2513	3525	3997
3	241	431	675	1055	1111	1678	1724	2543	2881	4040	4597
4	303	541	848	1325	1395	2106	2164	3191	3615	5070	5769
5	365	651	1020	1594	1678	2534	2604	3840	4350	6100	6941
6	426	761	1192	1863	1961	2961	3044	4488	5085	7131	8113
7	488	871	1364	2132	2245	3389	3484	5136	5820	8161	9285
8	549	981	1537	2401	2528	3817	3923	5785	6554	9191	10458
9	611	1091	1709	2670	2811	4245	4363	6433	7289	10222	11630
10	672	1201	1881	2939	3095	4673	4803	7082	8024	11252	12802
12	795	1421	2226	3478	3661	5529	5682	8379	9493	13313	15147
14	919	1640	2570	4016	4228	6385	6562	9675	10962	15373	17491
16	1042	1860	2915	4554	4795	7240	7441	10972	12432	17434	19836
18	1165	2080	3259	5093	5362	8096	8321	12269	13901	19494	22180
20	1288	2300	3604	5631	5928	8952	9201	13566	15370	21555	24525
22	1411	2520	3948	6169	6495	9808	10080	14863	16840	23615	26869
24	1534	2740	4293	6707	7062	10663	10960	16160	18309	25676	29214
26	1657	2960	4637	7246	7629	11519	11839	17457	19779	27737	31558
28	1780	3180	4982	7784	8195	12375	12719	18754	21248	29797	33903
30	1904	3400	5326	8322	8762	13231	13598	20051	22717	31858	36247
32	2027	3619	5671	8861	9329	14087	14478	21347	24187	33918	38591
34	2150	3839	6015	9399	9896	14942	15357	22644	25656	35979	40936
36	2273	4059	6360	9937	10462	15798	16237	23941	27125	38039	43280
38	2396	4279	6704	10476	11029	16654	17116	25238	28595	40100	45625
40	2519	4499	7049	11014	11596	17510	17996	26535	30064	42161	47969
50	3135	5598	8771	13705	14430	21789	22394	33019	37411	52464	59692
60	3750	6698	10494	16397	17263	26067	26791	39504	44758	62766	71414
70	4366	7797	12216	19088	20097	30346	31189	45988	52105	73069	83137
80	4982	8897	13939	21780	22931	34625	35587	52473	59452	83372	94859
90	5597	9996	15662	24471	25765	38904	39985	58957	66798	93675	106581
100	6213	11096	17384	27163	28598	43183	44382	65441	74145	103978	118304

$LEO_{S/G}$ = LESER Effective Orifice steam/gas please refer to page 04/03.

Metric Units

AD 2000-Merkblatt A2 [kg/h]

API Standard Orifice acc. to API 526	L	M	N		P		Q	R		T	
Extra Orifice				N+		P+			R+		T+
d_0 [inch]	56	63	69	75	83	95	110	133	142	168	180
A_0 [inch²]	2463.0	3117.3	3739.3	4417.9	5410.6	7088.2	9503.3	13892.9	15836.8	22167.0	25446.9
Set pressure [bar]	**Capacity** [kg/h]										
2.5	5459	6909	8260	9759	11991	15658	20993	30690	34984	48968	56213
3	6256	7918	9498	11222	13744	18005	24140	35290	40227	56307	64638
4	7852	9938	11921	14084	17249	22597	30296	44290	50487	70667	81123
5	9447	11957	14343	16946	20754	27189	36452	53290	60746	85027	97608
6	11043	13976	16765	19808	24259	31780	42609	62290	71005	99387	114092
7	12639	15996	19188	22670	27764	36372	48765	71289	81264	113747	130577
8	14234	18015	21610	25532	31269	40964	54921	80289	91523	128107	147062
9	15830	20034	24032	28393	34774	45556	61077	89289	101782	142467	163546
10	17425	22054	26455	31255	38279	50147	67234	98289	112041	156827	180031
12	20616	26093	31299	36979	45289	59331	79546	116289	132560	185547	213000
14	23807	30131	36144	42703	52299	68515	91859	134289	153078	214267	245969
16	26999	34170	40988	48427	59309	77698	104172	152288	173596	242987	278939
18	30190	38209	45833	54151	66319	86882	116484	170288	194115	271706	311908
20	33381	42247	50678	59875	73329	96065	128797	188288	214633	300426	344877
22	36572	46286	55522	65598	80339	105249	141109	206288	235151	329146	377846
24	39763	50325	60367	71322	87349	114432	153422	224288	255669	357866	410816
26	42954	54364	65212	77046	94359	123616	165735	242287	276188	386586	443785
28	46145	58402	70056	82770	101369	132800	178047	260287	296706	415306	476754
30	49336	62441	74901	88494	108379	141983	190360	278287	317224	444026	509724
32	52527	66480	79746	94217	115389	151167	202672	296287	337743	472746	542693
34	55718	70519	84590	99941	122399	160350	214985	314287	358261	501466	575662
36	58909	74557	89435	105665	129409	169534	227297	332286	378779	530185	608631
38	62101	78596	94280	111389	136419	178717	239610	350286	399297	558905	641601
40	65292	82635	99124	117113	143429	187901	251923	368286	419816	587625	674570
50	81247	102828	123348	145732	178480	233819	313486	458285	522407	731225	839416
60	97203	123022	147571	174351	213530	279737	375049	548284	624998	874824	1004262
70	113158	143216	171794	202970	248580	325655	436612	638283	727590	1018424	1169109
80	129114	163409	196017	231589	283630	371572	498175	728282	830181	1162023	1333955
90	145069	183603	220241	260209	318680	417490	559738	818281	932773	1305623	1498801
100	161025	203797	244464	288828	353731	463408	621301	908280	1035364	1449222	1663648

Capacities – Air (Metric Units)

Calculation of the capacity for air acc. to AD 2000-Merkblatt A2 based on set pressure plus 10% overpressure at 0° C and 1013 mbar. Capacities at 1 bar (14.5 psig) and lower are based on 0.1 bar (1.45 psig) overpressure.

Metric Units	**AD 2000-Merkblatt A2** [m_n^3/h]										
API Standard Orifice acc. to API 526	D	E	F		G		H		J	K	
Extra Orifice				G		H		J			K+
d_0 [mm]	11	14.7	18.4	23	23.6	29	29.4	35.7	38	45	48
A_0 [mm^2]	95.0	169.7	265.9	415.5	437.4	660.5	678.9	1001	1134.1	1590.4	1809.6
Set pressure [bar]	**Capacity** [m_n^3/h]										
2.5	211	376	589	921	969	1459	1505	2211	2513	3525	3997
3	241	431	675	1055	1111	1678	1724	2543	2881	4040	4597
4	303	541	848	1325	1395	2106	2164	3191	3615	5070	5769
5	365	651	1020	1594	1678	2534	2604	3840	4350	6100	6941
6	426	761	1192	1863	1961	2961	3044	4488	5085	7131	8113
7	488	871	1364	2132	2245	3389	3484	5136	5820	8161	9285
8	549	981	1537	2401	2528	3817	3923	5785	6554	9191	10458
9	611	1091	1709	2670	2811	4245	4363	6433	7289	10222	11630
10	672	1201	1881	2939	3095	4673	4803	7082	8024	11252	12802
12	795	1421	2226	3478	3661	5529	5682	8379	9493	13313	15147
14	919	1640	2570	4016	4228	6385	6562	9675	10962	15373	17491
16	1042	1860	2915	4554	4795	7240	7441	10972	12432	17434	19836
18	1165	2080	3259	5093	5362	8096	8321	12269	13901	19494	22180
20	1288	2300	3604	5631	5928	8952	9201	13566	15370	21555	24525
22	1411	2520	3948	6169	6495	9808	10080	14863	16840	23615	26869
24	1534	2740	4293	6707	7062	10663	10960	16160	18309	25676	29214
26	1657	2960	4637	7246	7629	11519	11839	17457	19779	27737	31558
28	1780	3180	4982	7784	8195	12375	12719	18754	21248	29797	33903
30	1904	3400	5326	8322	8762	13231	13598	20051	22717	31858	36247
32	2027	3619	5671	8861	9329	14087	14478	21347	24187	33918	38591
34	2150	3839	6015	9399	9896	14942	15357	22644	25656	35979	40936
36	2273	4059	6360	9937	10462	15798	16237	23941	27125	38039	43280
38	2396	4279	6704	10476	11029	16654	17116	25238	28595	40100	45625
40	2519	4499	7049	11014	11596	17510	17996	26535	30064	42161	47969
50	3135	5598	8771	13705	14430	21789	22394	33019	37411	52464	59692
60	3750	6698	10494	16397	17263	26067	26791	39504	44758	62766	71414
70	4366	7797	12216	19088	20097	30346	31189	45988	52105	73069	83137
80	4982	8897	13939	21780	22931	34625	35587	52473	59452	83372	94859
90	5597	9996	15662	24471	25765	38904	39985	58957	66798	93675	106581
100	6213	11096	17384	27163	28598	43183	44382	65441	74145	103978	118304

$LEO_{S/G}$ = LESER Effective Orifice steam/gas please refer to page 04/03.

