

# PRESSURE REGULATORS

Type 971



# 971 Regulators

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## Pressure Regulators

This series of “Top-Entry” appliances was designed to meet a wide range of applications, offering easy maintenance. The main features are as follows:

- *Extremely high precision of the regulated pressure, even in the presence of highly variable inlet pressures*
- *Easy adjustment of the delivery pressure by a simple replacement of the the control pilot setting spring*
- *High versatility for a wide range of different applications*

## Available Configurations

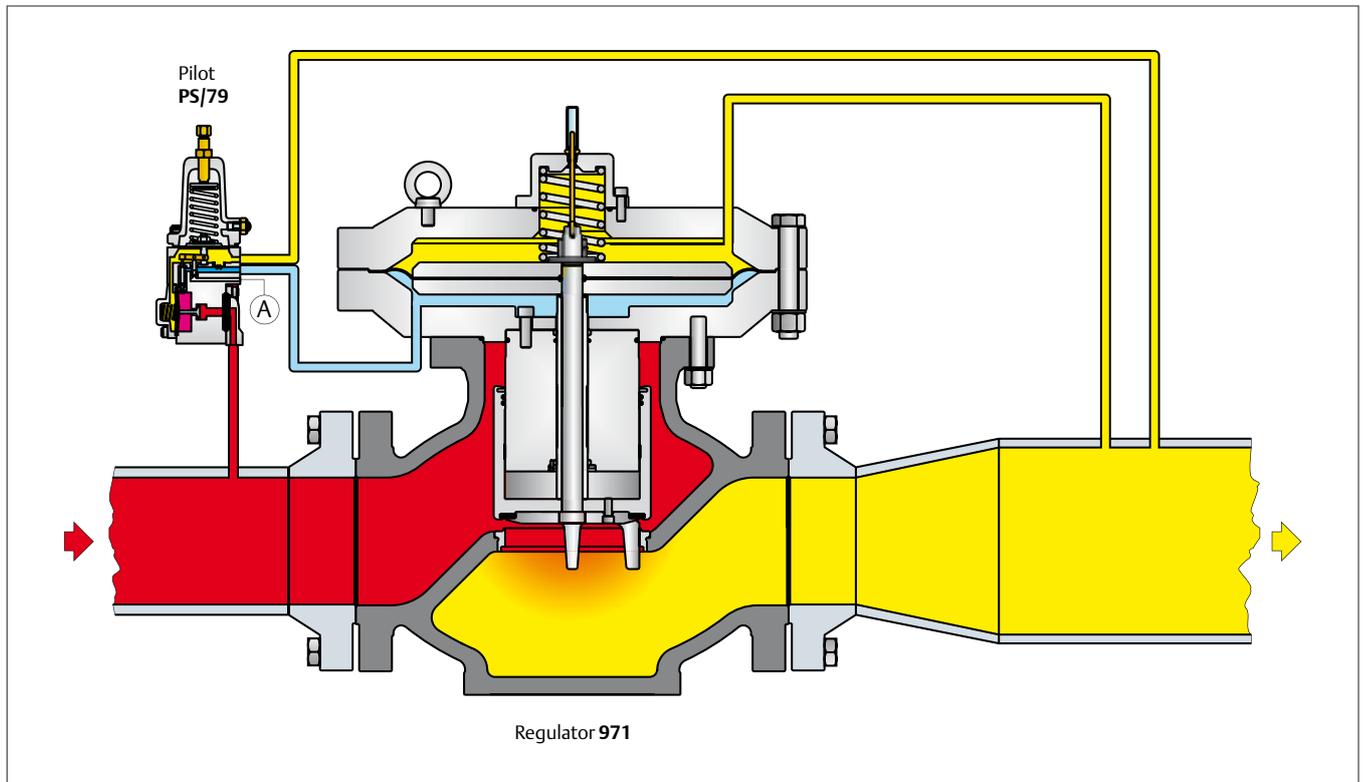
971 : Regulator

971-E : Monitor

Also available version with type SR silencer.



## Operation



■ Inlet pressure     
 ■ Motorization pressure     
 ■ Outlet pressure     
 Ⓐ Downstream or to a safe area

### How the Regulator Works

The Diaphragm Unit (permanently connected to the shutter) divides the regulator control head into two chambers.

