Bio Gas APPLICATION

Golden Rules Co.,Ltd

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Difference Between Mass Flow Rate and Volume Flow Rate

The nation's development item, 100% domestic goods,Patent **NO.** 10-1606497

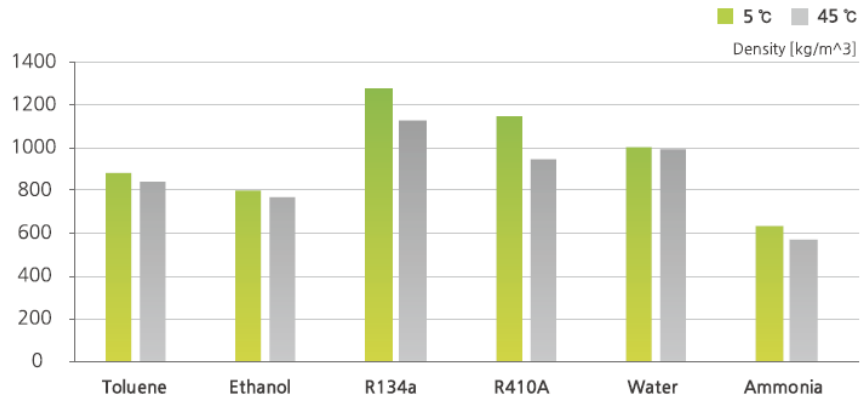
1. What is the difference between mass flow rate and volume flow rate?

Why Mass Flowmeter?

All fluids, including gases and liquids, contract and expand when temperature and pressure change. In particular, since gas is a compressible fluid and its density changes according to temperature and pressure when it flows inside the pipe, it is necessary to measure the flow rate considering the density. The flow rate per unit time considering the density is called the mass flow rate, and the flow rate excluding the density is called the volume flow rate. In short, volume flow (m3/s) is the apparent flow and mass flow (kg/s) is the actual flow.

Change in volume (volume) for the same mass due to temperature and pressure changes

In the liquid state, a change in temperature causes a change in volume rather than an effect of pressure. For hydrocarbons or refrigerants, this effect is noticeable. When refueling with gasoline or diesel, it will be more economical than hot hours in the middle of the day when the temperature is cold. For diesel, the volume difference between summer and winter is about 4%



In the gaseous state, the volume change easily occurs due to slight temperature and pressure changes, so it is necessary to measure the mass to remove the environmental change factor of the flow rate. In other words, it is necessary to measure the mass flow rate so that it does not fall into the apparent flow rate. The way to solve this problem is to reflect the density reflecting the compression coefficient of the gas in the flow calculation formula. Looking at the equation below, Z is the compression coefficient, and it forms a complex function.

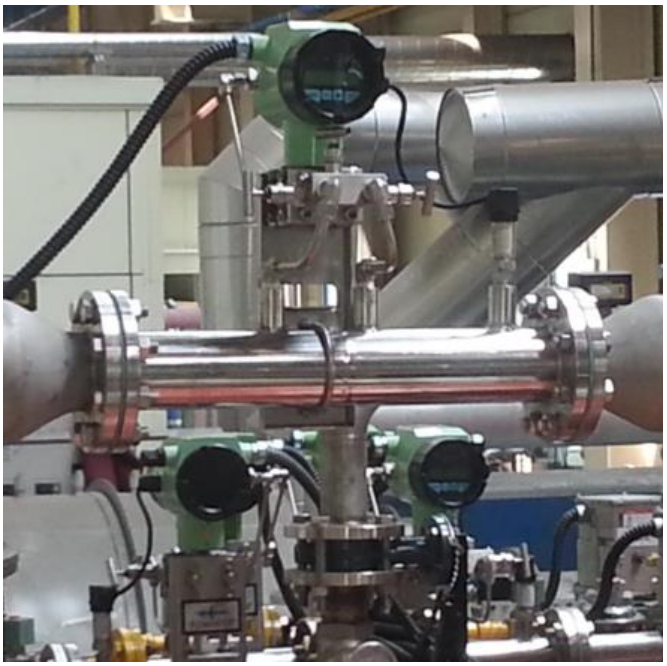
1. What is the difference between mass flow rate and volume flow rate?

Why Mass Flowmeter?

Term	Real gas	Perfect gas
Equation of state	$pV = ZRT$	$pV = RT$
Compressibility factor	Z	$Z = 1$
Isothermal deviation factor	$Y = \frac{p}{V}\left(\frac{\partial V}{\partial p}\right)_T = 1 - \frac{p}{Z}\left(\frac{\partial Z}{\partial p}\right)_T$	$Y = 1$
Isobaric deviation factor	$X = \frac{T}{V}\left(\frac{\partial V}{\partial T}\right)_p = 1 - \frac{T}{Z}\left(\frac{\partial Z}{\partial T}\right)_p$	$X = 0$

Comparison of equations of state between real gas and ideal gas according to compression coefficient (Z)

Among the methods of measuring mass flow, there are Coriolis and thermal flow meters, but the most reliable method is the hydrodynamic method that has been proven in the past. Differential pressure type flowmeters using clamping mechanisms (orifices, flow nozzles) were very complicated to obtain the mass flow rate by applying the density reflecting the compression coefficient (Z), but the FN mass flowmeter of Golden Rule Co., Ltd. By applying the density to the flow function, the mass flow rate of various gases can be measured. This unique technology has been registered as a new technology certification (NET) by the Korean Agency for Technology and Standards, and we manufacture flowmeters equipped with this technology.



FN mass flow meter installed at Korea Institute of Machinery and Materials

The amount of energy is calculated by measuring the flow rate of biogas as a mass flow rate, and the amount of biogas in a sewage treatment plant can be measured with the FN mass flow meter that replaces the inaccuracy of the existing thermal mass flow meter.

FN mass flow meter for biogas delivered to a domestic sewage treatment plant

Both vehicle charging of natural gas and the amount of gas at home are calculated in energy units (Joule) to calculate the price, and this can be done by measuring the mass flow.

The amount of hydrogen charged in a hydrogen vehicle must also be expressed in terms of mass flow to calculate the amount of electricity produced according to the amount of hydrogen to derive fuel economy. If the lightest hydrogen charge is applied by volume, the hydrogen car will most likely stop due to lack of fuel while driving.

Mass flow will be applied to most of our real life in the future. This means the development of measurement technology, and it is a technology that enables real-time energy management through smart metering and measurement.

Golden Rules

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Mass Flowmeter

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