Metric Units

AD 2000-Merkblatt A2 [m_n^3/h]

API Standard Orifice acc. to API 526	L	M	N		P		Q	R		T	
Extra Orifice				N+		P+			R+		T+
d_0 [inch]	56	63	69	75	83	95	110	133	142	168	180
A_0 [$inch^2$]	2463.0	3117.3	3739.3	4417.9	5410.6	7088.2	9503.3	13892.9	15836.8	22167.0	25446.9
Set pressure [bar]	**Capacity** [m_n^3/h]										
2.5	5459	6909	8260	9759	11991	15658	20993	30690	34984	48968	56213
3	6256	7918	9498	11222	13744	18005	24140	35290	40227	56307	64638
4	7852	9938	11921	14084	17249	22597	30296	44290	50487	70667	81123
5	9447	11957	14343	16946	20754	27189	36452	53290	60746	85027	97608
6	11043	13976	16765	19808	24259	31780	42609	62290	71005	99387	114092
7	12639	15996	19188	22670	27764	36372	48765	71289	81264	113747	130577
8	14234	18015	21610	25532	31269	40964	54921	80289	91523	128107	147062
9	15830	20034	24032	28393	34774	45556	61077	89289	101782	142467	163546
10	17425	22054	26455	31255	38279	50147	67234	98289	112041	156827	180031
12	20616	26093	31299	36979	45289	59331	79546	116289	132560	185547	213000
14	23807	30131	36144	42703	52299	68515	91859	134289	153078	214267	245969
16	26999	34170	40988	48427	59309	77698	104172	152288	173596	242987	278939
18	30190	38209	45833	54151	66319	86882	116484	170288	194115	271706	311908
20	33381	42247	50678	59875	73329	96065	128797	188288	214633	300426	344877
22	36572	46286	55522	65598	80339	105249	141109	206288	235151	329146	377846
24	39763	50325	60367	71322	87349	114432	153422	224288	255669	357866	410816
26	42954	54364	65212	77046	94359	123616	165735	242287	276188	386586	443785
28	46145	58402	70056	82770	101369	132800	178047	260287	296706	415306	476754
30	49336	62441	74901	88494	108379	141983	190360	278287	317224	444026	509724
32	52527	66480	79746	94217	115389	151167	202672	296287	337743	472746	542693
34	55718	70519	84590	99941	122399	160350	214985	314287	358261	501466	575662
36	58909	74557	89435	105665	129409	169534	227297	332286	378779	530185	608631
38	62101	78596	94280	111389	136419	178717	239610	350286	399297	558905	641601
40	65292	82635	99124	117113	143429	187901	251923	368286	419816	587625	674570
50	81247	102828	123348	145732	178480	233819	313486	458285	522407	731225	839416
60	97203	123022	147571	174351	213530	279737	375049	548284	624998	874824	1004262
70	113158	143216	171794	202970	248580	325655	436612	638283	727590	1018424	1169109
80	129114	163409	196017	231589	283630	371572	498175	728282	830181	1162023	1333955
90	145069	183603	220241	260209	318680	417490	559738	818281	932773	1305623	1498801
100	161025	203797	244464	288828	353731	463408	621301	908280	1035364	1449222	1663648

Capacities – Water (Metric Units)

Calculation of the capacity for water acc. to AD 2000-Merkblatt A2 based on set pressure plus 10% overpressure at 20° C (68° F). Capacities at 1 bar (14.5 psig) and lower are based on 0.1 bar (1.45 psig) overpressure.

Metric Units	**AD 2000-Merkblatt A2** [10^3 kg/h]										
API Standard Orifice acc. to API 526	D	E	F		G		H		J	K	
Extra Orifice				G		H		J			K+
d_0 [inch]	11	14.7	18.4	23	23.6	29	29.4	35.7	38	45	48
A_0 [inch²]	95.0	169.7	265.9	415.5	437.4	660.5	678.9	1001	1134.1	1590.4	1809.6
Set pressure [bar]	**Capacity** [10^3kg/h]										
2.5	5.53	9.88	15.5	24.2	25.5	38.4	39.5	58.3	66.0	92.6	105
3	6.06	10.8	17.0	26.5	27.9	42.1	43.3	63.8	72.3	101	115
4	7.00	12.5	19.6	30.6	32.2	48.6	50.0	73.7	83.5	117	133
5	7.82	14.0	21.9	34.2	36.0	54.4	55.9	82.4	93.3	131	149
6	8.57	15.3	24.0	37.5	39.4	59.6	61.2	90.3	102	143	163
7	9.25	16.5	25.9	40.5	42.6	64.3	66.1	97.5	110	155	176
8	9.89	17.7	27.7	43.3	45.5	68.8	70.7	104	118	166	188
9	10.5	18.7	29.4	45.9	48.3	72.9	75.0	111	125	176	200
10	11.1	19.8	31.0	48.4	50.9	76.9	79.0	117	132	185	211
12	12.1	21.6	33.9	53.0	55.8	84.2	86.6	128	145	203	231
14	13.1	23.4	36.6	57.2	60.2	91.0	93.5	138	156	219	249
16	14.0	25.0	39.2	61.2	64.4	97.3	100	147	167	234	266
18	14.8	26.5	41.5	64.9	68.3	103	106	156	177	248	283
20	15.6	27.9	43.8	68.4	72.0	109	112	165	187	262	298
22	16.4	29.3	45.9	71.7	75.5	114	117	173	196	275	312
24	17.1	30.6	47.9	74.9	78.9	119	122	181	205	287	326
26	17.8	31.9	49.9	78.0	82.1	124	127	188	213	299	340
28	18.5	33.1	51.8	80.9	85.2	129	132	195	221	310	352
30	19.2	34.2	53.6	83.8	88.2	133	137	202	229	321	365
32	19.8	35.3	55.4	86.5	91.1	138	141	208	236	331	377
34	20.4	36.4	57.1	89.2	93.9	142	146	215	243	341	388
36	21.0	37.5	58.7	91.8	96.6	146	150	221	250	351	400
38	21.6	38.5	60.3	94.3	99.3	150	154	227	257	361	411
40	22.1	39.5	61.9	96.7	102	154	158	233	264	370	421
50	24.7	44.2	69.2	108	114	172	177	261	295	414	471
60	27.1	48.4	75.8	118	125	188	194	285	323	453	516
70	29.3	52.3	81.9	128	135	203	209	308	349	490	557
80	31.3	55.9	87.5	137	144	217	224	330	373	524	596
90	33.2	59.3	92.9	145	153	231	237	350	396	555	632
100	35.0	62.5	97.9	153	161	243	250	368	417	585	666

LEO_L = LESER Effective Orifice liquids please refer to page 04/04.

