

# Stationary source emissions — Determination of low range mass concentration of dust —

## Part 2: Automated measuring systems

The European Standard EN 13284-2:2004 has the status of a  
British Standard

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# National foreword

This British Standard is the official English language version of EN 13284-2:2004.

The UK participation in its preparation was entrusted by Technical Committee EH/2, Air quality, to Subcommittee EH/2/1, Stationary source emissions, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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English version

## Stationary source emissions - Determination of low range mass concentration of dust - Part 2: Automated measuring systems

Emissions de sources fixes - Détermination de la faible concentration en masse de poussières - Partie 2: Systèmes automatiques de mesure

Emissionen aus stationären Quellen - Ermittlung der Staubmassenkonzentration bei geringen Staubkonzentrationen - Teil 2: Automatische Messeinrichtungen

This European Standard was approved by CEN on 22 July 2004.

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## Foreword

This document (EN 13284-2:2004) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2005, and conflicting national standards shall be withdrawn at the latest by March 2005.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative bibliography, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

## **Introduction**

This document describes the quality assurance procedures related to Automated Measuring Systems (AMS) for the determination of dust in flue gas, in order to meet the uncertainty requirements on measured values given by regulations, e.g. EC Directives ([1], [2]), national or other legislation.

This document is only applicable in conjunction with the general document on quality assurance of AMS described in EN 14181, and provides indications which are specific to dust measurements.

The calibration and validation of dust AMS are performed by parallel measurements with the reference manual gravimetric method described in EN 13284-1.

## 1 Scope

This document specifies specific requirements on automated measuring systems (AMS) for dust monitoring. It is derived from EN 14181 which is the general document on the quality assurance of AMS. It is only applicable in conjunction with EN 14181.

This document specifies test criteria for the QAL1 and specific requirements for QAL2, QAL3 and AST for dust AMS used for proving that the dust emissions from a source are compliant with emission limits below  $50 \text{ mg/m}^3$  (standard conditions) in ducted gaseous streams. This document is applicable by direct correlation with the standard reference method (SRM) described in EN 13284-1.

This document is primarily developed for emissions from waste incinerators. From a technical point of view, it may be applied to other processes, for which measurement at an emission limit is required with defined uncertainty.

## 2 Normative references

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

EN 13284-1:2001, *Stationary source emissions - Determination of low range mass concentration of dust - Part 1: Manual gravimetric method*.

EN 14181:2004, *Stationary source emissions – Quality assurance of automated measuring systems*.

EN ISO 14956, *Air quality - Evaluation of the suitability of a measurement procedure by comparison with a required measurement uncertainty (ISO 14956:2002)*.

EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:1999)*.

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13284-1:2001 and EN 14181:2004 and the following apply.

### 3.1 dust

particles, of any shape, structure or density, dispersed in the gas phase at the sampling point conditions which may be collected by filtration under specified conditions after representative sampling of the gas to be analysed, and which remain upstream of the filter and on the filter after drying under specified conditions

[EN 13284-1:2001]

### 3.2 automated measuring system (AMS)

measuring system permanently installed on site for continuous monitoring of emissions

NOTE 1 An AMS is a method which is traceable to a reference method.

NOTE 2 Apart from the analyser, an AMS includes facilities for taking samples (e.g. sample probe, sample gas lines, flow meters, regulators, delivery pumps) and for sample conditioning (e.g. dust filter, moisture removal devices, converters, diluters). This definition also includes testing and adjusting devices that are required for regular functional checks.

[EN 14181:2004]

NOTE 3 For the purpose of this document, AMS means automated dust measuring system.

### 3.3 cross sensitivity

response of the AMS to determinants other than dust concentration

NOTE Cross sensitivity can be caused for example by particle characteristics (including size, material type, electric charge, shape and moisture content), flow gas conditions (including velocity) and gas composition (including water vapour, water droplets).

### 3.4 emission limit value (ELV)

limit value related to the uncertainty requirement

NOTE For the EU directives [1] and [2] it is the daily emission value that relates to the uncertainty requirement.

### 3.5 linearity (lack of fit)

systematic deviation, within the range of application, between the accepted value of a reference material applied to the measuring system and the corresponding output signal from the AMS

NOTE Test for linearity is described in Annex B of EN 14181:2004.

### 3.6 limit of detection

minimum value of the measurand for which the measuring system is not in the basic state, with a stated probability

NOTE The basic state is usually represented by zero reference material.

### 3.7 period of unattended operation

maximum interval of time for which the performance characteristics remain within a predefined range without external servicing, e.g. refill, calibration, adjustment

### 3.8 reproducibility under field conditions ( $r$ )

measure of the agreement between two identical measuring systems applied in parallel in field tests at a level confidence of 95 % using the standard deviation of the difference of the paired measurements:

$$r = t_{n-1; 0,95} \times s_D$$

$$s_D = \sqrt{\frac{\sum_{i=1}^n (x_{1,i} - x_{2,i})^2}{2n}}$$

where

$r$  is the reproducibility under field conditions;

$t_{n-1; 0,95}$  is the two-sided Students t-factor at a confidence level of 95 % with a number of degrees of freedom  $n-1$ ;

$s_D$  is the standard deviation of the difference of paired measurements;

- $x_{1,i}$  is the  $i$ th measurement result of the first measuring system;
- $x_{2,i}$  is the  $i$ th measurement result of the second measuring system;
- $n$  is the number of parallel measurements

NOTE The reproducibility under field conditions is calculated from the half-hour averaged output signals during the three-month period.

### 3.9

#### Standard Reference Method (SRM)

method described and standardised to define an air quality characteristic, temporarily installed on site for verification purposes

[EN 14181:2004]

NOTE For the purposes of this document, the SRM is specified in EN 13284-1.

## 4 Principle

This document is derived from the general document on the quality assurance of AMS (EN 14181). It shall be applied in conjunction with that document. This document only deals with the specific aspects related to dust monitoring.

According to EN 14181, three different levels of quality assurance are defined, designated as Quality Assurance Levels (QAL). These levels cover the suitability of an AMS for its measuring task (QAL1), the validation of the AMS following its installation (QAL2), the control of the AMS during its ongoing operation on an industrial plant (QAL3). An annual Surveillance Test (AST) is also defined.

## 5 AMS performance criteria for QAL1

The performance of the AMS shall be assessed in a suitability test referred to as QAL1. Suitability tests for an AMS are usually carried out within the framework of certification or type approval procedures. The suitability test comprises a separate laboratory test and a three-month field test in a typical application.

The requirements for the tests used in QAL1 are given in Table 1. These requirements shall be used until general requirements on AMS are specified in a European Standard on AMS certification.

The manufacturer shall ensure that the delivered AMS has the same characteristics as the tested devices.