INTERNATIONAL STANDARD

ISO 9241-1

Second edition
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Ergonomic requirements for office work with visual display terminals (VDTs) —

Part 1:
General introduction

Exigences ergonomiques pour travail de bureau avec terminaux à écrans de visualisation (TEV) —

Partie 1: Introduction générale

Reference number
ISO 9241-1:1997(E)

Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9241-1 was prepared by Technical Committee ISO/TC 159, *Ergonomics,* Subcommittee SC 4, *Ergonomics of human system interaction.*

This second edition cancels and replaces the first edition (ISO 9241-1:1992), which has been technically revised.

ISO 9241 consists of the following parts, under the general title *Ergonomic requirements for office work with visual display terminals (VDTs)*:

— *Part 1: General introduction*
— *Part 2: Guidance on task requirements*
— *Part 3: Visual display requirements*
— *Part 4: Keyboard requirements*
— *Part 5: Workstation layout and postural requirements*
— *Part 6: Environmental requirements*
— *Part 7: Requirements for display with reflection*
— *Part 8: Requirements for displayed colours*
— *Part 9: Requirements for nonkeyboard input devices*
— *Part 10: Dialogue principles*
— *Part 11: Guidance on usability*
— *Part 12: Presentation of information*
— *Part 13: User guidance*
— *Part 14: Menu dialogues*
— *Part 15: Command dialogues*
— *Part 16: Direct manipulation dialogues*
— *Part 17: Form-filling dialogues*

Annex A of this part of ISO 9241 is for information only.

Introduction

One of the main concerns of ergonomics is to ensure that products and systems are fit for human use. In general this involves matching the design of products or systems, including displays, input devices, software, workplace, working environment and tasks, to the characteristics, capabilities and limitations of potential users. Improving the ergonomic properties of systems will improve performance, reduce errors and discomfort, and minimize health and safety risks. Failure to take account of human capabilities is wasteful, will reduce efficiency and result in boring, tedious work.

In practice, all users of products or systems are different; it is important to understand in what ways they vary and to quantify the variation so that account can be taken of it in design. Both hardware and software can be used for many different tasks, and in a variety of working environments, and it is also important to take these factors into consideration in design. Good ergonomic design is important in any product or system designed for human use. It is especially important when :

— use is intensive;

— accuracy or speed of the user's performance is critical;

— user acceptance is critical.

Work with visual display terminals (VDTs) is often both intensive and a significant part of many office workers' jobs. The characteristics of both hardware and software can substantially affect the user's performance. Increasingly, users, their representatives and managers are concerned with ensuring that work with VDTs is designed to appropriate standards. What is appropriate in one set of circumstances may be inappropriate in a different context; when using VDT ergonomics standards it is important to recognize that the potential range of application is very broad. Therefore ergonomics standards often take the form of recommendations, or requirements, which are conditional upon certain defined circumstances.

Ergonomic requirements for office work with visual display terminals (VDTs) —

Part 1:
General introduction

1 Scope

This part of ISO 9241

— introduces the multipart standard on ergonomic requirements for the use of visual display terminals for office tasks;

— provides guidelines for a user-performance approach;

— gives an overview of all parts of ISO 9241 currently published and of the anticipated content of those in preparation;

— provides some guidance on how to use ISO 9241;

— describes how conformance to ISO 9241 should be reported.

For the purposes of ISO 9241, office tasks are taken to include a wide range of generic text and data processing tasks. Due to the similarity of these tasks to tasks performed in other environments, e.g. medical, scientific, telecommunications, control rooms and public access, many of the requirements in ISO 9241 are appropriate to these environments as well.

ISO 9241 does not cover electrical safety of VDTs. This is covered by IEC 950.

NOTE — The ergonomic requirements of flat panel displays are covered in ISO 13406-1 and ISO 13406-2. More extensive guidance on human-centred design for interactive systems is provided in ISO 13407.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 9241. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9241 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of the IEC and ISO maintain registers of currently valid International Standards.

ISO 6385:—[1)], *Ergonomic principles of the design of work systems.*

3 Definitions

For the purposes of this part of ISO 9241, the definitions given in ISO 6385 and the following definitions apply.

3.1 user-performance approach
Approach to systems evaluation which sets requirements on a system based on the level of performance which users are expected to achieve when carrying out relevant tasks.

1) To be published. (Revision of ISO 6385:1981)

3.2 user-performance test
Test in which the level of performance of users is measured directly in order to evaluate a system.

