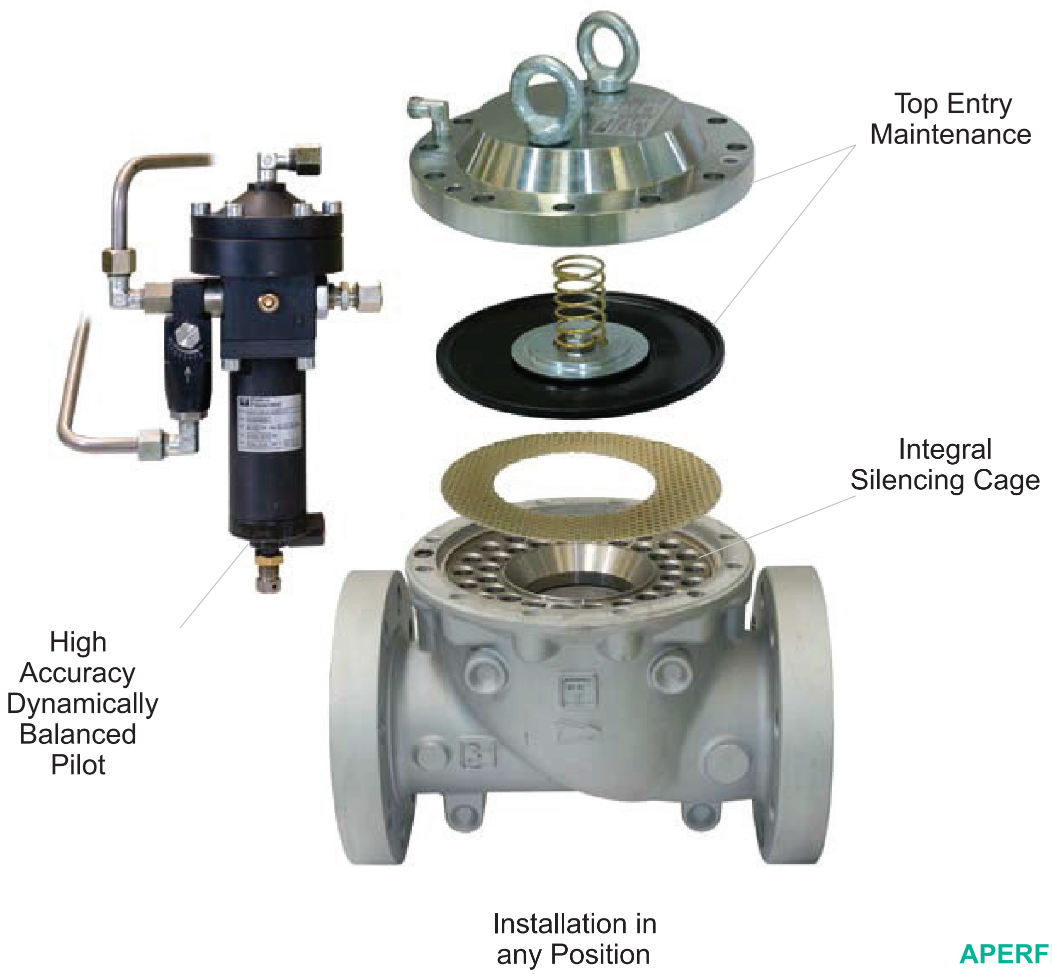
Pietro Fiorentini

Aperflux 101

Pressure Regulators

APERFLUX 101



INTRODUCTION

Aperflux 101 is a boot style, pilot-controlled pressure regulator for medium and high pressure applications. **Aperflux 101** is normally a fail open regulator and specifically will open under the following circumstances:

- breakage of main diaphragm
- lack of pressure feeding to the pilot circuit

These regulators are suitable for use with previously filtered, non-corrosive gases.

