High Efficiency Pilot Operated Safety Valve Series 810 and 820.

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Objectives of this Presentation. Expansion of specialised knowledge.

The objective of this presentation is to give an overview of the LESER **High Efficiency** product group in connection
with **pilot operated safety valves (POSV).**

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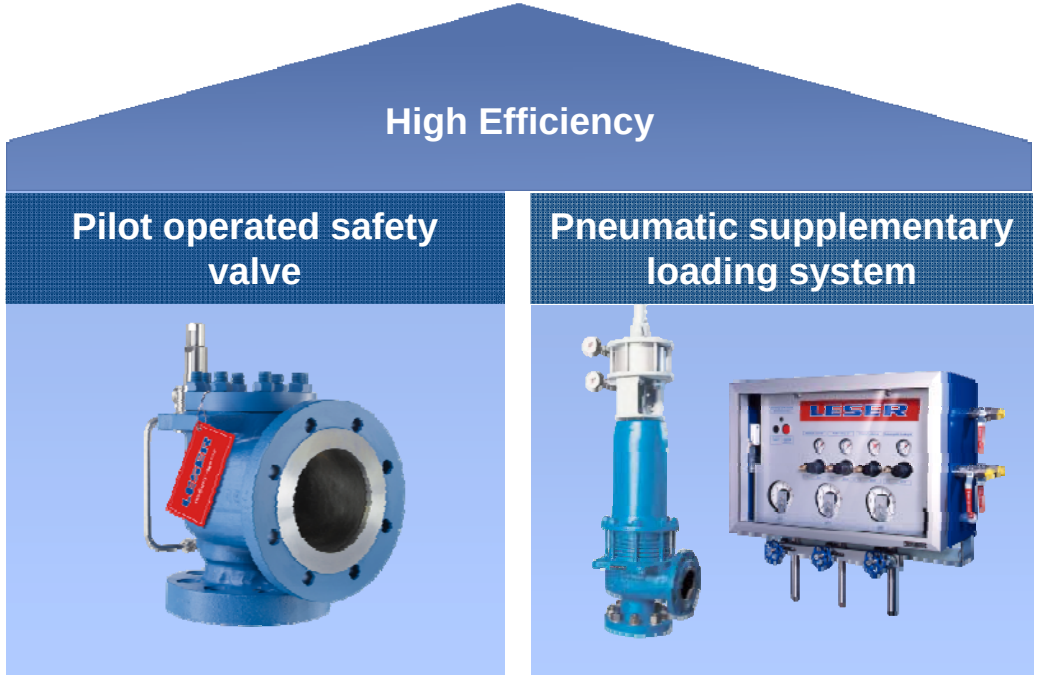
General. High Efficiency product group.

The **High Efficiency** product group is composed of the following:

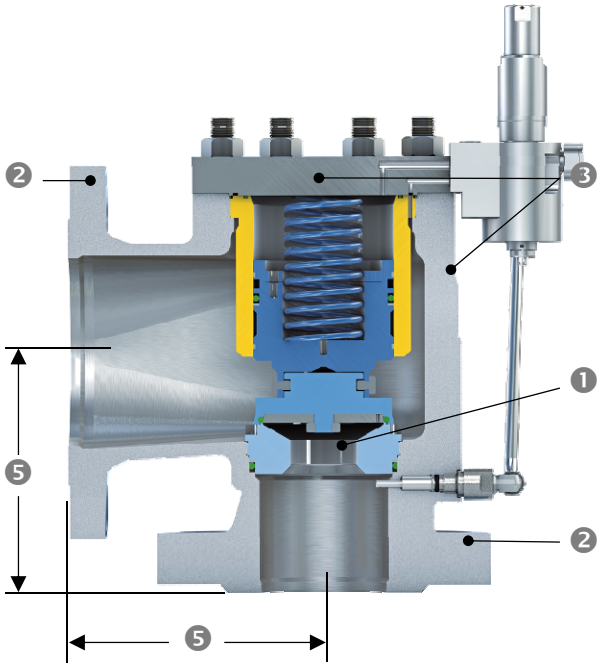


General. Based on API 526.

