GO REGULATOR, INC.

Technical Reference Material

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CRANE

CRANE Instrumentation & Sampling, Go Regulator
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For Your Safety

It is solely the responsibility of the system designer and user to select products suitable for their specific application requirements and to ensure proper installation, operation, and maintenance of these products. When selecting products, the total system design must be considered to ensure safe, trouble-free performance. Material compatibility, product ratings and application details should be considered in the selection. Improper selection or use of products described herein can cause personal injury or property damage.

Contact your authorized GO Regulator sales and service representative for information about additional sizes and special alloys.

SAFETY WARNING:

GO Regulator products are designed for installation only by professional suitably qualified licensed system installers experienced in the applications and environments for which the products are intended. These products are intended for integration into a system. Where these products are to be used with flammable or hazardous media, precautions must be taken by the system designer and installer to ensure the safety of persons and property. Flammable or hazardous media pose risks associated with fire or explosion, as well as burning, poisoning or other injury or death to persons and/or destruction of property. The system designer and installer must provide for the capture and control of such substances from any vents in the product(s). The system installer must not permit any leakage or uncontrolled escape of hazardous or flammable substances. The system operator must be trained to follow appropriate precautions and must inspect and maintain the system and its components including the product(s) and at regular intervals in accordance with timescales recommended by the supplier to prevent unacceptable wear or failure.

GO REGULATOR, INC.

Mass Spectrometer Helium Leak Certification

Mass spectrometer helium leak certification is available on all products manufactured by GO Regulator. With this service, we can provide test certification up to 2×10^{-10} standard cc/sec helium. The choice of inboard or outboard testing is also available.

When requesting test certification, specify the desired leak specification and whether inboard or outboard testing is to be performed.

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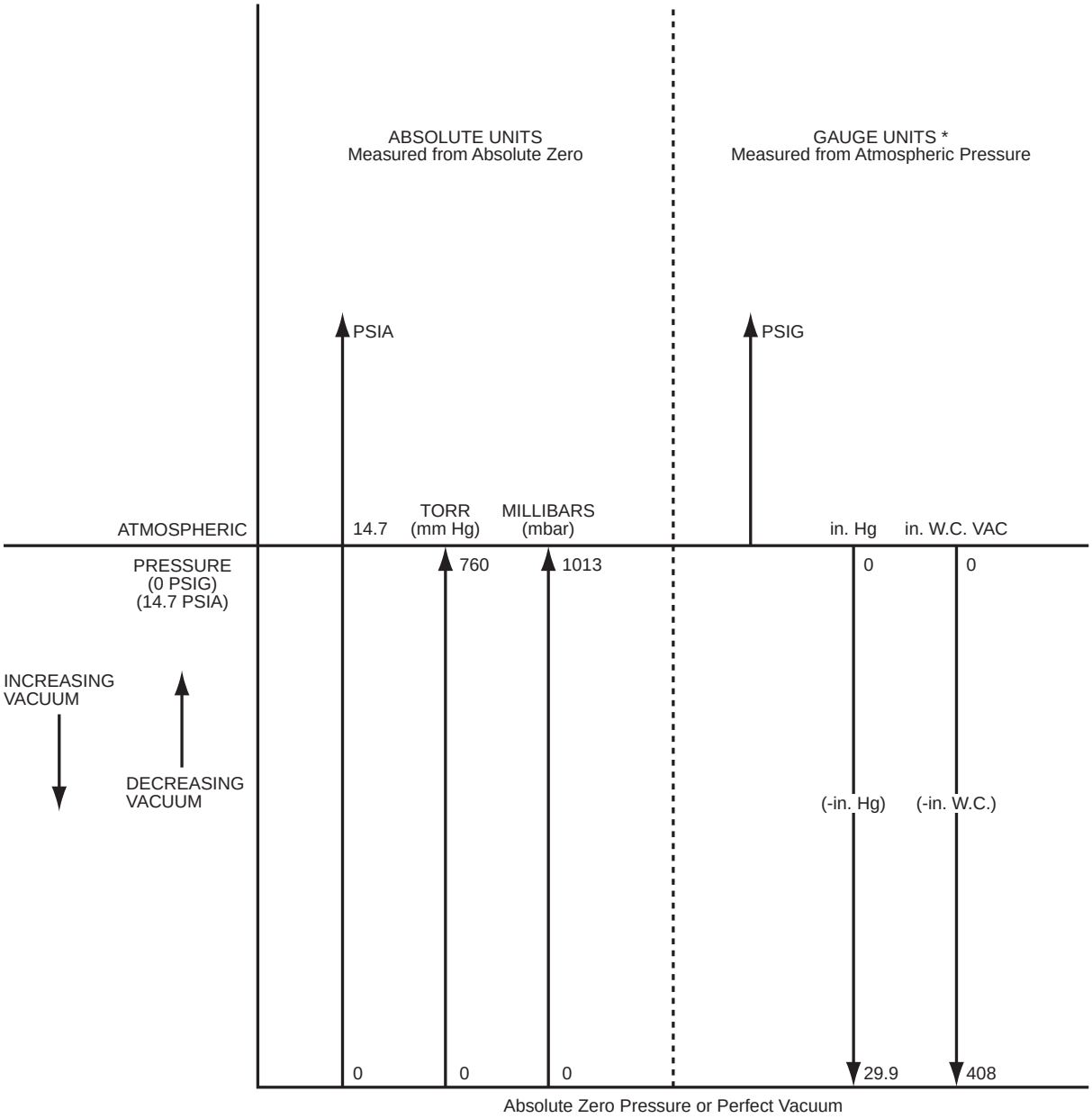
Subatmospheric Units of Measure