One of the chambers is connected to regulated pressure ( $P_d$ ), and the other to motorization pressure ( $P_m$ ) produced by the pilot according to pressure downstream.

Due to lack of pressure, the regulator spring acts on the diaphragm unit and closes the shutter.

The shutter moves to its open position when the force produced by motorization pressure ( $P_m$ ) acting on the diaphragm unit becomes greater than the force produced by downstream regulated pressure ( $P_d$ ) added to the load of the regulator spring. The shutter stays idle when the two forces are equal under these conditions, downstream pressure is equal to the system's set value.

Any change in requested flow-rate produces a variation in downstream regulated pressure and the regulator controlled by the pilot opens or closes to deliver the requested flow-rate while keeping downstream pressure uniform.

### How the Monitor Works

The Monitor or emergency regulator is used as a safety device in gas pressure reduction systems. The purpose of this device is to protect the system against possible overpressure, while keeping the reduction line in service.

The monitor controls downstream pressure at the same point as the main regulator and is set a little higher than the latter.

Under normal duty, the monitor is fully open as it detects a pressure value lower than its set value. If, due to any regulator fault, downstream pressure increases, when it exceeds the tolerated level, the monitor comes into operation and adjusts pressure to its own set value.

# 971 Regulators

## Features

**Applications** 971 type regulators 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 ANSI 300/600

Allowable pressure	PS	: up to 100 bar
Inlet pressure range	$b_{pu}$	: 1 to 100 bar
Set range	$W_d$	: 0.5 to 70 bar
Min. operating differential press.	$\Delta p_{min}$	: 0.5 bar

## Functional Features

Accuracy class	AC	: up to $\pm$ 1%
Lock-up pressure class	SG	: up to + 5%
Class of lock-up pressure zone	SZ	: up to 5%

### Flanged connections

Same Inlet and outlet: DN 250

### Temperature

Standard version Working: -10 °C +60 °C

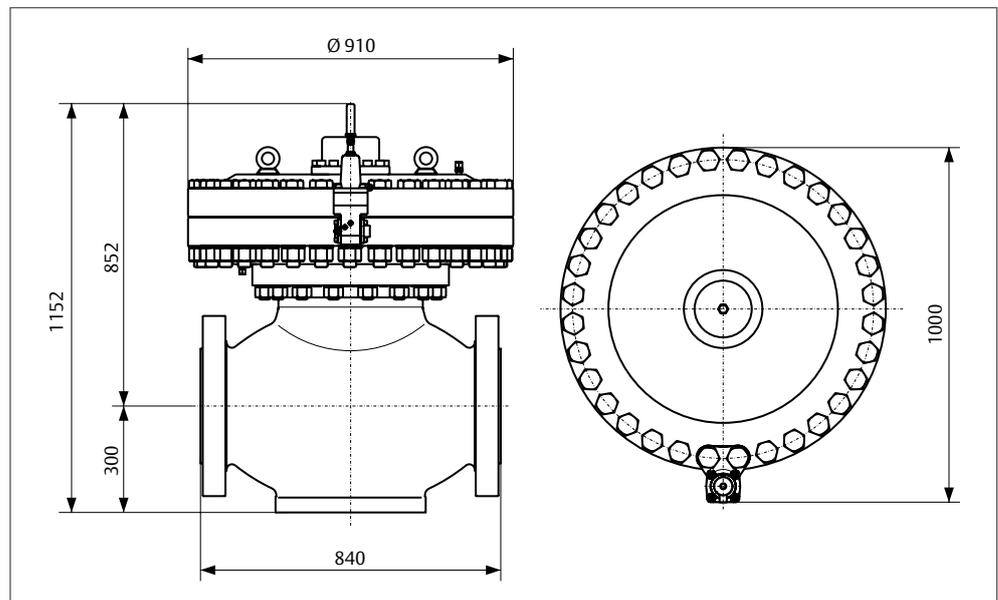
Low temperature version Working: -20 °C +60 °C

## Materials

Body and covers	Steel	Diaphragm	Fabric Nitrile (NBR)+PVC
Regulator sleeve	Steel	Pad	Nitrile (NBR) rubber
Seat	Stainless steel		

