

## Technical information

### Humidity

Since it has got a big influence on the friction coefficient of carbon brushes, humidity is one of the main operational parameters for the performance of carbon brushes.

#### Definition

The quantity of water vapour in the air is called humidity. The **absolute humidity** is the amount of water vapor in grams in one cubic meter of air. That is the decisive parameter for brush performance.

The maximum amount of water vapor which one cubic meter air can contain is called **maximal humidity** or saturation limit. The maximal humidity depends very much on the temperature. As more warm the air as more water vapor it can take.

The **relative humidity**, the value which can be measured with a common hygrometer, is the ratio between absolute humidity and maximal humidity and is given in percent.

$$\text{relative humidity} = \frac{\text{Absolute humidity}}{\text{maximal humidity}} \cdot 100 \%$$

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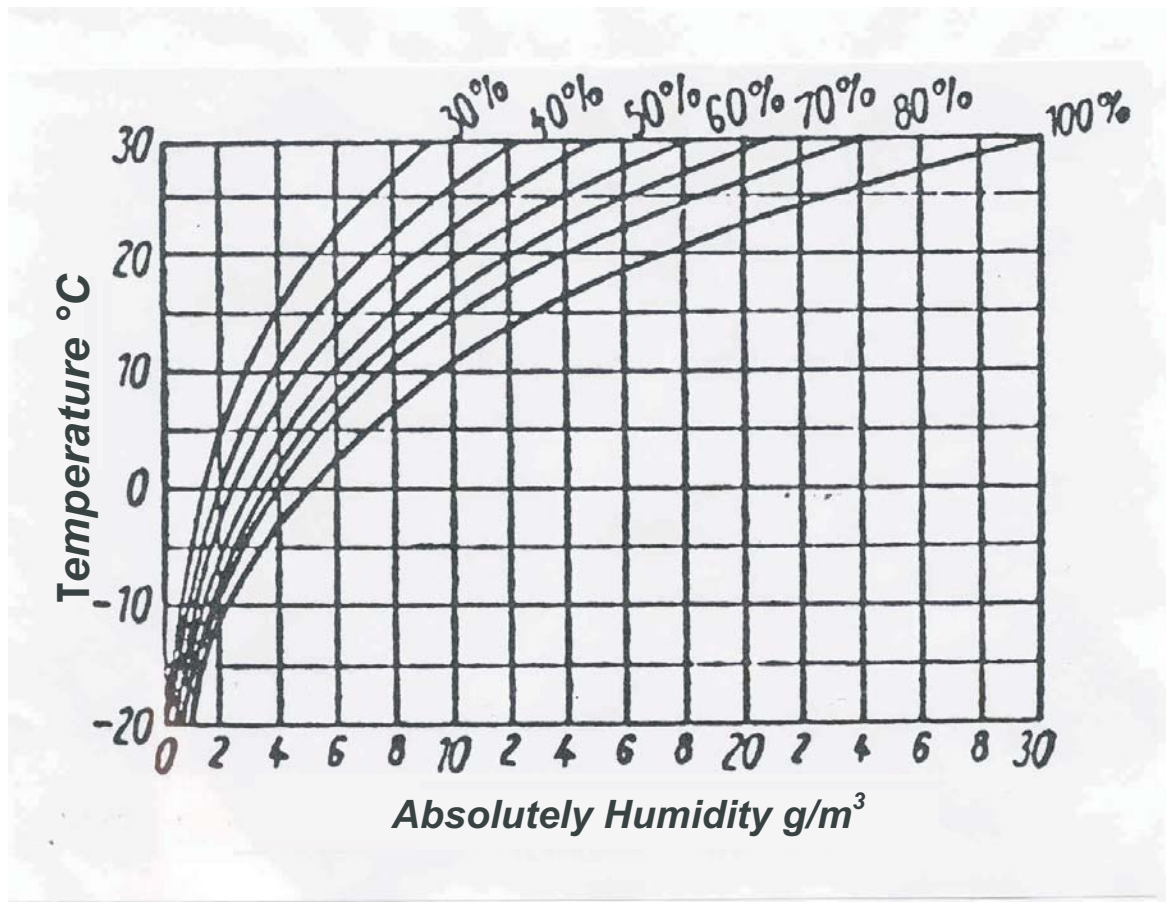
### Conversion of relative humidity to absolute humidity

For the conversion a diagram as given in pict.1 has to be used

An example for clarification:

- Measured value relative humidity 80 %.
- Air temperature is 20 °C.