* Gauge unit values are shown as minus (-) values.
This minus sign is not used in normal industry practice

technical data

Flow Calculations for GO Regulator Products

Formulas and Examples

Liquid Flow Formulas: $C_v = \frac{Q_L\sqrt{S_L}}{\sqrt{\Delta P}} \therefore Q_L = \frac{C_v\sqrt{\Delta P}}{\sqrt{S_L}}$

Example: Determine liquid flow (assume water) through a regulator in gallons per minute with the following conditions:

Given:

P_1 = 1000 psia

P_2 = 600 psia

S_L = 1.0

C_v = 0.8

Q_L = $\frac{C_v\sqrt{\Delta P}}{\sqrt{S_L}} = \frac{0.8\sqrt{1000-600}}{\sqrt{1}} = \frac{0.8\times 20}{1} =$ **16 GPM (Water)**

Gaseous Flow Formulas: a $C_v = \frac{Q_g\times 2\sqrt{S_g}}{P_1}$ b $C_v = \frac{Q_g\sqrt{S_g}}{\sqrt{\Delta P\times P_1}}$

Example: Determine C_v required for a regulator when inlet pressure (P_1) is equal or greater than two times outlet pressure (P_2) and the following items are known:

Given:

P_1 = 1000 psia

P_2 = 400 psia

Q_g = 400 SCFM

S_g = 1.0 (assume air in this example)

C_v = $\frac{Q_g\times 2\sqrt{S_g}}{P_1} = \frac{400\times 2}{1000} =$ **0.8 C_v**

* **Caution:** When sizing components for flow applications, attention must also be directed to the size of the plumbing. When flow requirements are at low pressures, the plumbing may be the flow limiting item rather than the regulator or valve.

Flow Calculations for GO Regulator Products

Definitions:

C_v: Flow coefficient for regulators and valves that expresses flow capabilities of a unit at full open condition. For liquids, this coefficient is defined as the flow of water at 60° F in gallons per minute at a pressure drop of one psig. For gases, this coefficient is defined as the flow of air at standard conditions in standard cubic feet per minute for each psig of inlet pressure.

S_L: Specific gravity of liquids relative to water, both at standard temperature of 60° F. (Specific gravity of water = 1.0 @ 60° F).

S_g: Specific gravity of a gas relative to air; equals the ratio of the molecular weight of the gas to that of air. (Specific gravity of air = 1.0 @ 60° F).

P: Line pressure (psia).

P_1: Inlet pressure expressed in psia.

P_2: Outlet pressure expressed in psia.

DP: Differential pressure ($P_1 - P_2$).

psia: Absolute pressure which is gauge pressure (PSIG) plus 14.7 (atmospheric pressure).