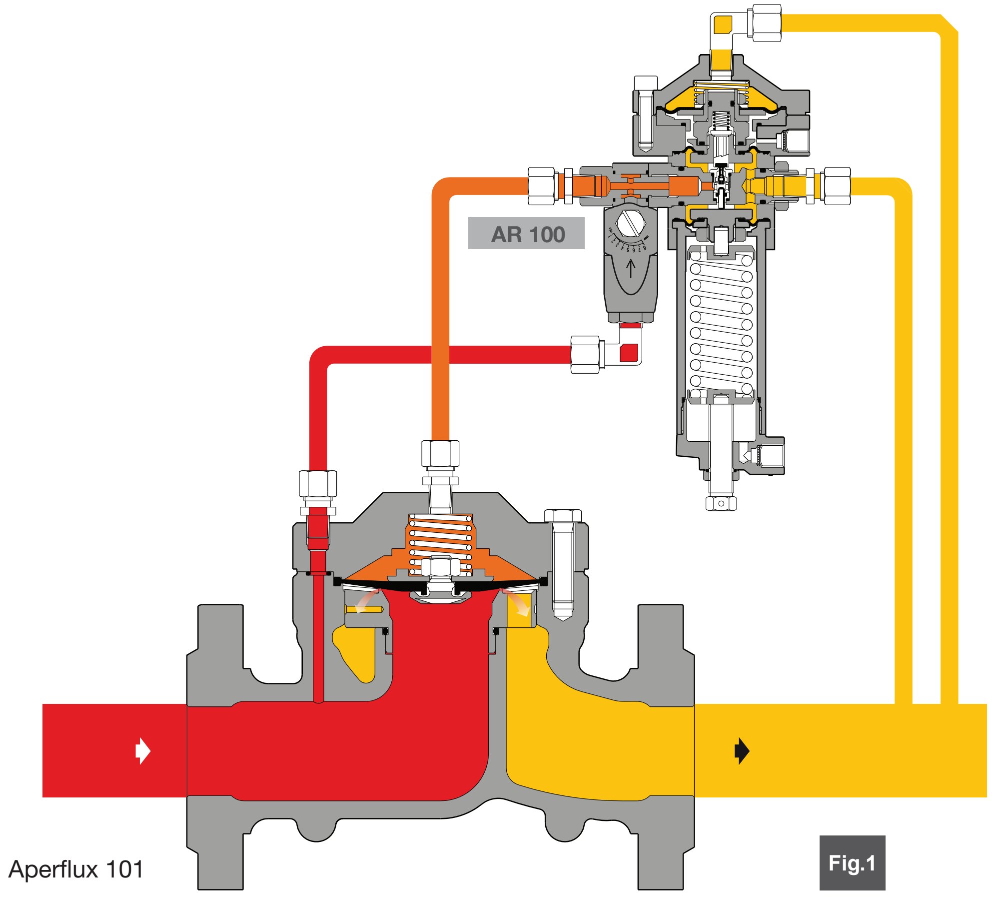


Fig.1

DESIGNED WITH YOUR NEEDS IN MIND

- COMPACT DESIGN
- EASY MAINTENANCE
- TOP ENTRY
- LOW NOISE
- HIGH TURNDOWN RATIO
- HIGH ACCURACY
- LOW OPERATIONAL COST

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FUNCTIONAL FEATURES *

- **Maximum Body inlet pressure:** Up to 1,480 PSIG
- **Maximum inlet pressure:** Up to 1,233 PSIG
- **Range of downstream pressure:** From 1,170 PSIG depending on installed pilot (see Pilot section)
- **Minimum working differential pressure:** 14.5 PSIG
- **Minimum ambient temperature:** Execution up - 40°F
- **Maximum Ambient temperature:** 140°F
- **Flowing gas temperature**: -4°F to140°F
- **Accuracy class AC:** Up to 1.5% Gauge
- **Look-up pressure class SG:** Up to 2.5% Gauge

DESIGN FEATURES

- **Nominal dimensions DN:** 2”, 3”
- **Flanged connections:** Class 150-300-600 RF or RTJ, according to ANSI B16.5 and PN 16 according to UNI 2282 or DIN 2263, (ISO 7005)

