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Varnost strojev - Vrednotenje emisije nevarnih snovi, ki jih prenaša zrak - 1. del: Izbor preskusnih metod

Safety of machinery - Evaluation of the emission of airborne hazardous substances - Part 1: Selection of test methods

Sicherheit von Maschinen - Bewertung der Emission von luftgetragenen Gefahrstoffen - Teil 1: Auswahl der Prüfverfahren

Sécurité des machines - Evaluation de l'émission de substances dangereuses véhiculées par l'air - Partie 1 : Choix des méthodes d'essai

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English Version

Safety of machinery - Evaluation of the emission of airborne hazardous substances - Part 1: Selection of test methods

Sécurité des machines - Evaluation de l'émission de substances dangereuses véhiculées par l'air - Partie 1 : Choix des méthodes d'essai

Sicherheit von Maschinen - Bewertung der Emission von luftgetragenen Gefahrstoffen - Teil 1: Auswahl der Prüfverfahren

This European Standard was approved by CEN on 1 November 2008.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN 1093-1:2008) has been prepared by Technical Committee CEN/TC 114 "Safety of machinery", 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of an identical text or by endorsement, at the latest by June 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1093-1:1998.

For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document.

This part 1 of EN 1093 *Safety of machinery - Evaluation of the emission of airborne hazardous substances* belongs to a series of documents, the other parts of which are the following:

— Part 2: Tracer gas method for the measurement of the emission rate of a given pollutant;

— Part 3: Test bench method for the measurement of the emission rate of a given pollutant;

— Part 4: Capture efficiency of an exhaust system, tracer method;

— Part 6: Separation efficiency by mass, unducted outlet;

— Part 7: Separation efficiency by mass, ducted outlet;

— Part 8: Pollutant concentration parameter, test bench method;

— Part 9: Pollutant concentration parameter, room method;

— Part 11: Decontamination index.

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

Introduction

The structure of safety standards in the field of machinery is as follows:

— **Type-A standards** (basic safety standards) giving basic concepts, principles for design, and general aspects that can be applied to all machinery;

— **Type-B standards** (generic safety standards) dealing with one safety aspect or one type of safeguard that can be used across a wide range of machinery:

  — Type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);

  — Type-B2 standards on safeguards (e.g. two-hand controls, interlocking devices, pressure sensitive devices, guards);

— **Type-C standards** (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

This European Standard is a type-B standard as stated in EN ISO 12100-1.

The provisions of this European Standard can be supplemented or modified by a type-C standard.

For machines which are covered by the scope of a type-C standard and which have been designed and built according to the provisions of that standard, the provisions of that type-C standard take precedence over the provisions of this type-B standard.

The concentration level of substances resulting from emission of airborne hazardous substances from machines depends upon factors including:

— emission rate of airborne hazardous substances ("pollutants") from the machine under examination, depending of the type of process and the production rate of the machine;

— performance of the pollutant control system associated with the machine and, in the case of air recirculation, the performance of the separation system;

— surrounding conditions, especially the air flow pattern, which can reduce the pollution (efficient general ventilation) or increase it (disturbing air, crossdraughts);

— worker's location in relation to the machine and its pollutant control system, and taking into account the workers movements;

— quality of maintenance; poor quality has generally an adverse effect on the performance of the pollutant control and the separation systems.

This European Standard concerns the first two points in this list and forms only one part of a comprehensive risk assessment. It is not for a risk assessment of the workplace. Evaluation of the parameters defined in this European Standard leads to an evaluation of the performance of the machine and its associated pollutant control system.

This European Standard can be used as a part of verification described in EN 626-2.

1 Scope

This European Standard specifies parameters which can be used for the assessment of the emission of pollutants from machines or the performance of the pollutant control systems integrated in machines. It gives guidance on the selection of appropriate test methods according to their various fields of application and types of machines including the effects of measures to reduce exposures to pollutants. The test methods are given in additional parts of this European Standard (see Table 1 and Annex A).

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 626-2, *Safety of machinery – Reduction of risks to health from hazardous substances emitted by machinery – Part 2: Methodology leading to verification procedures*

EN ISO 12100-1:2003, *Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

3.1
uncontrolled emission rate of a given pollutant
$\dot{m}_{\mathrm{u}}$

mass of pollutant emitted from the machine into the space around the machine per unit of time

NOTE Any measures to reduce the air pollution around the machine (e.g. capture devices, containment equipment, wetting process) should not be used or should be de-activated.

