

PRESSURE REGULATORS

Type 971



971 Regulators

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:

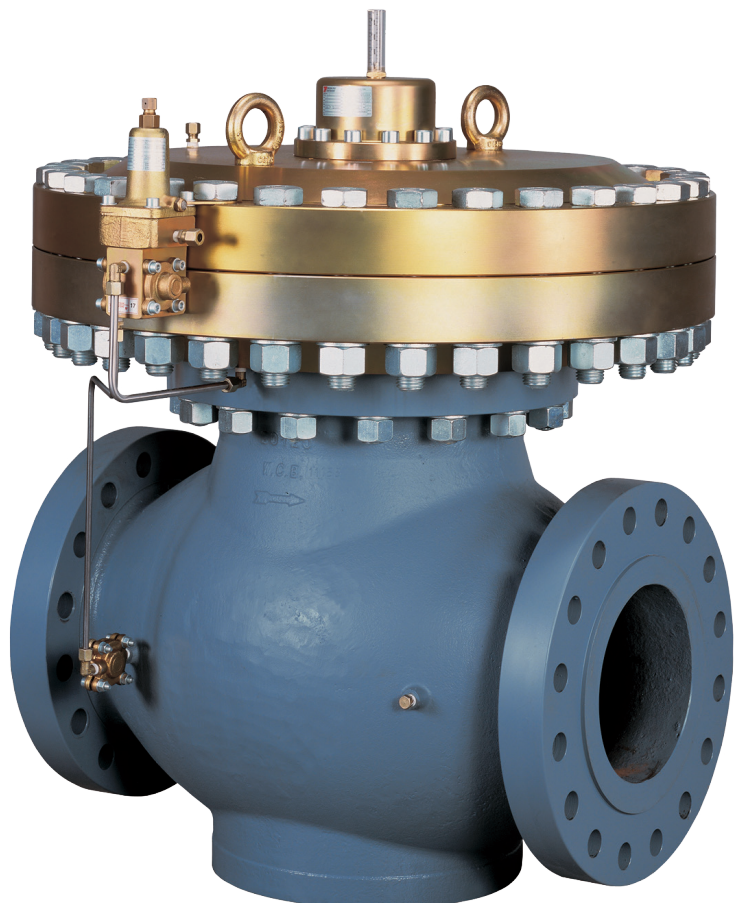
- *Extremely high precision of the regulated pressure, even in the presence of highly variable inlet pressures*
- *Easy adjustment of the delivery pressure by a simple replacement of the the control pilot setting spring*
- *High versatility for a wide range of different applications*

