

Schedule for

Hygrometric tables for use in the testing and operation of environmental enclosures

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Foreword

This revision of BS 4833 has been prepared under the direction of the Laboratory Apparatus Standards Committee. It contains equations and a series of tables which enable the relative humidity and dew-point temperature of the air of an environmental enclosure to be determined from a forced-ventilated wet- and dry-bulb hygrometer.

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) also have technical committees concerned with this subject.

This standard was first published in 1972 to provide a series of tables which permitted the relative humidity of environmental enclosures to be determined when the operating conditions were outside the range of the tables published by the Meteorological Office (Ref. 1).

Enclosures in which the temperature and relative humidity of the air are controlled are widely used for the conditioning and testing of atmosphere-sensitive materials or equipment, and are the subject of a series of British Standard publications. The standards so far published are:

BS 3718, *Laboratory humidity ovens (non-injection type)*.

BS 3898, *Laboratory humidity ovens (injection type)*.

BS 4194, *Design requirements and testing of controlled-atmosphere laboratories*.

BS 4864, *Recommendations on the design and testing of enclosures for environmental testing*.

For the testing and operation of environmental enclosures it is necessary to have means of measuring the relative humidity, and for this purpose the forced-ventilated wet- and dry-bulb hygrometer, sometimes called the aspirated psychrometer, is regularly used (see BS 1339, for terms used in this context). Often the air circulation in the enclosure provides adequate ventilation but sometimes a fan-aspirated hygrometer is necessary (see BS 2842, BS 4194 and BS 5248).

From the readings of these instruments the relative humidity can be obtained either by calculation, or more usually, by means of hygrometric tables.

When the 1972 edition of this BS 4833 was reviewed, it was recognized that the lower temperature range of the tables was inadequate and that the inclusion of dew-point temperature tables would be beneficial. It was also recognized that recent work (Ref. 2) had questioned the use of the value 6.66×10^{-4} for the psychrometric constant in the classic psychrometer equation.

This revision differs from the 1972 edition in the following respects.

a) The hectopascal is used instead of the millibar.

NOTE 1 The pascal is the SI unit of pressure, the newton per square metre.

NOTE 2 The 8th Congress of the World Meteorological Organization decided that the hectopascal is, from 1 January 1986 onwards, the preferred unit for the measurement of pressure for meteorological purposes.

b) The tables are computed using a basic thermodynamic equation instead of the classic psychrometer equation. A table showing the difference in relative humidity at 1 013 hPa, caused by this change, is included.

c) The tables for atmospheric pressure at 800 hPa and 1 120 hPa have been omitted as they are outside the range of normal interest for environmental enclosures. An equation and a table to permit the correction of the tabulated values, for atmospheric pressures other than 1 013 hPa, are included.

d) The dry-bulb temperature range of the 1 013 hPa table, with a wet-bulb depression of up to 15 degrees Celsius, has been extended down from 31 °C to 1 °C.

- e) The dry-bulb temperature range of the 1 013 hPa table, with a wet-bulb depression above 15 degrees Celsius, has been extended down from 60 °C to 24 °C.
- f) Additional tables giving dew-point temperatures have been introduced.
- g) A graphical plot has been included to illustrate the variation of relative humidity with dry-bulb temperature and wet-bulb depression.

This edition of the standard supersedes BS 4833:1972, which is withdrawn.

The tables and equations in this edition of this standard were produced by Dr J L Hales at the National Physical Laboratory, taking into account additional data on excess enthalpies supplied by Dr C Wormald, University of Bristol, and the graphical plot was supplied by Dynam Engineering Services Ltd., Blackburn. The British Standards Institution gratefully acknowledges the courtesy of those concerned in making available this material.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 54, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard gives a schedule of tables and equations that enable the relative humidity and dew-point temperature of the air to be determined from the readings of a forced-ventilated wet- and dry-bulb hygrometer or aspirated psychrometer over the range of dry-bulb temperatures from 1 °C to 99 °C at 1 013 hPa¹⁾ pressure.

Table 1 and Table 2 cover a range of wet-bulb depressions from 0.1 degrees Celsius to 15 degrees Celsius. Table 3 covers wet-bulb depressions from 16 degrees Celsius to 45 degrees Celsius, at wider intervals and lower resolution.

Table 4 shows the difference between the present tables and those corresponding to the 1972 edition of this standard, calculated from equations 13 and 14.

Table 5 lists relative humidity corrections to be applied for atmospheric pressures other than 1 013 hPa. Appendix A illustrates the variation of relative humidity with dry-bulb temperature and wet-bulb depression by means of a graphical plot.

The blank areas in the tables correspond either to depressions below the ice-point or to regions outside the range of applicability, the lower limit set for relative humidity is 1.0 %. Tabulations below the ice-point can be found in the Meteorological Office Tables (Ref. 1).

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Basis of tables

NOTE The tables in the 1972 edition were calculated from the classic psychrometer equation using the psychrometric constant $A = 6.66 \times 10^{-4}$. The value of A is currently under dispute (Ref. 2).

2.1 The tables have been computed by means of the basic thermodynamic equation (p.4 of Ref. 3) for the adiabatic evaporation of water in a psychrometer (i.e. all the heat of evaporation is supplied by the incoming air), which may be stated as follows.

The enthalpy of $(1 + r)$ g of moist air at temperature t (dry-bulb)
 + the enthalpy of $(r_w - r)$ g of water at temperature t_w (wet-bulb)
 = the enthalpy of $(1 + r_w)$ g of saturated air at temperature t_w .

The thermodynamic wet-bulb temperature t_w is assumed to equal the observed wet-bulb temperature of an aspirated psychrometer. This assumption (Ref. 4) is sufficiently accurate for the purposes of this standard, as shown in Table 4.

The thermodynamic equation (p. 4 of Ref. 3) has been rearranged as follows (see note 1):

$$r = \frac{h_a(t_w) - h_a(t) + r_w(t_w) [h_v(t_w) - h_l(t_w)]}{h_v(t) - h_l(t_w)} \quad (1)$$

where temperature suffixes are shown in round brackets.

$r_w(t_w)$ is computed using the following equation:

$$r_w = \varepsilon ef / (P - ef) \quad (2)$$

The following notation is used in these and subsequent equations; appended references give data origins:

- ε = 0.621954 [the ratio of the relative molar mass of water to that of dry air containing 400 μ L of CO₂ per litre (400 p.p.m. by volume) (Ref. 5)];
- A is psychrometric constant;
- $\bar{e}$ is vapour pressure of water in air at 1 013 hPa pressure (in Pa);
- e is pure phase saturation vapour pressure of water (Ref. 6, equation 16a) (in Pa);
- f is enhancement factor at saturation (Ref. 7, Table 20, adjusted slightly to allow for change of pressure from 1 000 hPa to 1 013 hPa, the value used for P throughout the tables);
- ef is saturation vapour pressure of water in air at a specified temperature (in Pa);
- $e'f$ is saturation vapour pressure of water in air at wet-bulb temperature (in Pa);
- $e''f''$ is saturation vapour pressure of water in air at dry-bulb temperature (in Pa);

¹⁾ 1 hPa = 100 Pa = 100 N/m² = 1 mbar

- h_a is enthalpy of dry air (Ref.7, Table 38) (in kJ/kg);
 h_l is enthalpy of liquid water (Ref. 8, Table 28) (in kJ/kg);
 h_v is enthalpy of water vapour (Ref. 8, Table 28) (in kJ/kg);
 P is total atmospheric pressure (in Pa);
 r is mixing ratio (mass ratio of water to air);
 r_w is mixing ratio at saturation vapour pressure;
 t is dry-bulb temperature (in °C);
 t_w is (thermodynamic) wet-bulb temperature (in °C);
 t_s is dew-point (saturation) temperature (in °C);
 T is temperature (in K);
 U is percentage relative humidity.

