

# RELIEF VALVES

Type VS- FL



# VS-FL Relief Valves

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## Relief Valves

This series of axial flow relief valves was designed to meet a wide range of applications.

Large appreciation from worldwide customers is a guarantee of the reliability and versatility of this product.

The main features are as follows:

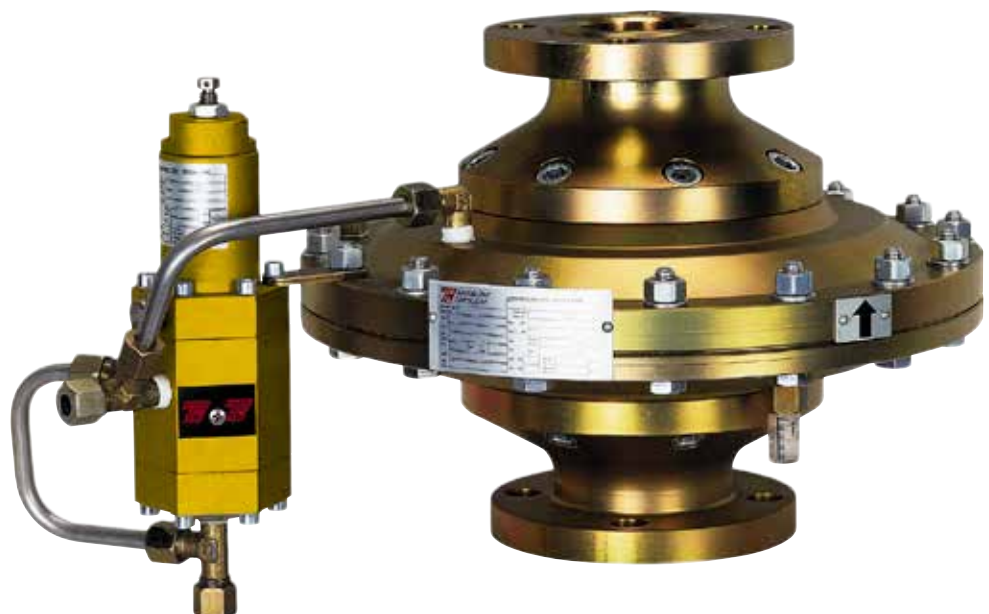
- *Counterbalanced shutter*
- *Full strength diaphragm*
- *Low number of parts*
- *Modularity design*
- *Reduced dimensions*
- *Easy Installation*

## Available Versions

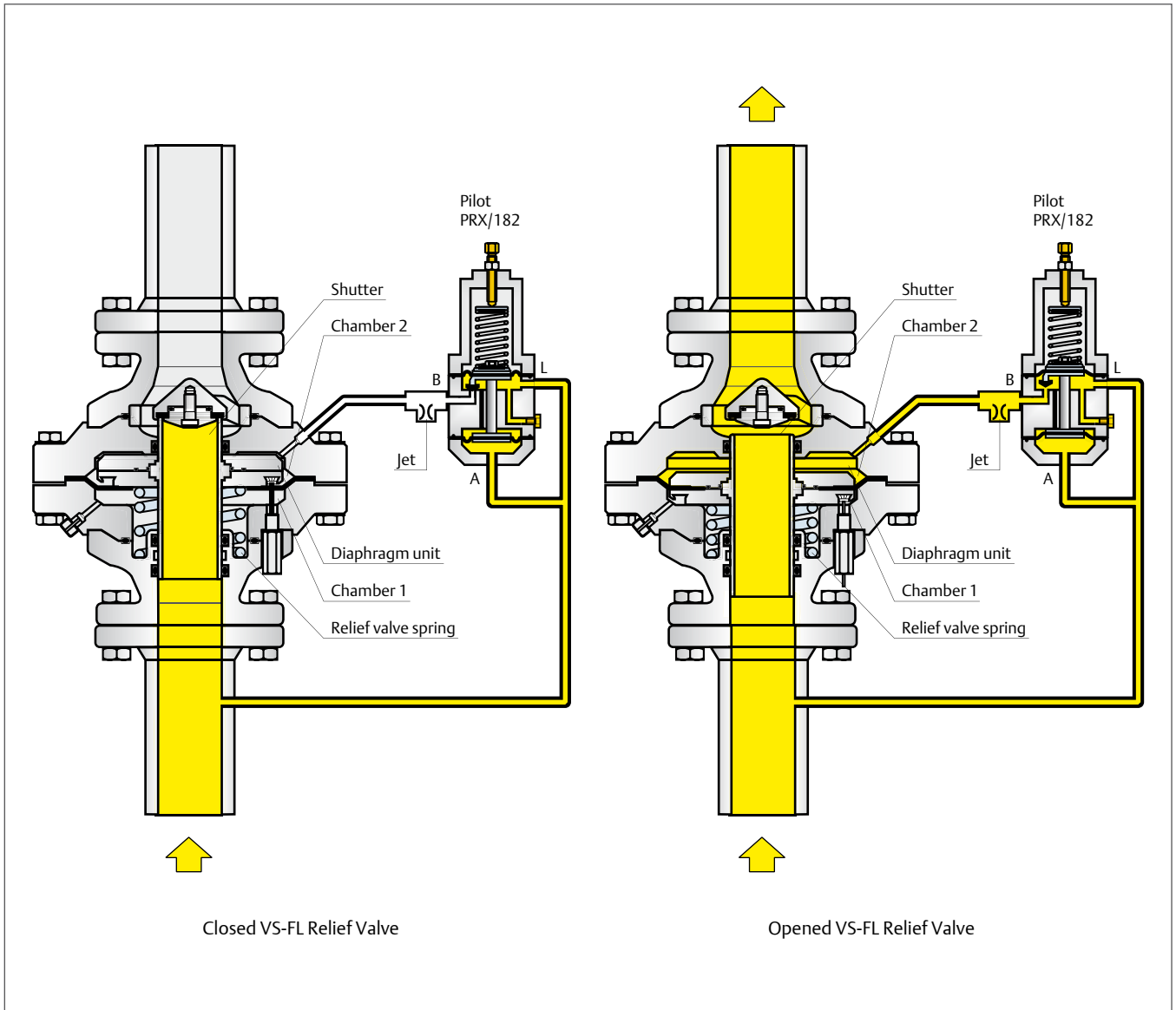
VS-FL-BP : For low and mid pressure applications. Pilot PRX/182.