Metric Units	AD 2000-Merkblatt A2 [10^3 kg/h]										
API Standard Orifice acc. to API 526	L	M	N		P		Q	R		T	
Extra Orifice				N+		P+			R+		T+
d_0 [inch]	56	63	69	75	83	95	110	133	142	168	180
A_0 [inch^2]	2463.0	3117.3	3739.3	4417.9	5410.6	7088.2	9503.3	13892.9	15836.8	22167.0	25446.9
Set pressure [bar]	**Capacity** [10^3kg/h]										
2.5	143	181	218	257	315	413	553	809	922	1290	1481
3	157	199	238	282	345	452	606	886	1010	1413	1622
4	181	229	275	325	398	522	700	1023	1166	1632	1873
5	203	257	308	364	445	583	782	1143	1303	1824	2094
6	222	281	337	398	488	639	857	1253	1428	1999	2294
7	240	304	364	430	527	690	925	1353	1542	2159	2478
8	256	325	389	460	563	738	989	1446	1649	2308	2649
9	272	344	413	488	597	783	1049	1534	1749	2448	2810
10	287	363	435	514	630	825	1106	1617	1843	2580	2962
12	314	397	477	563	690	904	1212	1771	2019	2826	3245
14	339	429	515	608	745	976	1309	1913	2181	3053	3505
16	363	459	551	650	797	1044	1399	2046	2332	3264	3747
18	385	487	584	690	845	1107	1484	2170	2473	3462	3974
20	405	513	616	727	891	1167	1564	2287	2607	3649	4189
22	425	538	646	763	934	1224	1641	2399	2734	3827	4393
24	444	562	674	797	976	1278	1714	2505	2856	3997	4589
26	462	585	702	829	1016	1330	1784	2608	2972	4160	4776
28	480	607	728	860	1054	1381	1851	2706	3085	4318	4956
30	497	628	754	891	1091	1429	1916	2801	3193	4469	5130
32	513	649	779	920	1127	1476	1979	2893	3298	4616	5299
34	529	669	803	948	1161	1521	2040	2982	3399	4758	5462
36	544	688	826	976	1195	1565	2099	3068	3498	4896	5620
38	559	707	848	1002	1228	1608	2156	3152	3593	5030	5774
40	573	726	870	1028	1260	1650	2212	3234	3687	5160	5924
50	641	811	973	1150	1408	1845	2473	3616	4122	5770	6623
60	702	889	1066	1260	1543	2021	2710	3961	4515	6320	7255
70	759	960	1152	1361	1666	2183	2927	4278	4877	6827	7837
80	811	1026	1231	1454	1781	2334	3129	4574	5214	7298	8378
90	860	1089	1306	1543	1889	2475	3319	4851	5530	7741	8886
100	907	1147	1376	1626	1992	2609	3498	5114	5829	8159	9367

Capacities – Steam (US Units)

Capacities for saturated steam according to ASME Section VIII (UV), based on set pressure plus 10% overpressure. Capacities at 2.07 bar (30 psig) and below are based on 0.207 bar (3 psig) overpressure.

US Units	**ASME Section VIII** [lb/h]										
API Standard Orifice acc. to API 526	D	E	F		G		H		J	K	
Extra Orifice				G		H		J			K+
d_0 [inch]	0.433	0.579	0.724	0.906	0.929	1.142	1.157	1.406	1.496	1.772	1.890
A_0 [inch^2]	0.147	0.263	0.412	0.644	0.678	1.024	1.052	1.552	1.758	2.465	2.805
Set pressure [psig]	**Capacity** [lb/h]										
35	ASME approval for steam under preparation										
40											
50											
60											
70											
80											
90											
100											
120											
140											
160											
180											
200											
220											
240											
260											
280											
300											
320											
340											
360											
380											
400											
420											
440											
460											
480											
500											
600											
700											
800											
900											
1000											
1100											
1200											
1300											
1400											
1480											

$LEO_{S/G}$ = LESER Effective Orifice steam/gas please refer to page 04/03.

US Units	ASME Section VIII [lb/h]										
API Standard Orifice acc. to API 526	L	M	N		P		Q	R		T	
Extra Orifice				N+		P+			R+		T+
d_0 [inch]	2.205	2.480	2.717	2.953	3.268	3.740	4.331	5.236	5.591	6.614	7.087
A_0 [inch^2]	3.818	4.832	5.796	6.848	8.386	10.987	14.730	21.534	24.547	34.359	39.443
Set pressure [psig]	**Capacity** [lb/h]										
35											
40											
50											
60											
70											
80											
90											
100											
120											
140											
160											
180											
200											
220											
240											
260											
280											
300											
320											
340											
360											
380											
400											
420											
440											
460											
480											
500											
600											
700											
800											
900											
1000											
1100											
1200											
1300											
1400											
1480											

ASME approval for steam under preparation

Capacities – Air (US Units)

Capacities for air according to ASME Section VIII (UV), based on set pressure plus 10 % overpressure at 16 °C (60 °F). Capacities at 2.07 bar (30 psig) and below are based on 0.207 bar (3 psig) overpressure.

US Units	**ASME Section VIII** [S. C. F. M.]										
API Standard Orifice acc. to API 526	D	E	F		G		H		J	K	
Extra Orifice				G		H		J			K+
d_0 [inch]	0.433	0.579	0.724	0.906	0.929	1.142	1.157	1.406	1.496	1.772	1.890
A_0 [inch²]	0.147	0.263	0.412	0.644	0.678	1.024	1.052	1.552	1.758	2.465	2.805
Set pressure [psig]	**Capacity** [S. C. F. M.]										
35	118	210	329	514	541	818	840	1239	1404	1969	2240
40	130	232	363	567	597	902	927	1367	1549	2172	2471
50	154	275	431	674	709	1071	1101	1623	1839	2579	2934
60	178	319	499	780	821	1240	1275	1879	2129	2986	3398
70	203	362	567	886	933	1409	1448	2136	2420	3393	3861
80	227	406	635	993	1045	1578	1622	2392	2710	3800	4324
90	251	449	703	1099	1157	1747	1796	2648	3000	4207	4787
100	276	492	771	1205	1269	1916	1970	2904	3290	4614	5250
120	324	579	908	1418	1493	2255	2317	3417	3871	5429	6176
140	373	666	1044	1631	1717	2593	2665	3929	4452	6243	7103
160	422	753	1180	1843	1941	2931	3012	4441	5032	7057	8029
180	470	840	1316	2056	2165	3269	3360	4954	5613	7871	8955
200	519	927	1452	2269	2389	3607	3707	5466	6193	8685	9882
220	568	1014	1588	2481	2613	3945	4055	5979	6774	9499	10808
240	616	1101	1724	2694	2837	4283	4402	6491	7354	10313	11734
260	665	1187	1860	2907	3060	4621	4750	7003	7935	11127	12660
280	714	1274	1996	3120	3284	4959	5097	7516	8515	11941	13587
300	762	1361	2133	3332	3508	5297	5445	8028	9096	12756	14513
320	811	1448	2269	3545	3732	5636	5792	8540	9676	13570	15439
340	859	1535	2405	3758	3956	5974	6140	9053	10257	14384	16366
360	908	1622	2541	3970	4180	6312	6487	9565	10837	15198	17292
380	957	1709	2677	4183	4404	6650	6835	10078	11418	16012	18218
400	1005	1796	2813	4396	4628	6988	7182	10590	11998	16826	19144
420	1054	1882	2949	4608	4852	7326	7530	11102	12579	17640	20071
440	1103	1969	3085	4821	5076	7664	7877	11615	13160	18454	20997
460	1151	2056	3221	5034	5300	8002	8225	12127	13740	19268	21923
480	1200	2143	3358	5246	5524	8340	8572	12640	14321	20083	22849
500	1249	2230	3494	5459	5747	8679	8920	13152	14901	20897	23776
600	1492	2664	4174	6522	6867	10369	10657	15714	17804	24967	28407
700	1735	3099	4855	7586	7987	12060	12395	18276	20706	29038	33039
800	1978	3533	5535	8649	9106	13750	14132	20838	23609	33108	37670
900	2222	3967	6216	9712	10226	15441	15870	23400	26512	37179	42301
1000	2465	4402	6897	10776	11345	17131	17607	25962	29414	41249	46933
1100	2708	4836	7577	11839	12465	18822	19345	28523	32317	45320	51564
1200	2951	5271	8258	12903	13584	20512	21082	31085	35220	49391	56196
1300	3194	5705	8938	13966	14704	22203	22820	33647	38122	53461	60827
1400	3438	6139	9619	15029	15824	23893	24557	36209	41025	57532	65458
1480	3632	6487	10163	15880	16719	25246	25947	38259	43347	60788	69163

$LEO_{S/G}$ = LESER Effective Orifice steam/gas please refer to page 04/03.

US Units — ASME Section VIII [S. C. F. M.]

