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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 9241-1:1992(E)

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*, Sub-Committee SC 4, *Signals and controls*.

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: Display requirements with reflections*

— *Part 8: Requirements for displayed colours*

— *Part 9: Requirements for non-keyboard input devices*

— *Part 10: Dialogue principles*

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— *Part 11: Usability statements*

— *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*

Annexes A and B of this part of ISO 9241 are for information only.

Introduction

ISO 9241 provides the ergonomic requirements for visual display terminals (VDTs) in which display screen equipment is used for office tasks including text and data processing.

The purpose of ISO 9241 is to promote good ergonomic design of VDT work and thus to ensure that VDT users can operate display screen equipment safely, efficiently, effectively and comfortably. In practice, this can only be achieved by careful design of the VDTs themselves, the workplaces and working environments in which they are used and the way the VDT work is designed, organized and managed. ISO 9241 is therefore intended for all those involved in ensuring safe and effective VDT work. Much of ISO 9241 deals with the design of the VDT itself and is provided to help designers and manufacturers to develop ergonomically-sound visual display terminals. This information is also relevant to purchasers who wish to specify VDTs for applications or systems in their own organizations. It is also relevant to those who wish to assess the suitability of existing or proposed equipment.

ISO 9241 also deals with the VDT workplace, the VDT working environment and the organization and management of VDT work. This information is intended for VDT users and for those responsible for their supervision and management.

ISO 9241 is concerned with the users operating the VDT rather than the design of the VDT per se. Unlike many standards for computer equipment, the emphasis is therefore on specifying factors affecting the user performance rather than specifying the physical characteristics of the equipment which might be assumed to give rise to the desired human performance outcome.

The specification and assessment of user performance is dependent on appropriate test methods and these form an important component of ISO 9241. However it is recognised that not every user of ISO 9241 will have the resources necessary to conduct user performance tests and so, where possible, specific design guidance is given, based on existing knowledge and current technology, which is known to achieve the same result. Some aspects of VDT use and design are not amenable to such user performance specification, for example the design of VDT tasks, and here ISO 9241 provides guidelines to assist manufacturers, designers, users and managers.

In view of the complexities of VDT ergonomics and the unfamiliar and multipurpose nature of ISO 9241, it has been organized into a number of parts, each dealing with a different aspect of VDT work. Unless otherwise stated, each part of ISO 9241 deals with one aspect of VDT use and makes the assumption that the other aspects are as specified in the other parts. Overall, the requirements specified and the tests described are designed to be appropriate to typical office VDT circumstances.

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

Part 1:
General introduction

1 Scope

This part of ISO 9241 applies to the ergonomic requirements for the use of visual display terminals for office tasks. For the purposes of this part of ISO 9241, office tasks include text and data processing but not computer-aided design tasks (CAD) or industrial process control tasks.

NOTE 1 VDTs typically comprise a display unit (often a cathode ray tube), a keyboard and some associated electronics and control circuitry. The VDT may be a terminal to a larger system or may be a self-contained computer. Other equipment including printers and communications devices may be connected and located at the VDT workplace or remotely.

This part of ISO 9241:

— introduces ISO 9241 as a whole;

— describes the basis of the user performance approach;

— gives an overview of the first six parts of ISO 9241; and

— provides guidance on how to use ISO 9241.

Annex A lists the planned further parts of ISO 9241 and summarizes their contents.

ISO 9241 does not cover electrical safety or radiation emission; some aspects of these are covered by the IEC publications listed in annex B.

2 Principles of the user performance approach

One of the main concerns of ergonomics is in ensuring that equipment is fit for human use. In general this involves matching the design of any controls, displays, material to be handled, workplace, working environment and tasks to the characteristics, strengths and limitations of the potential user under the appropriate working environment. Failure to take account of human limitations can lead to errors, reduced performance, discomfort and perhaps risk of injury. Failure to take account of human strengths can be wasteful, reduce efficiency and result in boring, tedious work.

In practice, all equipment users are different and it is important to understand in what ways they vary and to quantify the variation so that it is taken into account in the design. Good ergonomic design is important in any equipment designed for human use but it is especially important when the use is intensive or if the accuracy or speed of the user's performance is critical.

VDT use is often both intensive and sensitive to the user's performance and forms a significant part of many office workers' jobs. Increasingly, users, their representatives and managers are concerned with ensuring that VDTs are designed to appropriate ergonomic standards.

