



SLOVENSKI STANDARD

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Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles

Sicherheit von Maschinen - Ergonomische Gestaltungsgrundsätze - Teil 1: Begriffe und allgemeine Leitsätze

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Sécurité des machines - Principes ergonomiques de conception - Partie 1: Terminologie et principes généraux

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English Version

Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles

Sécurité des machines - Principes ergonomiques de
conception - Partie 1: Terminologie et principes généraux

Sicherheit von Maschinen - Ergonomische
Gestaltungsgrundsätze - Teil 1: Begriffe und allgemeine
Leitsätze

This European Standard was approved by CEN on 9 March 2006.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, 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 United Kingdom.

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

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Foreword

This European Standard (EN 614-1:2006) has been prepared by Technical Committee CEN/TC 122 “Ergonomics”, 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of an identical text or by endorsement, at the latest by October 2006, and conflicting national standards shall be withdrawn at the latest by October 2006.

This European Standard supersedes EN 614-1:1995.

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 EU Directive(s).

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

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Introduction

Ergonomically designed work systems enhance safety, improve human working and living conditions and counteract adverse effects on human health. Also they usually improve the operator-machine system performance and reliability. In this European Standard the term "ergonomics" refers to a multidisciplinary field of science and its application. Applying ergonomics to the design of work systems, especially where the design of machinery is concerned, ensures that human capabilities, skills, limitations and needs are taken into account.

The work system includes operators, job design, work equipment (e.g. machinery), work space, work environment, work process and the interactions between them. It can vary in complexity from a workshop with a single operator using hand held equipment to a process plant and its operators. Good design takes into account how the operator is expected to interact with the work equipment and how the work equipment fits into the system as a whole. This is particularly important the more the work equipment is interdependent on other components of the system. In its whole complexity, the working system is described in generic standards (e.g. EN ISO 6385).

Compliance with harmonised standards prepared by CEN/CENELEC enables manufacturers and suppliers to meet requirements of European legislation. EN ISO 12100-1 and EN ISO 12100-2 contain the concepts and general principles to guide designers in achieving safety for machinery for occupational and private purposes. Ergonomic principles can be incorporated into the design process by following this standard. In this way both the technical design and ergonomic principles are considered at the same time. The aim to enhance the health, safety and well-being of workers is reached by systematically minimising the risks according to EN 1050. EN 13861 provides information concerning applicable ergonomic B-type standards related to specific hazards.

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This standard is one of the European Standards covering specific topics identified in EN ISO 12100-1 and EN ISO 12100-2 as important to the safety of machinery.

1 Scope

This European Standard establishes the ergonomic principles to be followed during the process of design of machinery.

This European Standard applies to the interactions between operators and machinery when installing, operating, adjusting, maintaining, cleaning, dismantling, repairing or transporting equipment, and outlines the principles to be followed in taking the health, safety and well-being of the operator into account. This European Standard provides a framework within which the range of more specific ergonomics standards and other related standards relevant to machinery design should be applied.

The ergonomic principles given in this European Standard apply to all ranges of human abilities and characteristics to ensure safety, health and well-being and overall system performance. Information will need to be interpreted to suit the intended use.

NOTE Although the principles in this European Standard are orientated towards machinery for occupational use, they are also applicable to equipment and machinery for private use.

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2 Normative references

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

EN 894-3, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

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

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

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

3 Terms and definitions

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

3.1

allocation of functions

process of deciding how system functions shall be implemented, by humans, by equipment and/or hardware and/or software

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[EN ISO 6385:2004, 2.1]

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3.2

design population

designated group of workers delimited as a percentile range of the general population, defined according to relevant characteristics, e.g. gender, age, skill level, etc.

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[EN ISO 6385:2004, 2.2]

3.3

ergonomics

study of human factors

scientific discipline concerned with the understanding of interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance

[EN ISO 6385:2004, 2.3]

3.4

job

organization and sequence in time and space of an individual's work tasks or the combination of all human performance by one worker within a work system

[EN ISO 6385:2004, 2.4]

3.5

system function

broad category of activity performed by a system

[EN ISO 6385:2004, 2.5]

3.6**well-being**

condition perceived by the operator when using the machine as intended by reducing discomfort, fatigue and psychological stress to the minimum possible due to ergonomic principles

NOTE Well-being is a part of good health according to the WHO.