## Dimensions (mm)

Weigh with pilot = 1700 kg



## Calculation Procedures

**Symbols**

Q = Natural gas flow rate in Stm<sup>3</sup>/h  
 P1 = Absolute inlet pressure in bar  
 P2 = Absolute outlet pressure in bar  
 C<sub>g</sub> = Flow rate coefficient = 32500  
 C1 = Body shape factor = 31  
 d = Relative density of the gas

**Flow Rate Q**      **Sub-critical state** with  $P2 > \frac{P1}{2}$

$$Q = 0.525 \cdot C_g \cdot P1 \cdot \sin \left( \frac{3417}{C1} \cdot \sqrt{\frac{P1-P2}{P1}} \right)^{Deg}$$

**Critical state** with  $P2 \leq \frac{P1}{2}$

$$Q = 0.525 \cdot C_g \cdot P1$$

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

## DN Size

Calculate the required C<sub>g</sub> with the following formula:

**Sub-critical state** with  $P2 > \frac{P1}{2}$

$$C_g = \frac{Q}{0.525 \cdot P1 \cdot \sin \left( \frac{3417}{C1} \cdot \sqrt{\frac{P1-P2}{P1}} \right)^{Deg}}$$

**Critical state** with  $P2 \leq \frac{P1}{2}$

$$C_g = \frac{Q}{0.525 \cdot P1}$$

*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 (see table).*

Select the diameter of the regulator with C<sub>g</sub> higher than calculated value (see table).

After finding the DN of the regulator, 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)

# 971 Regulators

## Pilots

971 type regulators are equipped with the PS/ or PRX/ series pilots.

### PS/ and PRX/ Series



Regulator or Monitor	Application		Allowable Pressure PS (bar)	Set Range W <sub>d</sub> (bar)	Body and Covers Material
	Regulator	Monitor			
PS/79	PSO/79	REO/79	100	0.5 - 40	Steel
PS/80	PSO/80	REO/80		1.5 - 40	
PRX/120	PRX/120	PRX/125		1 - 40	
PRX-AP/120	PRX-AP/120	PRX-AP/120		30 - 70	

1/4" NPT female threaded connections

All PS/ series pilots are supplied with a filter (5 $\mu$  filtering degree) and built-in pressure stabilizer, with the exception of pilots PSO/79 and PSO/80. The SA/2 stabilizer filter must be used with PRX/ series pilots.

### SA/2



The stabilizer filter is equipped with a 5 $\mu$  filtering degree filter and is suitable for heating.

Model	Allowable Pressure PS (bar)	Supplied Pressure	Body and Covers Material
SA/2	100	3 bar + Downstream pressure	Steel