API Standard Orifice acc. to API 526	L	M	N		P		Q	R		T	
Extra Orifice				N+		P+			R+		T+
d_0 [inch]	2.205	2.480	2.717	2.953	3.268	3.740	4.331	5.236	5.591	6.614	7.087
A_0 [inch²]	3.818	4.832	5.796	6.848	8.386	10.987	14.730	21.534	24.547	34.359	39.443
Set pressure [psig]	**Capacity** [S. C. F. M.]										
35	3049	3858	4628	5468	6697	8773	11763	17196	19602	27437	31496
40	3364	4257	5107	6033	7389	9680	12979	18974	21628	30274	34753
50	3994	5055	6064	7164	8774	11495	15411	22529	25682	35947	41266
60	4625	5853	7021	8295	10159	13309	17843	26085	29735	41621	47779
70	5255	6651	7978	9426	11544	15123	20276	29641	33788	47294	54292
80	5885	7449	8935	10556	12928	16937	22708	33197	37841	52967	60804
90	6516	8246	9892	11687	14313	18751	25140	36752	41895	58641	67317
100	7146	9044	10849	12818	15698	20565	27572	40308	45948	64314	73830
120	8407	10640	12763	15079	18468	24194	32437	47420	54055	75661	86856
140	9668	12236	14677	17341	21237	27822	37302	54531	62161	87008	99882
160	10928	13831	16591	19602	24007	31450	42166	61643	70268	98355	112908
180	12189	15427	18505	21863	26776	35079	47031	68754	78374	109702	125933
200	13450	17023	20419	24125	29546	38707	51895	75866	86481	121049	138959
220	14711	18618	22333	26386	32316	42335	56760	82977	94587	132396	151985
240	15971	20214	24247	28648	35085	45964	61624	90089	102694	143743	165011
260	17232	21810	26162	30909	37855	49592	66489	97200	110800	155090	178037
280	18493	23405	28076	33171	40624	53220	71354	104312	118907	166437	191063
300	19754	25001	29990	35432	43394	56849	76218	111423	127014	177784	204088
320	21015	26596	31904	37693	46164	60477	81083	118535	135120	189131	217114
340	22275	28192	33818	39955	48933	64105	85947	125646	143227	200477	230140
360	23536	29788	35732	42216	51703	67734	90812	132758	151333	211824	243166
380	24797	31383	37646	44478	54472	71362	95676	139870	159440	223171	256192
400	26058	32979	39560	46739	57242	74990	100541	146981	167546	234518	269217
420	27318	34575	41474	49001	60012	78619	105406	154093	175653	245865	282243
440	28579	36170	43388	51262	62781	82247	110270	161204	183759	257212	295269
460	29840	37766	45302	53523	65551	85875	115135	168316	191866	268559	308295
480	31101	39362	47216	55785	68320	89504	119999	175427	199973	279906	321321
500	32361	40957	49130	58046	71090	93132	124864	182539	208079	291253	334346
600	38665	48936	58701	69353	84938	111274	149187	218096	248612	347988	399476
700	44969	56914	68271	80661	98786	129415	173510	253654	289145	404722	464605
800	51273	64892	77841	91968	112634	147557	197833	289212	329677	461457	529734
900	57577	72871	87412	103275	126482	165699	222155	324769	370210	518191	594863
1000	63881	80849	96982	114582	140330	183840	246478	360327	410743	574926	659992
1100	70185	88827	106552	125889	154178	201982	270801	395885	451276	631661	725121
1200	76488	96806	116123	137196	168026	220124	295124	431442	491809	688395	790250
1300	82792	104784	125693	148503	181874	238265	319447	467000	532341	745130	855379
1400	89096	112762	135264	159810	195722	256407	343770	502558	572874	801865	920508
1480	94139	119145	142920	168856	206800	270920	363228	531004	605300	847252	972611

Capacities – Water (US Units)

Capacities for water according to ASME Section VIII (UV), based on set pressure plus 10 % overpressure at 21 °C (70 °F). Capacities at 2.07 bar (30 psig) and below are based on 0.207 bar (3 psig) overpressure.

US Units	**ASME Section VIII** [US-G.P.M]										
API Standard Orifice acc. to API 526	D	E	F		G		H		J	K	
Extra Orifice				G		H		J			K+
d_0 [inch]	0.433	0.579	0.724	0.906	0.929	1.142	1.157	1.406	1.496	1.772	1.890
A_0 [inch²]	0.147	0.263	0.412	0.644	0.678	1.024	1.052	1.552	1.758	2.465	2.805
Set pressure [psig]	**Capacity** [US-G.P.M.]										
35	23.9	42.7	67.0	105	110	166	171	252	286	400	456
40	25.6	45.7	71.6	112	118	178	183	269	305	428	487
50	28.6	51.1	80.0	125	132	199	204	301	341	479	545
60	31.3	56.0	87.7	137	144	218	224	330	374	524	597
70	33.8	60.4	94.7	148	156	235	242	356	404	566	644
80	36.2	64.6	101	158	167	251	258	381	432	605	689
90	38.4	68.5	107	168	177	267	274	404	458	642	731
100	40.4	72.2	113	177	186	281	289	426	483	677	770
120	44.3	79.1	124	194	204	308	317	467	529	742	844
140	47.9	85.5	134	209	220	333	342	504	571	801	911
160	51.2	91.4	143	224	236	356	365	539	611	856	974
180	54.3	96.9	152	237	250	377	388	572	648	908	1033
200	57.2	102	160	250	263	398	409	603	683	957	1089
220	60.0	107	168	262	276	417	429	632	716	1004	1142
240	62.7	112	175	274	288	436	448	660	748	1049	1193
260	65.2	116	182	285	300	453	466	687	778	1092	1242
280	67.7	121	189	296	312	470	484	713	808	1133	1289
300	70.1	125	196	306	322	487	500	738	836	1173	1334
320	72.4	129	202	316	333	503	517	762	864	1211	1378
340	74.6	133	209	326	343	518	533	786	890	1248	1420
360	76.7	137	215	336	353	533	548	808	916	1284	1461
380	78.9	141	221	345	363	548	563	831	941	1320	1501
400	80.9	144	226	354	372	562	578	852	965	1354	1540
420	82.9	148	232	362	382	576	592	873	989	1387	1578
440	84.8	152	237	371	391	590	606	894	1013	1420	1616
460	86.8	155	243	379	399	603	620	914	1035	1452	1652
480	88.6	158	248	387	408	616	633	933	1058	1483	1687
500	90.4	162	253	395	416	629	646	953	1079	1514	1722
600	99.1	177	277	433	456	689	708	1044	1182	1658	1887
700	107	191	299	468	493	744	764	1127	1277	1791	2038
800	114	204	320	500	527	795	817	1205	1365	1915	2178
900	121	217	340	531	559	843	867	1278	1448	2031	2311
1000	128	228	358	559	589	889	914	1347	1526	2141	2436
1100	134	240	375	587	618	932	958	1413	1601	2245	2555
1200	140	250	392	613	645	974	1001	1476	1672	2345	2668
1300	146	260	408	638	671	1014	1042	1536	1740	2441	2777
1400	151	270	423	662	697	1052	1081	1594	1806	2533	2882
1480	156	278	435	680	716	1082	1112	1639	1857	2604	2963

LEO_L = LESER Effective Orifice liquids please refer to page 04/04.

US Units — ASME Section VIII [US-G.P.M]

API Standard Orifice acc. to API 526	L	M	N		P		Q	R		T	
Extra Orifice				N+		P+			R+		T+
d_0 [inch]	2.205	2.480	2.717	2.953	3.268	3.740	4.331	5.236	5.591	6.614	7.087
A_0 [inch²]	3.818	4.832	5.796	6.848	8.386	10.987	14.730	21.534	24.547	34.359	39.443
Set pressure [psig]	**Capacity** [US-G.P.M.]										
35	620	785	942	1112	1362	1785	2393	3498	3988	5582	6408
40	663	839	1007	1189	1457	1908	2558	3740	4263	5967	6850
50	741	938	1125	1330	1628	2133	2860	4181	4766	6672	7659
60	812	1028	1233	1457	1784	2337	3133	4580	5221	7308	8390
70	877	1110	1332	1573	1927	2524	3384	4947	5640	7894	9062
80	938	1187	1424	1682	2060	2698	3618	5289	6029	8439	9688
90	995	1259	1510	1784	2185	2862	3837	5610	6395	8951	10275
100	1048	1327	1592	1880	2303	3017	4045	5913	6741	9435	10831
120	1148	1453	1743	2060	2523	3305	4431	6478	7384	10336	11865
140	1240	1570	1883	2225	2725	3570	4786	6997	7976	11164	12816
160	1326	1678	2013	2379	2913	3816	5117	7480	8526	11935	13700
180	1407	1780	2135	2523	3090	4048	5427	7934	9044	12659	14531
200	1483	1876	2251	2659	3257	4267	5720	8363	9533	13343	15318
220	1555	1968	2361	2789	3416	4475	6000	8771	9998	13995	16065
240	1624	2055	2466	2913	3568	4674	6266	9161	10443	14617	16779
260	1690	2139	2566	3032	3713	4865	6522	9535	10869	15214	17465
280	1754	2220	2663	3146	3854	5048	6768	9895	11279	15788	18124
300	1816	2298	2757	3257	3989	5226	7006	10242	11675	16342	18760
320	1875	2373	2847	3364	4120	5397	7236	10578	12058	16878	19375
340	1933	2447	2935	3467	4246	5563	7459	10904	12429	17397	19972
360	1989	2517	3020	3568	4370	5724	7675	11220	12790	17902	20551
380	2044	2586	3103	3666	4489	5881	7885	11527	13140	18392	21114
400	2097	2654	3183	3761	4606	6034	8090	11827	13481	18870	21662
420	2148	2719	3262	3854	4720	6183	8290	12119	13814	19336	22197
440	2199	2783	3339	3944	4831	6329	8485	12404	14139	19791	22720
460	2248	2846	3414	4033	4939	6471	8675	12683	14457	20236	23230
480	2297	2907	3487	4120	5046	6610	8862	12955	14768	20671	23730
500	2344	2967	3559	4205	5150	6746	9045	13223	15073	21098	24219
600	2568	3250	3899	4606	5641	7390	9908	14485	16511	23111	26531
700	2774	3510	4211	4975	6093	7982	10702	15645	17834	24963	28656
800	2965	3753	4502	5318	6514	8533	11441	16725	19066	26686	30635
900	3145	3980	4775	5641	6909	9051	12135	17740	20222	28305	32493
1000	3315	4196	5033	5946	7283	9541	12791	18700	21316	29836	34251
1100	3477	4401	5279	6236	7638	10006	13416	19612	22356	31293	35923
1200	3632	4596	5513	6514	7978	10451	14012	20484	23350	32684	37520
1300	3780	4784	5738	6780	8303	10878	14584	21321	24304	34019	39052
1400	3923	4964	5955	7036	8617	11289	15135	22126	25221	35303	40526
1480	4033	5104	6123	7234	8860	11607	15561	22749	25932	36298	41668

