SLOVENSKI STANDARD
SIST EN 12198-1:2001

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Varnost strojev - Ocenjevanje in zmanjġevanje nevarnosti sevanj, ki jih oddajajo stroji - 1. del: Sploġna naḷ ela

Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery - Part 1: General principles

Sicherheit von Maschinen - Bewertung und Verminderung des Risikos der von Maschinen emittierten Strahlung - Teil 1: Allgemeine

Sécurité des machines - Estimation et réduction des risques engendrés par les rayonnements émis par les machines - Partie 1: Principes généraux

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ICS:

13.110	Varnost strojev	Safety of machinery
13.280	Varstvo pred sevanjem	Radiation protection

SIST EN 12198-1:2001 **en**

EUROPEAN STANDARD
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English version

Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery - Part 1: General principles

Sécurité des machines - Estimation et réduction des risques engendrés par les rayonnements émis par les machines - Partie 1: Principes généraux

Sicherheit von Maschinen - Bewertung und Verminderung des Risikos der von Maschinen emittierten Strahlung - Teil 1: Allgemeine Leitsätze

This European Standard was approved by CEN on 25 May 2000.

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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 Central Secretariat has the same status as the official versions.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This European Standard 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of an identical text or by endorsement, at the latest by December 2000, and conflicting national standards shall be withdrawn at the latest by December 2000.

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

For relationship with EC Directive(s), see informative Annex ZA, which is an integral part of this standard.

This European Standard deals with the essential requirement "Radiation" (see EN 292-2, Annex A, paragraph 1.5.10).

The annexes A and B are normative, and the annex C is informative.

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

Introduction

Machinery supplied by electrical power or containing radiation sources may emit radiation or generate electric and/or magnetic fields. The radiation emissions and fields will vary in frequency and magnitude.

The European Machinery Directive requires precautions to avoid or reduce risks caused by the emission of radiation from a machine. Machinery must be so designed and constructed that any emission of radiation is limited to the extent necessary for its operation and that the effects on exposed persons are non-existent or reduced to non-dangerous proportions (EN 292-2:1991/A1:1995).

To assess the risk of injury caused by radiation emissions and fields from a machine it is necessary to know the type of radiation emission, the level of the emission and the intensity of this emission with respect to possible adverse health effects.

This European Standard is intended to give manufacturers and type C-standards makers advice on how to identify radiation emissions from machinery, how to decide on their magnitude and significance, how to assess the risks and what means could be used to avoid or reduce the radiation emissions from machines.

This European Standard reflects the general principles for the identification and the assessment of radiation emission by machinery. Details of the measurement of the radiation emission will be given in part 2 of this standard. Part 3 of this standard will contain details of protective measures for avoiding or reducing radiation exposure of persons by reducing emissions and requiring the provision of information.

Radiation emitted by machinery may be intended for processing or may occur unintentionally. Clause 7 of this standard requires, that the manufacturer shall assign the machine to a design radiation emission category. For undesirable radiation emission the emission level should be reduced to values corresponding to category 0.

Functional radiation emission shall be limited to the necessary degree for the operation of the machine.

The remaining emission levels shall be assessed and an emission category shall be determined. If necessary protective measures will have to be applied.

This European Standard is a standard of B1-type in a series of standards for the safety of machinery.

1 Scope

This standard deals with the emission of radiation from machinery. This European Standard gives advice to manufacturers for the construction of safe machinery, if no relevant C-type standard exists. This radiation emission may be **functional** for processing or may be **undesirable**.

The issues of electromagnetic compatibility are not addressed in the standard.

This European Standard is intended to give advice to C-type standardization groups, on how to identify radiation emissions or fields[1], how to determine their significance and intensity, how to assess the possible risks and what means may be used to avoid or reduce radiation emissions. This advice should be elaborated in C-type standards for specific classes of machines as assessable requirements.

This standard deals with the emission of all types of electromagnetic non-ionizing radiation.

Ionizing radiation may be dealt with in other documents or in the future revisions.

This standard does not deal with the emission of laser radiation.