NOTE 1 The use of pure phase enthalpies for h_v (and h_l) is a close approximation to real-gas enthalpies. This is justified by the use of r_w values based on a value of ϵ which differs slightly from that given in Ref. 5. Also the real-gas values of h_v in Ref. 7, Table 38 are not easily fitted by an empirical expression. The main difference between real and ideal values of h_v lies in the excess enthalpy of water vapour and air. Calculations using recent excess enthalpy data showed that the associated relative humidity error in the tables approached 0.1 % at low humidity values and could exceed that figure only at humidity values below 3 % at t less than 25 °C.

Polynomial fits have been made to the listed values of some of the above quantities. The corresponding polynomial expressions with their constants are as follows.

$$h_a = -5.01700106 \times 10^{-5} + 1.00579797 t + 3.31673195 \times 10^{-6} t^2 + 1.51528644 \times 10^{-7} t^3 \quad (3)$$

$$h_l = 1.47785323 \times 10^{-2} + 4.21075061 t - 9.28209131 \times 10^{-4} t^2 + 1.03206062 \times 10^{-5} t^3 - 3.04271158 \times 10^{-8} t^4 \quad (4)$$

$$h_v = 2500.76867 + 1.83864919 t - 3.17435306 \times 10^{-4} t^2 - 4.37399356 \times 10^{-6} t^3 - 1.67529532 \times 10^{-8} t^4 \quad (5)$$

$$\ln e = -6095.1748 T^{-1} + 21.16173595 - 2.7222404 \times 10^{-2} T + 1.684079 \times 10^{-5} T^2 + 2.4505058 \ln T \quad (6)$$

$$f = 1.00394692 - 3.17735942 \times 10^{-6} t + 6.22020251 \times 10^{-7} t^2 - 6.7195073 \times 10^{-9} t^3 + 3.09909128 \times 10^{-10} t^4 - 3.41284073 \times 10^{-12} t^5 \quad (7)$$

$$\ln ef = 6.4193807 + 7.26359743 \times 10^{-2} t - 2.9747284 \times 10^{-4} t^2 + 1.09648838 \times 10^{-6} t^3 - 3.04518032 \times 10^{-9} t^4 + 2.58751419 \times 10^{-12} t^5 \quad (8)$$

$$t_s = -67.7663009 + 12.0228011 z - 1.53077209 z^2 + 0.327540624 z^3 - 2.46641398 \times 10^{-2} z^4 + 8.17519055 \times 10^{-4} z^5 \quad (9)$$

where

$$z = \ln ef \quad (10)$$

Equations 8 and 9 are based on the combination of equations 6 and 7.

NOTE 2 Values of ef (in Pa) produced by equation 8, are within 20 p.p.m. of those produced by equations 6 and 7. Values of t_s produced by equation 9 are within 12 mK of those produced by the reverse operation of equations 6 and 7.

Temperature t is in degrees Celsius (International Practical Temperature Scale 1968) and $T (= t + 273.15)$ is in kelvins.

To calculate values of r for particular values of t and t_w , these temperatures are substituted in equations 3, 4, 5 and 8 to give values of $h_a(t)$, $h_a(t_w)$, $h_v(t)$, $h_v(t_w)$, $h_l(t_w)$ and $ef(t_w)$. The ef value is then substituted in equation 2 to give a value of $r_w(t_w)$. All these values are then substituted in equation 1 to obtain the value of r . Further operations described below are used to convert r to U or t_s .

NOTE 3 Any or all of these operations may be combined in a computer program, which may include tabulation operations for Table 1 to Table 3.

The percentage relative humidity U is computed by means of the following equation:

$$U = 100 r (1 + r_w/\epsilon)/r_w(1 + r/\epsilon) \quad (11)$$

where r_w is at t . The t value is substituted in equation 8 to give $ef(t)$, which is then substituted in equation 2 to give $r_w(t)$.

For dew-point temperature t_s , r is converted to ef using equation 2 in rearranged, form:

$$ef = Pr_w / (r_w + \varepsilon) \quad (12)$$

ef is then converted to t_s using equations 9 and 10.

2.2 In the 1972 edition of this standard the vapour pressure of water in air (here $\bar{e}$) was calculated from the classic psychrometer equation:

$$\bar{e} = e'f' - AP(t - t_w) \quad (13)$$

where the value of A was taken as 6.66×10^{-4} .

U was obtained from the equation:

$$U = 100 \bar{e} / e''f'' \quad (14)$$

Calculations from these equations require values of $e'f'$ and $e''f''$ and these are obtained using equation 8.

To produce Table 4, equations 13 and 14 are employed in calculating values of U , which are then subtracted from the unrounded values of U in the corresponding positions in Table 1a to Table 3a. Thus Table 4 indicates the increase in relative humidity arising from use of the thermodynamic equation rather than of the classic psychrometer equation; it covers the increases compared with the values in the tables of the 1972 edition, with the addition of the dry-bulb temperature range 1 °C to 30 °C.

2.3 If it is required to calculate relative humidity (or dew-point temperature) at pressures other than 1 013 hPa, the following relationship, derived from equations 13 and 14, may be used to correct readings in Table 1a, Table 2a and Table 3a with an error not exceeding 0.2 %, up to ± 20 % change in pressure:

$$U_1 - U_2 = 6.66 (t - t_w)(P_2 - P_1) / 100 e''f'' \quad (15)$$

Thus, for example at $t = 31$ °C with $t - t_w = 15$ °C, $P_2 = 800$ hPa, $P_2 - P_1 = -213$ hPa, $e''f''$ is calculated from equation 8 as 45 hPa so that $U_2 - U_1 = +4.72$ %. The tabulated value for U_1 of 18.7 % is then corrected to U_2 equals 23.4 %. This compares with 23.3 % by direct calculation from equation 1 for a pressure of 800 hPa.

The magnitude of corrections to Table 1a, Table 2a and Table 3a at atmospheric pressures other than 1 013 hPa has been calculated by equation 15 and is given in Table 5. Even where an uncertainty of ± 2 % relative humidity is acceptable, the effect of pressure should be taken into account. To obtain the required correction multiply the selected value in Table 5 by one-tenth of the relevant wet-bulb depression.

NOTE The correction applies to whatever relative humidity appears in Table 1a, Table 2a or Table 3a. The relative effect of the correction is greatest at low relative humidities, which are associated with large wet-bulb depressions. The magnitude of the correction falls off markedly as the dry-bulb temperature (and hence $e''f''$) increases.

2.4 Certain types of psychrometer may be associated with A values differing from 6.66×10^{-4} . The effect of this change on the present tables can be calculated by using equation 16, applied in the same manner as in the above example for equation 15.

$$U_1 - U_2 = 100 P (t - t_w) (A_2 - A_1) / e''f'' \quad (16)$$

2.5 The calculation of the tables is valid to within the stated number of significant figures. The use of pure-phase enthalpies for h_v (see 2.1, note 1), plus the stated uncertainties of the enthalpy values in Refs. 7 and 8, implies that the tabulated values of relative humidity have an uncertainty of ± 0.2 %. Also, the assumption of adiabatic conditions in the psychrometer becomes increasingly unrealistic as the enthalpy change on evaporation increases, i.e. as the amount of water evaporated from the wet-bulb increases, consequent on reduction in U and increase in t (Ref. 9).

3 Applicability of tables

3.1 The tables apply to various types of forced-ventilated thermometer, provided that the air speed over the wet-bulb exceeds that required to obtain the full wet-bulb depression; for example, higher than 3.5 m/s for a mercury-in-glass thermometer or platinum resistance thermometer unit and higher than 1 m/s for some thermocouple units (see BS 3898, BS 4194 and BS 4864).

3.2 The precautions to be taken in order to obtain the correct wet-bulb temperature with this type of hygrometer are discussed elsewhere (Refs. 2, 10 and 11). As most of the sources of error are additive, they tend to give a high wet-bulb reading, therefore all the precautions need to be observed with care.

4 Tables

4.1 General information

The data in Table 1 to Table 4 is calculated for an atmospheric pressure of 1 013 hPa.

Throughout Table 1 to Table 3, “a” refers to relative humidity and “b” refers to dew-point temperature.

