

Absolute humidity of a gas mixture

The absolute humidity of a gas mixture is defined as the quantity of water vapour (kg) contained in each volume of the gas mixture. It is expressed in terms of kg water vapour per kg gas mixture. The water vapour present in the gas mixture generates a pressure, which is part of the total barometric gas pressure. The vapour pressure and the absolute humidity cannot exceed the saturation level at a given temperature. Above this level, water is separated out in liquid form. The maximum pressure is described as saturation pressure and is highly temperature dependent. The absolute humidity of the air is of limited practical significance, because one essential factor, the temperature, is not taken into account in the determination of absolute humidity.

Relative humidity of a gas mixture

Relative humidity is defined as the ratio of the actual water vapour pressure to the highest possible water vapour pressure:

$$\%rh = 100 \times p/ps$$

p = Water vapour pressure in the
gas mixture at ambient temperature

ps = Saturated water vapour pressure
at ambient temperature

Therefore, 100 %rh corresponds to the maximum amount of water vapour, which a gas mixture can contain. Below the saturation level, the water vapour pressure p and hence also the relative humidity (%rh) are proportional to the total barometric pressure. Since the highest possible water vapour pressure ps is extremely temperature dependent, the relative humidity is also temperature dependent. The relative humidity therefore decreases, when the temperature rises, and vice versa.

Influence of temperature fluctuations of ± 1 °C at various temperatures and humidities:

% rh	10 °C	20 °C	30 °C	50	70 °C
10 %rh	±0.7 %	±0.6 %	±0.6 %	±0.5 %	±0.5 %
50 %rh	±3.5 %	±3.2 %	±3.0 %	±2.6 %	±2.3 %
90 %rh	±6.3 %	±5.7 %	±5.4 %	±4.6 %	±4.1 %

It is extremely important that the probe and the sample to be measured have the same temperature to achieve useful measurements.

To gain a better understanding of the relationships, we refer to the h-x diagram of humidity in air (Mollier's diagram). This illustrates clearly the relationship between temperature, moisture content and relative humidity.