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Relative humidity tables

Scope

This technical information paper provides an easy method to determine relative humidity. Tables are provided to determine relative humidity from dry bulb and wet bulb temperature readings and barometric pressure. An equation is also provided to be able to calculate relative humidity from these readings.

Introduction

The tables presented in this technical information paper provide an easy way to obtain relative humidity.

For many years, the only available procedure for determining relative humidity from dry and wet temperature readings was to use tables, charts, and graphs. This involved calculations and locating the numbers in a table or picking out points in a graph. They also did not provide factors for barometer correction.

TAPPI T 402 "Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets, and Related Products" prescribes the proper temperature and humidity for the testing of paper products:

Fahrenheit 73.4 ± 1.8 (range 71.6 to 75.2)

Celsius 23 ± 1 (range 22 to 24)

Relative humidity 50% ± 2% (range 48% to 52%)

The tables presented are for the range of temperatures and relative humidities prescribed. The relative humidities in the tables are calculated for the barometric pressures indicated at the top of each table. Add 0.055% to the relative for each 0.1 psi increase. This is not an exact correction, but any resultant errors will be less than 0.1% RH.

Safety precautions

Broken thermometers must be discarded according to safety rules.

Procedure

The procedure for determining relative humidity is more detailed in ASTM E337 "Relative Humidity by Wet and Dry Bulb Psychrometer" (1). The dry and wet temperature figures are obtained with an Assmann psychrometer; then the Fahrenheit or Celsius degrees are located in the appropriate table columns. The relative humidity is found directly.

NOTE 1: Formula for conversion of F to C or vice versa:

$$^{\circ}\text{C} = \frac{5}{9} (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{F} = \left(\frac{9}{5} ^{\circ}\text{C} \right) + 32$$

For those who wish to calculate the relative humidity at different barometric pressures or to write a computer program for doing the same, the following equation is provided:

$$\%RH = \frac{P_{sw} - \{0.000367 * [1 + 0.00064 (T_w - 32)]\} * P_b * (T_d - T_w)}{P_{sd}} \quad 100$$

where

T_d	=	dry bulb temperature in F
T_w	=	Wet bulb temperature in F
P_b	=	barometric pressure in inches Hg
P_{sw}	=	saturated vapor pressure for wet bulb temperature from Table 11
P_{sd}	=	saturated vapor pressure for dry bulb temperature from Table 11

This equation is valid within the following restrictions:

Dry bulb and wet bulb temperatures must be between 47 and 78 F

$(T_d - T_w) \leq 5 \text{ F}$

Barometric pressure range of 28.9 - 31.0 inches Hg

To do a more exact calculation, see Chapter 6 in ASHRAE Handbook (3).

Table 1. Relative humidity chart: degrees Fahrenheit (dry bulb range = 70.0 - 70.9°F); barometric pressure = 29.240 in. of Hg

Wet bulb temp., °F	Relative humidity for indicated dry bulb temperature, %									
	70.0°F	70.1°F	70.2°F	70.3°F	70.4°F	70.5°F	70.6°F	70.7°F	70.8°F	70.9°F
59.2	52.6	52.3	...	...	...	...	...	...	...	...
59.3	53.0	52.7	52.4	...	...	...	...	...	...	...
59.4	53.4	53.1	52.8	52.4	...	...	...	...	...	...
59.5	53.8	53.5	53.1	52.8	52.5	...	...	...	...	...
59.6	54.2	53.9	53.5	53.2	52.9	52.6	...	...	...	...
59.7	54.6	54.3	53.9	53.6	53.3	52.9	52.6	...	...	...
59.8	55.0	54.7	54.3	54.0	53.7	53.3	53.0	52.7	52.4	...
59.9	55.4	55.1	54.7	54.4	54.1	53.7	53.4	53.1	52.8	52.4
60.0	55.8	55.5	55.1	54.8	54.5	54.1	53.8	53.5	53.1	52.8
60.1	56.2	55.8	55.5	55.2	54.8	54.5	54.2	53.9	53.5	53.2
60.2	56.6	56.2	55.9	55.6	55.2	54.9	54.6	54.2	53.9	53.6

Table 2. Relative humidity chart: degrees Fahrenheit (dry bulb range = 71.0 - 71.9°F); barometric pressure = 29.240 in. of Hg