3.7**work environment**

physical, chemical, biological, organizational, social and cultural factors surrounding a worker

[EN ISO 6385:2004, 2.6]

3.8**work equipment**

tools, including hardware and software, machines, vehicles, devices, furniture, installations and other components used in the work system

[EN ISO 6385:2004, 2.7]

3.9**operator
worker**

person or persons given the task of installing, operating, adjusting, maintaining, cleaning, repairing or transporting, machinery

[EU Directive 98/37/EC, Annex 1, 1.1.1, 3rd subclause]

3.10**work fatigue**

mental or physical, local or general non-pathological manifestation of excessive strain, completely reversible with rest

[EN ISO 6385:2004, 2.9]

3.11**work organization**

sequence and interaction of work systems fitted together to produce a specific result

[EN ISO 6385:2004, 2.10]

3.12**work process**

sequence in time and space of the interaction of workers, work equipment, materials, energy and information within a work system

[EN ISO 6385:2004, 2.11]

3.13**workstation**

combination and spatial arrangement of work equipment, surrounded by the work environment under the conditions imposed by the work tasks

[EN ISO 6385:2004, 2.12]

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3.14

work strain

internal response of the worker to being exposed to work stress depending on his/her individual characteristics (e.g. size, age, capacities, abilities, skills, etc.)

[EN ISO 6385:2004, 2.13]

3.15

work stress

external load

sum of those external conditions and demands in the work system which act to disturb a person's physiological and/or psychological state

[EN ISO 6385:2004, 2.14]

3.16

workspace

volume allocated to one or more persons in the work system to complete the work task

[EN ISO 6385:2004, 2.15]

3.17

work system

system comprising one or more workers and work equipment acting together to perform the system function, in the workspace, in the work environment, under the conditions imposed by the work tasks

[EN ISO 6385:2004, 2.16]

3.18

work task

activity or set of activities required by the worker to achieve an intended outcome

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[EN ISO 6385:2004, 2.17]

3.19

accessible design

design focussed on principles of extending standard design to people with some type of performance limitation to maximize the number of potential customers who can readily use a product, building or service which may be achieved by

- designing products, services and environments that are readily usable by most users without any modification,
- by making products or services adaptable to different users (adapting user interfaces), and
- by having standardized interfaces to be compatible with special products for persons with disabilities.

NOTE 1 Terms such as design for all, barrier-free design, inclusive design and transgenerational design are used similarly but in different contexts.

NOTE 2 Accessible design is a subset of universal design where products and environments are usable by all people, to the greatest extent possible, without the need for adaptation or specialised design.

[CEN/CENELEC Guide 6, 3.2]

4 General principles

4.1 General

Safety of machinery requires that ergonomic aspects are addressed. Risk reduction by design is required by EN 1050 which includes the need to follow ergonomic principles. This European Standard describes these ergonomic principles and gives a framework for incorporating them into the design process.

The observance of ergonomic principles applies to the intended use of machinery including its installation, adjustment, maintenance, cleaning, repair, dismantling and transport.

The objective is to design the machinery in its context with the work system to be consistent with human capabilities, limitations and needs. This requires an analysis of the work tasks that operators have to carry out and the effect of any constraints that the design and its influence to the environment (e.g. noise, vibration) is likely to have on the operators' health, safety and well-being.

Machinery shall be designed to take account of the variability in operators' characteristics. These include:

- body dimensions (see 4.3.2),
- posture (see 4.3.3),
- body movements (see 4.3.4),
- physical strength (see 4.3.5),
- mental abilities (see 4.4).

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The effects of the combination of factors (for example the combined effects of frequency, body postures and movements, the duration of operation and the total work duration) have to be taken into account.

The physical work environment will have an effect on the operator. This should be taken into account by avoiding impairing effects and promoting facilitating effects as far as possible (see 4.5).

All elements of the operator-machine-system such as displays, signals and control actuators shall be designed in such a way that clear and unambiguous interaction between the operator and the machine is possible.

In particular, maintenance operators shall be taken into account because they may have to access specific areas in which risk to health are particularly high.

Consideration of the above aspects allows the designer to identify and evaluate ergonomics related risk factors and to ensure that the machinery design incorporates means for adequately controlling them. This will improve health, safety, well-being and reliability of the operation and hence reduce the probability of errors at all stages of machinery use.

4.2 Accessible design for people with special requirements

Where it is required, the designer should take account of people with special requirements and apply ergonomic principles to accessible design and assistive technology in order to enable the use of machinery by people with special requirements.

NOTE Special needs includes sensory abilities like vision, tactile and acoustic input, physical abilities like dexterity, manipulation, movement, voice, strength and endurance, cognitive abilities like intellect, memory, language and literacy and allergies like contact allergy and respiratory allergy. For further see CEN/CENELEC Guide 6.