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English Version

Ambient air - Determination of the particle number concentration of atmospheric aerosol

Air ambiant - Détermination de la concentration en nombre de particules de l'aérosol atmosphérique

Außenluft - Bestimmung der Partikelanzahlkonzentration des atmosphärischen Aerosols

This Technical Specification (CEN/TS) was approved by CEN on 26 June 2016 for provisional application.

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European Foreword

This document (CEN/TS 16976:2016) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

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Introduction

There is a growing awareness of the significance of aerosol particles with diameters of $D < 1$ µm for human health as well as for their climatic impact. To assess air quality, it appears necessary to supplement gravimetrically determined mass concentrations such as PM_{10} or $PM_{2.5}$ with a measurement of the particle number concentration. Since ultrafine particles with diameters of $D < 0{,}1$ µm make an almost insignificant contribution to the mass of atmospheric aerosol particles, they can best be detected with counting measuring methods of sufficient sensitivity.

As particle measurement instrumentation allows determining either the particle number concentration or the particle number size distribution two Technical Specifications will be established:

— one dealing with the determination of the single parameter number concentration (a measure of "total" number concentration),

— one dealing with the determination of number concentration within a limited number of size ranges.

Clauses 5 and 6 contain general information about the method and the expected properties of the aerosol to be measured.

Clause 7 sets out the performance criteria for CPCs. Specifically, these are the relevant performance characteristics of CPC instruments (without any sampling system), the respective criteria that shall be met, and a description of how the tests shall be carried out. In general these tests are expected to be carried out by test houses or CPC manufacturers rather than users, and could form the basis for type testing of CPCs in future.

Clause 8 sets out the performance criteria and test procedures for the sampling and conditioning system (e.g. dilution). These may be applied by manufacturers of sampling systems, test houses or users (network operators).

Clause 9 sets out requirements for the installation, initial checks and calibrations, and operation of a CPC and sampling system at a monitoring site, including routine maintenance, data processing (including use of QA/QC data) and reporting. In general these will be the responsibility of users (network operators), though calibrations requiring test aerosols shall only be carried out by suitably qualified laboratories.

Clause 10 sets out Quality Assurance and Quality Control procedures, i.e. the ongoing checks and calibrations that are required on the CPC and sampling system during operation at a monitoring site. It is expected that these will be the responsibility of users (network operators), though calibrations requiring test aerosols shall only be carried out by suitably qualified laboratories. The main sources of measurement uncertainty are described.

1 Scope

This Technical Specification describes a standard method for determining the particle number concentration in ambient air in a range up to about 10^7 cm^{-3} for averaging times equal to or larger than 1 min. The standard method is based on a Condensation Particle Counter (CPC) operated in the counting mode and an appropriate dilution system for concentrations exceeding the counting mode range. It also defines the performance characteristics and the minimum requirements of the instruments to be used. The lower and upper sizes considered within this document are 7 nm and a few micrometres, respectively. This document describes sampling, operation, data processing and QA/QC procedures including calibration parameters.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 27891, *Aerosol particle number concentration — Calibration of condensation particle counters*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
actual flow rate
volumetric flow rate of an individual instrument, measured at its inlet under the actual air conditions

3.2
aerosol
a multi-phase system of solid and/or liquid particles suspended in a gas, ranging in particle size from 0,001 µm to 100 µm

3.3
calculation flow rate
flow rate which directly relates count rate and particle number concentration

Note 1 to entry: This flow rate is used for instrument internal calculation of the particle number concentration. It depends on the instrument type and may be nominal, factory-certified or actual inlet flow rate. It may also include a calibration factor unless the total inlet flow is analysed.

3.4
coincidence error
error that occurs with counting measuring methods when two or more particles are counted simultaneously as a single particle

Note 1 to entry: Coincidence error is related to particle number concentration, flow velocity through the sensing zone and size of sensing zone.