Q_L: Liquid flow in gallons per minute (GPM).

Q_g: Gas flow in standard cubic feet per minute (SCFM). (At standard conditions of 60° F and 14.7 psia).

Q: Volume flow rate in cubic feet per minute (CFM).

M: Mass flow rate in pounds per minute (lbs/min.).

CGA Connection Chart

CYLINDER GAS TYPE	CHEMICAL SYMBOL	CGA CONNECTION	
		STANDARD	ALTERNATIVE
Acetylene	C_2H_2	510	300
Air	—	590	346
Allene	CH_2:C:CH_2	510	
Ammonia anydrous	NH_3	240	705
Ammonia (VHP)	—	660	
Antimony pentafluoride	SbF_5	330	
Argon	Ar	580	
Argon (research grade)	—	590	
Arsine	AsH_3	350	660
Boron trichloride	BCl_3	660	330
Boron trifluoride	BF_3	330	
Bromine pentafluoride	BrF_5	670	
Bromine trifluoride	BrF_3	670	
Bromoacetone	$BrCH_2COCH_3$	330	660
Bromochlorodifluoromethane	$CBrClF_2$	668	660
Bromochloromethane	CH_2BrCl	668	660
Bromotrifluoroethylene	$BrFC:CF_2$	510	660
Bromotrifluoromethane	$CBrF_3$	668	320, 660
1, 3–butadiene	CH_2:CHCH:CH_2	510	
Butane	$CH_3CH_2CH_2CH_3$	510	
Butenes	CH_3CH_2CH:CH_2	510	
Carbon dioxide	CO_2	320	
Carbon monoxide	CO	350	
Carbonyl fluoride	COF_2	660	750
Carbonyl sulfide	COS	330	
Chlorine	Cl_2	660	
Chlorine pentafluoride	ClF_5	670	
Chlorine trifluoride	ClF_3	670	
Chlorodifluoroethane	CH_3CClF_2	510	660
Chlorodifluoromethane	$CHClF_2$	660	668
Chlorofluoromethane	CH2ClF	510	
Chloroheptafluorocyclobutane	C_4F_7Cl	660	668
Chloropentafluoroethane	C_2ClF_5	668	660
Chlorotrifluoromethane	$CClF_3$	668	320, 660
Cyanogen	C_2N_2	750	660
Cyanogon chloride	CNCl	750	660
Cyclobutane	C_4H_8	510	
Cyclopropane	C_3H_6	510	
Deuterium	D_2	350	
Deuterium chloride	DCl	330	
Deuterium fluoride	DF	330	
Deuterium selanide	D_2Se	350	330
Deuterium sulfide	D_2S	330	
Diborane	B_2H_6	350	
Dibromodifluoroethane	$C_2H_2Br_2F_2$	668	660
Dibormodifluoromethane	CBr_2F_2	668	660
1, 1–difluoroethylene	FCH:CHF	320	
Dichlorosilane	H_2SiCl_2	330	510
Diethylzinc	$(C_2H_5)_2Zn$	750	
Dimethylamine	$(CH_3)_2NH$	705	240
Dimethyl ether	CH_3OCH_3	510	
2, 2–dimethylpropane	$C(CH_3)_4$	510	
Diphosgene	$ClCO_2CCl_3$	750	660
Ethane	C_2H_6	350	

