



National Standards Authority of Ireland

IRISH STANDARD

I.S. EN 614-2:2000

ICS 13.110  
13.180

**SAFETY OF MACHINERY - ERGONOMIC  
DESIGN PRINCIPLES -  
PART 2: INTERACTIONS BETWEEN THE  
DESIGN OF MACHINERY AND WORK TASKS**

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*This Irish Standard was  
published under the  
authority of the National  
Standards Authority of  
Ireland  
and comes into effect on:  
October 27, 2000*

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EUROPEAN STANDARD

EN 614-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2000

ICS 13.110; 13.180

English version

## Safety of machinery - Ergonomic design principles - Part 2: Interactions between the design of machinery and work tasks

Sécurité des machines - Principes ergonomiques de  
conception - Partie 2: Interactions entre la conception des  
machines et les tâches du travail

Sicherheit von Maschinen - Ergonomische  
Gestaltungsgrundsätze - Teil 2: Wechselwirkungen  
zwischen der Gestaltung von Maschinen und den  
Arbeitsaufgaben

This European Standard was approved by CEN on 30 June 2000.

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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## Foreword

This European Standard 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of an identical text or by endorsement, at the latest by January 2001, and conflicting national standards shall be withdrawn at the latest by January 2001.

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 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

EN 614 consists of the following Parts, under the general title Safety of machinery – Ergonomic design principles:

- Part 1: Terminology and general principles
- Part 2: Interactions between the design of machinery and work tasks.

## Introduction

This European Standard helps the designer in applying ergonomics principles to the design of machinery, focusing especially on the interaction between the design of machinery and work tasks.

This is essential since the quality of design and safety of machinery depends on the prospective operators being able to perform their tasks with the machinery in a safe and competent manner. Applying ergonomics principles to the design of machinery and work tasks aims at minimizing the discomfort, fatigue and other impairing effects faced by the operator and thus contributes to the optimal functioning of the work system (EN 292-2:1991, Annex A.1, 1.1.2 (d)) and reduces the risks of negative health effects. Therefore, good design follows ergonomics principles, starts with the specification of system functions and anticipates how the prospective operator will interact with the machinery and other work equipment.

In the design of machinery and work tasks, the physical aspects of the operator's activities are not the only design parameters to be dealt with. Operator activities also include the perception and processing of information, determination of strategies, decision making and communication.

## 1 Scope

This European Standard establishes the ergonomics principles and procedures to be followed during the design process of machinery and operator work tasks.

This European Standard deals specifically with task design in the context of machinery design, but the principles and methods may also be applied to job design.

This European Standard is directed to designers and manufacturers of machinery and other work equipment. It will also be helpful to those who are concerned with the use of machinery and work equipment, e.g. to managers, organizers, operators and supervisors.

In this European Standard the designer refers to the person or group of persons responsible for the design.

## 2 Normative references

This European Standard 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 reference 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 (including amendments).

EN 614-1:1995      Safety of machinery – Ergonomic design principles – Part 1: Terminology and general principles

EN 894-1	Safety of machinery – Ergonomics requirements for the design of displays and control actuators – Part 1: General principles for human interactions with displays and control actuators
EN 292-1	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

### 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 614-1 apply.

### 4 Principles of work task design

Work task design covers the analysis and specification of functions and their allocation to the machine or the operator as part of the design process, and aims at contributing to the optimal functioning of work systems. Therefore, good design follows ergonomics principles and gives special attention to the intended operator population. Principles of good ergonomic design are given in EN 614-1. The aim shall be achieved by approaching the characteristics of well-designed operator work tasks given in 4.1 by following the methodology for work task design given in 4.2 and by performing an evaluation of work task design according to 4.3.

#### 4.1 Characteristics of well-designed operator work tasks

When designing machinery and work tasks, the designer shall ensure that the following ergonomics characteristics of well-designed work tasks are fulfilled. These characteristics take into account the differences and dynamic characteristics of the intended operator population, and shall be pursued by designing machinery and work tasks in interaction.

Thus, in the design process the designer shall

- a) **recognise the experience, capabilities and skills of the existing or expected operator population.**  
This includes the levels of general education and vocational training, as well as knowledge acquired in other similar working situations. It should be kept in mind that levels of training and knowledge vary across operator populations and change over time. Therefore, e.g. speed and complexity requirements and information on task performance should be adaptable to all intended users.
- b) **ensure that work tasks to be performed are identifiable as complete and meaningful whole units of work with a clearly identifiable beginning and end, rather than as isolated fragments of such tasks.**  
Therefore, each work task should in particular comprise not only performance components, but also preparatory (e.g. planning) and evaluative (e.g. inspection, checking) components.
- c) **ensure that work tasks performed are identifiable as a significant contribution to the total output of the work system.**  
The operator should be able to understand how and to what extent task performance and its outcome will affect the whole work system and its outcomes. Thus, unnecessary fragmentation of the work process, leading to narrow operator work tasks shall be avoided.
- d) **provide for the application of an appropriate variety of skills, capabilities and activities, and in particular provide for an appropriate combination of the following types of behaviour:**
  - **skill based behaviour,**  
which consists of an immediate, simple conscious or non-conscious reaction to cues from the work process,
  - **rule based behaviour,**  
which allows the operator to exert control of the work process by applying basic algorithmic rules (e.g. by making simple if-then decisions)
  - **knowledge based behaviour,**  
which requires the operator to develop and maintain a complex set of knowledge about the interrelationships in the process, in order to diagnose system states and faults, and to develop solutions and perform adequate actions.
- e) **provide an appropriate degree of freedom and autonomy to the operator.**  
The operator should be able to choose among alternative ways of task accomplishments and determine priority, pace and procedure of the work task. Rigidly fixed sequences, pace and working methods shall be avoided.

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