Operating Concepts in Comparison

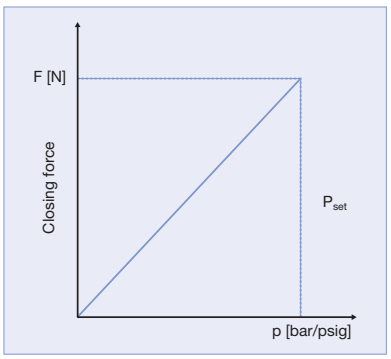
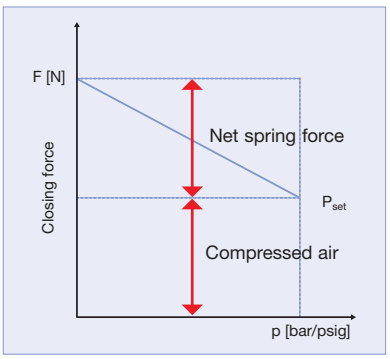
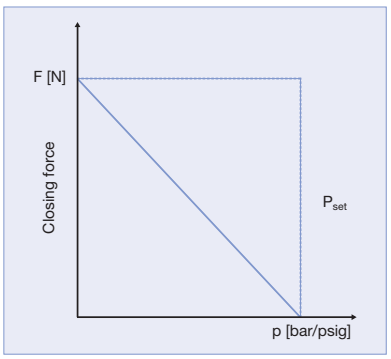
Based on the operating concept, the LESER product range can be broadly divided into:

– Spring loaded safety valves (Series 526, 441, 459)
– Safety valves with added control capabilities (Series 700, 810, 820)

Since control improves efficiency, LESER has named the products providing added control the High Efficiency group. The High Efficiency group includes:

– Pilot Operated Safety Valves (POSVs)
– Supplementary Loading System (SLS)

The following table summarizes the different operating concepts across the LESER product range.

	LESER High Efficiency product group		Other LESER product groups
Products	**LESER POSV (Series 810, 820) Pilot Operated Safety Valve**	**LESER SLS (Series 700) Supplemetary Loading System**	**LESER SLSV (Series 526, 441, 459) Spring Loaded Safety Valves**
			
Operating concepts	In the POSV, a pilot valve actuates the main valve based on the pressure sensed at the inlet.	SLS are systems which use external compressed air to control and support the action of a spring loaded safety valve.	SLSV operated by a spring force.
Closing force			
	In a POSV, the system pressure acts on the main valve piston trying to push it open. It is, however, opposed by the same pressure because system pressure is also re-directed to the dome area above the piston. Since the area of the piston exposed to pressure is larger in the dome than on the system side, this creates a greater net closing force on the main valve disc / nozzle. Approaching set pressure, closing forces increase.	The SLS uses external compressed air and an actuator to apply constant pressure on the main valve in addition to the spring force. This ensures seat tightness up to set pressure. Without supplementary loading, the safety valve works like a standard spring loaded safety valve.	When system pressure approaches set pressure, the net closing force of the disc / nozzle decreases. At set pressure, the closing force is equal to the opening force created by system pressure.

These safety valve products differ in their design and functional characteristics. They each have their specific benefits and applications.

Operating Concepts in Comparison

LESER offers a large variety of types, materials and options to suit any application.

The overview below presents these features and benefits with a focus on the High Efficiency product group.

	LESER High Efficiency product group		Other LESER product groups
Feature / Product	**LESER POSV (Series 810, 820) Pilot Operated Safety Valve**	**LESER SLS (Series 700) Supplemetary Loading System**	**LESER SLSV (Series 526, 441, 459) Spring Loaded Safety Valves**
Typical applications	Gas transmission (compressors)	Pulp and paper	Chemical and petrochemical plants
	Oil and gas: upstream, downstream (refineries, storage vessels)	Drum and superheater in sugar beet plants	Compressors
	Pulp and paper		Pumps
	Pumps		
Seat tightness	Tight up to 97% of set pressure	Tight up to set pressure	Tight up to 90% of set pressure
	Relieving and reseating close to set pressure	Relieving and reseating close to set pressure	
	Complies with API 527	Complies with API 527	
Full open (overpressure)	min.: 1%	min.: 1%	min.: 5%
	max.: 10%	max.: 1%	max.: 10%
Blowdown	min.: 2%	min.: 3%	min.: 7%
	max.: 15%	max.: 3%	max.: 20%
Opening characteristic	Pop action: complete valve opening within 1% overpressure Modulate action: proportional opening up to 10% overpressure	Complete valve opening within 1% overpressure	Full lift valve: complete opening within 5% overpressure Other valve types: proportional opening up to 10% overpressure
Back pressure ratio	Up to 70% possible	> 50% possible	Up to 50% possible
	Absolute back pressure depending on flange rating of outlet flange	Absolute back pressure depending on outlet flange rating and on design (conventional or bellows)	Absolute back pressure depending on design (conventional or bellows) and on outlet flange rating
Investment and installation costs	Low	Moderate	Low
Control capability	Control capability with no supplementary energy needed	Control capability for multiple safety valves	No control capability, no need for supplementary energy
Design	Small structural size	Actuator and control unit	Simple and sturdy design
	Low weight		
Dirty service	Sensitive to dirty medium	Insensitive to dirty medium	Insensitive to dirty medium
		Requires clean instrument air	
Temperature	-49 to 392 °F (ASME)	Suitable for hot steam applications (with condensate separator protecting control unit from medium)	Suitable for hot steam applications
	-45 to 200 °C (DIN)		
Approvals	World wide approvals	Approval acc. to PED	World wide approvals
Control line	Single pressure sensing to pilot	Triple redundancy control lines for high operating safety	No control line needed
Exchangability/ Retrofitting	API dimensions for easy exchangeability (API 526)	Existing valves can be retrofitted	API dimensions for easy exchangeability (API 526)
Valve size	1" to 8"	1" to 16"	1" to 16"
	DN 25 to DN 200	DN 25 to DN 400	DN 25 to DN 400
Set pressure	36 psig to 1480 psig (acc. to ASME B16.5)	Depending on the pressure range of the safety vavle	1.5 psig to 4350 psig
	2.5 bar to 63 bar (acc. to DIN EN 1092-1)		0.1 bar to 300 bar

LESER Effective Orifice (LEO)

- The LESER Effective Orifice (LEO) is used to compare the effective orifice A_0 API stated in API 526 with the actuel A_0 of the LESER safety valve.
- The LCL is calculated according to the following formula:

$$LEO_{S/G}\,[inch^2] = \left(\frac{d_0\,[mm^2]}{2{,}54}\right) \cdot \left(\frac{\pi}{4}\right) \cdot \left(\frac{K}{0{,}975}\right)$$