Radiation sources fixed to a machine which are used only for lighting are excluded from the scope of this standard.

This standard applies to machinery as defined in clause 3.1 of EN 292-1:1991.

2 Normative references

This European Standard is incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 292-1:1991, *Safety of machinery - Basic concepts, general principles for design - Part 1 : Basic terminology, methodology*

EN 292-2:1991 + A1:1995, *Safety of machinery - Basic concepts, general principles for design – Part 2 : Technical principles and specifications (and Amendment A1:1995)*

EN 1050, *Safety of machinery - Principles for risk assessment*

EN 1070, *Safety of machinery – Terminology*

EN 50082-1, *Electromagnetic compatibility – Generic immunity standard – Part 1 : Residential, commercial and light industry*

EN 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2 : Generic standards – Immunity for industrial environments (IEC 61000-6-2:1999)*

prEN 12198-2:1999, *Safety of machinery – Assessment and reduction of risks arising from radiation emitted by machinery – Part 2 : Radiation emission measurement procedure*

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[1] In the rest of the present document, the generic term "radiation" covers either the different types of radiation emitted by a machine (i.e. optical radiation), or fields (i.e. electromagnetic and/or magnetic fields) or waves (i.e. electromagnetic waves).

prEN 12198-3:1999, *Safety of machinery – Assessment and reduction of risks arising from radiation emitted by machinery – Part 3 : Reduction of radiation by attenuation or screening*

IEC 60050-845, *International electrotechnical vocabulary ; chapter 845 : Lighting*

3 Definitions

For the purposes of this European Standard, the following definitions apply in addition to the definitions given in EN 1070, and in IEC 60050-845 :

3.1
functional radiation emission
emission of radiation by a machine needed for its function in the process area

NOTE An example of functional radiation emission is a radiation beam used for thickness gauging.

3.2
undesirable radiation emission
all radiation emissions, other than functional radiation emissions emitted to any points outside the process area

NOTE An example of an undesirable radiation emission is the leakage radiation from a printing machine, in which the printing inks are cured by ultraviolet radiation.

3.3
trivial radiation emission
radiation emissions and fields, the intensity of which are so very low that cannot influence on the categorization of the machine, according to clause 7

3.4
accessible surface
hypothetical surface, just enveloping the machine, from which the measurement points are located

4 Classification of radiation emissions

4.1 Classification of radiation by frequency and wavelength

For the purposes of this standard, the classification of radiation by frequency and wavelength or energy is given in table 1.

Table 1 — Classification of non ionization radiation

Nature	Type	Frequency/ Wavelength
Electric and/or magnetic fields	Extremely low and low frequency	0 < f < 30 kHz
Electromagnetic waves	Radio frequency	30 kHz < f < 300 GHz
Optical radiation	Infrared	1 mm > λ > 780 nm
Optical radiation	Visible	780 nm > λ > 380 nm
Optical radiation	Ultra-violet	380 nm > λ > 100 nm
f = frequency. λ = wavelength.		

NOTE The above specified intervals of the frequency and wavelength of the radiation may be different in other documents dealing with radiation.

4.2 Characteristics of radiation emissions

Radiation emissions can also be characterized by their intensity, duration, frequency, spatial and spectral distribution, for example:

— continuous wawe ;

— modulated, pulsed ;

— broad-band (covering several frequencies) ;

— with continuous or discrete spectrum (line spectrum) ;

— geometrical characteristics ;

— coherent, non-coherent ;

— polarisation.

5 General procedure

The manufacturer of a machine shall carry out a risk assessment according to EN 1050. This includes the determination of the limits of the machinery, an identification of all hazards, a risk estimation and a risk evaluation. After the risk assessment measures for the reduction of unacceptable risks shall be applied if necessary. After that a repetition of the risk assessment, or only parts of it, may be necessary.

For those risks which are related to the emission of radiation from a machine the procedure of risk assessment and risk reduction which shall be carried out by the manufacturer consists of :

— an assessment of the risks due to the emission of all types of radiation (see clause 6) ;

— application of appropriate measures for the elimination or reduction of the radiation emissions, in order to reach the emission requirements (see clauses 7 and 8) ;

— verification of compliance with the requirements of this standard (see clause 9).