Design guidance relevant to current technology is useful to designers and has been included within ISO 9241. However, major emphasis is placed on specifying the factors affecting the performance of the user. Thus, for example, ISO 9241 sets legibility requirements for displays in terms of the performance which users should be able to achieve in performing typical office tasks. This user performance

approach deals directly with the ergonomics requirements and should be much less dependent on the current state of technology than product standards.

However, the user performance approach depends on sound methods of testing which include detailed specifications of which ergonomic factors are important for a particular item of equipment, how they should be 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 expected. All of these points are dealt with in each of the relevant parts of ISO 9241.

It is recognised that some users of ISO 9241 will not have the resources to carry out the test methods in full and are only using current technology in a relatively straightforward way. In order to help such users, prescriptive guidance has been provided which should achieve the specified level of user performance with current technology.

3 Overview of the first six parts of ISO 9241

3.1 Part 1: General introduction

The general introduction contains information about ISO 9241 and provides an overview of the first six parts. Some IEC standards useful for understanding safety aspects are given (see annex B) and the basis of the user performance approach adopted throughout ISO 9241 explained. Some guidance is given on how to use ISO 9241.

3.2 Part 2: Guidance on task requirements

ISO 9241-2 deals with the design of office VDT tasks. The aim is to enhance the efficiency and the well being of the individual user by applying practical ergonomics knowledge to the design of office VDT tasks.

The objectives of the task design are discussed. Well-designed tasks should:

a) facilitate task performance;

b) safeguard the user's health and safety;

c) promote individual well-being;

d) develop the individual's skills and capabilities.

The characteristics of well-designed tasks are presented. These include:

e) some variety in the activities and skills used;

f) a degree of individual control over the pace of work;

g) some cohesion so that the task forms an understandable part of the work of the organization;

h) an opportunity for the individuals to use their skills and experience, and to gain new skills;

i) sufficient feedback on the task performance in terms which are meaningful and helpful to the user.

ISO 9241-2 provides guidance on how task requirements can be identified and specified within individual organizations and how task requirements can be incorporated into the system design and implementation process.

3.3 Part 3: Visual display requirements

ISO 9241-3 deals with the characteristics of the visual display which determine its effectiveness in presenting an image to the user. The user performance objective is that the user should be able to detect and recognize the image accurately, quickly and without discomfort.

The display characteristics which influence detection and recognition performance are identified. Where appropriate, design guidance on the minimum, maximum and optimum values of each characteristic are presented.

Some of the characteristics are determined solely by the design of the display itself, for example the shape of the characters, but others, for example the contrast between the character and its background, are the result of an interaction between the display and the working environment. There are also interactions between the different characteristics, for example increasing the character brightness can change its apparent size or the thickness of its strokes.

The overall effect of these design characteristics is assessed in a visual display performance test. The test procedure and conditions are specified as well as the user performance criteria. User performance criteria are the minimum accuracy and speed achieved by the test subjects in the detection and recognition test and the discomfort experienced. The test may be used to compare the user performance of displays based on different technologies.

NOTE 2 The user performance test is still under development.

3.4 Part 4: Keyboard requirements

ISO 9241-4 deals with the characteristics of the keyboard which determine its effectiveness in accepting a string of keystrokes from the user. The user per-

formance objective is that the user should be able to locate and activate the appropriate keys accurately, quickly and without discomfort.

The keyboard characteristics which influence keying performance are identified. Where appropriate, design guidance on the minimum, maximum and optimum values of each characteristic are presented.

The overall effect of these design characteristics is assessed in a keyboard performance test. The test procedure and conditions are specified as well as the user performance criteria. User performance criteria are accuracy and speed achieved by the test subjects in the keying test and the discomfort experienced. This test should be used to compare the user performance of keyboards of dissimilar technologies.

NOTE 3 The user performance test is still under development.

3.5 Part 5: Workstation layout and postural requirements

The workplace comprises the furniture and fittings surrounding and supporting the VDT and its user. Its main components are the work surface and the chair.

ISO 9241-5 deals with the design of workplaces for VDT users. Good workplace design should facilitate efficient operation of the VDT and encourage the user to adopt a comfortable and healthy working posture.

The requirements for a healthy comfortable seated posture are discussed. These include:

a) the location of frequently-used equipment controls, displays and work surfaces within easy reach;

b) the location of frequently-viewed displays within easy view;

c) the opportunity to change position frequently;

d) avoiding excessively frequent repetitive movements with extreme extension or rotation of the limbs or trunk;

e) support for the back especially for the lumbar region.

The characteristics of the workplace which promote a healthy and comfortable posture are identified and design guidelines given.