NOTE — Parameters of performance which may be measured include accuracy, speed, and comfort.

4 General introduction to ISO 9241

4.1 Purpose and intended users

ISO 9241 establishes ergonomic requirements for office work with VDTs. Ergonomic design enhances the ability of VDT users to operate display screen equipment safely, healthily, effectively, efficiently and comfortably. This is achieved by careful design of the VDTs, the workplaces and working environments in which they are used, and the way the VDT work is organized, managed and performed. In practice, these different aspects may be the responsibility of a number of different people or organizations.

ISO 9241 is intended to help designers and manufacturers to develop ergonomically sound visual display terminals and software systems. ISO 9241 is also relevant to purchasers who wish to specify VDT systems for use in their own organizations, and to those who wish to evaluate the suitability of existing equipment, working environments and work practices.

4.2 Product specifications, technological change and the user-performance approach

ISO 9241 contains different types of information to be considered and used (where appropriate) when designing the ergonomic aspects of a system, or assessing the ergonomic properties of a system. Some parts provide general guidance to be considered in the design of equipment, software and tasks. Other parts include more specific design guidance and requirements relevant to current technology. ISO 9241 emphasizes the need to specify the factors affecting the performance of the users, and the need to adopt a user-performance approach to evaluate systems.

This user-performance approach deals directly with the ergonomic requirements for work with VDTs. Using this approach, it is possible to evaluate whether a device utilizing novel technology, with technical attributes different to those specified in a particular part of ISO 9241, is acceptable in ergonomic terms. This approach can be used even though there is no specific design guidance available and no body of data to provide such guidance.

The user-performance approach depends on reliable and valid methods of testing, either against absolute criteria or against a reference system. These are based on the context of use and include detailed specifications of the usability criteria and metrics, how they are measured (including, where appropriate, the test equipment to be used), what sample of subjects is appropriate, what experimental conditions are relevant and what level of performance is to be expected. Where a part of ISO 9241 specifies a user performance test, information is given relating to these points.

VDTs typically comprise a display unit, a keyboard, and some associated electronics and control circuitry. They can also include other input devices (e.g. pointing devices) and output devices (e.g. sound generators). The VDT can be a terminal to a larger system or can be a self-contained computer. Other equipment, including printers and communications devices, can be connected and located at the VDT workplace or remotely.

While the technology employed in the design and development of VDT working environments changes rapidly, the achievement of consensus for the purpose of setting standards takes place much less rapidly. Thus the technology commonly employed may be different by the time an International Standard becomes available. To deal with this problem, ISO 9241, where possible, provides alternative methods for evaluating compliance to particular requirements based on user performance rather than on product specifications.

5 Structure of ISO 9241

In view of the complexities of VDT ergonomics and the complex and multipurpose nature of ISO 9241, it has been organised into a number of parts, each dealing with a different aspect of VDT use, including the workplace and the environment. The requirements specified and the tests described are appropriate to office tasks (see clause 1). Table 1 gives an overview of the intended coverage of the various parts of ISO 9241.

Table 1 — Overview of parts of ISO 9241

Part No.	Title	Summary	Area of application
1	General introduction	Overview of all parts	General
2	Guidance on task requirements	Design of tasks and jobs involving work with VDTs	General
3	Visual display terminals	Design of screen hardware for VDTs, and a proposed user-performance test as an alternative route for conformance	Hardware
4	Keyboard requirements (to be published)	Ergonomic aspects of alphanumeric keyboard design, and a proposed user-performance test as an alternative route to conformance NOTE — For keyboard layout, see ISO 9995.	Hardware
5	Workstation layout and postural requirements (to be published)	Ergonomic requirements for a VDT workstation which will allow the user to adopt a comfortable and efficient posture	Environment
6	Environmental requirements (to be published)	Ergonomic requirements for the VDT working environment in order to prevent visual, acoustic and thermal environmental sources of stress and discomfort and to promote efficiency	Environment
7	Requirements for display with reflections (to be published)	Ergonomic requirements for, and details of, methods of measurement of reflections from the surface of display screens, including those with surface treatments	Hardware
8	Requirements for displayed colours (to be published)	Ergonomic requirements for multicolour displays which supplement the monochrome requirements in ISO 9241-3, including a user-performance test.	Hardware
9	Requirements for nonkeyboard input devices (to be published)	Ergonomic requirements for nonkeyboard input devices which can be used in conjunction with a VDT, including a proposed user-performance test as an alternative route to conformance	Hardware
10	Dialogue principles	Seven ergonomic principles important for design and evaluation of dialogues between humans and information systems	General
11	Guidance on usability (to be published)	Usability, and identification of information necessary to take into account when specifying or evaluating usability	General
12	Presentation of information (to be published)	Principles and recommendations for presenting and representing information on VDTs, including guidance on ways of representing complex information using alphanumeric and graphical/symbolic codes, screen layout and design, as well as the use of windows	Software

