# C Technical References

# Common Terms and Definitions

## Inlet Pressure

The pressure of media of gas or liquid on the inlet port of the regulator or valve;
Typical units of measure: psig, bar and MPa.

## Outlet Pressure

The pressure of media of gas or liquid on the outlet port of the regulator or valve.

## Accuracy

The variation in control pressure which occurs under steady state conditions within the control range of a regulator.

## Sensitivity

The ability of a pressure regulator to respond to change in discharge conditions: pressure, flow, temperature, etc.

## Flow Coefficient (Cv)

A flow coefficient is numerically equal to the number of U.S. Gallons of water at 60°F/16°C that will flow through a valve or regulator in one minute when the pressure differential between the inlet and outlet is 1 psi. When gas is used instead of liquid, the equation is modified to account for the use of a compressible fluid. For a regulator, Cv is determined when the regulator is wide open and not regulating. When determining flow performance use actual flow curves.

## Leakage - External

The loss of fluid from the external surfaces or joints of a regulator or valve. Example: From the body-bonnet-diaphragm joint. Leakage to atmosphere. The leakage rate is measured in std $cm^3/s$ Helium.

## Leakage - Internal

The loss of fluid through a regulator or valve, between pressure zones normally expected to be sealed. Example: Between the inlet pressure and the outlet pressure zones.

## Load Element

One of the three basic elements of a pressure reducing regulator. It provides the means by which the operator can set the force that determines the control pressure of a regulator. This element includes the spring and the stem.

## Sensing Element

One of the three basic elements of a pressure reducing regulator. It senses the changes of the outlet pressure and acts as a physical connection between the load element and control element.

## Control Element

One of the three basic elements of a pressure regulator to reduce the high inlet pressure to a stable lower outlet pressure by adjusting the orifice.

### Unbalanced Poppet

A poppet where the effective area of the poppet is influenced by the inlet pressure.

### Balanced Poppet

A poppet where the effective area of the poppet is not influenced by the inlet pressure.

# Gas Purity Values

| Type | Degree | Purity Value | Max. Contamination (ppm) |
|---|---|---|---|
| Pure | 2.5 | 99.5% | 5000 |
| | 3.0 | 99.9% | 1000 |
| High Purity | 3.5 | 99.95% | 500 |
| | 4.0 | 99.99% | 100 |
| | 4.5 | 99.995% | 50 |
| | 5.0 | 99.999% | 10 |
| | 5.5 | 99.9995% | 5 |
| | 6.0 | 99.9999% | 1.0 |
| Ultra High Purity | 7.0 | 99.99999% | 0.1 |

# How to Use the FITOK Flow Charts

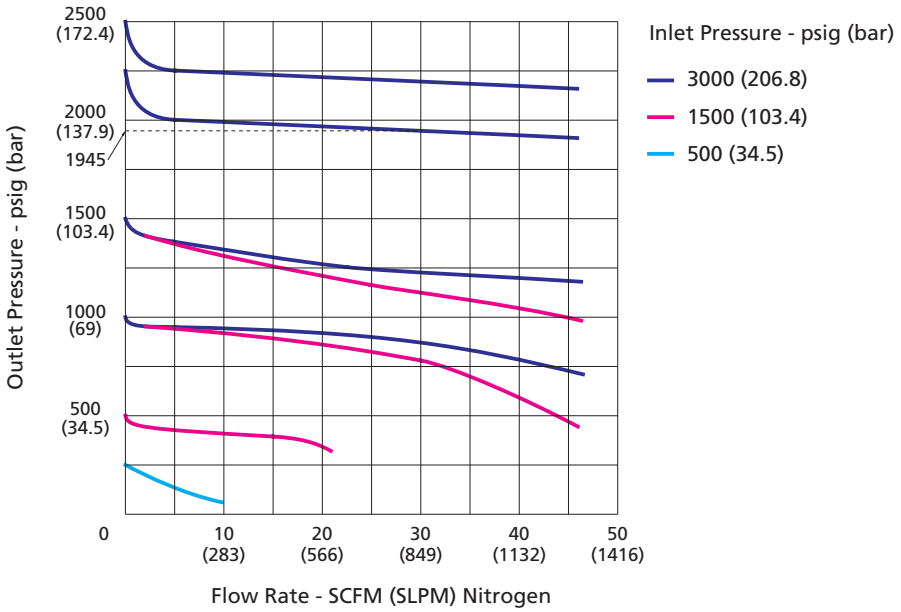
A FITOK Flow Chart is a graphic representation of test results in curves, showing the changes in outlet pressure of a regulator with the varying flow rate basing on different inlet pressures. The regulator is so designed that at the time the outlet pressure reaches the set pressure, the flow rate would be zero. The inlet pressure is indicated on the right end of each curve.