The first column lists the dry-bulb temperature (in °C), and the headings show the wet-bulb temperature depression (in degrees Celsius).

4.2 Temperature range

The ranges of temperature used are as follows.

a) *Table 1:*

dry-bulb temperature range	1 °C to 50 °C in steps of 1 °C
wet-bulb depressions	0.1 degree Celsius to 5.0 degrees Celsius in steps of 0.1 degree Celsius 5.2 degrees Celsius to 15.0 degrees Celsius in steps of 0.2 degree Celsius;

b) *Table 2:*

dry-bulb temperature range	51 °C to 99 °C in steps of 1 °C
wet-bulb depression	0.1 degree Celsius to 5.0 degree Celsius in steps of 0.1 degree Celsius 5.2 degrees Celsius to 15.0 degrees Celsius in steps of 0.2 degree Celsius;

c) *Table 3:*

dry-bulb temperature range	2 °C to 98 °C in steps of 2 °C
wet-bulb depression	16 degrees Celsius to 45 degrees Celsius in steps of 1 degree Celsius;

d) *Table 4:*

dry-bulb temperature range	2 °C to 98 °C in steps of 2 °C
wet-bulb depression	2 degrees Celsius to 40 degrees Celsius in steps of 2 degrees Celsius;

NOTE For a fuller explanation of Table 4, see 2.2.

e) *Table 5:*

dry-bulb temperature range	2 °C to 98 °C in steps of 2 °C
pressure range	875 hPa to 1 100 hPa in steps of 25 hPa.

Table 1a — Relative humidity from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	0.1	0.2	0.3	0.4	0.3	0.6	0.7	0.8	0.9	1.0
1	98.3	96.6	94.9	93.2	91.5	89.8	88.2	86.5	84.8	83.1
2	98.4	96.7	95.1	93.5	91.9	90.3	88.7	87.1	85.5	83.9
3	98.4	96.9	95.3	93.8	92.2	90.7	89.1	87.6	86.1	84.6
4	98.5	97.0	95.5	94.0	92.5	91.1	89.6	88.1	86.7	85.2
5	98.6	97.1	95.7	94.3	92.8	91.4	90.0	88.6	87.2	85.8
6	98.6	97.2	95.9	94.5	93.1	91.7	90.4	89.0	87.7	86.3
7	98.7	97.3	96.0	94.7	93.4	92.1	90.7	89.4	88.1	86.8
8	98.7	97.4	96.2	94.9	93.6	92.3	91.1	89.8	88.6	87.3
9	98.8	97.5	96.3	95.1	93.8	92.6	91.4	90.2	89.0	87.8
10	98.8	97.6	96.4	95.2	94.0	92.9	91.7	90.5	89.4	88.2
11	98.8	97.7	96.5	95.4	94.2	93.1	92.0	90.8	89.7	88.6
12	98.9	97.8	96.6	95.5	94.4	93.3	92.2	91.1	90.0	88.9
13	98.9	97.8	96.7	95.7	94.6	93.5	92.5	91.4	90.3	89.3
14	98.9	97.9	96.8	95.8	94.8	93.7	92.7	91.7	90.6	89.6
15	99.0	98.0	96.9	95.9	94.9	93.9	92.9	91.9	90.9	89.9
16	99.0	98.0	97.0	96.0	95.1	94.1	93.1	92.1	91.2	90.2
17	99.0	98.1	97.1	96.1	95.2	94.2	93.3	92.3	91.4	90.5
18	99.1	98.1	97.2	96.2	95.3	94.4	93.5	92.5	91.6	90.7
19	99.1	98.2	97.3	96.3	95.4	94.5	93.6	92.7	91.8	91.0
20	99.1	98.2	97.3	96.4	95.5	94.7	93.8	92.9	92.0	91.2
21	99.1	98.3	97.4	96.5	95.7	94.8	93.9	93.1	92.2	91.4
22	99.1	98.3	97.4	96.6	95.8	94.9	94.1	93.3	92.4	91.6
23	99.2	98.3	97.5	96.7	95.9	95.0	94.2	93.4	92.6	91.8
24	99.2	98.4	97.6	96.7	95.9	95.1	94.3	93.5	92.8	92.0
25	99.2	98.4	97.6	96.8	96.0	95.2	94.5	93.7	92.9	92.1
26	99.2	98.4	97.7	96.9	96.1	95.3	94.6	93.8	93.1	92.3
27	99.2	98.5	97.7	96.9	96.2	95.4	94.7	93.9	93.2	92.5
28	99.2	98.5	97.7	97.0	96.3	95.5	94.8	94.1	93.3	92.6
29	99.3	98.5	97.8	97.1	96.3	95.6	94.9	94.2	93.5	92.7
30	99.3	98.6	97.8	97.1	96.4	95.7	95.0	94.3	93.6	92.9
31	99.3	98.6	97.9	97.2	96.5	95.8	95.1	94.4	93.7	93.0
32	99.3	98.6	97.9	97.2	96.5	95.8	95.2	94.5	93.8	93.1
33	99.3	98.6	97.9	97.3	96.6	95.9	95.2	94.6	93.9	93.2
34	99.3	98.6	98.0	97.3	96.6	96.0	95.3	94.7	94.0	93.3
35	99.3	98.7	98.0	97.4	96.7	96.0	95.4	94.7	94.1	93.5
36	99.3	98.7	98.0	97.4	96.7	96.1	95.5	94.8	94.2	93.6
37	99.4	98.7	98.1	97.4	96.8	96.2	95.5	94.9	94.3	93.7
38	99.4	98.7	98.1	97.5	96.8	96.2	95.6	95.0	94.4	93.7
39	99.4	98.7	98.1	97.5	96.9	96.3	95.7	95.1	94.4	93.8
40	99.4	98.8	98.2	97.5	96.9	96.3	95.7	95.1	94.5	93.9
41	99.4	98.8	98.2	97.6	97.0	96.4	95.8	95.2	94.6	94.0
42	99.4	98.8	98.2	97.6	97.0	96.4	95.8	95.3	94.7	94.1
43	99.4	98.8	98.2	97.6	97.1	96.5	95.9	95.3	94.7	94.2
44	99.4	98.8	98.2	97.7	97.1	96.5	95.9	95.4	94.8	94.2
45	99.4	98.8	98.3	97.7	97.1	96.6	96.0	95.4	94.9	94.3
46	99.4	98.9	98.3	97.7	97.2	96.6	96.0	95.5	94.9	94.4
47	99.4	98.9	98.3	97.8	97.2	96.6	96.1	95.5	95.0	94.5
48	99.4	98.9	98.3	97.8	97.2	96.7	96.1	95.6	95.1	94.5
49	99.4	98.9	98.4	97.8	97.3	96.7	96.2	95.6	95.1	94.6
50	99.5	98.9	98.4	97.8	97.3	96.8	96.2	95.7	95.2	94.6