The following items are standardized according to API:

1. Orifice designation and area (D to T) [1]
2. Flange size and pressure rating, inlet and outlet [2]
3. Materials
4. Pressure-temperature limits
5. Center-to-face dimensions, inlet and outlet (as nozzle model dimension a + 34 mm)

LESER also offers Extra Orifices (maximum possible seat area in relation to the nominal inlet size); not for POSV > CL 600 inlet flange class. Values for pilot operated safety valves exceed the limits of spring loaded safety valves



Area of Application. Applications.

Due to the suitability for applications with high back pressure and seat tightness requirements, POSV can be used in a multitude of industrial areas.

Areas of application are, among others:

- compressors in gas main systems
- blow-off pipes in the oil and gas industry
- feed pipes in the oil and gas industry
- pumps in all industries
- Off-shore (platform, FPSO)
- LPG-Carrier

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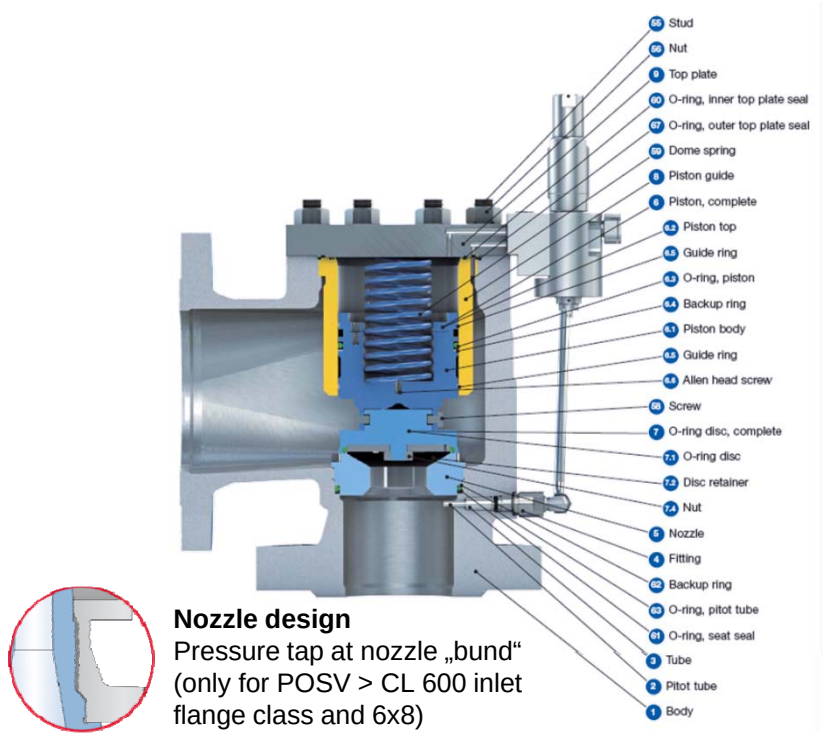
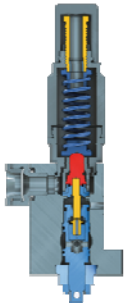
Design. Sectional drawing.



Nozzle design
Pressure tap at nozzle „bund“ (only for POSV > CL 600 inlet flange class and 6x8)

Design. Pilot valve.

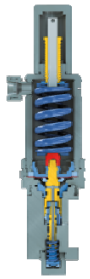
Pop Action
Series 810



Full lift
characteristic, opens within 1%

Pilot versions:
Size 1: 2.5 – 151 bar
Size 2: 151.01 – 256 bar

Modulate Action
Series 820



Modulating like proportional
spring loaded valve

Pilot versions:
Size 1: 2.5 – 30 bar
Size 2: 30.01 – 102 bar
Size 3: 102.01 – 256 bar
Size 4: 256.01 – 426 bar

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Main Features. Product structure.

	Pop Action	Modulate Action
Series	810	820
Type	811	821
Type of opening	Pop action	Modulate action
Opening characteristic	quick complete opening	gradual and proportional opening
Overpressure	+ 1 %	max. 10 %
Closing pressure	3 to 7% adjustable (also adjustable to 15%)	max. 7% fixed
API Standard Orifice	1D2 – 8T10	1D2 – 8T10
Extra Orifice	1G2 – 8T+10	1G2 – 8T+10

Main Features. Key figures in US units.