13	User guidance (to be published)	Recommendations for the design and evaluation of user-guidance attributes of software user interfaces, including prompts, feedback, status, on-line help and error management	Software
14	Menu dialogues (to be published)	Ergonomic design of menus in user-computer dialogues, covering menu structure, navigation, option selection and execution, and menu presentation (by various techniques including windowing, panels, buttons, fields, etc.)	Software
15	Command dialogues (to be published)	Ergonomic design of command languages used in user-computer dialogues, covering command language structure and syntax, command representations, input and output considerations, feedback and help.	Software
16	Direct manipulation dialogues (to be published)	Ergonomic design of direct manipulation dialogues, including manipulation of objects, and design of metaphors, objects and attributes; those aspects of "graphical user interfaces" which are directly manipulated, and not covered by other parts of ISO 9241.	Software
17	Form-filling dialogues (to be published)	Ergonomic design of form-filling dialogues, including form structure and output considerations, input considerations and form navigation	Software

6 Guidance on use of ISO 9241

In order to optimize the ergonomic properties of a system, or to evaluate those properties, the following steps should be taken and iterated as necessary:

— specify ergonomic requirements in terms of the objectives for usability, health and safety and of the context of use of the system, including characteristics of users, tasks and the environment;

— design systems applying principles, recommendations and standards to satisfy the ergonomic requirements;

— evaluate the system in comparison to ergonomic requirements.

In the event of failure to meet ergonomic requirements:

— diagnose the steps to be taken to improve the system.

In addition to these steps, there is a continuing need to communicate information on ergonomic requirements and the ergonomic properties of systems to different parties, for example from ergonomists to systems developers or from systems developers to users of the system.

Different parts of ISO 9241 can be used in these activities. For instance, in defining ergonomic requirements, it is essential that the context of use is specified, otherwise it is not possible to make decisions about usability objectives for a system and hence to make appropriate design choices. ISO 9241-11 provides a framework and guidance for describing the context of use.

When the context of use is understood and usability objectives have been specified, further action depends on who is using ISO 9241 for what purpose. A systems designer can obtain specific guidance on the choice between a number of design alternatives. A purchaser can identify appropriate requirements for a procurement specification. An evaluator can assess an existing system against ergonomic requirements.

All ergonomic requirements should be guided by knowledge of the context of use. Given such knowledge, it is possible to specify requirements either in terms of required product attributes or in terms of user performance that should be achieved. Specifying ergonomic requirements in terms of user performance can allow greater flexibility in

design, since a required level of user performance could be achieved by a number of different design solutions which do not correspond to the specific guidance given in the standard (see ISO 9241-11).

Each of the parts of ISO 9241 contains some general guidance on the particular area that it covers, while the following parts provide extensive general guidance:

Part 2 Guidance on task requirements

Part 10 Dialogue principles

Part 11 Guidance on usability

Specific requirements and recommendations which can be used for design and evaluation are contained in the following parts.

Equipment:

Part 3 Visual display requirements

Part 4 Keyboard requirements

Part 7 Requirements for display with reflections

Part 8 Requirements for displayed colours

Part 9 Requirements for nonkeyboard input devices

Environment:

Part 5 Workstation layout and postural requirements

Part 6 Environmental requirements

Software:

Part 12 Presentation of information

Part 13 User guidance

Part 14 Menu dialogues

Part 15 Command dialogues

Part 16 Direct manipulation dialogues

Part 17 Form-filling dialogues

User-performance tests with associated test methods may be found in the following parts.

Part 3 Visual display requirements

Part 4 Keyboard requirements

Part 5 Workstation layout and postural requirements

Part 8 Requirements for displayed colours

Part 9 Requirements for nonkeyboard input devices

Part 11 provides guidance on the conduct of user-performance testing for evaluating systems in terms of effectiveness, efficiency and satisfaction in their context of use.