Table 1b — Dew-point temperature from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
1	0.8	0.5	0.3	0.0	−0.2	−0.5	−0.7	−1.0	−1.3	−1.5
2	1.8	1.5	1.3	1.1	0.8	0.6	0.3	0.1	−0.2	−0.4
3	2.8	2.5	2.3	2.1	1.9	1.6	1.4	1.1	0.9	0.7
4	3.8	3.6	3.3	3.1	2.9	2.7	2.4	2.2	2.0	1.7
5	4.8	4.6	4.4	4.1	3.9	3.7	3.5	3.3	3.0	2.8
6	5.8	5.6	5.4	5.2	5.0	4.8	4.5	4.3	4.1	3.9
7	6.8	6.6	6.4	6.2	6.0	5.8	5.6	5.4	5.2	5.0
8	7.8	7.6	7.4	7.2	7.0	6.8	6.6	6.4	6.2	6.0
9	8.8	8.6	8.4	8.2	8.0	7.9	7.7	7.5	7.3	7.1
10	9.8	9.6	9.4	9.3	9.1	8.9	8.7	8.5	8.3	8.1
11	10.8	10.6	10.5	10.3	10.1	9.9	9.7	9.5	9.4	9.2
12	11.8	11.6	11.5	11.3	11.1	10.9	10.8	10.6	10.4	10.2
13	12.8	12.7	12.5	12.3	12.1	12.0	11.8	11.6	11.4	11.3
14	13.8	13.7	13.5	13.3	13.2	13.0	12.8	12.7	12.5	12.3
15	14.8	14.7	14.5	14.3	14.2	14.0	13.9	13.7	13.5	13.4
16	15.8	15.7	15.5	15.4	15.2	15.0	14.9	14.7	14.6	14.4
17	16.8	16.7	16.5	16.4	16.2	16.1	15.9	15.7	15.6	15.4
18	17.8	17.7	17.5	17.4	17.2	17.1	16.9	16.8	16.6	16.5
19	18.8	18.7	18.6	18.4	18.2	18.1	17.9	17.8	17.6	17.5
20	19.9	19.7	19.6	19.4	19.3	19.1	19.0	18.8	18.7	18.5
21	20.9	20.7	20.6	20.4	20.3	20.1	20.0	19.8	19.7	19.5
22	21.9	21.7	21.6	21.4	21.3	21.1	21.0	20.9	20.7	20.6
23	22.9	22.7	22.6	22.4	22.3	22.2	22.0	21.9	21.7	21.6
24	23.9	23.7	23.6	23.5	23.3	23.2	23.0	22.9	22.8	22.6
25	24.9	24.7	24.6	24.5	24.3	24.2	24.1	23.9	23.8	23.6
26	25.9	25.7	25.6	25.5	25.3	25.2	25.1	24.9	24.8	24.7
27	26.9	26.7	26.6	26.5	26.3	26.2	26.1	25.9	25.8	25.7
28	27.9	27.7	27.6	27.5	27.4	27.2	27.1	27.0	26.8	26.7
29	28.9	28.8	28.6	28.5	28.4	28.2	28.1	28.0	27.8	27.7
30	29.9	29.8	29.6	29.5	29.4	29.2	29.1	29.0	28.9	28.7
31	30.9	30.8	30.6	30.5	30.4	30.3	30.1	30.0	29.9	29.7
32	31.9	31.8	31.6	31.5	31.4	31.3	31.1	31.0	30.9	30.8
33	32.9	32.8	32.6	32.5	32.4	32.3	32.1	32.0	31.9	31.8
34	33.9	33.8	33.6	33.5	33.4	33.3	33.2	33.0	32.9	32.8
35	34.9	34.8	34.6	34.5	34.4	34.3	34.2	34.0	33.9	33.8
36	35.9	35.8	35.6	35.5	35.4	35.3	35.2	35.0	34.9	34.8
37	36.9	36.8	36.7	36.5	36.4	36.3	36.2	36.1	35.9	35.8
38	37.9	37.8	37.7	37.5	37.4	37.3	37.2	37.1	36.9	36.8
39	38.9	38.8	38.7	38.5	38.4	38.3	38.2	38.1	37.9	37.8
40	39.9	39.8	39.7	39.5	39.4	39.3	39.2	39.1	39.0	38.8
41	40.9	40.8	40.7	40.5	40.4	40.3	40.2	40.1	40.0	39.8
42	41.9	41.8	41.7	41.5	41.4	41.3	41.2	41.1	41.0	40.9
43	42.9	42.8	42.7	42.6	42.4	42.3	42.2	42.1	42.0	41.9
44	43.9	43.8	43.7	43.6	43.4	43.3	43.2	43.1	43.0	42.9
45	44.9	44.8	44.7	44.6	44.4	44.3	44.2	44.1	44.0	43.9
46	45.9	45.8	45.7	45.6	45.4	45.3	45.2	45.1	45.0	44.9
47	46.9	46.8	46.7	46.6	46.4	46.3	46.2	46.1	46.0	45.9
48	47.9	47.8	47.7	47.6	47.4	47.3	47.2	47.1	47.0	46.9
49	48.9	48.8	48.7	48.6	48.4	48.3	48.2	48.1	48.0	47.9
50	49.9	49.8	49.7	49.6	49.5	49.3	49.2	49.1	49.0	48.9

Table 1a — Relative humidity from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
1										
2	82.3	80.7	79.1	77.5	76.0	74.4	72.9	71.3	69.7	68.2
3	83.0	81.5	80.0	78.5	77.0	75.5	74.0	72.5	71.0	69.5
4	83.7	82.3	80.8	79.4	77.9	76.5	75.1	73.6	72.2	70.8
5	84.4	83.0	81.6	80.2	78.8	77.5	76.1	74.7	73.3	72.0
6	85.0	83.6	82.3	81.0	79.7	78.3	77.0	75.7	74.4	73.1
7	85.5	84.3	83.0	81.7	80.4	79.1	77.9	76.6	75.3	74.1
8	86.1	84.8	83.6	82.4	81.1	79.9	78.7	77.5	76.2	75.0
9	86.6	85.4	84.2	83.0	81.8	80.6	79.4	78.3	77.1	75.9
10	87.0	85.9	84.7	83.6	82.4	81.3	80.1	79.0	77.9	76.8
11	87.5	86.3	85.2	84.1	83.0	81.9	80.8	79.7	78.6	77.5
12	87.9	86.8	85.7	84.6	83.6	82.5	81.4	80.4	79.3	78.3
13	88.2	87.2	86.1	85.1	84.1	83.0	82.0	81.0	80.0	78.9
14	88.6	87.6	86.6	85.6	84.5	83.5	82.5	81.6	80.6	79.6
15	88.9	87.9	87.0	86.0	85.0	84.0	83.1	82.1	81.1	80.2
16	89.2	88.3	87.3	86.4	85.4	84.5	83.5	82.6	81.7	80.7
17	89.5	88.6	87.7	86.7	85.8	84.9	84.0	83.1	82.2	81.3
18	89.8	88.9	88.0	87.1	86.2	85.3	84.4	83.5	82.6	81.8
19	90.1	89.2	88.3	87.4	86.6	85.7	84.8	84.0	83.1	82.2
20	90.3	89.5	88.6	87.7	86.9	86.0	85.2	84.4	83.5	82.7
21	90.6	89.7	88.9	88.0	87.2	86.4	85.6	84.7	83.9	83.1
22	90.8	90.0	89.1	88.3	87.5	86.7	85.9	85.1	84.3	83.5
23	91.0	90.2	89.4	88.6	87.8	87.0	86.2	85.4	84.7	83.9
24	91.2	90.4	89.6	88.8	88.1	87.3	86.5	85.8	85.0	84.2
25	91.4	90.6	89.8	89.1	88.3	87.6	86.8	86.1	85.3	84.6
26	91.5	90.8	90.0	89.3	88.6	87.8	87.1	86.3	85.6	84.9
27	91.7	91.0	90.2	89.5	88.8	88.1	87.3	86.6	85.9	85.2
28	91.9	91.2	90.4	89.7	89.0	88.3	87.6	86.9	86.2	85.5
29	92.0	91.3	90.6	89.9	89.2	88.5	87.8	87.1	86.4	85.8
30	92.2	91.5	90.8	90.1	89.4	88.7	88.0	87.4	86.7	86.0
31	92.3	91.6	91.0	90.3	89.6	88.9	88.3	87.6	86.9	86.3
32	92.4	91.8	91.1	90.4	89.8	89.1	88.5	87.8	87.2	86.5
33	92.6	91.9	91.3	90.6	90.0	89.3	88.7	88.0	87.4	86.7
34	92.7	92.0	91.4	90.8	90.1	89.5	88.8	88.2	87.6	87.0
35	92.8	92.2	91.5	90.9	90.3	89.6	89.0	88.4	87.8	87.2
36	92.9	92.3	91.7	91.0	90.4	89.8	89.2	88.6	88.0	87.4
37	93.0	92.4	91.8	91.2	90.6	90.0	89.4	88.8	88.2	87.6
38	93.1	92.5	91.9	91.3	90.7	90.1	89.5	88.9	88.3	87.7
39	93.2	92.6	92.0	91.4	90.8	90.3	89.7	89.1	88.5	87.9
40	93.3	92.7	92.1	91.6	91.0	90.4	89.8	89.2	88.7	88.1
41	93.4	92.8	92.3	91.7	91.1	90.5	90.0	89.4	88.8	88.2
42	93.5	92.9	92.4	91.8	91.2	90.7	90.1	89.5	89.0	88.4
43	93.6	93.0	92.5	91.9	91.3	90.8	90.2	89.7	89.1	88.6
44	93.7	93.1	92.6	92.0	91.4	90.9	90.3	89.8	89.2	88.7
45	93.8	93.2	92.6	92.1	91.6	91.0	90.5	89.9	89.4	88.8
46	93.8	93.3	92.7	92.2	91.7	91.1	90.6	90.0	89.5	89.0
47	93.9	93.4	92.8	92.3	91.8	91.2	90.7	90.2	89.6	89.1
48	94.0	93.4	92.9	92.4	91.9	91.3	90.8	90.3	89.8	89.2
49	94.0	93.5	93.0	92.5	91.9	91.4	90.9	90.4	89.9	89.4
50	94.1	93.6	93.1	92.6	92.0	91.5	91.0	90.5	90.0	89.5