VS-FL : For mid and high pressure applications. Pilot PRX/182 or PRX-AP/182.

Also available version with type SR, SRII silencers.



## Operation



The diaphragm unit (permanently connected to the shutter) divides the relief valve actuator into two chambers.

The chamber 1 is connected to the atmospheric pressure, chamber 2 is connected to the pilot.

In normal working conditions the two chambers are not containing pressure and the relief valve spring acts on the diaphragm unit and closes the shutter.

If the line pressure exceeds the pilot set point, the pilot allows the gas to flow from the line to chamber 2.

The shutter moves to its open position when the force produced by gas pressure acting on the diaphragm unit becomes greater than the load of the relief valve spring.

Once the excess gas is released and line pressure returns to normal working conditions, the pilot stops the pressure flow, Chamber 2 is no longer being fed, it is emptied through the jet.

The diaphragm unit is pushed upward by the relief valve spring and the shutter moves to its closed position.

# VS-FL Relief Valves

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## Features

## Applications

VS-FL relief valves are used in reduction, distribution and conveying stations of suitably filtered natural gas.

This product has been designed to be used with fuel gases of 1st and 2nd family according to EN 437, and with other non aggressive and non fuel gases. For any other gases, other than natural gas, please contact your local sales agent.

## Technical Features

### Flange rating PN 16 - ANSI 150

Allowable pressure	PN 16	PS : 16 bar
	ANSI 150	PS : 20 bar

Set range

VS-FL-BP PN 16 ANSI 150 DN 25-40-50	W <sub>d</sub> : 0.5 to 8 bar
VS-FL-BP PN 16 DN 65-80-100-150	W <sub>d</sub> : 0.5 to 16 bar
VS-FL-BP ANSI 150 DN 65-80-100-150	W <sub>d</sub> : 0.5 to 19.3 bar

### Flange rating ANSI 300/600

Allowable pressure	ANSI 300	PS : 50 bar
	ANSI 600	PS : 100 bar

Set range

VS-FL ANSI 300 all sizes	W <sub>d</sub> : 1 to 50 bar
VS-FL ANSI 600 all sizes	W <sub>d</sub> : 1 to 80 bar

## Functional Features

### Flanged connections

Identical Inlet and outlet : DN 25 - 40 - 50 - 65 - 80 - 100 - 150 - 200\* - 250\*

(\* ) DN 200 and DN 250 BP versions are not available

### Temperature

Standard version  
Working -10 °C +60 °C

Low temperature version  
Working -20 °C +60 °C

## Materials

Flanges and covers	Carbon steel
Diaphragms	Fabric NBR+PVC/Nitrile rubber
Pads	NBR Nitrile rubber (FKM available on request)