- This table applies only for LESER safety valves with ASME approval to steams and gases.
- The appropriate K_{dr}/α_w-values you can take from the table.
- EO means Extra Orifice (see page 01/09)

$LEO_{S/G}$ **LESER Effective Orifice (for steam, gas and vapor)**

Orifice acc. to API 526	LESER series	DN	Size	d_0 [inch]	d_0 [mm]	K_{dr}/α_w value	$LEO_{S/G}$ [inch²]	% of higher orifice	% of lower orifice
D							**0,110**	**100,0%**	**100,0%**
	811, 821	25	1"	0.433	11,0	0,820	**0,124**	63,2%	112,6%
	811, 821	32	1 1/2"	0.433	11,0	0,820	**0,124**	63,2%	112,6%
E							**0,196**	**100,0%**	**100,0%**
	811, 821	25	1"	0.579	14,7	0,820	**0,221**	63,2%	112,6%
	811, 821	32	1 1/2"	0.579	14,7	0,820	**0,221**	63,2%	112,6%
F							**0,307**	**100,0%**	**100,0%**
	811, 821	25	1"	0.724	18,4	0,820	**0,347**	68,9%	112,9%
	811, 821	32	1 1/2"	0.724	18,4	0,820	**0,347**	68,9%	112,9%
G							**0,503**	**100,0%**	**100,0%**
	811, 821	32	1 1/2"	0.929	23,6	0,820	**0,570**	72,6%	113,4%
	811, 821	50	2"	0.929	23,6	0,820	**0,570**	72,6%	113,4%
	811, 821 EO	25	1"	0.906	23,0	0,820	**0,542**	69,0%	107,7%
H							**0,785**	**100,0%**	**100,0%**
	811, 821	40	1 1/2"	1.157	29,4	0,820	**0,885**	68,8%	112,7%
	811, 821	50	2"	1.157	29,4	0,820	**0,885**	68,8%	112,7%
	811, 821 EO	32	1 1/2" x 2"	1.142	29,0	0,820	**0,861**	66,9%	109,7%
J							**1,287**	**100,0%**	**100,0%**
	811, 821	50	2"	1.496	38,0	0,820	**1,478**	80,4%	114,9%
	811, 821	80	3"	1.496	38,0	0,820	**1,478**	80,4%	114,9%
	811, 821 EO	32	1 1/2" x 3"	1.406	35,7	0,820	**1,305**	71,0%	101,4%
K							**1,838**	**100,0%**	**100,0%**
	811, 821	80	3"	1.772	45,0	0,820	**2,073**	72,7%	112,8%
	811, 821 EO	50	2"	1.890	48,0	0,820	**2,359**	82,7%	128,3%
L							**2,853**	**100,0%**	**100,0%**
	811, 821	80	3"	2.205	56,0	0,820	**3,211**	89,2%	112,5%
	811, 821 EO	100	4"	2.205	56,0	0,820	**3,211**	89,2%	112,5%
M							**3,600**	**100,0%**	**100,0%**
	811, 821	100	4"	2.480	63,0	0,820	**4,064**	93,6%	112,9%
N							**4,340**	**100,0%**	**100,0%**
	811, 821	100	4"	2.717	69,0	0,820	**4,874**	76,4%	112,3%
	811, 821 EO	80	3"	2.953	75,0	0,820	**5,759**	90,3%	132,7%
P							**6,380**	**100,0%**	**100,0%**
	811, 821	100	4"	3.268	83,0	0,820	**7,053**	63,8%	110,6%
	811, 821 EO	100	4"	3.740	95,0	0,820	**9,240**	83,6%	144,8%
Q							**11,050**	**100,0%**	**100,0%**
	811, 821	150	6"	4.331	110,0	0,820	**12,388**	77,4%	112,1%
R							**16,000**	**100,0%**	**100,0%**
	811, 821	150	6"	5.236	133,0	0,820	**18,111**	69,7%	113,2%
	811, 821 EO	150	6"	5.591	142,0	0,820	**20,645**	79,4%	129,0%
T							**26,000**	**100,0%**	**100,0%**
	811, 821	200	8"	6.614	168,0	0,820	**28,897**	96,3%	111,1%
	811, 821 EO	200	8"	7.087	180,0	0,820	**33,172**	110,6%	127,6%

LESER Effective Orifice (LEO)

- The LESER Effective Orifice (LEO) is used to compare the effective orifice A_0 API stated in API 526 with the actuel A_0 of the LESER safety valve.
- The LCL is calculated according to the following formula:

$$LEO_L\,[inch^2] = \left(\frac{d_0\,[mm^2]}{2{,}54}\right) \cdot \left(\frac{\pi}{4}\right) \cdot \left(\frac{K}{0{,}975}\right)$$

- This table applies only for LESER safety valves with ASME approval to liquids.
- The appropriate K_{dr}/α_w-values you can take from the table.
- EO means Extra Orifice (see page 01/09)

LEO_L **LESER Effective Orifice (for liquids)**

Orifice acc. to API 526	LESER series	DN	Size	d_0 [inch]	d_0 [mm]	K_{dr}/α_w value	LEO_L [inch²]	% of higher orifice	% of lower orifice
D							**0,110**	**100,0%**	**100,0%**
	811, 821	25	1"	0.433	11,0	0,689	**0,156**	79,7%	141,9%
	811, 821	32	1 1/2"	0.433	11,0	0,689	**0,156**	79,7%	141,9%
E							**0,196**	**100,0%**	**100,0%**
	811, 821	25	1"	0.579	14,7	0,689	**0,279**	90,8%	142,3%
	811, 821	32	1 1/2"	0.579	14,7	0,689	**0,279**	90,8%	142,3%
F							**0,307**	**100,0%**	**100,0%**
	811, 821	25	1"	0.724	18,4	0,689	**0,437**	86,9%	142,3%
	811, 821	32	1 1/2"	0.724	18,4	0,689	**0,437**	86,9%	142,3%
G							**0,503**	**100,0%**	**100,0%**
	811, 821	32	1 1/2"	0.929	23,6	0,689	**0,719**	91,6%	142,9%
	811, 821	50	2"	0.929	23,6	0,689	**0,719**	91,6%	142,9%
	811, 821 EO	25	1"	0.906	23,0	0,689	**0,683**	87,0%	135,7%
H							**0,785**	**100,0%**	**100,0%**
	811, 821	40	1 1/2"	1.157	29,4	0,689	**1,115**	86,7%	142,1%
	811, 821	50	2"	1.157	29,4	0,689	**1,115**	86,7%	142,1%
	811, 821 EO	32	1 1/2" x 2"	1.142	29,0	0,689	**1,085**	84,3%	138,2%
J							**1,287**	**100,0%**	**100,0%**
	811, 821	50	2"	1.496	38,0	0,689	**1,863**	101,4%	144,8%
	811, 821	80	3"	1.496	38,0	0,689	**1,863**	101,4%	144,8%
	811, 821 EO	32	1 1/2" x 3"	1.406	35,7	0,689	**1,815**	98,7%	141,0%
K							**1,838**	**100,0%**	**100,0%**
	811, 821	80	3"	1.772	45,0	0,689	**2,613**	91,6%	142,2%
L							**2,853**	**100,0%**	**100,0%**
	811, 821	80	3"	2.205	56,0	0,689	**4,047**	112,4%	141,8%
	811, 821	100	4"	2.205	56,0	0,689	**4,047**	112,4%	141,8%
	811, 821 EO	50	2"	1.890	48,0	0,689	**2,973**	82,6%	104,2%
M							**3,600**	**100,0%**	**100,0%**
	811, 821	100	4"	2.480	63,0	0,689	**5,122**	118,0%	142,3%
N							**4,340**	**100,0%**	**100,0%**
	811, 821	100	4"	2.717	69,0	0,689	**6,144**	96,3%	141,6%
P							**6,380**	**100,0%**	**100,0%**
	811, 821	100	4"	3.268	83,0	0,689	**8,890**	80,4%	139,3%
	811, 821 EO	80	3"	2.953	75,0	0,689	**7,259**	65,7%	113,8%
Q							**11,050**	**100,0%**	**100,0%**
	811, 821	100	6"	4.331	110,0	0,689	**15,614**	97,6%	141,3%
	811, 821 EO	100	4"	3.740	95,0	0,689	**11,646**	72,8%	105,4%
R							**16,000**	**100,0%**	**100,0%**
	811, 821	150	6"	5.236	133,0	0,689	**22,826**	87,8%	142,7%
	811, 821 EO	150	6"	5.591	142,0	0,689	**26,020**	86,7%	100,1%
T							**26,000**	**100,0%**	**100,0%**
	811, 821	200	8"	6.614	168,0	0,689	**36,421**	121,4%	140,1%
	811, 821 EO	200	8"	7.087	180,0	0,689	**41,809**	139,4%	160,8%

LESER Valve Sizes for Orifice Letters

The following table shows the available valve sizes for a required orifice for the LESER Pilot Operated Safety Valve (POSV) compared to the LESER Series 526. Please note that for a given orifice, the POSV can sometimes be offered in a smaller valve size for the same orifice. The benefits of using a smaller valve size are lower cost and less weight.