Table 1b — Dew-point temperature from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
1										
2	− 0.7	− 1.0	− 1.2	− 1.5	− 1.8	− 2.1	− 2.3	− 2.6	− 2.9	− 3.2
3	0.4	0.2	− 0.1	− 0.4	− 0.6	− 0.9	− 1.2	− 1.4	− 1.7	− 2.0
4	1.5	1.3	1.0	0.8	0.5	0.3	0.0	− 0.3	− 0.5	− 0.8
5	2.6	2.4	2.1	1.9	1.6	1.4	1.1	0.9	0.6	0.4
6	3.7	3.4	3.2	3.0	2.8	2.5	2.3	2.0	1.8	1.5
7	4.7	4.5	4.3	4.1	3.9	3.6	3.4	3.2	2.9	2.7
8	5.8	5.6	5.4	5.2	5.0	4.7	4.5	4.3	4.1	3.8
9	6.9	6.7	6.5	6.3	6.1	5.8	5.6	5.4	5.2	5.0
10	7.9	7.7	7.5	7.3	7.1	6.9	6.7	6.5	6.3	6.1
11	9.0	8.8	8.6	8.4	8.2	8.0	7.8	7.6	7.4	7.2
12	10.0	9.9	9.7	9.5	9.3	9.1	8.9	8.7	8.5	8.3
13	11.1	10.9	10.7	10.5	10.4	10.2	10.0	9.8	9.6	9.4
14	12.1	12.0	11.8	11.6	11.4	11.2	11.1	10.9	10.7	10.5
15	13.2	13.0	12.8	12.7	12.5	12.3	12.1	12.0	11.8	11.6
16	14.2	14.1	13.9	13.7	13.5	13.4	13.2	13.0	12.9	12.7
17	15.3	15.1	14.9	14.8	14.6	14.4	14.3	14.1	13.9	13.8
18	16.3	16.1	16.0	15.8	15.7	15.5	15.3	15.2	15.0	14.8
19	17.3	17.2	17.0	16.9	16.7	16.5	16.4	16.2	16.1	15.9
20	18.4	18.2	18.1	17.9	17.7	17.6	17.4	17.3	17.1	17.0
21	19.4	19.2	19.1	18.9	18.8	18.6	18.5	18.3	18.2	18.0
22	20.4	20.3	20.1	20.0	19.8	19.7	19.5	19.4	19.2	19.1
23	21.4	21.3	21.2	21.0	20.9	20.7	20.6	20.4	20.3	20.1
24	22.5	22.3	22.2	22.0	21.9	21.8	21.6	21.5	21.3	21.2
25	23.5	23.4	23.2	23.1	22.9	22.8	22.6	22.5	22.4	22.2
26	24.5	24.4	24.2	24.1	24.0	23.8	23.7	23.5	23.4	23.3
27	25.5	25.4	25.3	25.1	25.0	24.9	24.7	24.6	24.4	24.3
28	26.6	26.4	26.3	26.2	26.0	25.9	25.8	25.6	25.5	25.3
29	27.6	27.4	27.3	27.2	27.0	26.9	26.8	26.6	26.5	26.4
30	28.6	28.5	28.3	28.2	28.1	27.9	27.8	27.7	27.5	27.4
31	29.6	29.5	29.4	29.2	29.1	29.0	28.8	28.7	28.6	28.4
32	30.6	30.5	30.4	30.2	30.1	30.0	29.9	29.7	29.6	29.5
33	31.6	31.5	31.4	31.3	31.1	31.0	30.9	30.8	30.6	30.5
34	32.7	32.5	32.4	32.3	32.2	32.0	31.9	31.8	31.7	31.5
35	33.7	33.5	33.4	33.3	33.2	33.0	32.9	32.8	32.7	32.5
36	34.7	34.6	34.4	34.3	34.2	34.1	33.9	33.8	33.7	33.6
37	35.7	35.6	35.4	35.3	35.2	35.1	35.0	34.8	34.7	34.6
38	36.7	36.6	36.5	36.3	36.2	36.1	36.0	35.9	35.7	35.6
39	37.7	37.6	37.5	37.4	37.2	37.1	37.0	36.9	36.8	36.6
40	38.7	38.6	38.5	38.4	38.2	38.1	38.0	37.9	37.8	37.7
41	39.7	39.6	39.5	39.4	39.3	39.1	39.0	38.9	38.8	38.7
42	40.7	40.6	40.5	40.4	40.3	40.2	40.0	39.9	39.8	39.7
43	41.7	41.6	41.5	41.4	41.3	41.2	41.0	40.9	40.8	40.7
44	42.8	42.6	42.5	42.4	42.3	42.2	42.1	41.9	41.8	41.7
45	43.8	43.6	43.5	43.4	43.3	43.2	43.1	43.0	42.8	42.7
46	44.8	44.7	44.5	44.4	44.3	44.2	44.1	44.0	43.9	43.7
47	45.8	45.7	45.5	45.4	45.3	45.2	45.1	45.0	44.9	44.8
48	46.8	46.7	46.6	46.4	46.3	46.2	46.1	46.0	45.9	45.8
49	47.8	47.7	47.6	47.4	47.3	47.2	47.1	47.0	46.9	46.8
50	48.8	48.7	48.6	48.5	48.3	48.2	48.1	48.0	47.9	47.8