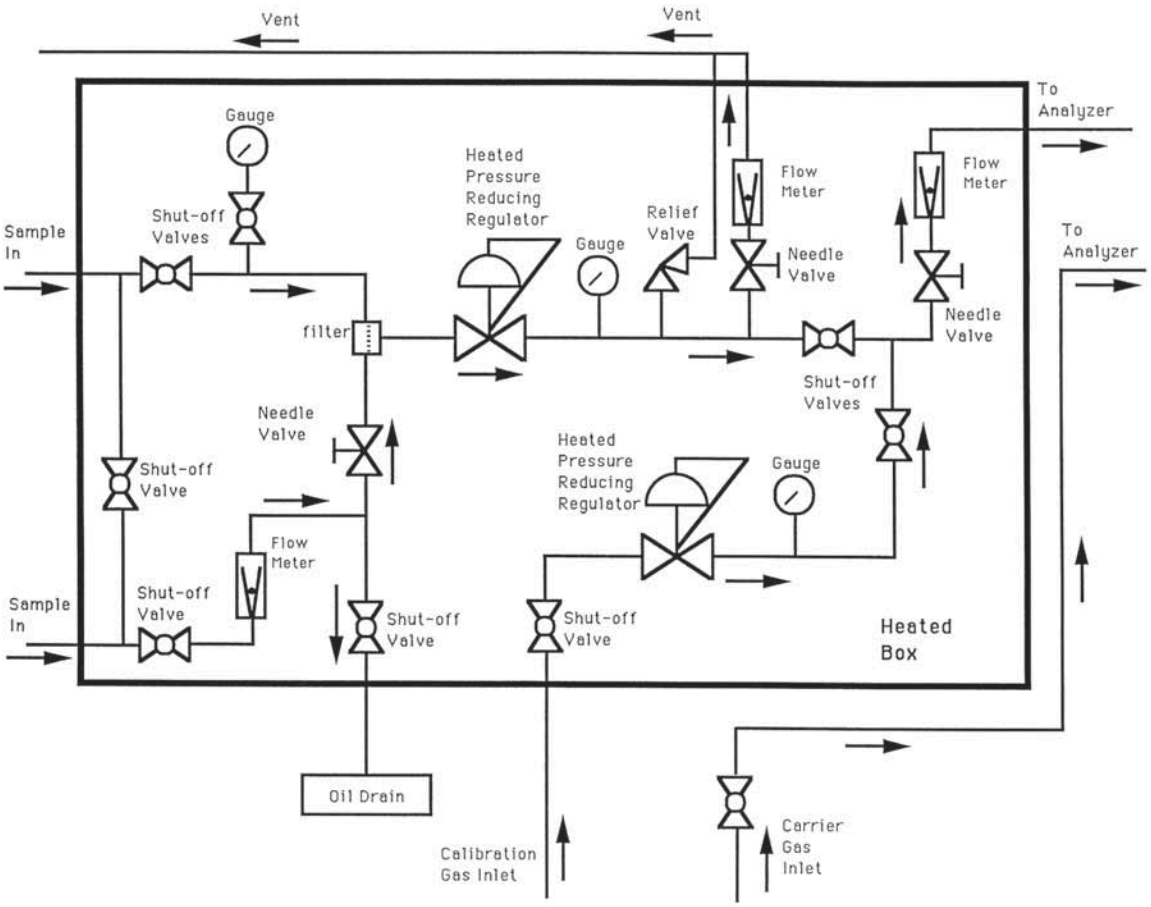
CGA Connection Chart

Ethane (research grade)	—	350	
Ethylacetylene	$CH_3CH_2C{:}CH$	510	
Ethylchloide	CH3CH2Cl	510	300
Ethyldichloroarsine	$C_2H_5AsCl_2$	750	660
Ethylene	$CH_2{:}CH_2$	350	
Ethylene oxide	C_2H_4O	510	
Ethyl ether	$(C_2H_5)_2O$	510	
Ethyl fluoride	C_2H_5F	750	660
Fluorine	F_2	679	670
Freon® 12 (dichlorodifluoromethane)	$CCl2F_2$	660	
Freon® 13 (chlorotrifluoromethane)	$CClF_3$	320	
Freon® 1381 (bromotrifluoromethane)	$CBrF_3$	320	
Freon® 14 (tetrafluoromethane)	CF_4	320	
Freon® 22 (chlorodifluoromethane)	$CHClF_2$	660	620
Freon® 114 (1, 2–dichlorotetrafluorethane)	ClF_2CClF_2	660	
Freon® 116 (hexafluoroethane)	C_2F_6	320	
Freon® C318 (octafluorocyclobutane)	C_4F_8	660	
Genetron® 21 (dichlorofluoromethane)	$CHCl_2F$	660	
Genetron® 23 (fluoroform)	CHF_3	320	
Genetron® 115 (monochloropentafluoroethane)	BrF_2CCF_3	660	
Genetron® 152A (1, 1–difluoroethane)	FCH_2CH_2F	660	
Germane	GeH_4	660	750
Helium	He	580	677
Heptafluorobutyronitrile	C_4F_2N	750	660
Hexafluoroacetone	C_3F_8O	660	330
Hexafluorocyclobutene	C_4F6	750	660
Hexafluorodimethyl peroxide	CF_3OOCF_3	755	660
Hexafluoroethane	C_2F_8	660	668
Hexafluoropropylene	$CF_3CF{:}CF_2$	668	660
Hydrogen	H_2	350	
Hydrogen bromide	HBr	330	
Hydrogen chloride	HCl	330	
Hydrogen cyanide	HCN	750	160
Hydrogen fluoride	HF	330	660
Hydrogen iodide	HI	330	660
Hydrogen selenide	H_2Se	350	660
Hydrogen sulfide	H_2S	330	
Iodine pentafluoride	IF_5	670	
Isobutane	C_4H_{10}	510	
Isobutylene	C_4H_8	510	
Krypton (research grade)	Kr	590	
“Manufactured gas B”	—	350	
“Manufactured gas C”	—	350	
Lewisite	$ClCH{:}CHAsCl_2$	750	660
Methane	CH_4	350	
Methylacetylene	$CH_3C{:}CH$	510	
Methyl bromide	CHBr	320	660
3–methyl 1–butene	$(CH_3)_2CHCH{:}CH_2$	510	
Methyl chloride	CH_3Cl	660	510
Methyldichloroarsine	CH_2AsCl_2	750	
Methylene fluoride	CH_2F_2	320	
Mehtylethylether	$CH_3OC_2H_5$	510	
Methyl fluoride	CH_3F	350	
Methyl formate	$HCOOCH_3$	510	660
Methyl mercaptan	CH_2SH	330	750
Monoethylamine	$CH_3CH_2NH_2$	240	705
Monomethylamine	CH_3NH_2	240	705
Mustard gas	$S(C_2H_4Cl)_2$	750	350
Natural gas	—	350	677
Neon	Ne	590	580