Class 150 x 150 — Series 800 – Pilot Operated Safety Valve

DN I+O	25 x 50	40 x 50	40 x 80	50 x 80	80 x 100	100 x 150	150 x 200	200 x 250
Valve size	1" x 2"	1½" x 2"	1½" x 3"	2" x 3"	3" x 4"	4" x 6"	6" x 8"	8" x 10"
Orifice								
D								
E								
F								
G								
H								
J								
K								
L								
M								
N								
P								
Q								
R								
T								

Class 300 x 150

DN I+O	25 x 50	40 x 50	40 x 80	50 x 80	80 x 100	100 x 150	150 x 200	200 x 250
Valve size	1" x 2"	1½" x 2"	1½" x 3"	2" x 3"	3" x 4"	4" x 6"	6" x 8"	8" x 10"
Orifice								
D								
E								
F								
G								
H								
J								
K								
L								
M								
N								
P								
Q								
R								
T								

Class 600 x 150

DN I+O	25 x 50	40 x 50	40 x 80	50 x 80	80 x 100	100 x 150	150 x 200	200 x 250
Valve size	1" x 2"	1½" x 2"	1½" x 3"	2" x 3"	3" x 4"	4" x 6"	6" x 8"	8" x 10"
Orifice								
D								
E								
F								
G								
H								
J								
K								
L								
M								
N								
P								
Q								
R								
T								

LESER Valve Sizes for Orifice Letters

Class 150 x 150 — Series 526 – Spring Loaded Safety Valve

DN $_{I+O}$	25 x 50	40 x 50	40 x 80	50 x 80	80 x 100	100 x 150	150 x 200	150 x 250	200 x 250
Valve size	1" x 2"	1½" x 2"	1½" x 3"	2" x 3"	3" x 4"	4" x 6"	6" x 8"	6" x 10"	8" x 10"
Orifice									
D									
E									
F									
G									
H									
J									
K									
L									
M									
N									
P									
Q									
R									
T									

Class 300 x 150

DN $_{I+O}$	25 x 50	40 x 50	40 x 80	50 x 80	80 x 100	100 x 150	150 x 200	150 x 250	200 x 250
Valve size	1" x 2"	1½" x 2"	1½" x 3"	2" x 3"	3" x 4"	4" x 6"	6" x 8"	6" x 10"	8" x 10"
Orifice									
D									
E									
F									
G									
H									
J									
K									
L									
M									
N									
P									
Q									
R									
T									

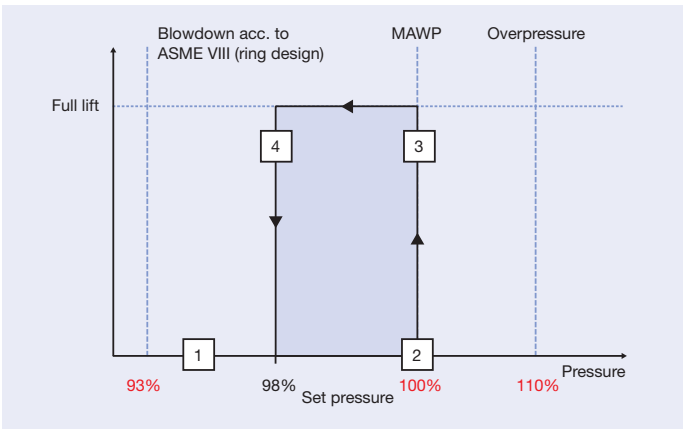
Class 600 x 150

DN $_{I+O}$	25 x 50	40 x 50	40 x 80	50 x 80	80 x 100	100 x 150	150 x 200	150 x 250	200 x 250
Valve size	1" x 2"	1½" x 2"	1½" x 3"	2" x 3"	3" x 4"	4" x 6"	6" x 8"	6" x 10"	8" x 10"
Orifice									
D									
E									
F									
G									
H									
J									
K									
L									
M									
N									
P									
Q									
R									
T									

Operating Characteristic Curves of LESER Safety Valves

These curves show the operating characteristic that are specific to the LESER Pilot Operated Safety Valve or POSV (POSV Series 810, Pop Action, and 820, Modulate Action), to the Supplementary Loading System (SLS) and to spring loaded safety valves. Other POSV features are explained on page 01/08. The operating characteristic refers to the different patterns of opening and closing of a safety valve product in response to pressure change. It affects crucial benefits like the ability to operate a plant at maximum operating temperature or the amount of medium loss.

POSV Series 810 – Pop Action



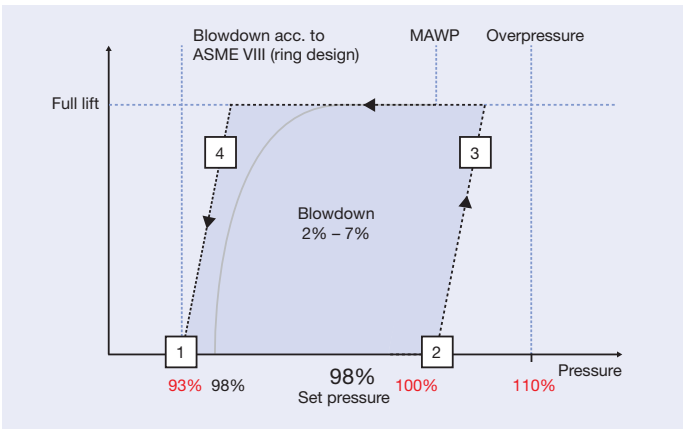
Valve Operating State / Action

1) Standard operating pressure
2) Set pressure reached
3) Opening: Rapid opening, Pop Action behavior
4) Rapid closing (blowdown customer adjustable from 3 – 7%, or up to -15% beyond API standard)

Benefits

- Higher operating pressure, short blowdown = higher plant efficiency
- Seat tightness up to set pressure = low vibration sensitivity
- Immediate full lift = maximum discharge
- Short blowdown

POSV Series 820 – Modulate Action



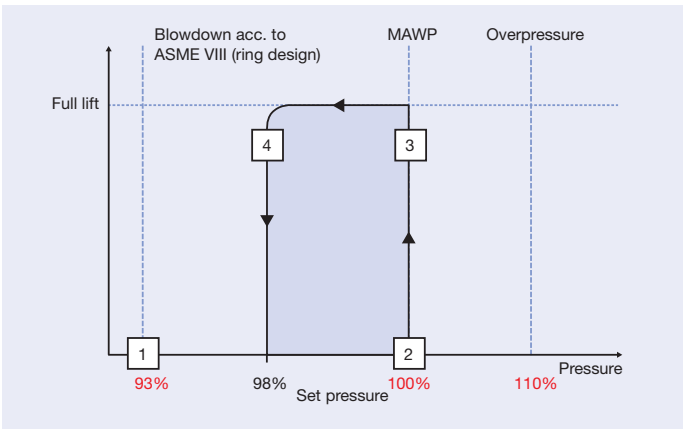
Valve Operating State / Action

1) Standard operating pressure
2) Set pressure reached
3) Opening: Modulate Action behavior, partial opening possible
4) Modulate closing, smooth (blowdown fixed at factory at max. 7%)

Benefits

- Higher operating pressure = higher plant efficiency
- Seat tightness up to set pressure = low vibration sensitivity
- Lift adapted to pressure increase = only necessary amount is discharged
- Medium loss is minimized

Supplementary Loading System (SLS)