Table 1a — Relative humidity from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
1										
2										
3	68.1	66.6	65.1	63.7	62.2	60.7	59.3	57.8	56.4	54.9
4	69.4	68.0	66.6	65.2	63.8	62.4	61.0	59.6	58.2	56.8
5	70.6	69.3	67.9	66.6	65.2	63.9	62.6	61.2	59.9	58.6
6	71.8	70.5	69.2	67.9	66.6	65.3	64.0	62.7	61.5	60.2
7	72.8	71.6	70.3	69.1	67.9	66.6	65.4	64.2	62.9	61.7
8	73.8	72.6	71.4	70.2	69.0	67.8	66.7	65.5	64.3	63.1
9	74.8	73.6	72.4	71.3	70.1	69.0	67.9	66.7	65.6	64.4
10	75.6	74.5	73.4	72.3	71.2	70.1	69.0	67.9	66.8	65.7
11	76.4	75.4	74.3	73.2	72.1	71.1	70.0	68.9	67.9	66.8
12	77.2	76.2	75.1	74.1	73.0	72.0	71.0	70.0	68.9	67.9
13	77.9	76.9	75.9	74.9	73.9	72.9	71.9	70.9	69.9	68.9
14	78.6	77.6	76.6	75.7	74.7	73.7	72.8	71.8	70.8	69.9
15	79.2	78.3	77.3	76.4	75.4	74.5	73.6	72.6	71.7	70.8
16	79.8	78.9	78.0	77.0	76.1	75.2	74.3	73.4	72.5	71.6
17	80.4	79.5	78.6	77.7	76.8	75.9	75.0	74.1	73.3	72.4
18	80.9	80.0	79.1	78.3	77.4	76.6	75.7	74.8	74.0	73.1
19	81.4	80.5	79.7	78.8	78.0	77.2	76.3	75.5	74.7	73.8
20	81.9	81.0	80.2	79.4	78.6	77.7	76.9	76.1	75.3	74.5
21	82.3	81.5	80.7	79.9	79.1	78.3	77.5	76.7	75.9	75.1
22	82.7	81.9	81.1	80.3	79.6	78.8	78.0	77.2	76.5	75.7
23	83.1	82.3	81.6	80.8	80.0	79.3	78.5	77.8	77.0	76.3
24	83.5	82.7	82.0	81.2	80.5	79.7	79.0	78.3	77.5	76.8
25	83.8	83.1	82.4	81.6	80.9	80.2	79.4	78.7	78.0	77.3
26	84.2	83.4	82.7	82.0	81.3	80.6	79.9	79.2	78.5	77.8
27	84.5	83.8	83.1	82.4	81.7	81.0	80.3	79.6	78.9	78.2
28	84.8	84.1	83.4	82.7	82.0	81.3	80.7	80.0	79.3	78.6
29	85.1	84.4	83.7	83.0	82.4	81.7	81.0	80.4	79.7	79.0
30	85.3	84.7	84.0	83.3	82.7	82.0	81.4	80.7	80.1	79.4
31	85.6	85.0	84.3	83.6	83.0	82.4	81.7	81.1	80.4	79.8
32	85.9	85.2	84.6	83.9	83.3	82.7	82.0	81.4	80.8	80.1
33	86.1	85.5	84.8	84.2	83.6	83.0	82.3	81.7	81.1	80.5
34	86.3	85.7	85.1	84.5	83.8	83.2	82.6	82.0	81.4	80.8
35	86.5	85.9	85.3	84.7	84.1	83.5	82.9	82.3	81.7	81.1
36	86.8	86.1	85.5	84.9	84.4	83.8	83.2	82.6	82.0	81.4
37	87.0	86.4	85.8	85.2	84.6	84.0	83.4	82.8	82.3	81.7
38	87.1	86.6	86.0	85.4	84.8	84.2	83.7	83.1	82.5	82.0
39	87.3	86.8	86.2	85.6	85.0	84.5	83.9	83.3	82.8	82.2
40	87.5	86.9	86.4	85.8	85.2	84.7	84.1	83.6	83.0	82.5
41	87.7	87.1	86.6	86.0	85.4	84.9	84.3	83.8	83.2	82.7
42	87.8	87.3	86.7	86.2	85.6	85.1	84.6	84.0	83.5	82.9
43	88.0	87.5	86.9	86.4	85.8	85.3	84.8	84.2	83.7	83.2
44	88.2	87.6	87.1	86.5	86.0	85.5	84.9	84.4	83.9	83.4
45	88.3	87.8	87.2	86.7	86.2	85.7	85.1	84.6	84.1	83.6
46	88.4	87.9	87.4	86.9	86.4	85.8	85.3	84.8	84.3	83.8
47	88.6	88.1	87.5	87.0	86.5	86.0	85.5	85.0	84.5	84.0
48	88.7	88.2	87.7	87.2	86.7	86.2	85.7	85.2	84.7	84.2
49	88.9	88.3	87.8	87.3	86.8	86.3	85.8	85.3	84.8	84.3
50	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.0	84.5

Table 1b — Dew-point temperature from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	2.1	2.2	2.2	2.2	2.5	2.6	2.7	2.8	2.9	3.0
1										
2										
3	− 2.3	− 2.6	− 2.9	− 3.2	− 3.5	− 3.8	− 4.1	− 4.5	− 4.8	− 5.1
4	− 1.1	− 1.4	− 1.6	− 1.9	− 2.2	− 2.5	− 2.8	− 3.1	− 3.4	− 3.8
5	0.1	− 0.1	− 0.4	− 0.7	− 1.0	− 1.3	− 1.5	− 1.8	− 2.1	− 2.4
6	1.3	1.0	0.8	0.5	0.3	0.0	− 0.3	− 0.6	− 0.8	− 1.1
7	2.5	2.2	2.0	1.7	1.5	1.2	1.0	0.7	0.4	0.2
8	3.6	3.4	3.1	2.9	2.7	2.4	2.2	1.9	1.7	1.4
9	4.8	4.5	4.3	4.1	3.8	3.6	3.4	3.1	2.9	2.7
10	5.9	5.7	5.5	5.2	5.0	4.8	4.6	4.3	4.1	3.9
11	7.0	6.8	6.6	6.4	6.2	6.0	5.7	5.5	5.3	5.1
12	8.1	7.9	7.7	7.5	7.3	7.1	6.9	6.7	6.5	6.3
13	9.2	9.0	8.8	8.6	8.4	8.2	8.0	7.8	7.6	7.4
14	10.3	10.1	10.0	9.8	9.6	9.4	9.2	9.0	8.8	8.6
15	11.4	11.2	11.1	10.9	10.7	10.5	10.3	10.1	9.9	9.7
16	12.5	12.3	12.2	12.0	11.8	11.6	11.4	11.2	11.1	10.9
17	13.6	13.4	13.2	13.1	12.9	12.7	12.5	12.4	12.2	12.0
18	14.7	14.5	14.3	14.2	14.0	13.8	13.6	13.5	13.3	13.1
19	15.7	15.6	15.4	15.2	15.1	14.9	14.7	14.6	14.4	14.2
20	16.8	16.6	16.5	16.3	16.2	16.0	15.8	15.7	15.5	15.3
21	17.9	17.7	17.5	17.4	17.2	17.1	16.9	16.7	16.6	16.4
22	18.9	18.8	18.6	18.5	18.3	18.1	18.0	17.8	17.7	17.5
23	20.0	19.8	19.7	19.5	19.4	19.2	19.1	18.9	18.8	18.6
24	21.0	20.9	20.7	20.6	20.4	20.3	20.1	20.0	19.8	19.7
25	22.1	21.9	21.8	21.6	21.5	21.3	21.2	21.0	20.9	20.7
26	23.1	23.0	22.8	22.7	22.5	22.4	22.3	22.1	22.0	21.8
27	24.2	24.0	23.9	23.7	23.6	23.5	23.3	23.2	23.0	22.9
28	25.2	25.1	24.9	24.8	24.6	24.5	24.4	24.2	24.1	23.9
29	26.2	26.1	26.0	25.8	25.7	25.6	25.4	25.3	25.1	25.0
30	27.3	27.1	27.0	26.9	26.7	26.6	26.5	26.3	26.2	26.1
31	28.3	28.2	28.0	27.9	27.8	27.6	27.5	27.4	27.2	27.1
32	29.3	29.2	29.1	28.9	28.8	28.7	28.6	28.4	28.3	28.2
33	30.4	30.2	30.1	30.0	29.9	29.7	29.6	29.5	29.3	29.2
34	31.4	31.3	31.1	31.0	30.9	30.8	30.6	30.5	30.4	30.2
35	32.4	32.3	32.2	32.0	31.9	31.8	31.7	31.5	31.4	31.3
36	33.4	33.3	33.2	33.1	32.9	32.8	32.7	32.6	32.4	32.3
37	34.5	34.3	34.2	34.1	34.0	33.8	33.7	33.6	33.5	33.3
38	35.5	35.4	35.2	35.1	35.0	34.9	34.8	34.6	34.5	34.4
39	36.5	36.4	36.3	36.1	36.0	35.9	35.8	35.7	35.5	35.4
40	37.5	37.4	37.3	37.2	37.0	36.9	36.8	36.7	36.6	36.4
41	38.5	38.4	38.3	38.2	38.1	38.0	37.8	37.7	37.6	37.5
42	39.6	39.4	39.3	39.2	39.1	39.0	38.9	38.7	38.6	38.5
43	40.6	40.5	40.3	40.2	40.1	40.0	39.9	39.8	39.6	39.5
44	41.6	41.5	41.4	41.2	41.1	41.0	40.9	40.8	40.7	40.5
45	42.6	42.5	42.4	42.3	42.1	42.0	41.9	41.8	41.7	41.6
46	43.6	43.5	43.4	43.3	43.2	43.0	42.9	42.8	42.7	42.6
47	44.6	44.5	44.4	44.3	44.2	44.1	44.0	43.8	43.7	43.6
48	45.6	45.5	45.4	45.3	45.2	45.1	45.0	44.9	44.7	44.6
49	46.7	46.5	46.4	46.3	46.2	46.1	46.0	45.9	45.8	45.6
50	47.7	47.6	47.4	47.3	47.2	47.1	47.0	46.9	46.8	46.7