## Calculation Procedures

### Symbols

Q = Natural gas flow rate in  $\text{Stm}^3/\text{h}$   
 P1 = Absolute inlet pressure in bar  
 P2 = Absolute outlet pressure in bar

$C_g$  = Flow rate coefficient  
 $C_1$  = Body shape factor  
 $d$  = Relative density of the gas

### Flow Coefficients

DN		VS-FL-BP	VS-FL-BP-SR	VS-FL	VS-FL-SR	VS-FL-SRII
25	$C_g$	590	580	590	580	540
	$C_1$	32,1	33,4	32,1	33,4	33,5
40	$C_g$	1400	1350	1400	1350	-
	$C_1$	28	28	28	28	-
50	$C_g$	2300	2200	2300	2200	2000
	$C_1$	32,6	33,7	32,6	33,7	33,4
65	$C_g$	3500	3350	3500	3350	-
	$C_1$	29	29	29	29	-
80	$C_g$	5200	5000	5200	5000	4400
	$C_1$	32,1	33	32,1	33	30,0
100	$C_g$	8000	7400	8000	7400	6500
	$C_1$	32,1	32,7	32,1	32,7	32,9
150	$C_g$	20300	17800	20300	17800	16200
	$C_1$	27,6	29,8	27,6	29,8	31,7
200	$C_g$	-	-	30900	-	25335
	$C_1$	-	-	28,6	-	32,3
250	$C_g$	-	-	52100	-	42500
	$C_1$	-	-	32,3	-	35,5

### Flow Rate Q

**Sub-critical state** with:  $P_2 > \frac{P_1}{2}$

$$Q = 0.525 \cdot C_g \cdot P_1 \cdot \text{sine} \left( \frac{3417}{C_1} \cdot \sqrt{\frac{P_1 - P_2}{P_1}} \right)^\circ$$

N.B. the sine argument is expressed in sexagesimal degree

**Critical state** with:  $P_2 \leq \frac{P_1}{2}$

$$Q = 0.525 \cdot C_g \cdot P_1$$

For other gases with different densities, the flow rate calculated with the above formulas must be multiplied by the correction factor:

$$F = \sqrt{\frac{0.6}{d}}$$

Gas	Relative Density $d$	Factor $F$
Air	1	0.78
Butane	2.01	0.55
Propane	1.53	0.63
Nitrogen	0.97	0.79

# VS-FL Relief Valves

## DN Sizes

Calculate the required  $C_g$  with the following formula:

**Sub-critical** with:  $P_2 > \frac{P_1}{2}$

$$C_g = \frac{Q}{0.525 \cdot P_1 \cdot \text{sine} \left( \frac{3417}{C_1} \cdot \sqrt{\frac{P_1 - P_2}{P_1}} \right)^\circ}$$

N.B. The sine argument is expressed in sexagesimal degree

**Critical state** with:  $P_2 \leq \frac{P_1}{2}$

$$C_g = \frac{Q}{0.525 \cdot P_1}$$

N.B. The above formulas apply to natural gas flow rate only. If the flow rate value (Q) refers to other gasses, divide it by the correction factor F.

Select the diameter of the relief valve with  $C_g$  higher than calculated value.

After finding the DN of the relief valve, check that gas speed on the seat does not exceed 120 m/sec, using the following formula:

$$V = 345.92 \cdot \frac{Q}{DN^2} \cdot \frac{1 - 0.002 \cdot P_u}{1 + P_u}$$

- V = Velocity (m/s)
- 345.92 = Numerical constant
- Q = Flow rate under standard conditions (Stm<sup>3</sup>/h)
- DN = Regulator nominal diameter (mm)
- P<sub>u</sub> = Inlet pressure in relative value (bar)