MATERIALS **

- **Body:** Cast steel ASTM A 352 LCC for classes ANSI 600 and 300; Cast steel ASTM A 216 WCB for classes ANSI 150 and PN 16
- **Head covers:** Cast steel ASTM A 350 LF2
- **Diaphragm:** Rubberized canvas
- **Seat:** Stainless steel for DN =< DN 80 (3”), carbon steel with stainless steel sealing edge for DN >= DN 100 (4”)
- **Sealing ring:** Nitril rubber
- **Connection fittings**: In zinc-plated carbon steel according to DIN 2353; stainless steel on request

* Different functional features available on request.
** The materials indicated above refer to the standard models. Different materials can be provided according to specific needs.

CHOOSING THE PRESSURE REGULATOR

Sizing of regulators is usually made on the basis of Cg valve and K_G sizing coefficients (Table 1).
Flow rates at fully open position and various operating conditions are related by the following formulae where:

Q = flow rate in Stm3/h
Pu = inlet pressure in bar (abs)
Pd = outlet pressure in bar (abs).

A > When the Cg and K_G values of the regulator are known, as well as Pu and Pd, the flow rate can be calculated as follows:

A-1 in sub critical conditions: (Pu<2xPd)

$$Q = K_G \sqrt{Pd \, (Pu - Pd)} \qquad Q = 0.526 \times Cg \times Pu \times \text{sen}\left(K1 \times \sqrt{\frac{Pu - Pd}{Pu}}\right)$$

A-2 in critical conditions: (Pu ≥2xPd)

$$Q = \frac{K_G}{2} \times Pu \qquad Q = 0.526 \times Cg \times Pu$$

B > Vice versa, when the values of Pu, Pd and Q are known, the Cg or KG values, and hence the regulator size, may be calculated using:

B-1 in sub-critical conditions: (Pu<2xPd)

$$K_G = \frac{Q}{\sqrt{Pd \, (Pu - Pd)}} \qquad Cg = \frac{Q}{0.526 \times Pu \times \text{sen}\left(K1 \times \sqrt{\frac{Pu - Pd}{Pu}}\right)}$$

B-2 in critical conditions (Pu ≥2xPd)

$$K_G = \frac{2 \times Q}{Pu} \qquad Cg = \frac{Q}{0,526 \times Cg \times Pu}$$

Table 1: Cg, K_G and K1

coefficient Nominal diameter (mm)	50	66% TRIM	33% TRIM	80
Size (inches)	2"	2"	2"	3"
Cg coefficient	1682	1110	555	4200
KG coefficient	1768	1166	583	4414
K1 coefficient	103	103	103	108

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Sizing

The formula is applicable to natural gas having a relative density of 0.61 w.r.t. air and a regulator inlet temperature of 15 °C. For gases having a different relative density (S) and temperature (t) in °C, the value of the flow rate, calculated as above, must be multiplied by a correction factor, as follows:

$$Fc = \sqrt{\frac{175.8}{S \times (273.16 + t)}}$$

Table 2 lists the correction factors Fc for a number of gases at 15°C.

Table 2: Correction factors FC

Type of gas	Relative density	Fc Factor
Air	1.0	0.78
Propane	1.53	0.63
Butane	2.0	0.55
Nitrogen	0.97	0.79
Oxygen	1.14	0.73
Carbon dioxide	1.52	0.63

Caution

In order to get optimal performance, to avoid premature erosion phenomena, and limit noise emissions, it is recommended to check that the gas speed at the outlet flange does not exceed the following values:

PD ≤ 72.5 PSIG V ≤ 656 ft./sec.
PD ≥ 72.5 PSIG V ≤ 492 ft./sec.

