

Basic principles of vacuum technology, brief overview

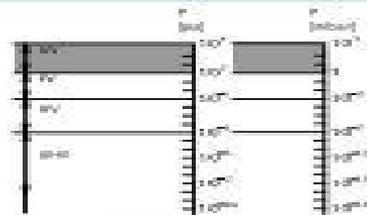
1 Introduction

Basic principles of vacuum technology

What is a vacuum?

A vacuum is a space entirely devoid of matter ("absolute vacuum"). In practice we talk about a vacuum when the air pressure in a space lies below atmospheric pressure.

Vacuum ranges



Units of measurement

There are a large number of national and international units of measurement. The most commonly used units are Pascal (Pa) and bar.

- 100 Pa = 1 hPa
- 1 hPa = 1 mbar
- 1 mbar = 0.001 bar

The vacuum level is often expressed as a % value. However, these are always relative values.

- 02r = Rough vacuum
- 04r = Medium vacuum
- 06r = High vacuum
- 09r = Ultra-high vacuum

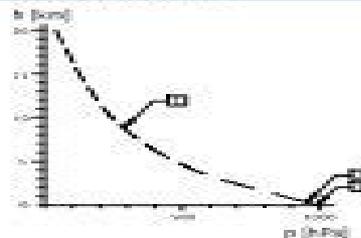
What is a vacuum used for?

The vacuum plays a vital role in research in the fields of chemistry, biology and physics. It is also indispensable in many industrial processes.

Measuring the pressure of vacuum

In the rough vacuum range, the pressure gauges used are mainly mechanical, but some digital pressure gauges are also used. In the high and ultra-high vacuum range, highly sensitive pressure gauges are used.

Atmospheric pressure



- 1 Mount Everest
- 2 Festo
- 3 Sea level

Understanding vacuum

Air is a gas mixture with gases. 10^{25} particles per m^3 of air at one bar air pressure.

Particles exert pressure or force on the walls of a defined space. The fewer particles there are in the space, the lower the force exerted on the walls.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

100% vacuum would mean that there are no particles present. Pressure = 0.

Vacuum specification options

A vacuum can be specified as an absolute value, i.e. with a positive sign from 1 to 0 bar, with 0 as absolute zero. Or it can be specified as a relative value with a negative sign from 0 to -1 bar, with 0 as a reference point, or as a %.

Effects of changes on vacuum technology

As altitude increases, the air pressure in the atmosphere falls. This same effect reduces the attainable vacuum level of an ejector. Nevertheless, the performance level of 80% remains unchanged in this case.

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Michael Rajnik



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