1/4" NPT female threaded connections

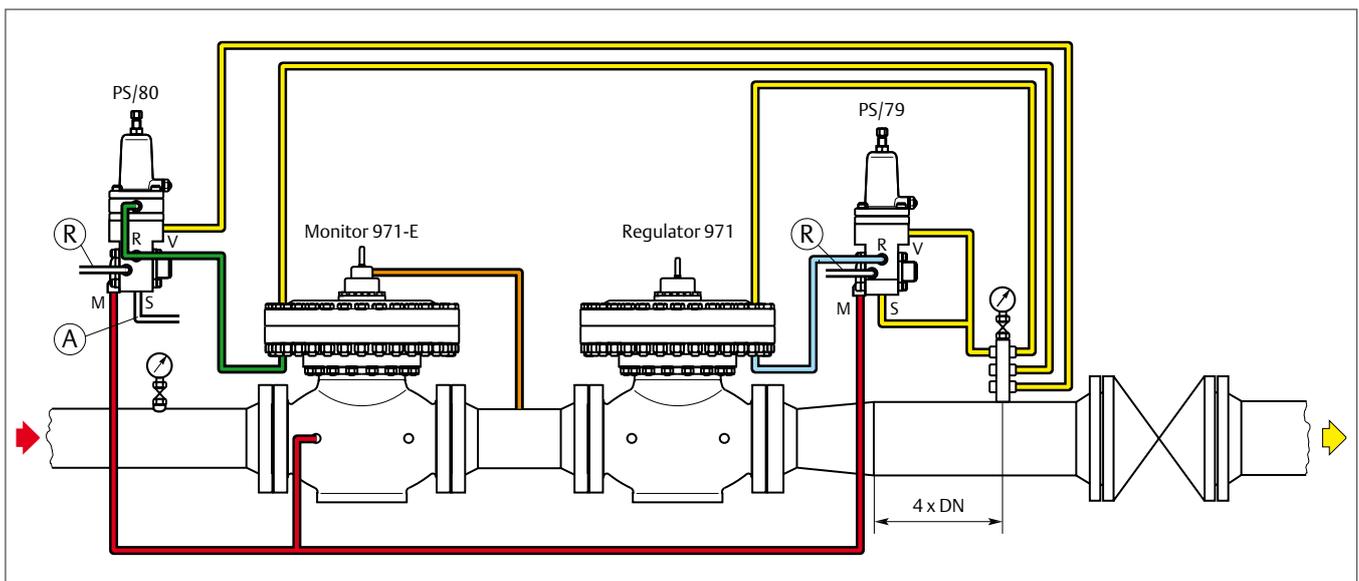
### Booster Valve



Model	Allowable Pressure PS (bar)	Set Range W <sub>d</sub> (bar)	Body and Covers Material
PRX/131	100	0.5 - 40	Steel
PRX-AP/131		30 - 80	

1/4" NPT female threaded connections

## Example of Connections



- Inlet pressure
- Intermediate pressure
- Regulator motorization pressure
- Monitor motorization pressure
- Outlet pressure
- A Downstream or to a safe area
- R To the heating system

## Silencers

### SR

This silencer is fitted near the regulator shutter and is highly efficient up to a theoretical speed of 80 m/s calculated at the outlet flange.

Beyond this speed could be necessary to act on the noise generated by the expansion cone usually installed downstream of the regulator.

### STP

Habitually used down-stream of regulator can be combined with the SR silencer.

Overall reduction in noise level is the sum of the reduction produced by SR plus the STP induced reduction.

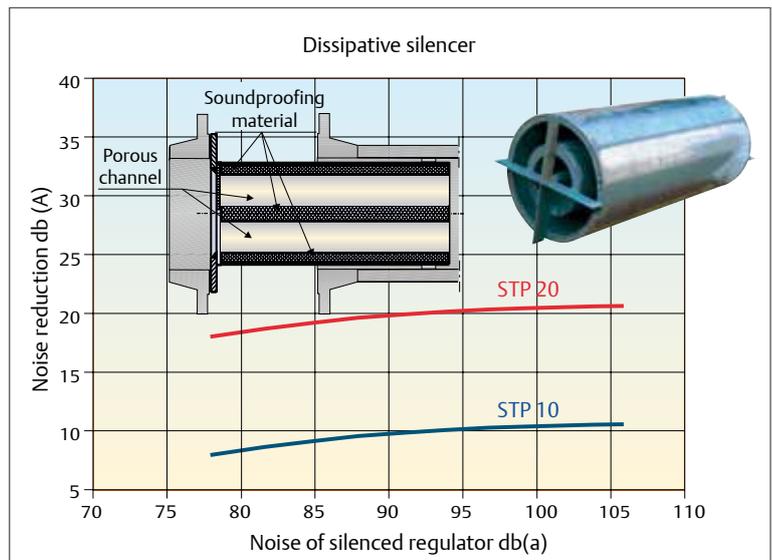
The STP silencer consists of one or more porous channels clad with soundproofing material.

Sound penetrates inside the soundproofing layer and is transformed into heat by friction.

The silencer is fitted in the pipe and is secured with two flanges.

Two types of silencers are supplied:

- STP10 10 dB(A) attenuation, length of 1m
- STP20 20 dB(A) attenuation, length of 2m



## Accessories

### Type PA1/75 Proportional Travel Transmitter

In order to communicate the valve position, a potentiometer-type straightaway position transmitter is used connected to the regulator travel indicator.

Thanks to this transducer, it is possible to know accurately the valve position and thus have correct information on the regulator operating condition.

This transducer features a single element as foreseen by EN 50020 standards and can thus be used in hazardous areas.

Single element transducers, if fitted in intrinsic safety circuits, should be protected through suitable safety barriers anyway.

### Proximity Switch

In order to send the regulator/monitor opening/closing signal, a proximity switch suitable for installation in hazardous area is used.

The use of this switch foresees the application of an intrinsic safety separation barrier which should be installed in safe area.

The distance between the proximity switch and the barrier should be calculated according to the type of gas and installation electrical specifications.



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