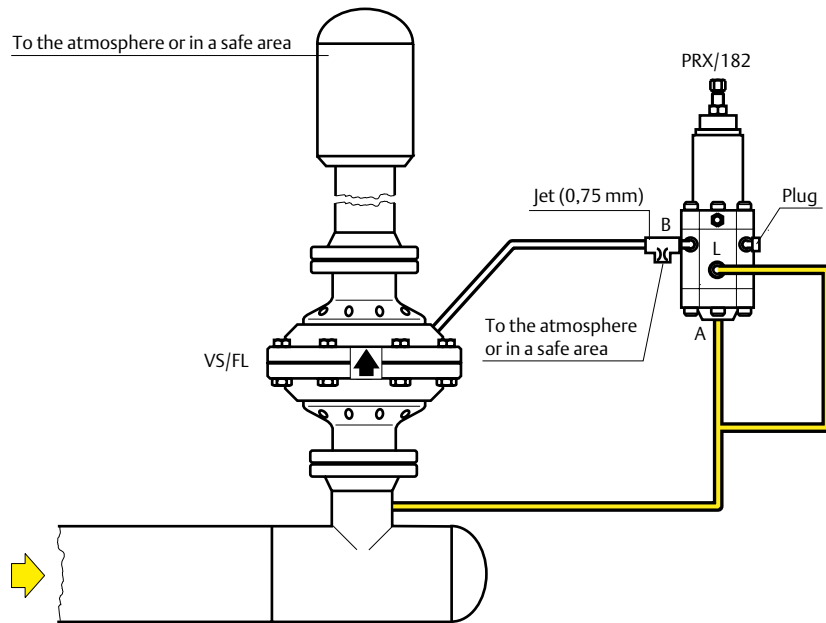
## Pilots

VS-FL relief valves are equipped with the PRX/ series pilots.

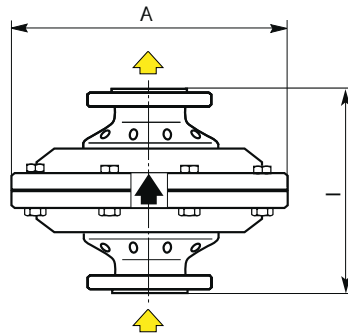
Model	Allowable Pressure PS (bar)	Set Range W <sub>d</sub> (bar)	Body and Covers Material
PRX/182	100	0.5 - 40	Steel
PRX-AP/182		30 - 80	
N.B.: 1/4" NPT female threaded connections			



## Examples of Connections



## Overall Dimensions (mm) and Weights (kg)



DN	Dimensions				Weights	
	Face to Face - I		A		PN 16 - ANSI 150 VS-FL-BP	ANSI 300 - ANSI 600 VS-FL
	PN 16 - ANSI 150 VS-FL-BP	ANSI 300 - ANSI 600 VS-FL	PN 16 - ANSI 150 VS-FL-BP	ANSI 300 - ANSI 600 VS-FL		
25	184	210	285	225	24	31
40	222	251	306	265	37	47
50	254	286	335	287	48	60
65	276	311	370	355	68	88
80	298	337	400	400	83	148
100	352	394	450	480	105	201
150	451	508	590	610	255	480
200	-	610	-	653	-	620
250	-	752	-	785	-	1150

Note: For DN 200 ANSI 300 face to face is 568 mm, for DN 250 ANSI 300 face to face is 708 mm.

#### Industrial Regulators

##### Emerson Process Management Regulator Technologies, Inc.

###### USA - Headquarters

McKinney, Texas 75070 USA  
Tel: +1 800 558 5853  
Outside US: +1 972 548 3574

###### Europe

Bologna 40013, Italy  
Tel: +39 051 419 0611

###### Asia-Pacific

Shanghai 201206, China  
Tel: +86 21 2892 9000

###### Middle East and Africa

Dubai, United Arab Emirates  
Tel: +971 4811 8100

#### Natural Gas Technologies

##### Emerson Process Management Regulator Technologies, Inc.

###### USA - Headquarters

McKinney, Texas 75070 USA  
Tel: +1 800 558 5853  
Outside US: +1 972 548 3574

###### Europe

Bologna 40013, Italy  
Tel: +39 051 419 0611  
Chartres 28008, France  
Tel: +33 2 37 33 47 00

###### Asia-Pacific

Singapore 128461, Singapore  
Tel: +65 6770 8337

###### Middle East and Africa

Dubai, United Arab Emirates  
Tel: +971 4811 8100

#### LP-Gas Equipment

##### Emerson Process Management Regulator Technologies, Inc.

###### USA - Headquarters

McKinney, Texas 75070 USA  
Tel: +1 800 558 5853  
Outside US: +1 972 548 3574

#### TESCOM

##### Emerson Process Management Tescom Corporation

###### USA - Headquarters

Elk River, Minnesota 55330-2445 USA  
Tel: +1 763 241 3238  
+1 800 447 1250

###### Europe

Selmsdorf 23923, Germany  
Tel: +49 38823 31 287

###### Asia-Pacific

Shanghai 201206, China  
Tel: +86 21 2892 9499

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**Francel SAS**, 3 Avenue Victor Hugo, CS 80125, Chartres 28008, France  
SIRET 552 068 637 00057 APE 2651B, N° TVA : FR84552068637, RCS Chartres B 552 068 637, SAS capital 534 400 Euro

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