Valve Operating State / Action

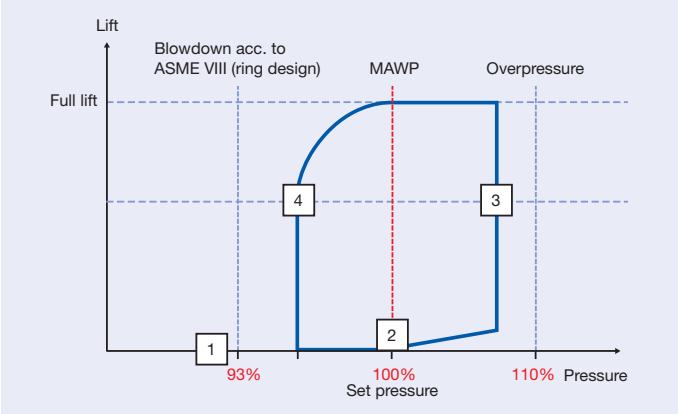
1) Standard operating pressure
2) Set pressure reached
3) Rapid opening up to maximum lift
4) Rapid closing from max. lift down to 0

Benefits

- Higher operating pressure, short blowdown = higher plant efficiency
- Seat tightness up to set pressure = low vibration sensitivity
- Immediate full lift = maximum discharge
- Additional control capability for other plant equipment

Operating Characteristic Curves of LESER Safety Valves

Spring loaded safety valve: Valve set at first audible discharge (LESER setting)



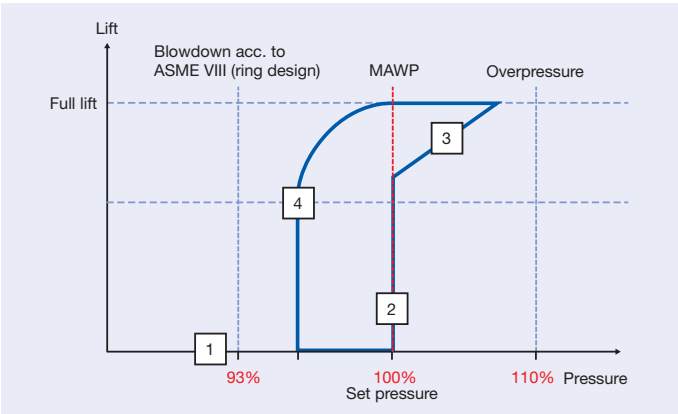
Valve Operating State / Action

1) Standard operating pressure (usually less than 90%)
2) Set pressure reached, first audible discharge
3) Rapid opening after popping point
4) Rapid closing with proper reseating (typical blowdown ring design 7%)

Benefits

- Cost efficient
- Low medium loss and low risk of valve damage when testing set pressure

Spring loaded safety valve: Valve set at pop



Valve Operating State / Action

1) Standard operating pressure (usually less than 90%)
2) Set pressure reached, with pop action up to commonly 70% of max. lift
3) Pressure increase to reach max. lift
4) Rapid closing with proper reseating (typical blowdown ring design 7%)

Benefits

- Cost efficient

Further Information

Customer Service

Catalogue

LESER catalogues provide you with all product-related information you need:

• **High Performance**	Series 441, 458	• **Critical Service**	Series 447, 546
• **Compact Performance**	Series 437, 459	• **Modulate Action**	Series 429, 433
• **API**	Series 526	• **High Efficiency**	Series 810, 820
• **Clean Service**	Series 48X	• **Best Availability**	Series 310, KUB

For quick access to all LESER catalogues please use the download portal **www.leser.com** or order the **catalogue CD** which includes all catalogues in different languages as pdf-files.

For ordering the **catalogue CD** or printed catalogues please contact:
Fax: +49 40 251 65-500
E-Mail: **sales@leser.com**

VALVESTAR®

VALVESTAR® 7, the sizing program for safety valves developed by LESER, supports all leading worldwide codes and standards in 15 languages.

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Online sizing with VALVESTAR Web: **www.valvestar.com**
Further information and updates: **www.valvestar.com**

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At the ontime service you receive information about your order concerning:

- Delivery dates
- Partial deliveries
- Consignment and delivery records
- Reducing delivery times

Your order number is required.

Simone Pinkert
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E-Mail: **ontime@leser.com**

Certificates

If any material test report is missing please visit
www.leser.com/certificates
or contact **certificates@leser.com**

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E-Mail: **certificate@leser.com**

Customer Service

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If there is any claim related to LESER products or services
(e.g. safety valves, damaged shipments, etc.) please contact:

Ralf Lemke
Fon: +49 (4871) 27-122
Fax: +49 (4871) 27-298
E-Mail: **claims@leser.com**

Seminars

LESER offers the following standard seminars:

Seminar 1: The Safety Valve
Seminar 2: Repair and Maintenance
Seminar 3: VALVESTAR®

LESER offers these seminars also in English and on the spot.
Further details concerning content and dates of the seminar
as well as applications forms can be found at **www.leser.com**

Please send the registration form to:

Diana Sadowski
Fon: +49 40 25165-147
Fax: +49 40 25165-547
seminar@leser.com

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Fax: +49 40 25165-541
wesenberg.m@leser.com

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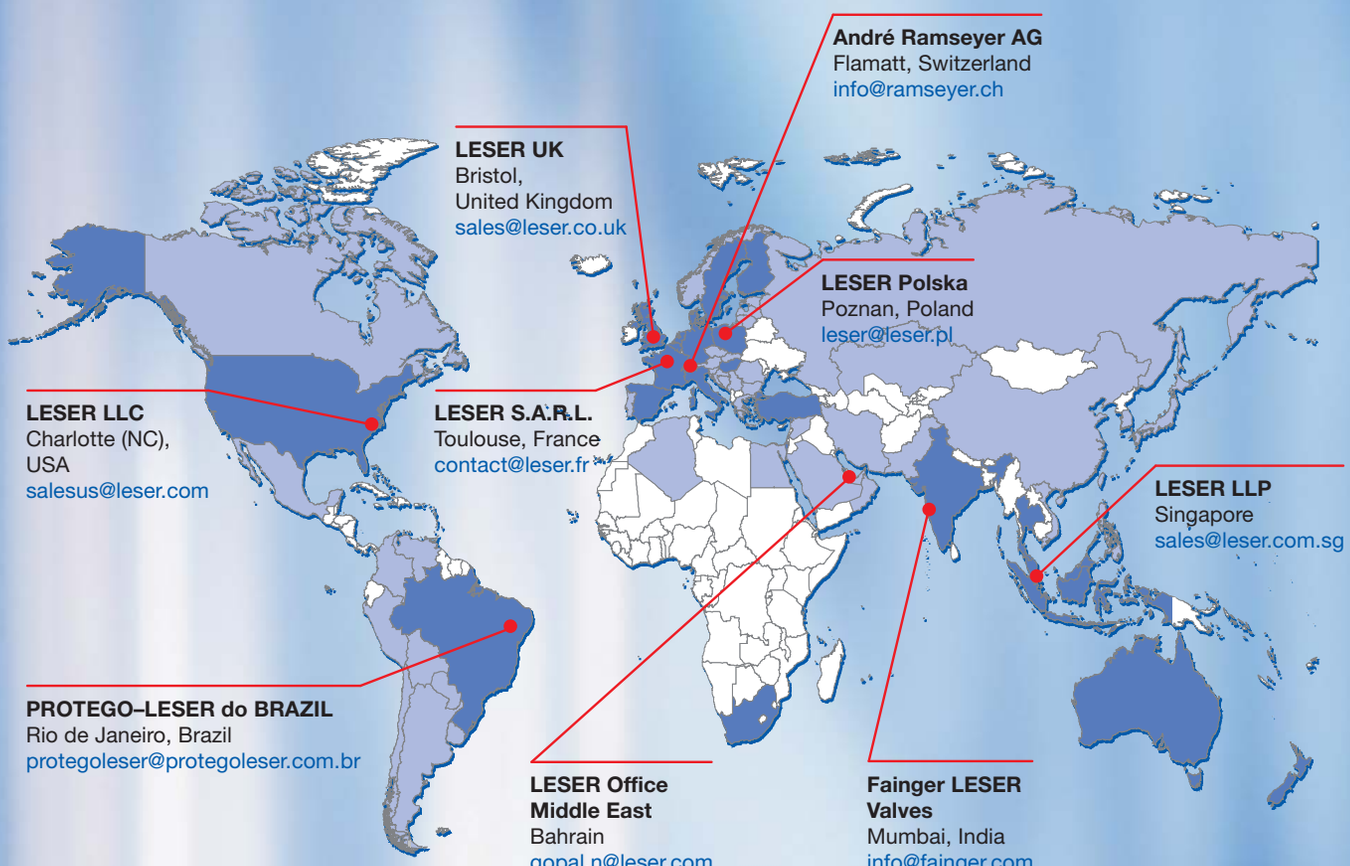

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