Table 1a — Relative humidity from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0
1										
2										
3										
4	55.4	54.1	52.7	51.3	50.0	48.6	47.3	45.9	44.6	43.2
5	57.3	55.9	54.6	53.3	52.0	50.7	49.4	48.1	46.8	45.5
6	58.9	57.7	56.4	55.2	53.9	52.7	51.4	50.2	48.9	47.7
7	60.5	59.3	58.1	56.9	55.7	54.5	53.3	52.1	50.9	49.7
8	62.0	60.8	59.6	58.5	57.3	56.2	55.0	53.9	52.7	51.6
9	63.3	62.2	61.1	60.0	58.8	57.7	56.6	55.5	54.4	53.3
10	64.6	63.5	62.4	61.4	60.3	59.2	58.1	57.1	56.0	55.0
11	65.8	64.7	63.7	62.7	61.6	60.6	59.6	58.5	57.5	56.5
12	66.9	65.9	64.9	63.9	62.9	61.9	60.9	59.9	58.9	57.9
13	67.9	67.0	66.0	65.0	64.0	63.1	62.1	61.2	60.2	59.2
14	68.9	68.0	67.0	66.1	65.2	64.2	63.3	62.4	61.4	60.5
15	69.8	68.9	68.0	67.1	66.2	65.3	64.4	63.5	62.6	61.7
16	70.7	69.8	68.9	68.0	67.2	66.3	65.4	64.5	63.7	62.8
17	71.5	70.7	69.8	68.9	68.1	67.2	66.4	65.5	64.7	63.8
18	72.3	71.4	70.6	69.8	68.9	68.1	67.3	66.4	65.6	64.8
19	73.0	72.2	71.4	70.6	69.7	68.9	68.1	67.3	66.5	65.7
20	73.7	72.9	72.1	71.3	70.5	69.7	68.9	68.2	67.4	66.6
21	74.3	73.6	72.8	72.0	71.2	70.5	69.7	68.9	68.2	67.4
22	74.9	74.2	73.4	72.7	71.9	71.2	70.4	69.7	68.9	68.2
23	75.5	74.8	74.0	73.3	72.6	71.8	71.1	70.4	69.6	68.9
24	76.1	75.3	74.6	73.9	73.2	72.4	71.7	71.0	70.3	69.6
25	76.6	75.9	75.1	74.4	73.7	73.0	72.3	71.6	71.0	70.3
26	77.1	76.4	75.7	75.0	74.3	73.6	72.9	72.2	71.6	70.9
27	77.5	76.8	76.2	75.5	74.8	74.1	73.5	72.8	72.1	71.5
28	78.0	77.3	76.6	76.0	75.3	74.6	74.0	73.3	72.7	72.0
29	78.4	77.7	77.1	76.4	75.8	75.1	74.5	73.8	73.2	72.6
30	78.8	78.1	77.5	76.9	76.2	75.6	75.0	74.3	73.7	73.1
31	79.2	78.5	77.9	77.3	76.6	76.0	75.4	74.8	74.2	73.6
32	79.5	78.9	78.3	77.7	77.1	76.4	75.8	75.2	74.6	74.0
33	79.9	79.3	78.7	78.0	77.4	76.8	76.2	75.6	75.1	74.5
34	80.2	79.6	79.0	78.4	77.8	77.2	76.6	76.1	75.5	74.9
35	80.5	79.9	79.3	78.8	78.2	77.6	77.0	76.4	75.9	75.3
36	80.8	80.2	79.7	79.1	78.5	77.9	77.4	76.8	76.2	75.7
37	81.1	80.5	80.0	79.4	78.8	78.3	77.7	77.2	76.6	76.0
38	81.4	80.8	80.3	79.7	79.1	78.6	78.0	77.5	76.9	76.4
39	81.7	81.1	80.5	80.0	79.4	78.9	78.4	77.8	77.3	76.7
40	81.9	81.4	80.8	80.3	79.7	79.2	78.7	78.1	77.6	77.1
41	82.2	81.6	81.1	80.5	80.0	79.5	78.9	78.4	77.9	77.4
42	82.4	81.9	81.3	80.8	80.3	79.8	79.2	78.7	78.2	77.7
43	82.6	82.1	81.6	81.1	80.5	80.0	79.5	79.0	78.5	78.0
44	82.8	82.3	81.8	81.3	80.8	80.3	79.8	79.3	78.7	78.2
45	83.1	82.5	82.0	81.5	81.0	80.5	80.0	79.5	79.0	78.5
46	83.3	82.8	82.3	81.8	81.3	80.8	80.3	79.8	79.3	78.8
47	83.5	83.0	82.5	82.0	81.5	81.0	80.5	80.0	79.5	79.0
48	83.7	83.2	82.7	82.2	81.7	81.2	80.7	80.2	79.8	79.3
49	83.8	83.4	82.9	82.4	81.9	81.4	80.9	80.5	80.0	79.5
50	84.0	83.5	83.1	82.6	82.1	81.6	81.2	80.7	80.2	79.7