The gas speed at the outlet flange may be calculated by means of the following formula:

$$V = 345.92 \frac{Q}{DN^2} \times \frac{1 \quad 0.002 \times Pd}{1 + Pd}$$

Where:
V = gas speed in m/sec
Q = gas flow rate in Stm3/h
DN = nominal size of regulator in mm
Pd = outlet pressure in barg

Pilot System

Aperflux 101 regulators are equipped with series 300 pilot as listed below:
- 302/. control range Wd: 11.6 to 137.7 pPSIG
- 304/. control range Wd: 101.5 to 623.5 PSIG
- 305/. control range Wd: 290 to 870.2 PSIG
- 307/. control range Wd: 594.6 to 1073.3 PSIG

Pilots may be adjusted manually or remotely as shown in table 3:

PILOTS	Aperflux 101
Pilot type .../A	Manual setting
Pilot type .../D	Electric remote setting control
Pilot type .../CS	Pneumatic remote setting control

Restrictor

The pilot system comes complete with an adjustable **AR100** restrictor. The flow rate of the pilot system is controlled by the bleed rate through **AR100** restrictor. The KG coefficients of the **AR100** adjustable restrictor for its various degrees of opening are shown on Fig. 2. KG formula used for calculating the flow rate of regulator can be applied for adjustable restrictor **AR100**. It is necessary to consider that pressure drop through the adjustable **AR100** restrictor should be about 2.9 PSIG at the minimum opening flow of the regulator and about 14.5 PSIG at the maximum opening flow of regulator main diaphragm.

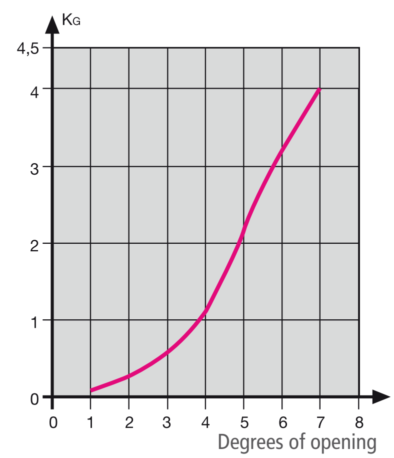


Fig.2

Accessories on Request

For regulator
- Internal connection for pilot bleed
- Flow-limiting devices
- Limit switches
- Stainless steel fittings, single or dual sealing

For pilot
- Supplementary filter CF 14
- Dehydrating filter CF 14/D

In-line Monitor

The monitor is generally installed upstream of the main regulator. Although the function of the monitor regulator is different, the two regulators are virtually identical from the point of view of their mechanical components. The only difference is that monitor is set at a higher pressure than the main regulator. The Cg and K_G coefficients of the regulator plus in-line monitor system are about 20% lower than those of the regulator alone.

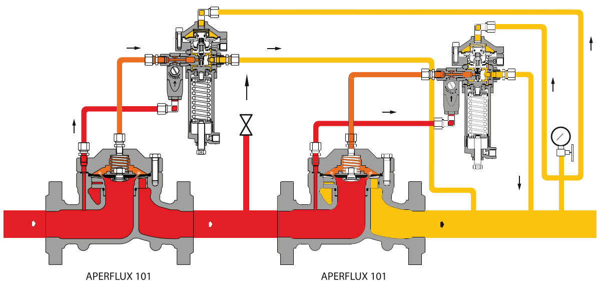


Fig.3

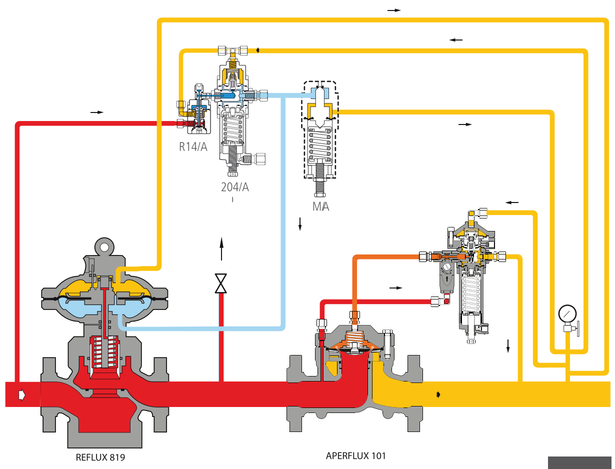


Fig.4

M/A Accelerator

When the monitor is required to take over more rapidly in the event of a main regulator failure, an M/A accelerator pilot is installed on the monitor (Fig. 4). Installation of the accelerator is mandatory when monitor is used on safety accessory. Depending on a downstream pressure signal, this device discharges the gas enclosed in the motorisation chamber of the monitor regulator, allowing the monitor to take over faster.