Wet bulb temp., °F	Relative humidity for indicated dry bulb temperature, %									
	71.0°F	71.1°F	71.2°F	71.3°F	71.4°F	71.5°F	71.6°F	71.7°F	71.8°F	71.9°F
59.2	49.4	49.1	48.8	48.5	48.2	47.9	...	...	...	...
59.3	49.8	49.5	49.2	48.9	48.6	48.3	48.0	...	...	...
59.4	50.2	49.9	49.6	49.3	49.0	48.7	48.3	48.0	...	...
59.5	50.6	50.3	50.0	49.6	49.3	49.0	48.7	48.4	48.1	...
59.6	51.0	50.6	50.3	50.0	49.7	49.4	49.1	48.8	48.5	48.2
59.7	51.3	51.0	50.7	50.4	50.1	49.8	49.5	49.2	48.9	48.6
59.8	51.7	51.4	51.1	50.8	50.5	50.2	49.8	49.5	49.2	48.9
59.9	52.1	51.8	51.5	51.2	50.8	50.5	50.2	49.9	49.6	49.3
60.0	52.5	52.2	51.9	51.5	51.2	50.9	50.6	50.3	50.0	49.7
60.1	52.9	52.6	52.2	51.9	51.6	51.3	51.0	50.7	50.4	50.0
60.2	...	52.9	52.6	52.3	52.0	51.7	51.4	51.0	50.7	50.4
60.3	...	...	53.0	52.7	52.4	52.0	51.7	51.4	51.1	50.8
60.4	...	...	...	53.1	52.7	52.4	52.1	51.8	51.5	51.2
60.5	...	...	...	...	53.1	52.8	52.5	52.2	51.9	51.5
60.6	...	...	...	...	...	53.2	52.9	52.6	52.2	51.9
60.7	...	...	...	...	...	...	53.3	52.9	52.6	52.3
60.8	...	...	...	...	...	...	...	...	53.0	52.7
60.9	...	...	...	...	...	...	...	...	...	53.1
61.0	...	...	...	...	...	...	...	...	...	...
61.1	...	...	...	...	...	...	...	...	...	...
61.2	...	...	...	...	...	...	...	...	...	...

Table 3. Relative humidity chart: degrees Fahrenheit (dry bulb range = 72.0 - 72.9°F); barometric pressure = 29.240 in. of Hg

Wet bulb temp., °F	Relative humidity for indicated dry bulb temperature, %									
	72.0°F	72.1°F	72.2°F	72.3°F	72.4°F	72.5°F	72.6°F	72.7°F	72.8°F	72.9°F
59.2	...	...	...	...	...	...	...	...	...	...
59.3	...	...	...	...	...	...	...	...	...	...
59.4	47.1	...	...	...	...	...	...	...	...	...
59.5	47.5	47.2	46.9	...	...	...	...	...	...	...
59.6	47.9	47.6	47.3	47.0	...	...	...	...	...	...
59.7	48.2	47.9	47.7	47.4	47.1	...	...	...	...	...
59.8	48.6	48.3	48.0	47.7	47.4	47.1	...	...	...	...
59.9	49.0	48.7	48.4	48.1	47.8	47.5	47.2	46.9	...	...
60.0	49.4	49.1	48.8	48.5	48.2	47.9	47.6	47.3	47.0	...
60.1	49.7	49.4	49.1	48.8	48.5	48.2	47.9	47.6	47.3	47.0
60.2	50.1	49.8	49.5	49.2	48.9	48.6	48.3	48.0	47.7	47.4
60.3	50.5	50.2	49.9	49.6	49.3	49.0	48.7	48.4	48.1	47.8
60.4	50.9	50.5	50.2	49.9	49.6	49.3	49.0	48.7	48.4	48.1
60.5	51.2	50.9	50.6	50.3	50.0	49.7	49.4	49.1	48.8	48.5
60.6	51.6	51.3	51.0	50.7	50.4	50.1	49.8	49.5	49.2	48.9
60.7	52.0	51.7	51.4	51.0	50.7	50.4	50.1	49.8	49.5	49.2
60.8	52.4	52.0	51.7	51.4	51.1	50.8	50.5	50.2	49.9	49.6
60.9	52.7	52.4	52.1	51.8	51.5	51.2	50.9	50.6	50.3	50.0
61.0	53.1	52.8	52.5	52.2	51.9	51.6	51.2	50.9	50.6	50.3
61.1	...	53.2	52.9	52.6	52.2	51.9	51.6	51.3	51.0	50.7
61.2	...	...	...	52.9	52.6	52.3	52.0	51.7	51.4	51.1
61.3	...	...	...	53.3	53.0	52.7	52.4	52.0	51.7	51.4
61.4	...	...	...	...	...	53.0	52.7	52.4	52.1	51.8
61.5	...	...	...	...	...	...	53.1	52.8	52.5	52.2
61.6	...	...	...	...	...	...	...	53.2	52.9	52.5
61.7	...	...	...	...	...	...	...	...	...	52.9