Table 1b — Dew-point temperature from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0
1										
2										
3										
4	− 4.1	− 4.4	− 4.7	− 5.1	− 5.4	− 5.8	− 6.2	− 6.5	− 6.9	− 7.3
5	− 2.7	− 3.0	− 3.4	− 3.7	− 4.0	− 4.3	− 4.7	− 5.0	− 5.4	− 5.7
6	− 1.4	− 1.7	− 2.0	− 2.3	− 2.6	− 2.9	− 3.2	− 3.6	− 3.9	− 4.2
7	− 0.1	− 0.4	− 0.7	− 1.0	− 1.2	− 1.5	− 1.8	− 2.1	− 2.5	− 2.8
8	1.2	0.9	0.6	0.4	0.1	− 0.2	− 0.5	− 0.8	− 1.1	− 1.3
9	2.4	2.2	1.9	1.6	1.4	1.1	0.9	0.6	0.3	0.0
10	3.6	3.4	3.2	2.9	2.7	2.4	2.2	1.9	1.6	1.4
11	4.8	4.6	4.4	4.1	3.9	3.7	3.4	3.2	2.9	2.7
12	6.0	5.8	5.6	5.4	5.1	4.9	4.7	4.4	4.2	4.0
13	7.2	7.0	6.8	6.6	6.4	6.1	5.9	5.7	5.5	5.2
14	8.4	8.2	8.0	7.8	7.6	7.3	7.1	6.9	6.7	6.5
15	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.1	7.9	7.7
16	10.7	10.5	10.3	10.1	9.9	9.7	9.5	9.3	9.1	8.9
17	11.8	11.6	11.4	11.3	11.1	10.9	10.7	10.5	10.3	10.1
18	12.9	12.8	12.6	12.4	12.2	12.0	11.8	11.7	11.5	11.3
19	14.0	13.9	13.7	13.5	13.3	13.2	13.0	12.8	12.6	12.4
20	15.2	15.0	14.8	14.6	14.5	14.3	14.1	13.9	13.8	13.6
21	16.3	16.1	15.9	15.8	15.6	15.4	15.2	15.1	14.9	14.7
22	17.3	17.2	17.0	16.9	16.7	16.5	16.4	16.2	16.0	15.9
23	18.4	18.3	18.1	18.0	17.8	17.6	17.5	17.3	17.2	17.0
24	19.5	19.4	19.2	19.1	18.9	18.7	18.6	18.4	18.3	18.1
25	20.6	20.4	20.3	20.1	20.0	19.8	19.7	19.5	19.4	19.2
26	21.7	21.5	21.4	21.2	21.1	20.9	20.8	20.6	20.5	20.3
27	22.7	22.6	22.4	22.3	22.1	22.0	21.9	21.7	21.6	21.4
28	23.8	23.7	23.5	23.4	23.2	23.1	22.9	22.8	22.6	22.5
29	24.9	24.7	24.6	24.4	24.3	24.2	24.0	23.9	23.7	23.6
30	25.9	25.8	25.6	25.5	25.4	25.2	25.1	24.9	24.8	24.7
31	27.0	26.8	26.7	26.6	26.4	26.3	26.1	26.0	25.9	25.7
32	28.0	27.9	27.7	27.6	27.5	27.3	27.2	27.1	26.9	26.8
33	29.1	28.9	28.8	28.7	28.5	28.4	28.3	28.1	28.0	27.9
34	30.1	30.0	29.8	29.7	29.6	29.4	29.3	29.2	29.1	28.9
35	31.1	31.0	30.9	30.8	30.6	30.5	30.4	30.2	30.1	30.0
36	32.2	32.1	31.9	31.8	31.7	31.5	31.4	31.3	31.2	31.0
37	33.2	33.1	33.0	32.8	32.7	32.6	32.5	32.3	32.2	32.1
38	34.3	34.1	34.0	33.9	33.8	33.6	33.5	33.4	33.3	33.1
39	35.3	35.2	35.0	34.9	34.8	34.7	34.5	34.4	34.3	34.2
40	36.3	36.2	36.1	36.0	35.8	35.7	35.6	35.5	35.3	35.2
41	37.3	37.2	37.1	37.0	36.9	36.7	36.6	36.5	36.4	36.2
42	38.4	38.3	38.1	38.0	37.9	37.8	37.7	37.5	37.4	37.3
43	39.4	39.3	39.2	39.0	38.9	38.8	38.7	38.6	38.4	38.3
44	40.4	40.3	40.2	40.1	40.0	39.8	39.7	39.6	39.5	39.4
45	41.4	41.3	41.2	41.1	41.0	40.9	40.7	40.6	40.5	40.4
46	42.5	42.4	42.2	42.1	42.0	41.9	41.8	41.7	41.5	41.4
47	43.5	43.4	43.3	43.1	43.0	42.9	42.8	42.7	42.6	42.4
48	44.5	44.4	44.3	44.2	44.0	43.9	43.8	43.7	43.6	43.5
49	45.5	45.4	45.3	45.2	45.1	45.0	44.8	44.7	44.6	44.5
50	46.5	46.4	46.3	46.2	46.1	46.0	45.9	45.7	45.6	45.5

Table 1a — Relative humidity from dry-bulb readings from 1 °C to 50 °C and wet-bulb depressions up to 15 degrees Celsius at 1 013 hPa pressure

	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0
1										
2										
3										
4										
5	44.3	43.0	41.7	40.4	39.2	37.9	36.6	35.4	34.1	32.9
6	46.5	45.2	44.0	42.8	41.6	40.4	39.2	37.9	36.7	35.5
7	48.5	47.3	46.2	45.0	43.8	42.7	41.5	40.3	39.2	38.0
8	50.4	49.3	48.2	47.1	45.9	44.8	43.7	42.6	41.5	40.4
9	52.2	51.1	50.1	49.0	47.9	46.8	45.7	44.7	43.6	42.5
10	53.9	52.9	51.8	50.8	49.7	48.7	47.6	46.6	45.6	44.6
11	55.5	54.5	53.4	52.4	51.4	50.4	49.4	48.4	47.4	46.5
12	56.9	55.9	55.0	54.0	53.0	52.1	51.1	50.1	49.2	48.2
13	58.3	57.4	56.4	55.5	54.5	53.6	52.7	51.7	50.8	49.9
14	59.6	58.7	57.8	56.8	55.9	55.0	54.1	53.2	52.3	51.4
15	60.8	59.9	59.0	58.1	57.3	56.4	55.5	54.6	53.8	52.9
16	61.9	61.1	60.2	59.3	58.5	57.6	56.8	55.9	55.1	54.3
17	63.0	62.1	61.3	60.5	59.7	58.8	58.0	57.2	56.4	55.6
18	64.0	63.2	62.4	61.6	60.7	59.9	59.1	58.3	57.6	56.8
19	64.9	64.1	63.3	62.6	61.8	61.0	60.2	59.4	58.7	57.9
20	65.8	65.0	64.3	63.5	62.7	62.0	61.2	60.5	59.7	59.0
21	66.7	65.9	65.2	64.4	63.7	62.9	62.2	61.5	60.7	60.0
22	67.5	66.7	66.0	65.3	64.5	63.8	63.1	62.4	61.7	60.9
23	68.2	67.5	66.8	66.1	65.4	64.6	63.9	63.2	62.5	61.8
24	68.9	68.2	67.5	66.8	66.1	65.4	64.7	64.1	63.4	62.7
25	69.6	68.9	68.2	67.5	66.9	66.2	65.5	64.8	64.2	63.5
26	70.2	69.5	68.9	68.2	67.6	66.9	66.2	65.6	64.9	64.3
27	70.8	70.2	69.5	68.9	68.2	67.6	66.9	66.3	65.6	65.0
28	71.4	70.8	70.1	69.5	68.8	68.2	67.6	66.9	66.3	65.7
29	71.9	71.3	70.7	70.1	69.4	68.8	68.2	67.6	67.0	66.4
30	72.5	71.8	71.2	70.6	70.0	69.4	68.8	68.2	67.6	67.0
31	73.0	72.3	71.7	71.1	70.5	69.9	69.3	68.8	68.2	67.6
32	73.4	72.8	72.2	71.6	71.1	70.5	69.9	69.3	68.7	68.1
33	73.9	73.3	72.7	72.1	71.5	71.0	70.4	69.8	69.2	68.7
34	74.3	73.7	73.2	72.6	72.0	71.4	70.9	70.3	69.8	69.2
35	74.7	74.2	73.6	73.0	72.5	71.9	71.3	70.8	70.2	69.7
36	75.1	74.6	74.0	73.4	72.9	72.3	71.8	71.2	70.7	70.2
37	75.5	74.9	74.4	73.8	73.3	72.8	72.2	71.7	71.1	70.6
38	75.9	75.3	74.8	74.2	73.7	73.2	72.6	72.1	71.6	71.0
39	76.2	75.7	75.1	74.6	74.1	73.5	73.0	72.5	72.0	71.5
40	76.5	76.0	75.5	75.0	74.4	73.9	73.4	72.9	72.4	71.9
41	76.9	76.3	75.8	75.3	74.8	74.3	73.8	73.3	72.8	72.2
42	77.2	76.6	76.1	75.6	75.1	74.6	74.1	73.6	73.1	72.6
43	77.5	77.0	76.4	75.9	75.4	74.9	74.4	74.0	73.5	73.0
44	77.7	77.2	76.7	76.2	75.8	75.3	74.8	74.3	73.8	73.3
45	78.0	77.5	77.0	76.5	76.1	75.6	75.1	74.6	74.1	73.6
46	78.3	77.8	77.3	76.8	76.3	75.9	75.4	74.9	74.4	74.0
47	78.5	78.1	77.6	77.1	76.6	76.2	75.7	75.2	74.7	74.3
48	78.8	78.3	77.8	77.4	76.9	76.4	76.0	75.5	75.0	74.6
49	79.0	78.6	78.1	77.6	77.2	76.7	76.2	75.8	75.3	74.9
50	79.3	78.8	78.3	77.9	77.4	77.0	76.5	76.0	75.6	75.1