	Type 811 (Pop Action)	Type 821 (Modulate Action)
Size	1” x 2” … 8” x 10”	1” x 2” … 8” x 10”
Orifice	D…T and extra orifice	D…T and extra orifice
Set pressure	ASME B16.5: 36 psig … 6170 psig DIN EN 1092-1: 36 psig … 5800 psig	ASME B16.5: 36 psig … 6170 psig DIN EN 1092-1: 36 psig … 5800 psig
Temperature range	-54 °F … + 500 °F[1)]	-54 °F … + 500 °F[1)]
Pressure ratings	CL150…CL2500	CL150…CL2500

[1)] Temprature range > +392 °F in preperation

Main Features. Key Figures in Metric Units.

	Type 811	Type 821
Size	1” x 2” … 8” x 10”	1” x 2” … 8” x 10”
Orifice	D…T and extra orifice	D…T and extra orifice
Set pressure	ASME B16.5: 2.5 bar … 256 bar DIN EN 1092-1: 2.5 bar … 250 bar	ASME B16.5: 2.5 bar … 426 bar DIN EN 1092-1: 2.5 bar … 400 bar
Temperature range	-48 °C … + 260 °C[1)]	-48 °C … + 260 °C[1)]
Pressure ratings	PN 10…PN 400	PN 10…PN 400

[1)] Temprature range > +392 °F in preperation

Benefits. High Efficiency – Pilot Operated Safety Valves.

LESER **pilot operated safety valves increase the efficiency and productivity** of a system that must be secured.

Benefits:

- **Seat tightness of the safety valve**
  up to the set pressure
- **Low overpressure and blowdown differences**
- **High backpressure** up to 70% of set pressure possible
  - **Solution** that can be used worldwide for the pilot operated safety valves market, due to worldwide approvals

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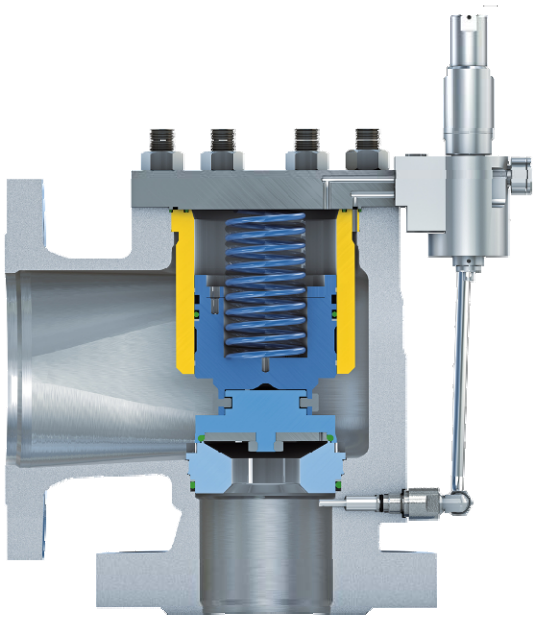
Benefits. Breakdown of the two safety valve designs – advantages.

Advantages of ... / over	Pilot operated safety valve	Spring-loaded safety valve
Spring-loaded safety valve	■ smaller size, lower weight ■ seat tightness up to set pressure ■ lower overpressure and blowdown differences ■ higher set pressures ■ higher operating pressures ■ higher back pressures ■ adjustable blowdown difference	
Pilot operated safety valve		■ less sensitive ■ doesn't need a "clean" medium ■ very good for high temperatures ■ More widely accepted and known globally

Benefits. Main Valve.