Nickel carbonyl	$Ni(CO)_4$	320	750
Nitric oxide	NO	660	750, 160
Nitrogen	N_2	580	
Nitrogen (research grade)	—	590	
Nitrogen dioxide	NO_2	660	160
Nitrogen trifluoride	NF_3	679	
Nitrogen trioxide	N_2O_3	660	160
Nitrosyl chloride	NOCl	660	330
Nitrosyl fluoride	NOF	330	
Nitrous oxide	N_2O	326	
Nitryl fluoride	NO_2F	330	
Octafluorocyclobutane	C_4F_8	660	668

CGA Connection Chart

Octafluoropropane	C_3F_8	660	668
Oxygen	O_2	540	
Oxygen difluoride	OF_2	679	
Ozone	O_3	660	755
Pentaborane	B_5H_9	660	750
Pentachlorofluoroethane	CCl_3CCl_2F	668	660
Pentafluoroethane	CF_3CHF_2	668	660
Pentafluoroethyl iodide	CF_3CF_2I	668	660
Pentafluoropropionitrile	CF_3CF_2CN	750	660
Perchloryl fluoride	ClO_3F	670	
Perfluorobutane	C_4F_{10}	668	
Perfluorobutene–2	C_4F_8	660	
Phenylcarbylamine chloride	$C_6H_5N:CCl_2$	330	660
Phosgene	$COCl_2$	660	
Phosphine	PH_3	660	350
Perfluoropropane	—	660	
Phosphorous pentafluoride	PF_5	330	
Phosphorous trifluoride	PF_3	330	
Propane	C_3H_8	510	
Propylene	C_3H_6	510	
Silane	SiH_4	350	510
Silicone tetrafluoride	SiF_4	330	
Stibine	SbH_3	350	
Sulfur dioxide	SO_2	660	668
Sulfur hexafluoride	SF_6	590	668
Sulfur tetrafluoride	SF_4	330	
Sulfuryl fluoride	SO_2F_2	660	330
1, 1, 1, 2–tetrachlorodifluoroethane	$C_2Cl_4F_2$	668	660
1, 1, 2, 2–tetrafluorochloroethane–1	C_2HClF_4	668	660
Tetrafluoroethylene	C_2F_4	350	660
Tetrafluorohydrazine	N_2F_4	679	
Tetrafluoromethane	CF_4	580	320
Tetramethyllead	$(CH_3)_4Pb$	750	350
Trichlorofluoromethane	CCl_3F	668	660
Trichlorotrifluoroethane	CF_3CCl_3	668	660
Triethylaluminum	$(C_2H_5)_3Al$	750	350
Triethylborane	$(C_2H_5)_3B$	750	350
Trifluoroacetonitrile	CF_2CN	750	350
Trifluoroacetyl chloride	CF_3COCl	330	
1, 1, 1–trifluoroethane	CH_3CF_3	510	
Trifluoroethylene	C_2F_3H	510	
Trifluoromethyl hypofluorite	CF_3OF	679	
Trifluoromethyl iodide	CF_3I	668	660
Trimethylamine	$(CH_3)_3N$	240	705
Trimethylstibine	$(CH_3)_3Sb$	750	350
Tungsten hexafluoride	WF_6	330	670
Uranium hexafluoride	UF_6	330	
Vinyl bromide	C_2H_3Br	290	510
Vinyl chloride	C_2H_3Cl	290	510
Vinyl fluoride	C_2H_3F	320	350
Vinyl methyl ether	$C_2H_3OCH_3$	290	510
Xenon	Xe	580	677
Xenon (research grade)	—	590	

