HUMIDITY OF AIR

TECHNICAL NOTE ■ STA BE 16-39 GB

GENERAL REMARKS

Humidity plays an important part in brush operation as it contributes to maintain friction within acceptable limits.

In **dry** air (or in any other dry gas), the skin deteriorates, the friction becomes greater, the brushes vibrate, wear more and more quickly and finally pulverize.

This occurs particularly in the cases of:

– Aircraft machines working in rarefied air at high altitudes;
– Machines working out-doors during hard winters or in cold climates;
– Machines working in a desiccated atmosphere (hydrogen or nitrogen);
– Closed, water-tight motors.

It should be noted that, on the other hand, in a hot atmosphere and oversaturated humidity, brush operation is also upset.

The skin tends to thicken and areas of selective current conduction are established on the brushes, causing grooves or furrows on the commutator.

This occurs in cases where machines are installed in paper and pulp mills and in certain tropical countries.

For satisfactory operation, the desired humidity can fortunately vary within a wide margin; the two critical thresholds are:
≈ 2 g of water per m^3 air, **beneath** which pulverization of the brushes occurs; and
≈ 25 g of water per m^3 air **above** which the deterioration of the commutators is frequently noticed.

(The optimum hygrometrical conditions are situated between 8 and 15 g/m^3).

DEFINITIONS

The quantity of vapour in suspension in atmospheric air depends upon the temperature and indirectly upon the pressure.

Saturation occurs when the pressure p of the water vapour in the atmosphere is equal to the maximum pressure P of water vapour at the ambient temperature T.

With P being an increasing function of T, the hotter the air, the more moisture it can contain.

By definition:

– **Absolute humidity** is the weight of the water vapour (expressed in g) contained in 1 cubic meter of air.
– **Specific humidity** is the weight of the water vapour (in g) contained in 1 kg of humid air (under a pressure of 1 bar and at the temperature of 0°C, 1 m^3 of dry air weighing 1.293 kg).
– **Relative humidity** - or hygrometrical state - is the ratio of the weight of water vapour contained in a determined volume of air to the weight of water vapour which is contained in the same volume of satured air, at the same temperature, and at the same pressure.

Relative humidity and absolute humidity (the only ones to be considered for brush operation) are tightly linked, and diagrams exist which give the absolute humidity when the relative humidity and the ambient temperature are known.

METHODS OF MEASUREMENT

There are several types of hygrometers in existence for measuring the relative humidity.

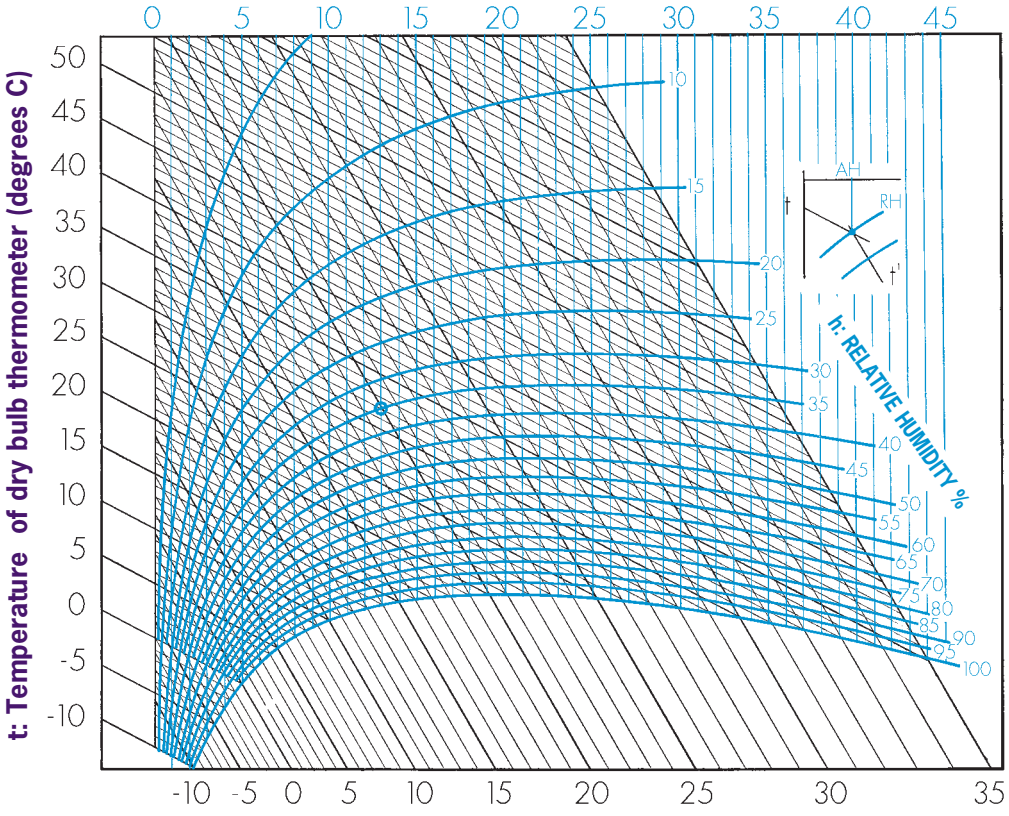
The most simple hygrometer is the "hair" hygrometer which measures directly in % humidity but it is not very precise.

The method using wet and dry bulb thermometers is preferable because it is precise and only two mercury thermometers are necessary; the dry bulb is used to measure the ambient temperature, and the wet bulb, maintained in this state by saturated cotton wool, shows a lower temperature, varying according to the amount of moisture in the atmosphere - the drier the atmosphere the lower the indicated temperature.

Besides there are easy to use devices which permit the measurement of the "dry" temperature and the relative humidity.

The graph below permits determination of absolute humidity (in g/m³) from the ambient temperature (in °C) read from the dry thermometer and relative humidity (in %) or the temperature (in °C) read from the wet thermometer.

g: ABSOLUTE HUMIDITY (gr. per m³ of air)



Imprimé en France - S.I.C. - CHATEAUNEUF sur LOIRE - 02 38 58 63 63

BE 16-39 GB 7070