To use the FITOK Flow Charts, the first step is to select the chart that fits the following:
- Regulator model
- Expected flow range
- Inlet pressure range
- Outlet pressure range

Subsequently, select a curve, if available, plotted for the exact inlet pressure and set pressure of the outlet (zero flow). Locate the set pressure on the vertical axis. Follow the curve until it crosses the vertical line corresponding to the desired flow rate. Read horizontally from the cross point to the vertical axis to locate the actual working pressure for this flow rate. If no curve is plotted for the exact pressure, extrapolate a new curve between and referring to the two closest existing curves.

**Example:**
Using the flow chart to determine the pressure drop (from the set pressure to the outlet pressure at 30 SCFM condition).
Given Conditions: Inlet pressure=3000 psig, Set pressure=2250 psig
Steps: 1. Locate the curve based on inlet pressure (3000 psig) and set outlet pressure (2250 psig)
2. Follow the curve until it crosses the vertical line corresponding to 30 SCFM;
3. Read horizontally from the cross point to the vertical axis. The corresponding pressure read is 1945 psig. Therefore, the pressure drop is 305 psig.

## Flow Chart




**Notes:**
1. The performance of regulator is more accurate in the range where the curve is comparatively flat.
2. All test results on the FITOK Flow Charts are based on utilization of nitrogen as a medium in standard testing conditions. Please contact FITOK for additional information.

# Conversion Factors

## Pressure

| From \ To | psi | bar | atm | KPa | ft. of $H_2O$ | in. of $H_2O$ | mm of Hg | in. of Hg | $Kg/cm^2$ |
|---|---|---|---|---|---|---|---|---|---|
| psi | 1 | 0.068948 | 0.06805 | 6.89465 | 2.3089 | 27.708 | 51.175 | 2.036 | 0.070307 |
| bar | 14.5038 | 1 | 0.98692 | 100 | 33.4883 | 401.8596 | 750.062 | 29.53 | 1.0197 |
| atm | 14.696 | 1.01325 | 1 | 101.3171 | 33.932 | 407.1827 | 760 | 29.921 | 1.0332 |
| KPa | 0.14504 | 0.010 | 0.00987 | 1 | 0.33456 | 4.01472 | 7.5006 | 0.29613 | 0.0102 |
| ft. of $H_2O$ | 0.433107 | 0.029891 | 0.02947 | 2.989 | 1 | 12 | 22.4198 | 0.882646 | 0.03048 |
| in. of $H_2O$ | 0.03609 | 0.002499 | 0.00246 | 0.0249089 | 0.08333 | 1 | 1.86832 | 0.073556 | 0.00254 |
| mm of Hg | 0.019337 | 0.001333 | 0.00132 | 0.133322 | 0.044603 | 0.535240 | 1 | 0.03937 | 0.00136 |
| in. of Hg | 0.49115 | 0.033864 | 0.03342 | 3.376895 | 1.134 | 13.6 | 25.4 | 1 | 0.034532 |
| $Kg/cm^2$ | 14.22334 | 0.980665 | 0.9678 | 98.03922 | 32.8084 | 393.7008 | 735.5592 | 28.95903 | 1 |

## Flow

| From \ To | $cm^3/min$ | $cm^3/sec$ | $ft^3/hr$ | $ft^3/min$ | $m^3/hr$ | $m^3/min$ | L/hr | L/min |
|---|---|---|---|---|---|---|---|---|
| $cm^3/min$ | 1 | 0.0166667 | 0.0021189 | 0.0000353 | 0.00006 | 0.000001 | 0.06 | 0.001 |
| $cm^3/sec$ | 60 | 1 | 0.127134 | 0.0021189 | 0.0036 | 0.00006 | 3.6 | 0.06 |
| $ft^3/hr$ | 471.9474 | 7.86579 | 1 | 0.0166667 | 0.0283168 | 0.0004719 | 28.31685 | 0.4719474 |
| $ft^3/min$ | 28316.85 | 471.9474 | 60 | 1 | 1.699008 | 0.0283168 | 1699.008 | 28.31686 |
| $m^3/hr$ | 16666.67 | 277.7778 | 35.31467 | 0.5885777 | 1 | 0.0166667 | 1000 | 16.66667 |
| $m^3/min$ | 1000000 | 16666.67 | 2118.876 | 35.31467 | 60 | 1 | 60000 | 1000 |
| L/hr | 16.66667 | 0.2777778 | 0.0353147 | 0.0005885 | 0.001 | 0.0000167 | 1 | 0.0166667 |
| L/min | 1000 | 16.66667 | 2.118876 | 0.0353147 | 0.06 | 0.001 | 60 | 1 |

