Leak Detection Systems

LEAK RATE DEFINITION

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LEAK RATE

Leak rate is affected by the pressure difference (inlet vs outlet), the type of gas that is leaking and the flow charateristics of the leak path. In terms of units, a leak rate can be defined in different ways, but if the SI units are used, then this is expressed in mbar litre/second.

1 mbar litre/sec is the amount of gas necessary to be removed from a 1 litre container in 1 second to reduce the pressure by 1mbar.

More generally, the gas flow produced by a leak in a container can be defined as follows:

$$Q = V \frac{\Delta p}{\Delta t}$$

Where Δp is the difference between the internal pressure and the external pressure, Δt is the time, and V is the volume of the container itself.

The units can be changed using specific conversion factors.

Example: What is the leak rate for a 22cm diameter football with the following characteristics?

- P1 1.9 BarA
- P2 1.0 Bar A
- ΔP 0.9 Bar + 900mbar
- V 5.575 litres
- ΔT 3.600*24*30 = 2,592,00 secs

Q = (900 * 5.575) / 2592000
Q = 1.94E-03 mbarl/s

ΔT = (ΔP * V) / Q)
ΔT = (900 * 5.575) / 1.935E-6
ΔT = 2593023256 secs
ΔT = 30011.84 days
ΔT = 82.22 years

Among the handful of experts, VES has earned a reputation for its substantial experience in a number of sectors, having delivered helium leak detection systems to many of the world's largest manufacturers for over three decades.

DIFFERENT LEAK RATES FOR DIFFERENT GASES

Different gases have different values of viscosity; therefore the leak rate from an orifice of given geometry in the unit of time will be different if the leaking gas is helium or hydrogen for example.

In laminar flow conditions, the equation linking leak rates of different gases is the following:

$$Q_1 = \frac{\eta_1}{\eta_2} Q_2$$

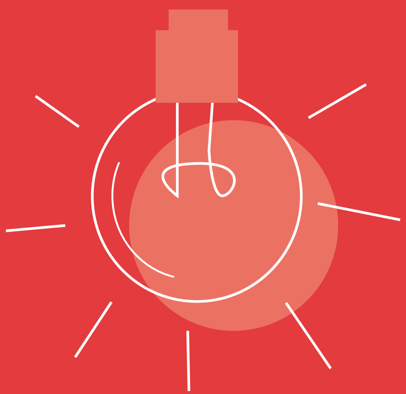
In molecular flow conditions, instead the equation is:

$$Q_1 = \sqrt{\frac{\eta_1}{\eta_2}} Q_2$$

Where Q represents the leak rate of the two gases, and η is the relative viscosity.

Note: Sometimes leak rates are defined in atm cc/sec.
The relationship between atm cc/sec and mbar litre/sec is the following:

1atm cc/sec = 1013mbar 0.001litres/sec = 1.013mbar litre/s



Interesting Fact

Everything that is manufactured leaks to some degree, so having no leak at all in a product is impossible. However it is possible to have different leak rates, which of course depend on the quality of the materials, the precision of the work/forming process carried out on the parts (welding, die-casting, etc.)
It is therefore important to define how small the maximum acceptable leak rate is for a product, any component with a bigger leak rate should be classified as a reject or sent to a rework station. A helium leak detection system is designed to give a measurement of the leak rate associated with a specific component, so that this can be classified as a 'pass' or 'fail'.

WHO ARE VES?

Vacuum Engineering Services are a specialist company offering customised leak test solutions to a variety of industries worldwide.

Formed in 1994, we offer unrivalled expertise in helium leak testing. We use our design and manufacturing expertise to provide bespoke leak detection systems that can be found across the world and are actively supported by our worldwide aftersales network.

Our leak test machines are used for guaranteeing leak tightness to very high levels and are used across the automotive, HVAC, fire safety, and nuclear industries. These machines are utilised on production lines in operation 24/7, where reliable results are vital.

For information on our leak test systems please don't hesitate and get in touch with us via the contact details below.

WHO USES VES?

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