The intersection point of the 80 % curve with the temperature line is projected onto the x-axis. A value of 14 g/m<sup>3</sup> absolute humidity can be read off from the diagram.



Pict. 1 Nomogram for the conversion of relative into absolute humidity

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An easy conversion is possible on the following website:

<http://www.cactus2000.de/de/unit/masshum.shtml>

### Dry air

In dry air, in vacuum or e.g. with a protecting gas atmosphere the water skin on the collector surface is absent which is important for a stable friction coefficient of the brush material. The skin deteriorates, the friction coefficient increases, the brushes begin to vibrate and the brush wear will increase.

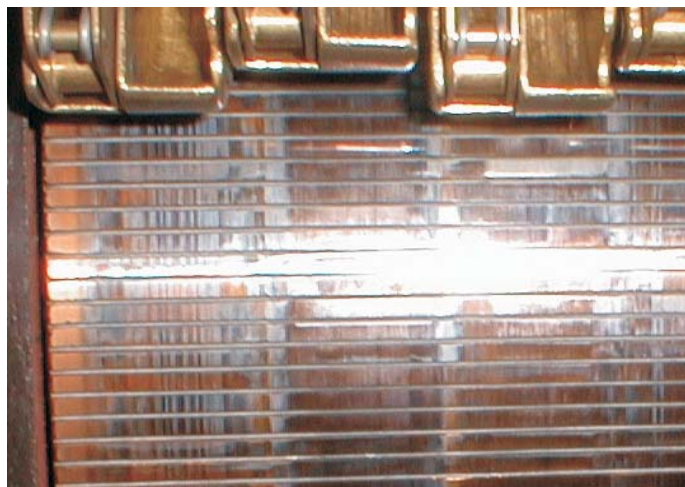
Typical applications are:

- Aircraft motors
- Cold environments , e.g. in winter time or in elevated heights
- Motors under protecting gas
- Fully encapsulated motors

### High humidity

Hot atmospheres and oversaturated humidity influence the brush performance negatively, too. The brushes tend to overfilm, the film will become patchy and grooves will be formed.

(pict. 2)



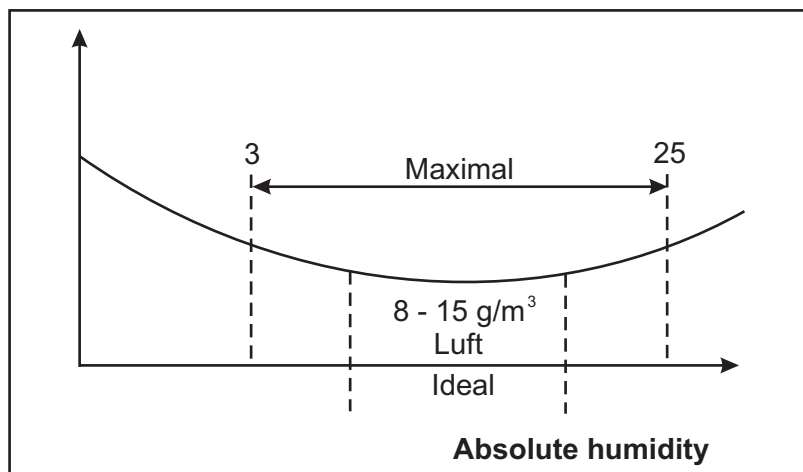
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Typical application with high humidity are

- Pumps in pulp and paper mills
- Motors in certain tropical countries

For dry air and humid environments as well carbon brush grades with adapted operational performance can be offered.

### Guide line values



The following guide line values are valid for the absolute humidity

- Lower limit 2 g /m<sup>3</sup>
- Optimum 8 – 16 g/m<sup>3</sup>
- Upper limit 25 g/m<sup>3</sup>