Compliance with these guidelines is only intended to ensure a minimum quality of VDT workplace. There will be applications where the special demands of the tasks or of the environments require a higher standard of workplace to promote efficient operation and healthy comfortable postures.

3.6 Part 6: Environmental requirements

ISO 9241-6 deals with the design of the working environment for VDT users. The objective is to provide a working environment which should facilitate efficient operation of the VDT and provide the user with comfortable working conditions.

The characteristics of the working environment which influence efficient operation and user comfort are identified and design guidelines presented.

Even when it is possible to control the working environment within strict limits, individuals will vary in their judgements of its acceptability partly because individuals do vary in their preferences and partly because different tasks often require different environments. Therefore some individual discretion with respect to the environment is essential.

4 Guidance on how to use ISO 9241

ISO 9241 is intended for all those involved in ensuring safe and effective VDT work. Its purpose is to promote the health and safety of VDT users and to ensure that they can operate VDT equipment efficiently and comfortably. This requires careful design of the VDTs themselves, of the workplaces and working environments in which they are used and of the way the VDT work is designed, organized and managed. In practice, these different aspects can be the responsibility of a number of different people or organizations.

Each of the interested parties will find different parts of ISO 9241 relevant to their requirements: for example, the relevance of the first six parts to particular users is given below.

ISO 9241-1, ISO 9241-3 and ISO 9241-4 are concerned with the design of the VDT itself and are provided to help designers and manufacturers to develop ergonomically-sound visual display terminals. This information is also relevant to purchasers who wish to specify VDTs for systems in their own organizations or to assess the suitability of existing or proposed equipment.

ISO 9241-5 and ISO 9241-6 deal with the VDT workplace and the VDT working environment. This information is intended for manufacturers and designers of VDT workplaces and environments and also for VDT users and for those responsible for their supervision and management.

ISO 9241-2 deals with the organization and management of VDT work and is intended for VDT users and for those responsible for their supervision and management.

The relevance of each of the first six parts of ISO 9241 to these different groups is illustrated in table 1.

Although the major emphasis is on the design of new equipment and installations, ISO 9241 may also be used to assess the suitability of existing installations.

Table 1 — First six parts of ISO 9241 and applicability

Part n°	Part title	VDT users	Equipment designers	Managers of users	System designers
1	General introduction	*	*	*	*
2	Guidance on task requirements	*		*	*
3	Visual display requirements		*		*
4	Keyboard requirements		*		*
5	Workstation layout and postural requirements	*	*	*	*
6	Environmental requirements	*	*	*	*

Annex A
(informative)

Information on planned parts 7 to 17 of ISO 9241

The titles, and a short summary of the intended contents, of parts 7 to 17 of ISO 9241 are given below.

a) **Part 7: Display requirements with reflections**

ISO 9241-7 is intended to contain details of methods for the measurement of glare and reflections from the surface of display screens, including those with surface treatments.

b) **Part 8: Requirements for displayed colours**

ISO 9241-8 is intended to deal with the requirements for multi-colour displays which are largely in addition to the monochrome requirements in ISO 9241-3.

c) **Part 9: Requirements for non-keyboard input devices**

ISO 9241-9 is intended to deal with the ergonomic requirements for non-keyboard input devices which can be used in conjunction with a visual display terminal. It will cover such devices as the mouse and other pointing devices. It will also include a performance test.

d) **Part 10: Dialogue principles**

ISO 9241-10 is intended to present high-level ergonomic principles which apply to the design of dialogues between humans and information systems.

e) **Part 11: Usability statements**

This is intended to provide a framework for an ergonomic requirements specification which includes descriptions of the context of use, the evaluation procedures to be carried out and the criteria to be satisfied when the usability of the system is evaluated.

f) **Part 12: Presentation of information**

ISO 9241-12 is intended to deal with the specific ergonomics issues involved in representing and presenting information in a visual form. It will include guidance on ways of representing complex information, screen layout and design as well as the use of windows.

g) **Part 13: User guidance**

ISO 9241-13 will deal with various forms of user guidance including documentation, help screens, within-system aids and error handling systems.

h) **Part 14: Menu dialogues**

The first dialogue technique for which material is available concerns dialogue menus. ISO 9241-14 is intended to contain a large number of guidelines developed from the published literature and from other relevant research.

i) **Part 15: Command dialogues**

Part 16: Direct manipulation dialogues

Part 17: Form filling dialogues

These other dialogue techniques have been identified as suitable topics for future standardization. At present they are in the very early stages but some material is already being reviewed within the committees for each of the types of dialogue technique.