It may be reasonable to integrate the "verification" step into the "risk assessment" procedure (see 6.2).

When specifying C-type-standards for particular machines or a group of machines, details of this procedure shall be included.

6 Risk assessment

6.1 General

The machine manufacturer shall identify the radiation emissions and assess the risks from those radiation emissions. This assessment shall include any foreseeable personal exposures arising from any machine emissions at any stage in its life. (See Annex A).

The radiation emissions may arise from :

a) the whole machine or parts of it ;

b) material processed in the machine ;

c) interaction between the machine and the material being processed.

NOTE 1 Details of the methodology of the risk assessment are given in EN 292-1 and in EN 1050.

NOTE 2 The level of risk depends on the properties of the radiation, the likelihood that personal exposure will occur and the degree of exposure. The health effects of radiation exposure will depend on the type of radiation as well as the intensity and duration of exposure. These effects may be in the short or long term and may be reversible or irreversible.

6.2 Procedure for the risk assessment

6.2.1 General

The procedure for the risk assessment due to radiation emission of machinery consists of the following steps :

— Identification of the radiation emissions (sources, type of radiation, approximate level of emission, etc.).

Trivial emissions may be ignored in the following steps of the risk assessment procedure and the steps described in clauses 7, 8, 9 and 10. In the absence of relevant type C-standards, the manufacturer shall determine whether radiation emissions are trivial or not on the basis of a technical experts experience, calculations or measurements. Their conclusions shall be documented in a technical data file.

— Measurement or detailed prediction of emission levels shall be made at all points where people may be exposed during normal use.

— Identification of the highest emissions of each radiation type during all phases of use of the machine (see Annex A). Foreseable misuse during these phases shall also be considered (see 3.12 of EN 292-1:1991).

6.2.2 Procedure

— Allocation of a radiation emission category according to clause 7.1 for the operation, setting and cleaning stages of the use of the machine. The allocation shall be made on the basis of measurement including uncertainty as appropriate, (see part 2) and/or prediction of the radiation emission for all relevant points.

— Check that the levels of emission at the machine's accessible surface during the use of the machine are so low, that the emission levels do not exceed the category 0 emission limits according to 7.1.

If the machine category is not 0 (see 7.1), then the following steps shall be carried out :

- Assessment of the possible exposure situations during intended use of the machine (exposed people (adults, children, informed, uninformed etc.), exposure time, frequency of exposure, distance from source, intended or not, radiation emission, etc.).
- Assessment if the allocated radiation emission category for the operation, setting and cleaning stage of the use of the machine is acceptable for the assessed exposure situations.
- Identification of secondary hazards (production of hazardous substances, e.g. ozone, degradation of plastics, disturbance of pacemakers and other electrical implants, hazards caused by electromagnetic interference with safety relevant electrical equipment in the vicinity (see EN 50082-1 and EN 61000-6-2).

6.2.3 Conclusion

Allocate the overall emission category for the machine in accordance with 7.1.

7 Requirements

7.1 Classification of machines due to radiation emission levels

Depending on the level of radiation emission, the manufacturer shall assign the machine a radiation emission category. Three categories are considered according to table 2.

The relation between the level of radiation emission and the radiation emission category is specified in Annex B for each type of radiation.

Table 2 — Classification of machines due to radiation emission levels

Category	Restrictions and protective measures	Information and training
0	no restriction	no information needed
1	restrictions : limitation of access, protective measures may be needed	Information about hazards, risks and secondary effects
2	special restrictions and protective measures essential	Information about hazards, risks and secondary effects ; training may be necessary

The assignment of radiation emission category shall be done for the setting, operation and cleaning phases of the use of the machine.

This shall be done for all types of radiation emissions. The manufacturer shall take into account that the radiation emissions may vary with changing environmental or operating conditions and duty cycles of the machine. The overall category for the machine is that with the highest number of the categories determined for all different types of radiation emission during the setting, operation and cleaning phases of the use of the machine.