- **Tubing** of the pilot **integrated** in the top plate. Reduces the danger of leakage points, damage to lines, and freezing of condensate. There are only a few mounting parts.
- Integral cast support brackets on the body for **easier handling and safer installation.**
- Self-draining body **prevents residue and reduces corrosion.**
- Sealing concept for optimal functional tightness with O-ring-/ sealing plate- and metal disc version.
- All parts that are permanently in contact with the medium are always designed with corrosion-inhibiting stainless steel (top plate is nickel-coated for cast steel body).
- Nozzle design with least possible contact of the medium to main valve body.
- Pressure ratings beyond API 526 300x300 |



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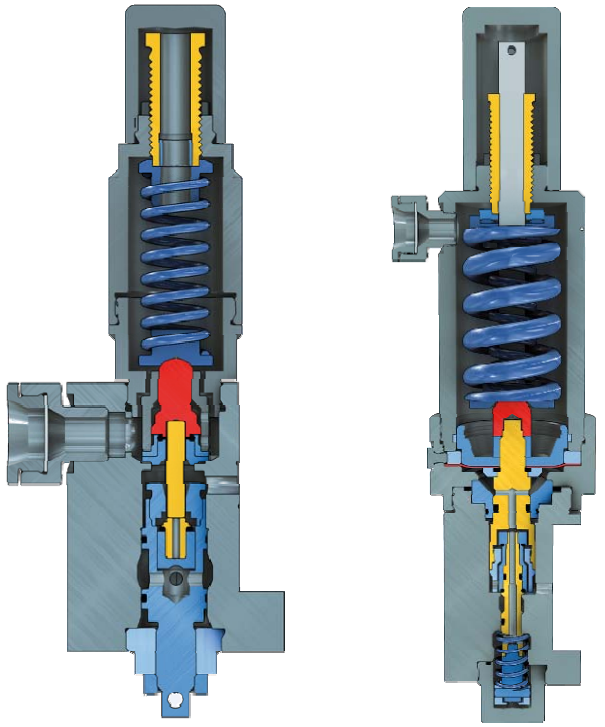
Benefits. Pilot.

- **Robust and not sensitive to vibrations –** safe working even if there are vibrations and oscillations in the system
- **Large pressure range** of 2.5 – 426 bar / 36 – 6170 psig ensures that it can be used for a multitude of applications
- **Backflow preventer** integrated in the manifold block, improves the variable usability of the standard version.
- **Exchangeability of pilot control with same piping** reduces quantity of needed parts.
- **Soft seal concept** up to 426 bar/ 6170 psig – tightness with soft seals at highest level also for “Explosive Decompression”
- **Application-specific selection:**
  - fast opening with pop action
  - proportional opening with modulate action



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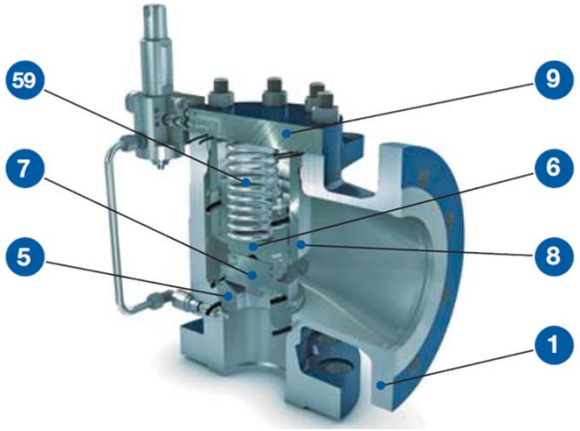
Materials. According to ASME & DIN Standards.

- LESER POSVs are available in **three standard or equivalent materials** (WCB, LCB and CF8M)
- **Other materials** on request (e.g. Monel®, Duplex®, Super Duplex®, Inconel®)

Materia				
Item	**Component**	**Type 8112/8212**	**Type 8113/8213**	**Type 8114/8214**
	Material	Steel	Low temperature Steel	Stainless Steel
1	Body	SA 216 WCB 1.0619	SA 352 LCB	SA 351 CF8M 1.4408
5	Nozzle	316L/CF8M 1.4404/ 1.4408	316L/CF8M 1.4404/ 1.4408	316L/CF8M 1.4404/ 1.4408
6	Piston	316L 1.4404	316L 1.4404	316L 1.4404
7	Disc	316L 1.4404	316L 1.4404	316L 1.4404
8	Piston Guide	316L 1.4404	316L 1.4404	316L 1.4404
9	Cover	SA 105 1.0460 nickel-plated	316L 1.4404	316L 1.4404
59	Dome Spring	St. Steel 1.4310	St. Steel 1.4310	St. Steel 1.4310



