

## Definition of Leak Rate (LR)

### Leak Rate according to DIN EN 1330-08

Leak rate is the throughput of p·V per unit of time of a certain fluid thru a leak under specified conditions:

$$q_L = \frac{\Delta (p \cdot V)}{\Delta t}$$

$q_L$ : leak rate	SI-unit: $Pa \cdot m^3/s$
$p$ : pressure	typical unit: $mbar \cdot l/s$
$V$ : volume	$1 Pa \cdot m^3/s = 10 mbar \cdot l/s$
$t$ : time	

### The specification of the following conditions is absolutely necessary!!!

$p_i$ : pressure inside (absolute)  
 $p_a$ : pressure outside (absolute)  
 Fluid: air, He (100%), water, ...  
 $T$ : temperature

### Why this definition?

The relation between volume and mass (number of molecules) for incompressible fluids (liquids) is clearly given by the density:

$$V = \frac{m}{\rho}$$

$V$ : volume
$m$ : mass
$\rho$ : density

For compressible fluids (gases) the volume is strongly depending on the pressure and the temperature by constant mass (number of molecules). Therefore a definition using the mass or the number of molecules is required. Using the gas equation this results in:

$$p \cdot V = N \cdot k_B \cdot T$$

oder

$$p \cdot V = m \cdot R \cdot T$$

$p$ : pressure
$V$ : volume
$N$ : number of molecules
$k_B$ : Boltzmann-constant
$m$ : mass of molecule
$R$ : gas constant
$T$ : temperature

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