Typical Pressure Regulator Applications



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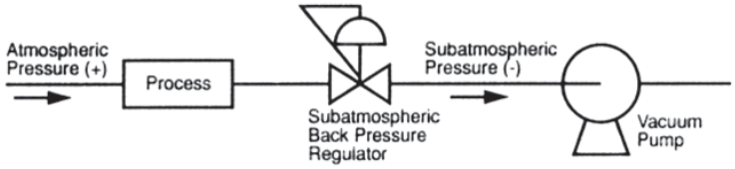
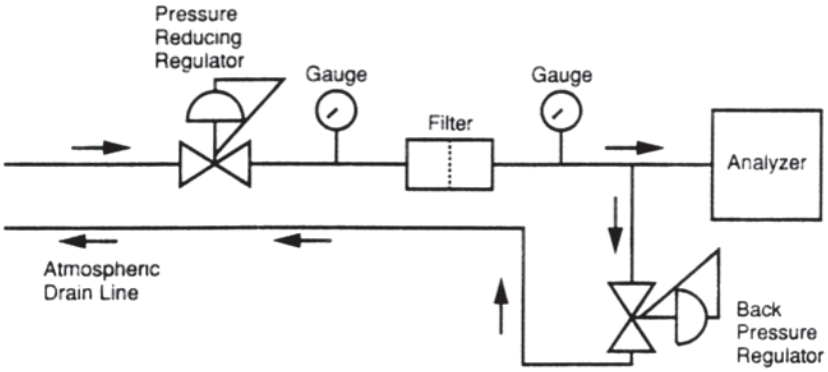
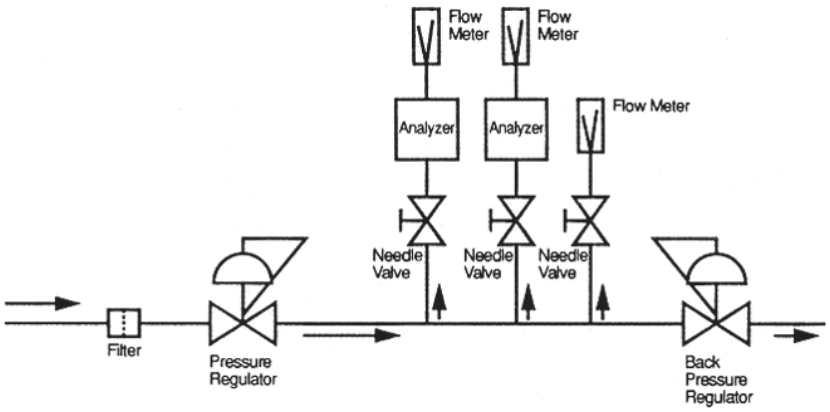
Typical Pressure Regulator Applications