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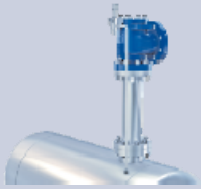
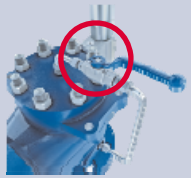
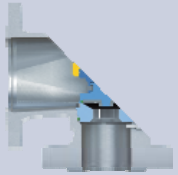
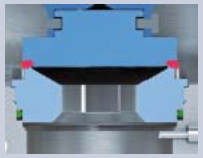
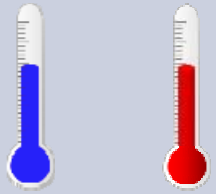
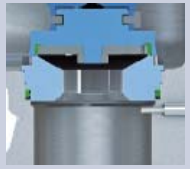
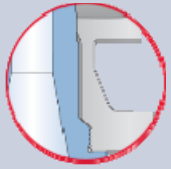
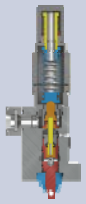
Options.

									
-	Backflow reventer (standard)	R28	Remote sensing	R26	Field test connection	R30	Pilot supply filter	R24 R27	Manual blowdown
NACE INTERNATIONAL									
R70 R93	Sour gas acc. to NACE MRO103 and MRO175	R33	Pilot test gag	Connec-tions	300 x 300, 600 x300,500x600, 2500x600	R65	Stellited disc for HD-POSV	R3C R3L	from -48° C up to +260° C[1)]

Options.

							
M43 M45 M50	BV Approval, DNV Approval, RINA Approval	I39 R67	Sealing plate disc PEEK from 30 bar PTFE up to 51 bar	R69	Nozzle for POSV from 4x6 >100bar and 6x8 up to 100bar	R3A R3B	Soft sealing ED-Design (Explosive Decom-pression), > 51 bar
							
	ATEX producer explanation	R4A	Needle valve at field test connection	-	Spare part single pilot		

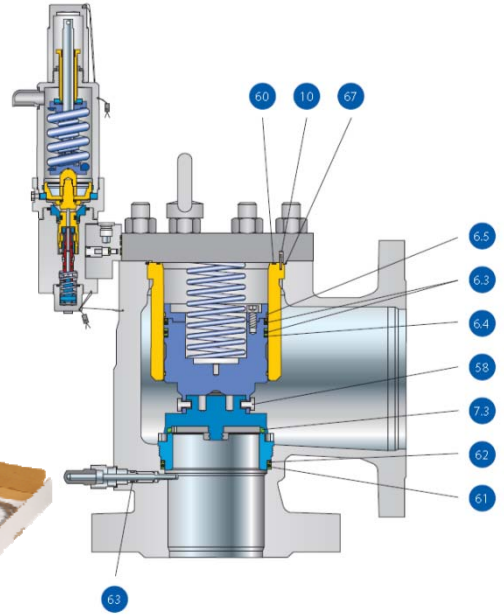
Spare Parts Kits. Contents of the POSV kits.

The POSV kits are separately available for the main valve and the pilot valve for all sizes.

Valve size	1 x 2 to 8 x 10[1)]
Orifice	D E F G H J K L M N P Q R T
Flange class	CL150 – CL2500 [2)]
O-ring material	FKM | EPDM | FFKM[3)]

Component for main valve
All necessary gaskets
All necessary O-rings
Guide ring
Back up ring
Parallel pin
Screw
Lubricant oil

Component for pilot
All necessary gaskets
All necessary O-rings
Lubricant oil



1) > 4x6 only up to 600x150

2) In preparation

3) FFKM only for article numbers until CL1500

Approvals.

Worldwide approvals for standardised design

Europe	ISO 4126-4
Germany	ISO 4126-4; VdTÜV Merkblatt 100
USA	ASME Sec. VIII Div. 1
Canada	CRN
China	AQSIQ
Eurasian Custom Union	EAC

Thank you for your attention