
International Standard



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Atmospheres for conditioning and testing — Determination of relative humidity — Part 1: Aspirated psychrometer method

Atmosphères de conditionnement et d'essai — Détermination de l'humidité relative — Partie 1: Méthode utilisant un psychromètre à aspiration

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4677/1 was prepared by Technical Committee ISO/TC 125, *Enclosures and conditions for testing*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Atmospheres for conditioning and testing — Determination of relative humidity — Part 1: Aspirated psychrometer method

0 Introduction

This part of ISO 4677, dealing with the aspirated psychrometer, and ISO 4677/2, dealing with the whirling psychrometer, specify methods for the accurate measurement of humidity, but they do not specify the full details of the psychrometers required. This is to ensure that well-designed instruments which have gained acceptance in different countries are not arbitrarily excluded. Nevertheless, the methods are not necessarily suitable for all traditional designs. They could have been made so only if the lowest common performance factor had been accepted.

The course adopted, of specifying only the essential features of a few important classes of psychrometers, necessarily has some limitations. It should therefore be understood that good practice should be followed, both in implementing the requirements of the appropriate part of this International Standard and in detailing aspects of the design and the procedure which are not specified.

Neither this part of ISO 4677 nor ISO 4677/2 should be regarded as specifying requirements for psychrometers suitable for meteorological applications or other outdoor applications. Nevertheless, in both parts, humidity is measured on the scale employed almost universally for meteorological measurements at the Earth's surface and for the purposes of testing materials.

This scale has, in effect, been established by the general acceptance of particular psychrometric formulae for particular designs of psychrometers. The formula of Sprung for the Assmann psychrometer and that of Ferrel for a whirling psychrometer are representative. These formulae may be expressed in terms of the psychrometer coefficient A which appears in the psychrometer equation given in clause 7. Sprung's result corresponds to a constant value for A of $6,6 \times 10^{-4} \text{ K}^{-1}$, while Ferrel's result corresponds to a value that increases from $6,6 \times 10^{-4} \text{ K}^{-1}$ to $6,8 \times 10^{-4} \text{ K}^{-1}$ as the wet-bulb temperature increases from 0 to 30 °C. In both cases, the uncertainty in A is about 10 %. However, it is known that the true values of A for two instruments differ by much less than 10 %. The prevailing humidity scale may therefore be regarded as defined by specifying that A is constant and equal to $6,7 \times 10^{-4} \text{ K}^{-1}$ for both instruments. Since the accuracy with which A needs to be known in order to achieve a particular accuracy in the measurement of relative humidity decreases rapidly as the wet-bulb temperature rises in the range above 40°C, this definition may be regarded as applying for wet-bulb temperatures up to almost 100 °C (assuming approximately standard atmospheric pressure).

The uncertainties in relative humidity given in this International Standard relate to departures from the results that would correspond to this scale. The relationship between this scale and the true humidity scale is a question for the future. The present uncertainty in the relationship corresponds to the uncertainty in A of about 10 %. A decrease in A by this amount would, for example, result in a derived relative humidity of 50,0 % at 20 °C being changed to 51,8 %.

The aspirated psychrometer method is more accurate than that using the whirling psychrometer. In addition, it offers advantages in regard to the smaller space which it requires, the possibility of using alternative types of thermometers (for example electrical), the shielding of the thermometer bulbs from extraneous radiation and the fewer demands which it makes on the skills of the observer.

When the flow of air in the psychrometer is transverse, the instrument somewhat resembles the whirling psychrometer but, when the flow of air is axial, the radiation shield of the wet bulb plays an essential role, and additional geometrical features have to be specified.

In this International Standard, "r.h." is used as an abbreviation for "relative humidity". It does not denote a unit. Uncertainties in the relative humidity are expressed in the form $\pm u$ % r.h., the meaning of which is that the relative humidity is expected to lie in the range $(U - u)$ % to $(U + u)$ %, where U is the observed relative humidity. All uncertainties are at the 95 % confidence level.

1 Scope and field of application

1.1 Scope

This part of ISO 4677 specifies a method for the determination of the relative humidity of atmospheres for conditioning and testing having temperatures within the range from 5 to 80 °C using a psychrometer ventilated by aspiration. The property is determined with an uncertainty either not exceeding ± 3 % r.h. or not exceeding ± 2 % r.h., depending on the uncertainty in the value obtained for the wet-bulb temperature depression and on whether or not the dry-bulb temperature exceeds 40 °C.