Available Configurations

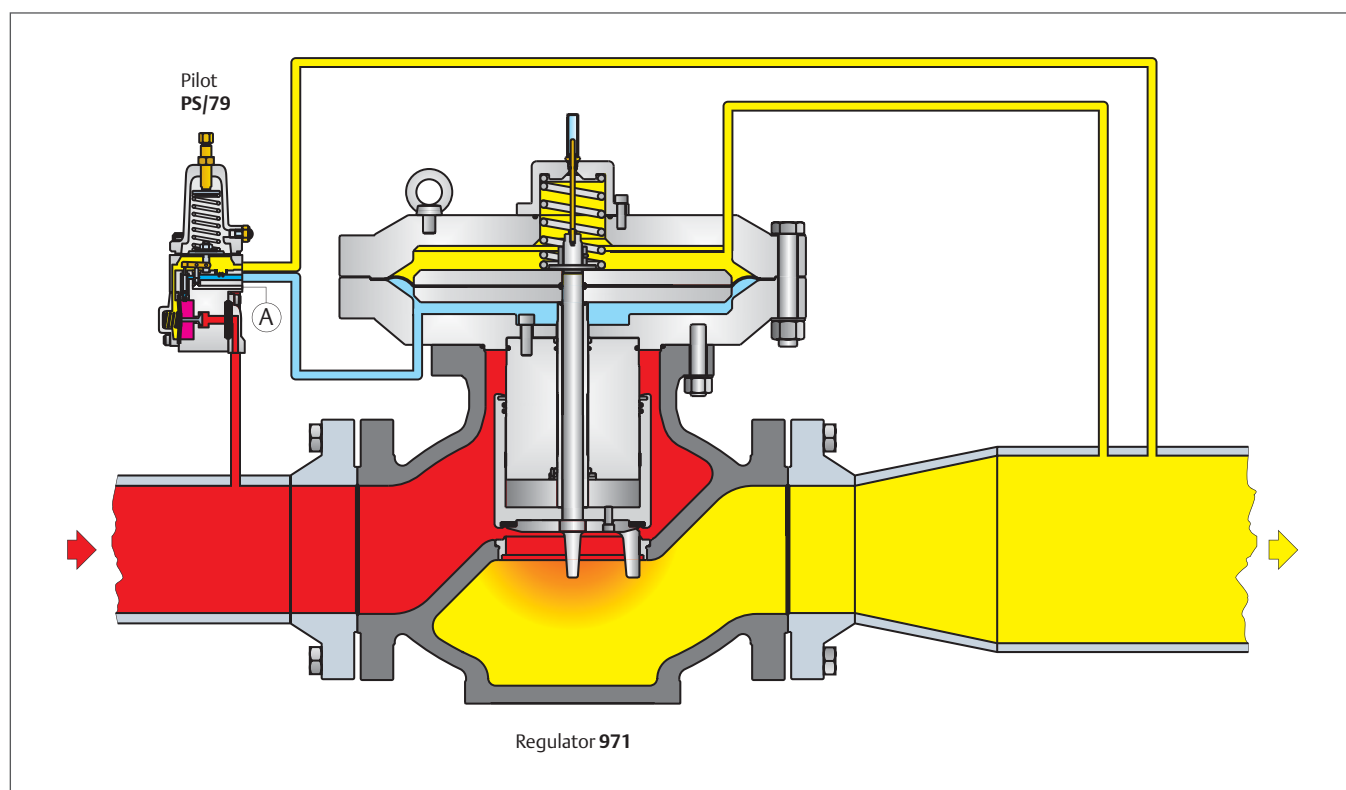
971 : Regulator

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.	Δp_{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

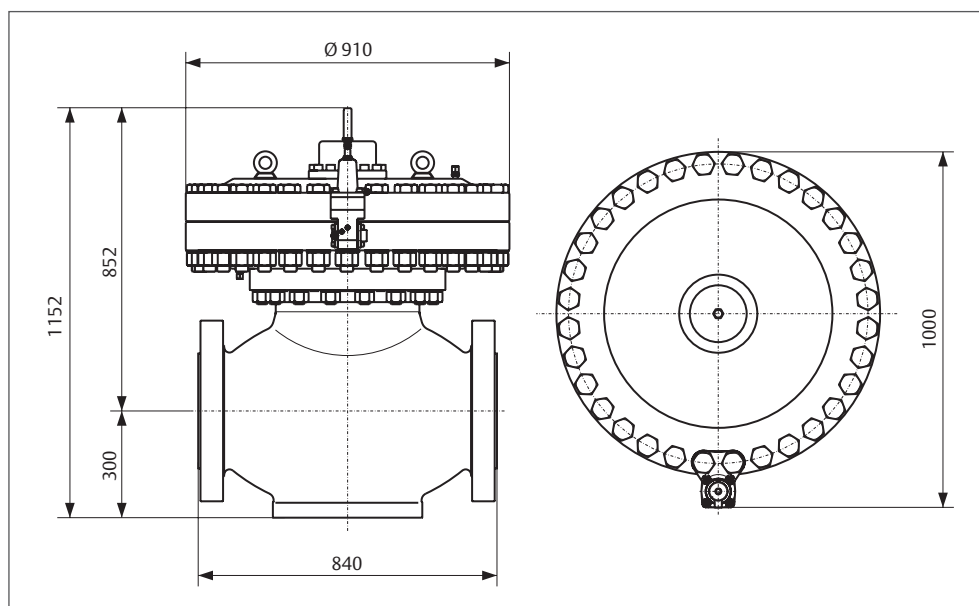
Low temperature version Working: -20 °C +60 °C

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^3/h
 P_1 = Absolute inlet pressure in bar
 P_2 = Absolute outlet pressure in bar
 C_g = Flow rate coefficient = 32500
 C_1 = Body shape factor = 31
 d = Relative density of the gas

Flow Rate Q

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

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

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

DN Size

Calculate the required C_g with the following formula:

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

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

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 (see table).

Select the diameter of the regulator with C_g 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:

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

V = Velocity (m/s)
 345.92 = Numerical constant
 Q = Flow rate under standard conditions (Stm^3/h)
 DN = Regulator nominal diameter (mm)
 P_u = Inlet pressure in relative value (bar)

971 Regulators

Pilots

Type 971 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 _d (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 μ 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 μ 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

