

Es. H₂ è più leggera dell'aria, perciò se in un flusso medio dell'aria facciamo passare H₂ la lettura che facciamo va moltiplicata per $\frac{1}{0.07} = \frac{1}{0.07} \approx 14$

FLUSSOMETRO

Specific gravities of gases commonly used in heat treating

Gas that meter is calibrated for (SG ₁), or is used for (SG ₂)	Specific gravity, SG
Air	1.00
Acetylene (C ₂ H ₂)	0.907
Ammonia (NH ₃)	0.59
Dissociated ammonia	0.295
Argon (Ar)	1.38
Butane (C ₄ H ₁₀)	2.02
Carbon dioxide (CO ₂)	1.529
City gas	0.59
Endothermic, cracked	0.59
Exothermic, cracked (lean)	1.00
Exothermic, cracked (rich)	0.85
Forming gas (95% N ₂ -5% H ₂)	0.927
Forming gas (90% N ₂ -10% H ₂)	0.87
Helium (He)	0.138
Hydrogen (H ₂)	0.0695
Natural gas (CH ₄)	0.65
Nitrogen (N ₂)	0.96
Oxygen (O ₂)	1.105
Propane (C ₃ H ₈)	1.522

Courtesy Waukeet Engineering Co. Inc., Milwaukee (www.waukeetmeters.com)

to calculate the actual flow when another gas is being metered:

$$Fa = Fi \times \sqrt{\frac{SG_1}{SG_2}} = Fi \cdot \sqrt{\frac{MW_1}{MW_2}}$$

where Fa = actual flow, Fi = flow indicated by the scale reading on the flowmeter, SG₁ = specific gravity of the "nameplate" gas (the gas the meter is calibrated for), and SG₂ = specific gravity of the gas to be used in the flowmeter. Specific gravities of many of the gases commonly used in heat treating are listed in the table.

Do I need to maintain my flow devices? All flowmeters eventually require maintenance. It is a sad truth that some units require more maintenance than others, so this factor should be considered when a unit is selected. However, in most heat treating operations, the equipment manufacturer has already made that choice for you, so understanding what maintenance is required and when it should be performed is of paramount importance.

Flowmeters have moving parts and require internal inspection, especially if the fluid is dirty or viscous. For example, in furnaces using endothermic gas, flowmeters often become contaminated with carbon (soot) and must be cleaned. The flowmeter must be disassembled, all internal moving parts cleaned, and dirty fluid in the flowmeter tube replaced. *Caution:* This involves isolating the flowmeter, or waiting until the unit is shut down.

Note that maintenance must be performed in a safe manner, as many of the gases involved are asphyxiants as well as being flammable, toxic, and life threatening.

MW indicator height

Remember, too, that all flow measurement devices that use secondary instruments such as pressure sensors to actuate a control valve or send a signal to a remote source must be periodically inspected, calibrated, repaired, and/or replaced. Improper location of the flowmeter itself, the secondary sensor, or readout devices can result in measurement errors and hidden costs.

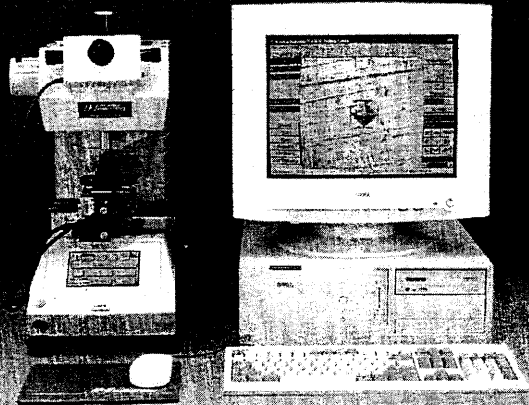
Do I really need to learn about my flowmeters to be in control, stay in control, operate safely, and keep the cost of my operation as low as possible? Simply stated, "Yes." Hopefully, this discussion has helped reinforce this idea. Now go and check your flow devices! **HTP**

References

- North American Combustion Handbook, 2nd Ed.: North American Mfg. Co., Cleveland, Ohio, 1978.
- Private Correspondence: Vytas Brazunas, Automation Intelligence LLC, Milwaukee, Wis.

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