The set point of M/A accelerator is usually higher than set point of the monitor by 4.35 to 7.5 PSIG.

In case of monitor override configuration (2-stage cut) the accelerator may be not necessary.

Installation

Whenever Aperflux 101 pressure regulator is being installed, it is essential to follow a few basic rules in order to ensure the achievement equipment's operational and performance characteristics.

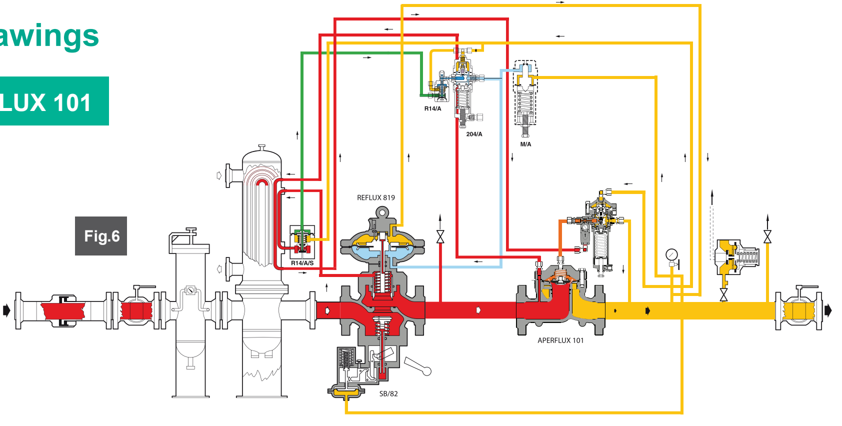
These rules may be summarised as follows:

- Filtering: the gas arriving from the main pipeline must be adequately filtered; it is also advisable to make sure that the pipe upstream of the regulator is perfectly clean and void of residual impurities.
- Pre-heating: whenever the pressure drop at the regulator is considerable, the gas must be pre-heated enough to avoid the formation of ice during decompression (for reference natural gas the temperature drop is about 1°F for every atmosphere (14.5 PSIG) of pressure reduction).
- Condensate collector: natural gas sometimes contain traces of vapour-state hydrocarbons that can interfere with the functioning of the pilot. It is therefore necessary to install a condensate collector, complete with drainage system, upstream of the pilot circuit.
- Outlet pipe size must also be sized correctly so the velocity is not too high. High velocity will result in improper pressure control.
- Impulse take-off: for correct operation, the impulse take-off must be located in the right position. Between the regulator and the downstream take-off there must be a straight lengh of pipe ≥ 4 times the diameter of the outlet pipe and downstream the take-of, if there must be a further lengh of pipe ≥ 2 times the same diameter.