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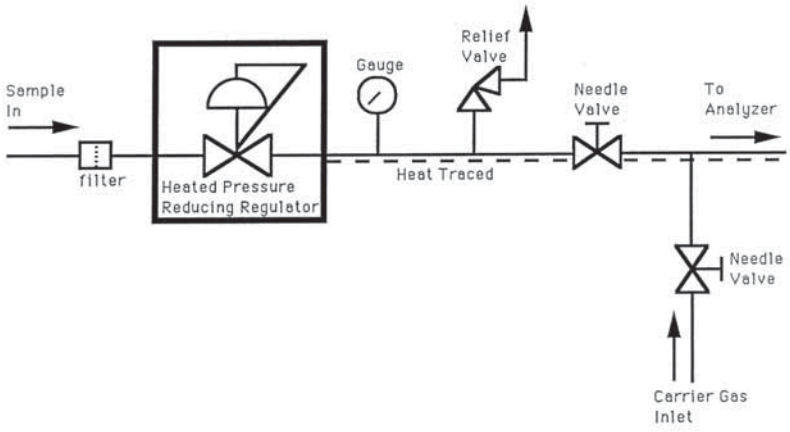

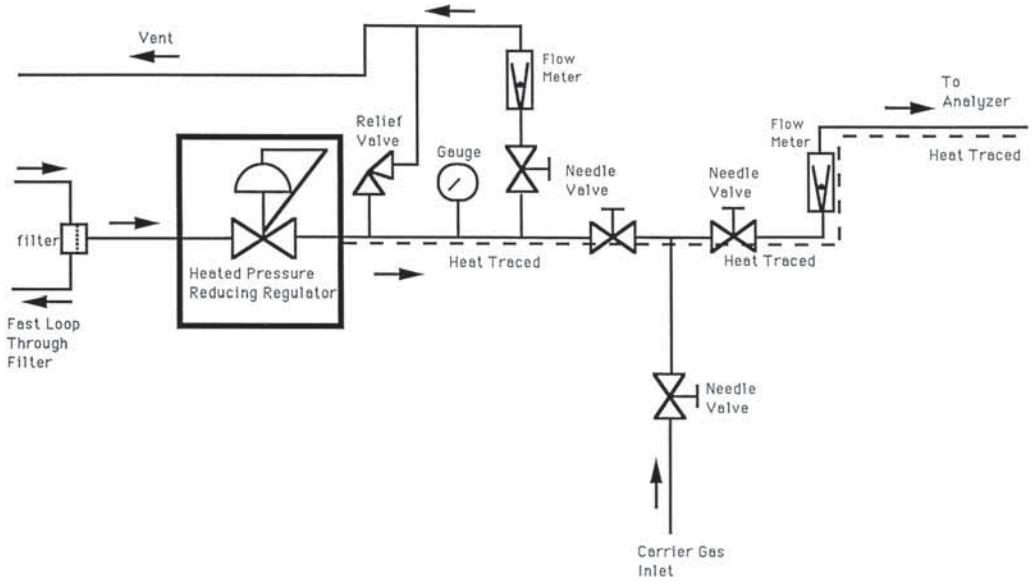

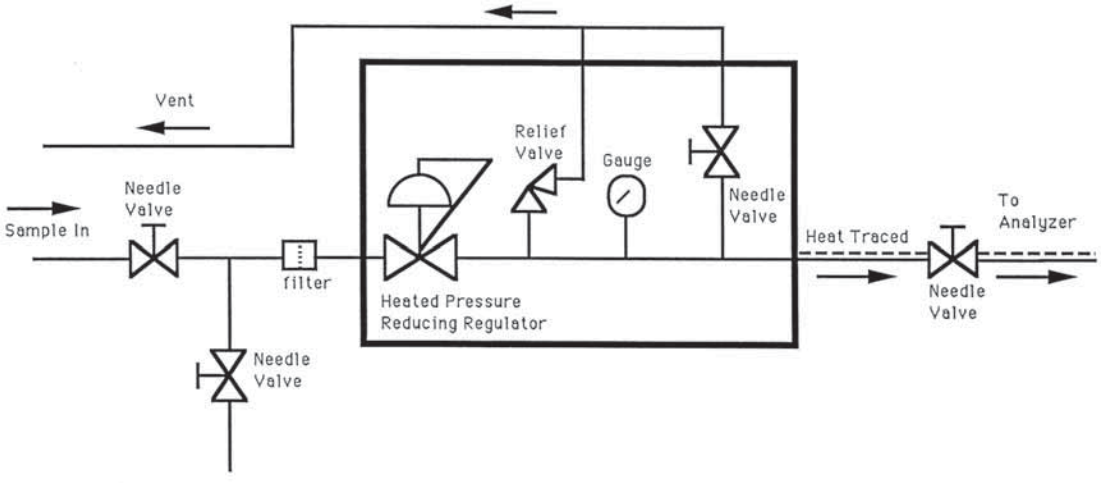

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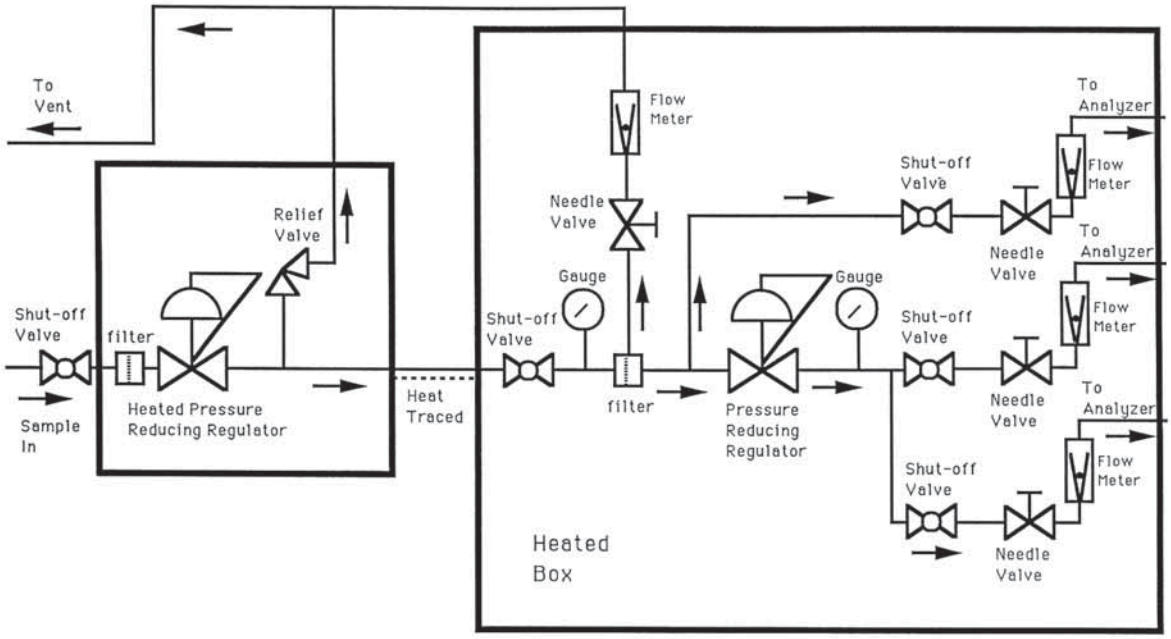

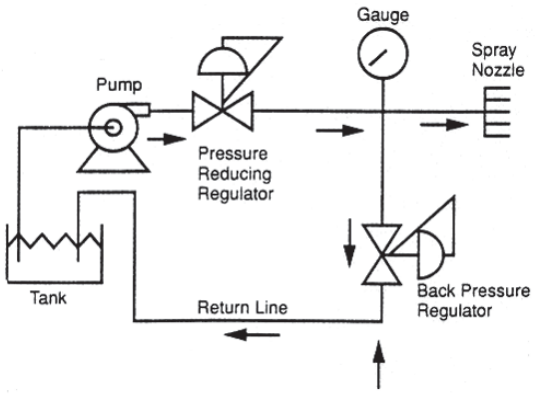

Notes

GO REGULATOR, INC.

The Small Bore Instrumentation Specialists

We specialize in small bore instrumentation products up to 2" that deliver benchmark performance quality & safety; provide the broadest array of superior alloy offerings in the market; decades of proven success in a wide range of industries; a roster of "who's who" customers & projects globally; original "Best Solution" engineering & designs; and are focused on continuous improvement in all aspects of our business.

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