3.2
controlled emission rate of a given pollutant
$\dot{m}_{\mathrm{k}}$

mass of pollutant emitted from the machine into the space around the machine per unit of time, taking into account the effects of measures to reduce the air pollution

NOTE Any measures to reduce the air pollution around the machine (e.g. capture devices, containment equipment, wetting process) should be used or activated.

3.3
capture efficiency
η_c

<pollutant control system> ratio of the mass flow rate of a given pollutant directly collected by the pollutant control system to the uncontrolled mass flow rate of this pollutant emitted from the machine

NOTE 1 The capture efficiency, as a percentage, can be calculated by the following equation:

$$\eta_c = \frac{\dot{m}_u - \dot{m}_k}{\dot{m}_u} \times 100 \quad (1)$$

This equation is applicable only if $\dot{m}_u - \dot{m}_k$ represents the pollutant mass flow rate directly captured. This parameter is not usable when the amount of emission is affected by the control system.

NOTE 2 Where the pollutant control system is an exhaust system and provided comparable discharge and flow patterns of the real pollutant can be simulated by a tracer technique, the equation becomes:

$$\eta_c = \frac{q_C}{q_E} \times 100 \quad (2)$$

where

q_C flow rate of tracer collected by exhaust system during operation;

q_E flow rate of tracer emitted (measured by emitting the tracer directly into exhaust system during the first phase)

NOTE 3 For further details, see EN 1093-4:1996+A1:2008, Clause 5.

3.4
separation efficiency by mass
η_s

<air cleaning system> ratio of the mass of pollutant retained by the air cleaning system (m_3) to the mass of pollutant entering the air cleaning system (m_1) during a given period

NOTE 1 For special applications the number of fibres or particles is measured instead of the mass.

NOTE 2 The separation efficiency of an air cleaning system, as a percentage, can be calculated by the following equation:

$$\eta_s = \frac{m_3}{m_1} \times 100 \quad (3)$$

NOTE 3 In certain cases it can be necessary to consider only that part of pollutants (e.g. size of particles) which is actually hazardous for exposed persons; e.g. separation efficiency of a separation system against hazardous dust is measured as a function of particle size – otherwise the results are possibly not reliable for health and safety purposes.

3.5
pollutant concentration parameter
P_c
the measured concentration of a given pollutant in defined position(s) near the machine

3.6
decontamination index
I_A
the average of the ratio, obtained at a number of specified locations in the surroundings, of the ambient air quality improvement to the real pollutant mean concentration with the pollutant control system not in operation

NOTE 1 Corrections can be necessary to take into account air pollution caused by other operations ("the background level").

NOTE 2 The decontamination index can be calculated by the following equation:

$$I_A = \frac{1}{n}\sum_{i=1}^{n} \frac{C_{ai} - C_{mi}}{C_{ai} - C_{fi}} \quad (4)$$

where

C_{ai} real pollutant concentration measured at specified location in the surrounding under the following condition: machine in operation, pollutant control system not in operation;

C_{mi} real pollutant concentration measured at specified location in the surrounding under the following condition: machine and pollutant control system in operation;

C_{fi} real pollutant concentration measured at specified location in the surrounding under the following condition: machine and pollutant control system not in operation ("the background level");

n number of specified locations

NOTE 3 When the "background level" is negligible, the decontamination index reduces to:

$$I_A = 1 - \frac{1}{n}\sum_{i=1}^{n} \frac{C_{mi}}{C_{ai}} \quad (5)$$

4 Types of test methods

4.1 General

When particle size distribution is determined at the same time as pollutant concentration, an assessment parameter for each size fraction can be defined. For the determination of each assessment parameter (see Clause 3), different test methods can be considered. The test methods should be selected according to the following criteria:

— nature of pollutant used;

— nature of the test environment.

4.2 Nature of pollutant used

As far as possible, the real pollutant should be used for the testing. However, in some cases tracer techniques allow a more convenient testing. The addition of tracer material to the real pollutant requires several conditions to be met, in particular comparable discharge and flow patterns of the real pollutant and the tracer material, respectively.

Depending on the test method, two types of pollutants shall be considered:

— real pollutant which may be an aerosol (solid or liquid) or a gas;