Possible Installation Drawings

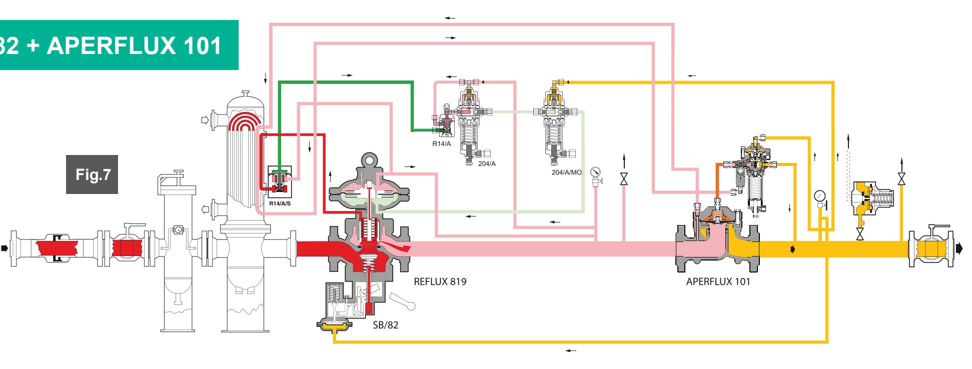
REFLUX 819 + SB/82 + APERFLUX 101

Fig.6



REFLUX 819/MO +SB82 + APERFLUX 101

Fig.7



REFLUX 819 + SB/82 + APERFLUX 101

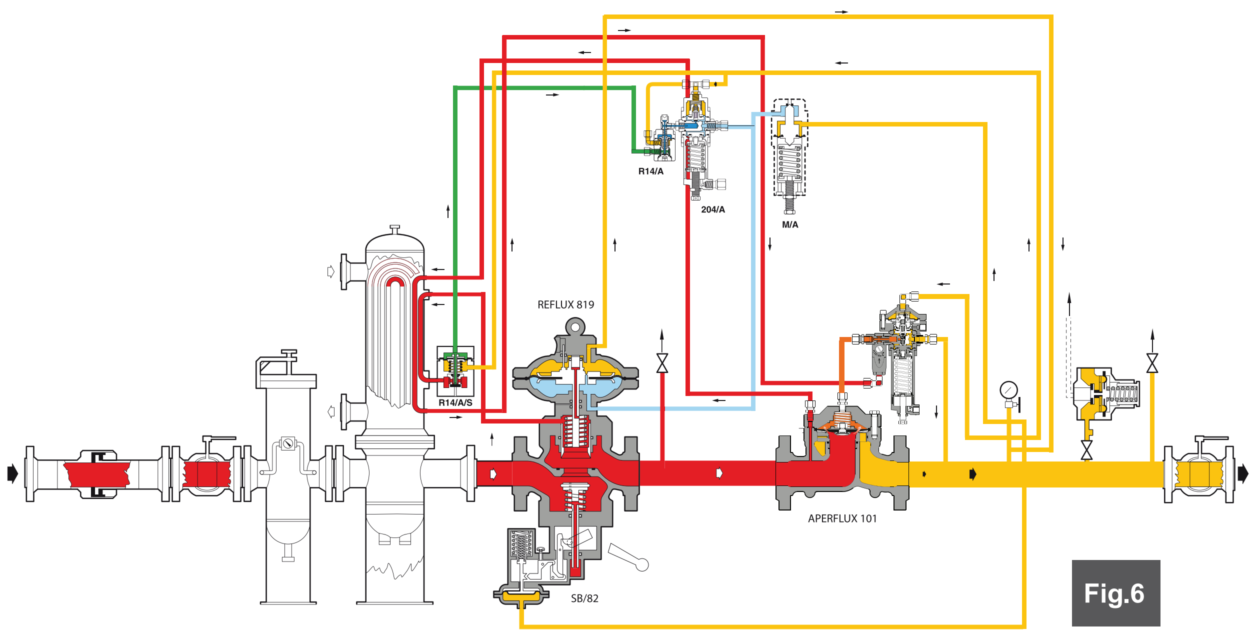


Fig.6

REFLUX 819/MO +SB82 + APERFLUX 101

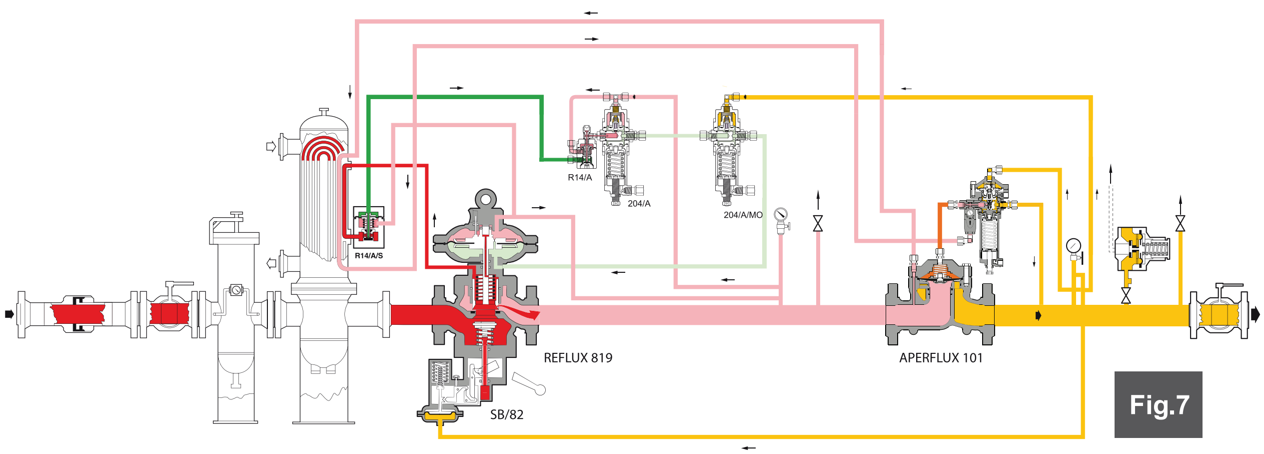
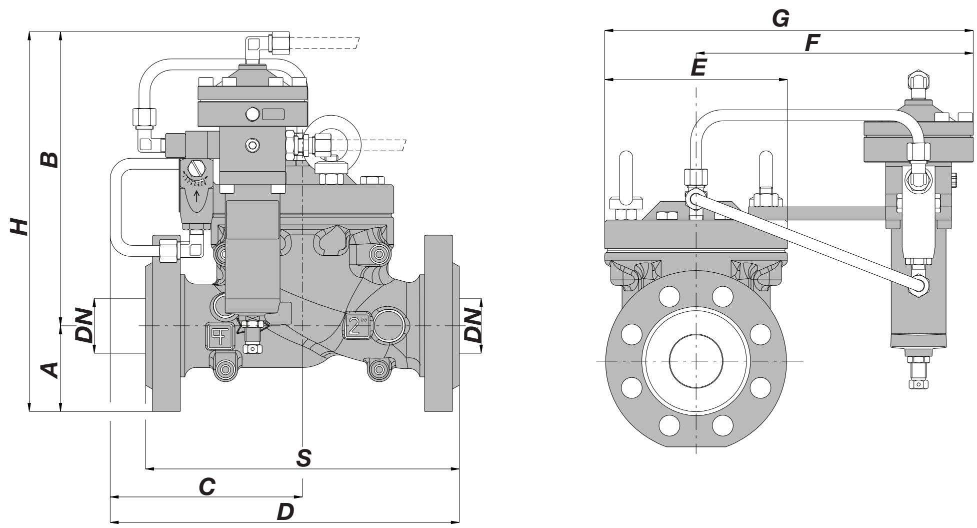


Fig.7



Overall Dimensions in Inches		
Size (mm)	50	80
Inches	2”	3”
A	3.0	4.0
B	10.7	11.5
C	6.9	7.3
D	12.2	13.5
D	12.2	13.6
E	6.6	9.3
F	10.0	11.4
G	13.4	16.0
H	13.7	15.4
S (ANSI 300)	10.5	12.5
S (ANSI 600)	11.25	13.25

Connections are 3/8" O.D. double locking fittings stainless steel

Weights in lbs (with P302)

Weight in Lbs		
ANSI 300	54	104
ANSI 600	59	113

Face to face dimensions S according to ASME B16.5, IEC 534-3, and EN 334

EQUIPMENT CONTROLS COMPANY

Ph: 800.554.1036
www.equipmentcontrols.com