## Density

| From \ To | $gms/cm^3$ | $kg/m^3$ | $lbs/ft^3$ | $lbs/in^3$ | lbs/U.S. gal |
|---|---|---|---|---|---|
| $gms/cm^3$ | 1 | 1000 | 62.428 | 0.0361273 | 8.3454 |
| $kg/m^3$ | 0.001 | 1 | 0.062428 | $3.61273\times10^{-5}$ | 0.0083454 |
| $lbs/ft^3$ | 0.0160185 | 16.018463 | 1 | $5.78704\times10^{-4}$ | 0.13368 |
| $lbs/in^3$ | 27.679905 | 27679.9 | 1728 | 1 | 231 |
| lbs/U.S. gal | 0.1198264 | 119.8264 | 7.4805195 | 0.004329 | 1 |

# Material Compatibility for Gases

## Codes

1 Recommended
2 Use with Limitations
3 Not Applicable
4 Insufficient Data

| Material / Media | Metals | | | | | | Plastics | | | | Elastomers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Copper | Brass | Aluminum | SS | Hastelloy C 22 | Monel | PCTFE | Teflon PTFE | PEEK | Polyimide | FKM | Buna-N | EPDM |
| Acetylene | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 1 | 1 | 1 |
| Ammonia | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 4 | 3 | 3 | 2 | 1 |
| Argon | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Argon/Methane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| Arsine | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 1 | 4 | 1 |
| Boron Trichloride | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 4 | 4 | 4 | 3 | 4 |
| Boron Trifluoride | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 4 | 4 | 4 | 3 | 4 |
| N-Butane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 |
| Carbon Dioxide | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Carbon Monoxide | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 1 | 1 | 1 |
| Chlorine | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 4 | 2 | 1 | 3 | 1 |
| Deuterium | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 |
| Diborane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 4 |
| Ethane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| Ethylene | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| Fluorine | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 |
| Hydrogen | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Hydrogen Chloride | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 4 | 2 | 2 | 3 | 1 |
| Hydrogen Flouride | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 4 | 4 | 4 | 3 | 1 |
| Hydrogen Sulphide | 3 | 3 | 3 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 1 | 4 | 1 |
| Hydrogen Lodide | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Helium | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Hexafluoro Ethane | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 4 | 4 | 4 | 4 |

| Material / Media | Metals | | | | | | Plastics | | | | Elastomers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Copper | Brass | Aluminum | SS | Hastelloy C 22 | Monel | PCTFE | Teflon PTFE | PEEK | Polyimide | FKM | Buna-N | EPDM |
| Isobutene | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| Isobutane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| Krypton | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 |
| Methane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| Methyl Chloride | 4 | 4 | 3 | 1 | 1 | 4 | 4 | 1 | 4 | 4 | 1 | 3 | 3 |
| Methyl Mercaptan | 3 | 2 | 1 | 1 | 4 | 4 | 1 | 1 | 4 | 4 | 4 | 4 | 4 |
| Neon | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Nitrogen | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Nitrous Oxide | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 |
| Nitrogen Dioxide | 4 | 2 | 2 | 1 | 4 | 2 | 1 | 1 | 4 | 4 | 4 | 4 | 4 |
| Nitrogen Trifluoride | 2 | 4 | 4 | 2 | 4 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Nitrogen Monoxide | 3 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 4 | 4 | 4 | 4 | 4 |
| Phosphine | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 2 | 4 | 1 |
| Propane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| Propylene | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 |
| Oxygen | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Sulphur Dioxide | 2 | 2 | 2 | 1 | 1 | 4 | 1 | 1 | 4 | 4 | 3 | 3 | 1 |
| Sulphur Hexafluoride | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Silane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 1 | 4 | 4 |
| Synthetic Air | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Tetrafluoro Methane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 1 | 4 | 4 |
| Trifluoro Methane R23 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 |
| Xenon | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

# Ordering Details for Specialty Gas Application



**Company** _____

**Name** _____

**Tel** _____

**E-mail** _____

**Application Information**

Gas _____ Chemical formula _____ Purity _____

Upstream pressure _____ psig, _____ bar, _____ Mpa

Downstream pressure range _____ psig, _____ bar, _____ Mpa

Temperature _____°C _____°F Cv or flow rate _____

Application _____

_____

**Pressure Regulator Data**

Single-stage ☐ Dual-stage ☐

Material (mostly gas type dependent): Stainless Steel ☐ Brass ☐ Hastelloy ☐

◎ Cylinder pressure regulator ☐

Cylinder connection Yes ☐ No ☐

Purge unit Yes ☐ No ☐

◎ Panel and line pressure regulator ☐

2 ports ☐ 3 ports ☐ 4 ports ☐

◎ Pressure control panel ☐

Purge unit Yes ☐ No ☐

◎ Changeover system ☐

With line regulator Yes ☐ No ☐

◎ Point-of-use panel ☐