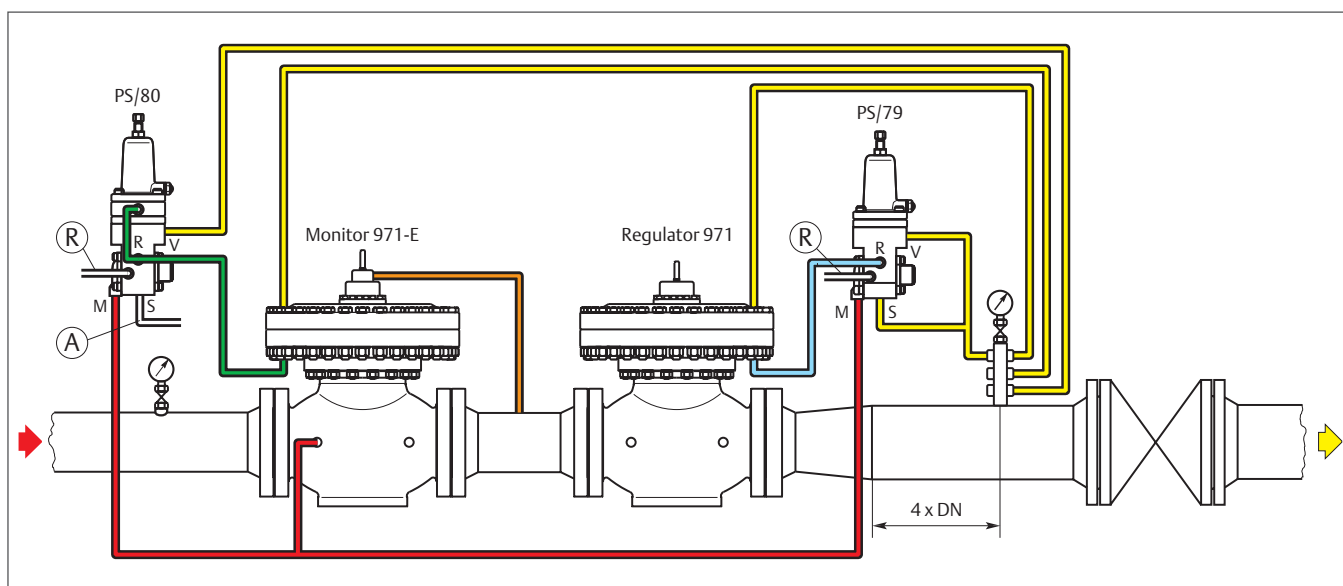
Booster Valve



Model	Allowable Pressure PS (bar)	Set Range W _d (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 ■ Regulator motorization pressure ■ Outlet pressure R To the heating system
■ Intermediate pressure ■ Monitor motorization pressure A Downstream or to a safe area

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.

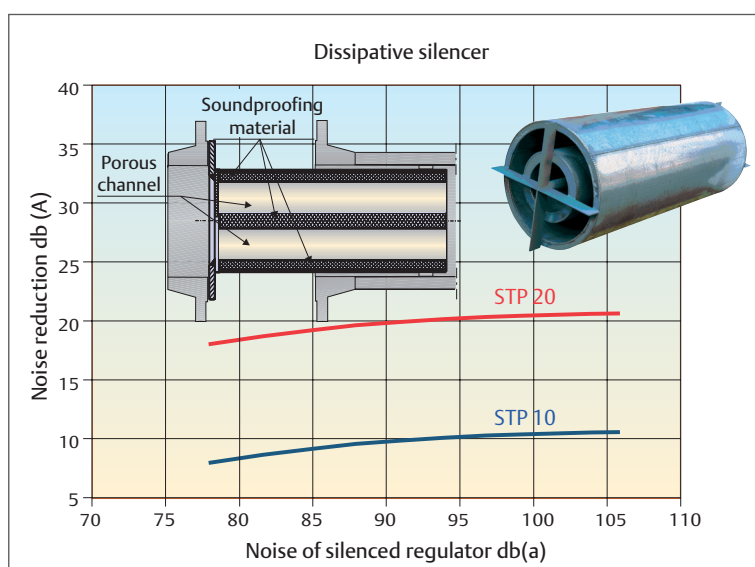
The STP silencer consists of one or more porous channels clad with soundproofing material.

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.



 Webadmin.Regulators@emerson.com

 Tartarini-NaturalGas.com

 Facebook.com/EmersonAutomationSolutions

 LinkedIn.com/company/emerson-automation-solutions

 Twitter.com/emr_automation

Emerson

America

McKinney, Texas 75070 USA
T +1 800 558 5853
+1 972 548 3574

Europe

Bologna 40013, Italy
T +39 051 419 0611

Asia Pacific

Singapore 128461, Singapore
T +65 6777 8211

Middle East and Africa

Dubai, United Arab Emirates
T +971 4 811 8100

D104038X012 © 2015, 2024 Emerson Process Management Regulator Technologies, Inc. All rights reserved. 07/24.
The Emerson logo is a trademark and service mark of Emerson Electric Co. All other marks are the property of their prospective owners.
Tartarini™ is a mark owned by one of the companies in the Emerson Automation Solutions business unit of Emerson Electric Co.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available upon request. We reserve the right to modify or improve the designs or specifications of such products at any time without notice.

Emerson Process Management Regulator Technologies, Inc does not assume responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use and maintenance of any Emerson Process Management Regulator Technologies, Inc. product remains solely with the purchaser.

Emerson Process Management s.r.l.

Emerson Automation Solutions - Stabilimento di/Site of: Castel Maggiore - Bologna
Sede Legale/Legal Entity: Piazza Meda 5, 20121 Milano, Italy
Sede Amministrativa/Administrative Headquarters: OMT Tartarini, Via Clodoveo Bonazzi 43,
40013 Castel Maggiore (Bologna), Italy
C.F. - P.I. e R.I. di MI 13186130152 - REA di MI/n.1622916
Direz. e Coord. (art. 2497 bis CC): EMERSON ELECTRIC CO. St. Louis (USA) Socio Unico

