

CONFIRMED
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Definitions, formulae and constants relating to the humidity of the air

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Foreword

The humidity of the air is of great importance in many industrial processes, in the majority of which the important consideration is not the actual moisture content but the ratio of this to the maximum amount of water vapour which could be in the moist air at the actual temperature and actual pressure. The quantitative relations involved could, of course, be discussed in terms usual in dealing with the physical chemistry of mixtures but, for historical reasons, and because the methods of measurement found useful in practice are not the most direct, a special terminology has grown up which is peculiar to this one specialized subject. The present standard deals with this special nomenclature.

In the first edition of this British Standard attention was directed to the confusion which existed in the nomenclature of hygrometric measurement, almost every term in use having more than one meaning and, conversely, a single concept having as many as four different names.

Today the position is a little better, in that to most terms there is an unambiguous meaning, but much remains to be done, for it is not yet true that each concept has a single name. This is due to the wide range of industries and applications of humidity measurements.

In carrying out the revision, some of the explanations have been altered to take account of the present state of the subject, a definition of each term in general use has been given, and the number of names which may be attached to any given concept has been reduced, though it has not been possible to eliminate alternative names completely. The meaning of terms, e.g. "specific enthalpy" and "adiabatic", used in humidity work, does not necessarily agree with the meaning assigned to those terms in general thermodynamics, but it is felt that departures from current practice would lead to confusion.

A great deal of thought has been given to the symbols for the quantities which occur most frequently. Those in use up to the present form an incoherent, and indeed chaotic, collection and an attempt has been made to render them a little more systematic; a proposal to make a fresh start, with all the symbols newly assigned, might invite people to ignore the proposals entirely, so attention has been confined to regularizing the use of subscript letters and superscript dashes.

It cannot be hoped that the recommended nomenclature and symbolism will immediately supersede other systems, more especially as the World Meteorological Organization has meanwhile put forward a somewhat different system. The advantages and disadvantages of adopting it in its entirety were weighed carefully, but it was felt that British users were unlikely to find it acceptable.

It is hoped that when the time comes for the next revision, usage on both sides of the Atlantic will have developed so far as to permit a systematic nomenclature to be formulated, which will be acceptable to all the English-speaking peoples.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 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 defines terms relating to the measurement of the humidity of the air and gives relevant formulae with values for their associated constants. Vapour pressure tables and a bibliography are included.

2 Definitions

2.01 absolute humidity

the mass of water vapour present in unit volume of moist air. Typical units are the grain per cubic foot and the gramme per cubic metre

NOTE In meteorology the preferred term is *vapour concentration*. In the past, other terms such as *vapour density* and even *moisture content by volume* have been used for this concept.

2.02 adiabatic saturation temperature

see definitions 2.19 and 2.20

2.03 dew point

the temperature at which the vapour pressure of the water vapour in the air is equal to the saturation vapour pressure over water. If the ideal gas laws held, this would be equal to the temperature at which the mixing ratio has its saturation value. The latter temperature, which is the one measured in practice, is distinguished as the *thermodynamic dew point*, and is the temperature at which condensation begins to occur under normal conditions when the initial mixture is cooled at constant pressure

NOTE At all temperatures, for purposes of determining dew point, the saturation vapour pressure and the saturation mixing ratio are to be evaluated with reference to liquid water and not to ice.

2.04 enthalpy of moist air

this is virtually equal to the sum of the enthalpies of the dry air and of the water vapour (see 4.8). It should be noted that the *specific enthalpy of air* is taken as the enthalpy of that mass of air which contains unit mass of dry air. In the U.K. and in Western Europe for hygrometric calculations, enthalpy is normally reckoned from the freezing point as datum. In the U.S.A. it is customary to calculate the enthalpy of the dry air from 0 °F and that of the water vapour from the freezing point. Enthalpy may be expressed in terms of any conventional heat units

2.05 hoar-frost point

the temperature at which the vapour pressure of the water vapour in the air is equal to the saturation vapour pressure over ice. If the ideal gas laws held, this would be equal to the temperature at which the mixing ratio is equal to the saturation value over ice. The latter temperature, which is the one measured in practice, is distinguished as the *thermodynamic hoar-frost point* and is the temperature at which deposition begins to occur under normal conditions when the initial mixture is cooled at constant pressure

2.06 humid volume

the volume of that quantity of moist air which contains unit mass of dry air. It may be expressed in cubic feet per pound of dry air or in cubic metres per kilogramme of dry air

2.07 hygrometer

any instrument used for the measurement of humidity

2.08 mixing ratio

the ratio of the mass of water vapour to the mass of dry air with which the water vapour is associated

2.09 moisture content (term deprecated)

the term is deprecated because it has been used for two different concepts. In one concept the term represented the mass of water vapour per unit mass of dry air; this is now called *mixing ratio*. In the other concept the term signified the mass of water vapour per unit mass of moist air; this is now called *specific humidity*

2.10 mole

one mole of any element or compound is the amount of substance that contains the same number of molecules as there are atoms in 0.012 kg (exactly) of the pure carbon nuclide carbon 12

2.11 mole fraction

the mole fraction of a component of a mixture is the ratio of the number of moles of that component to the total number of moles present. To every mixing ratio there is a corresponding mole fraction