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Air quality — Handling of temperature, pressure and humidity data

Qualité de l'air — Traitement des données de température, de pression et d'humidité

Reference number
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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 8756 was prepared by Technical Committee ISO/TC 146, *Air quality*, Subcommittee SC 4, *General aspects*.

Annex A of this International Standard is for information only.

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Air quality — Handling of temperature, pressure and humidity data

1 Scope

This International Standard describes procedures for adjusting air quality measurements for changes in temperature, pressure and humidity during the sampling period. It also specifies the reference conditions of temperature, pressure and humidity to be used when reporting the results.

The procedures and reference conditions are applicable to air quality measurement methods and apply to measurements made in ambient and workplace atmospheres and to the measurement of stationary source emissions.

2 Procedures for adjustment of air quality measurements for changes in atmospheric pressure, temperature and humidity during the sampling period

2.1 Ambient and Workplace Atmospheres

2.1.1 General

Atmospheric temperature, pressure and humidity may all change during the sampling period, which may be of a duration of several minutes or several weeks, depending on the location at which the air quality measurements are made (workplace or ambient) and the purpose for which they are required. Pressure and absolute humidity change slowly, but temperature and relative humidity changes may be much more sudden. For example, a daily change in pressure may be of the order of approximately 4 000 Pa taking place fairly smoothly at a rate of 200 Pa/h. Temperature changes may be approximately 20 °C in the course of several hours, although in heated indoor workplaces the temperature is likely to remain fairly constant. Conversely, in some workplaces in industrial plants (e.g. near blast furnaces), changes may be very sudden and large.

The effect of change in humidity will be different for different methods of air quality measurement and is not merely a correction for the volume of air sampled. For the effect of humidity, it is essential to refer to the specific air quality measurement method.

2.1.2 Sampling period of up to 15 min duration

Atmospheric temperature, pressure and humidity are unlikely to change significantly in any 15 min period and corrections for changes are therefore unnecessary.

In this case, the atmospheric temperature and pressure (where relevant, the absolute or relative humidity) should be noted at the time of sampling.

2.1.3 Sampling period of up to 1 h duration

Atmospheric pressure is unlikely to change greatly during a 1 h sampling period, but the temperature may change significantly during normal weather conditions.

In this case, atmospheric pressure should be noted once during the sampling period, the temperature measured at the start and finish of sampling and the mean value recorded. Where relevant, the absolute or relative humidity should be noted once during the sampling period, preferably at the middle of the period.

2.1.4 Sampling period of up to 12 h duration

Atmospheric temperature and pressure (and, where relevant, absolute or relative humidity) should be measured at the start of the sampling period and then at intervals of 1 h. The mean values should be used in calculating air quality results. Sometimes, particu-

larly when measuring ambient air quality, it may not be possible to measure temperature, pressure and humidity at hourly intervals. In such cases, the measurements should be made as often as possible throughout the sampling period. The time-weighted average values should then be calculated for use in the air quality measurement. (See note 1.)

If it is impossible to make any temperature, pressure or humidity measurements during the sampling period, measurements should be made at the commencement and conclusion of the sampling period and the mean values used in the subsequent air quality measurement calculation. However, this procedure is very much less accurate than that using time-weighted average values.

The decision on the frequency of measurement of temperature, pressure and humidity values during the sampling period should be made in the light of changes known to have occurred in similar situations and the magnitude of the error that can be tolerated for the purpose the measurements are being made. The relevance of the humidity measurement should be ascertained from the specific air quality measurement method.

NOTE 1 Time-weighted averages will not give the time-average value for the sampling period, but the difference between the true average and the time-weighted average will be small and, in nearly all cases, the error will be smaller than the total error in the actual measurement of the air quality parameter.

2.1.5 Sampling periods of greater than 12 h duration

Where relevant, temperature, pressure and absolute or relative humidity should be measured at the beginning of the sampling period, and if possible, recorded continuously, but if not, then at sufficiently frequent intervals (6 h is the suggested duration) during sampling, to obtain a reasonably accurate mean value for the sampling period. The relevance of humidity measurements should be ascertained from the specific air quality measurement method. The frequency of the temperature and pressure measurements will depend on their variation expected from previous experience in similar situations and the degree of error acceptable in the final result. (See note 1.)

For very long sampling periods (e.g. one week or more) and when recording devices are unavailable, maximum and minimum thermometers may be used to record the daily extreme values.

2.2 Stationary source emissions

2.2.1 General

Changes in atmospheric pressure, temperature and humidity will have little effect on the results of emission measurements, bearing in mind the difficulties and uncertainties of sampling gas emissions from industrial plants.

Volumes of sample gas should be corrected for temperature and pressure, and wet gas volumes corrected to a dry basis whenever the gas in the volume (or flow) measuring devices is not dry.

2.2.2 All sampling periods

Sampling gaseous emissions involves following very stringent procedures specified in particular measurement methods and the procedures should be followed exactly in respect of frequency and method of measurement of temperature, pressure and humidity of the emissions.

3 Reference conditions of temperature, pressure and humidity

As measurements of air quality parameters are made at different temperatures, pressures and humidities, it is essential that results should be expressed with respect to standard reference conditions, so that reliable comparisons can be made of air qualities measured at different places and times and under different climatic conditions.

For methods of measurement of air quality, the standard reference conditions recommended are as follows:

reference pressure: 101,3 kPa;

reference temperature: 273 K.

Because of the difficulties of adjusting results for varying humidity values, as humidity does not merely affect the sample volume and its effects are different for different measurement methods, a reference humidity value should only be used where applicable, for example in measurements of emissions from stationary sources.

In these cases, the standard reference value should be[1)]

reference humidity: zero (i.e. dry gas).

4 Reporting results of air quality measurements

It is recognized that the reference values for temperature and pressure given in clause 3 will not be typical of normal conditions found in many parts of the world, but the values are chosen simply to enable air quality measurements to be compared reliably, without variations being obscured by temperature and pressure differences.

Therefore, in reporting air quality measurements all results should be

a) given for the temperature and pressure (and where relevant, humidity) at which the measurements were made (see note 2);

b) corrected to the reference temperature and pressure (and where relevant, humidity) values, using the equation

$$R_0 = R_1 \times \frac{101{,}3}{p_1} \times \frac{T_1}{273}$$

where

R_0 is the result, expressed in units of mass or number per unit volume of air at the reference temperature and pressure;

R_1 is the result, expressed in units of mass or number per unit volume of air measured at temperature T_1, in kelvins, and pressure p_1, in kilopascals.

(see notes 2 and 3);

c) with reference to the specified reference conditions, for example 20 °C or 25 °C and 101,3 kPa for workplace and ambient atmospheres, for compliance with national standards and regulations.

NOTES

2 The temperature and pressure at which the measurement was made may be single values, mean values, time-weighted averages, etc. as described in clause 2.

3 The humidity correction is not included. The calculation given in the specific method for the measurement of air quality should be used.

1) Thermodynamic properties of steam are tabulated, for example, in bibliographic references [1, 2] in annex A.

Annex A
(informative)

Bibliography

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[2] SCHMIDT, E. *Properties of Water and Steam in SI-Units;* 0 - 800 °C, 0 - 1 000 bar; 3rd, enl. print./ed. by Ulrich Grigull; Berlin, Heidelberg, New York: Springer; München: Oldenbourg, 1982.

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