Leak Rate-Nomogram

Leak rate formula

Using the leak rate formula, it is possible to estimate if the pressure loss due to the leakage is detectable with relative or differential pressure test devices. The formula can only be used under stable conditions, which are characterized by a time-dependent linear decrease in pressure loss.

$$\frac{dp}{dt}\left[\frac{Pa}{s}\right] = \frac{Q_L\,[ml/min]}{V[ml]} \bullet \frac{100.000\,Pa}{60\,s}$$

The time-dependent pressure loss **dp/dt** is directly proportional to the leak rate $\mathbf{Q_L}$ and inversely proportional to the effective test part volume **V**. The effective test part volume is the sum of test part volume, adaption volume, volume of the pneumatic line between test device and adaption, and internal volume of the measuring circuit of the test device.

Nomogram for graphical representation of leak rate formula

An adapted diagram is used to illustrate these dependences by means of nomograms. For this, we use the logarithmic application of pressure loss, which, compared to a linear representation, presents the advantage that a large range of values for time-dependent pressure loss can be represented in an easy-to-read way.

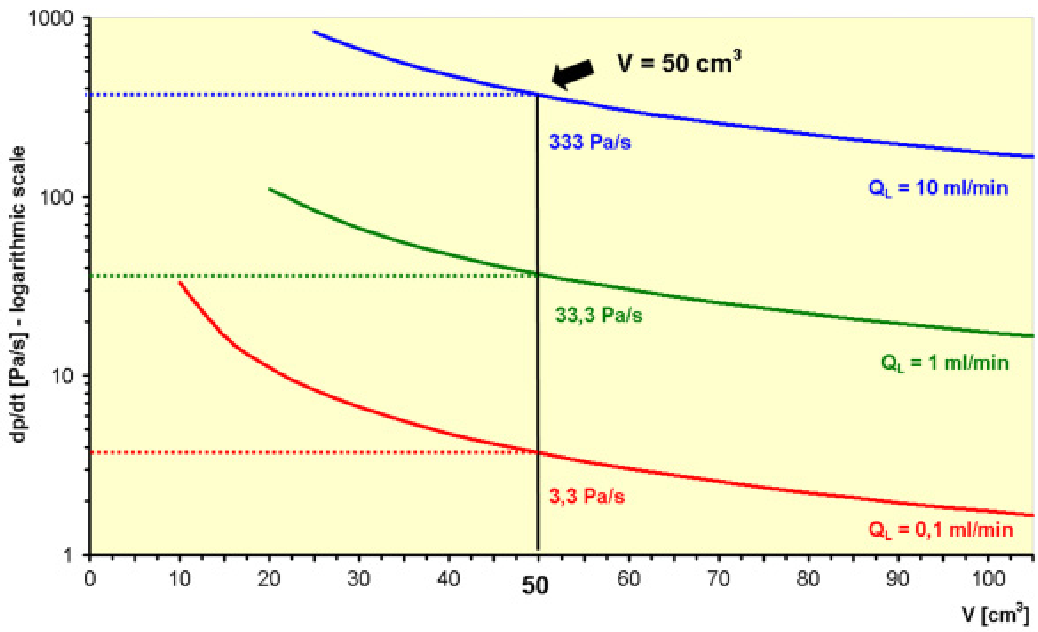

Diagram 1: Time-dependent pressure loss dp/dt (in logarithmic scale) against volume at different leak rates.

In this example, the diagram can be read as follows:

Volume V	**Leak rate Q_L**		**Time-dependent pressure loss dp/dt**
50 cm³	10 ml/min	0,16667 mbar*l/s	333 Pa/s
50 cm³	1,0 ml/min	0,01667 mbar*l/s	33,3 Pa /s
50 cm³	0,1 ml/min	0,00167 mbar*l/s	3,3 Pa/s

The leak rate is often given in the unit mbar'l/s. The conversion between these two units can be easily calculated: Q_L [ml/min] = Q_L [mbar*l/s] * 60.

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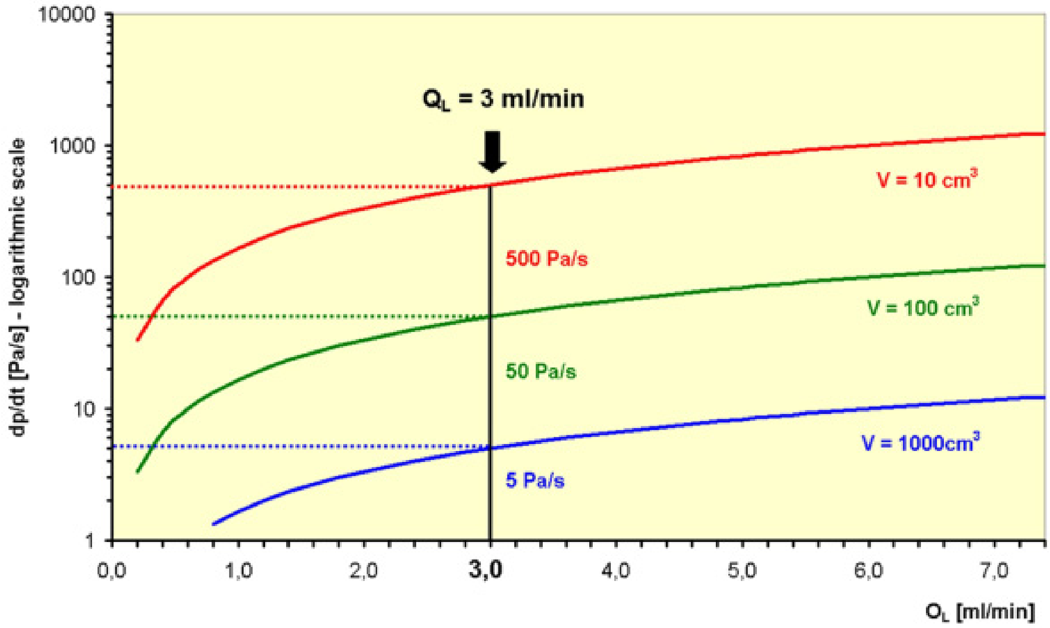

Diagram 2: Time-dependent pressure loss dp/dt (in logarithmic scale) against leak rate at different volumes.

In this example, the diagram is read as follows:

Leak rate Q_L		**Volume V**	**Time-dependent pressure loss dp/dt**
3,0 ml/min	***0,05 mbar*l/s***	10 cm^3	500 Pa/s
3,0 ml/min	***0,05 mbar*l/s***	100 cm^3	50 Pa /s
3,0 ml/min	***0,05 mbar*l/s***	1000 cm^3	5 Pa/s

Time-dependent pressure loss and choice of device

Typical application ranges of differential pressure leak detectors are characterized by time-dependent pressure loss values from 1 Pa/s < dp/dt < 75 Pa/s, whereas relative pressure leak detectors are used from dp/dt > 75 Pa/s. These are approximate values, which are used for a rough orientation. Further parameters for the selection of sensor technology are for example the parameters for cycle time and measuring equipment ability, in the form of the C_g value.

CETA-leak detectors

Differential pressure leak detector	CETATEST 810 with differential pressure sensor
	CETATEST 815 with differential pressure sensor
	CETATEST 510 with differential pressure sensor
Relative pressure leak detector	CETATEST 710 with relative pressure sensor

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