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

**Part 5:**

**Workstation layout and postural requirements**

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

*Partie 5: Aménagement du poste de travail et exigences relatives aux  
postures*

ISO 9241-5:1998

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International Organization for Standardization  
Case postale 56 • CH-1211 Genève 20 • Switzerland  
Internet iso@iso.ch

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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 9241-5 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Sub-committee SC 4, *Ergonomics of human-system interaction*, Working Group WG 3, *Control, workplace and environmental requirements*.

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: *Guidance on the work environment*
- Part 7: *Requirements for display with reflections*
- Part 8: *Requirements for displayed colours*
- Part 9: *Requirements for non-keyboard 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

The purpose of this part of ISO 9241 is to promote and enhance performance and comfort while minimizing risks to users' safety and health. Users of visual display terminals (VDTs) in office work typically adopt a range of postures (seated with leaning, upright or reclining torso, standing or a combination of both). Workplaces which accommodate such usage can encourage movement, promote comfort and reduce physical, mental and visual problems.

This part of ISO 9241 is intended for use by product and workstation designers and implementers.

While drafting the text, the concept concerning the Frankfurt Plane was discussed but not included. The concept will be considered in a revision of this part of ISO 9241 in due course.

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

## Part 5: Workstation layout and postural requirements

### 1 Scope

This part of ISO 9241 specifies ergonomic guiding principles which apply to the user requirements, design, and procurement of workstation equipment for office tasks using VDTs.

In particular, the general principles and requirements specified in this part of ISO 9241 apply to the standards specifying technical design of furniture and equipment constituting the workplace.

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### 2 Normative references

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

ISO 6385:1981, *Ergonomic principles in the design of work systems*.

ISO 9241-2:1992, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 2: Guidance on task requirements*.

ISO 9241-3:1992, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 3: Visual display requirements*.

ISO 9241-6:—<sup>1</sup>, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 6: Guidance on the work environment*.

### 3 Definitions

For the purposes of this part of ISO 9241, the following definitions apply.

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1) To be published.

**3.1  
angle of view**

angle between the line-of-sight and the line orthogonal to the surface of the display at the point where the line-of-sight intersects the image surface of the display

[ISO 9241-3:1992]

**3.2  
anthropometry**

study and measurement of the physical dimensions of the human body

**3.3  
armrest**

support for the lower arms

**3.4  
back rest**

part of a work chair which provides support for the back

**3.5  
castor**

wheeled component on the bottom of furniture to facilitate appropriate movement on the floor surface

**3.6  
design reference posture**

posture specified for the purpose of workstation design to define relative positions and dimensions

**3.7  
deviation**

alteration from the neutral position

**3.8  
dynamic posture**

body position which changes, with relative movements of the limbs or other parts of the human body in relation to one another or with respect to a fixed object (such as a workstation)

**3.9  
extension**

movement that increases the angle between two adjacent bones; hand extension is the movement of the hand in the dorsal direction

NOTE Dorsal pertains to the back of the hand, palmar to the palm.

**3.10  
flexion**

movement that decreases the angle between two adjacent bones; hand flexion is the movement of the hand in the palmar direction

NOTE Palmar pertains to the palm of the hand.

**3.11  
gloss**

the mode of appearance by which reflected highlights of objects are perceived as superimposed on the surface due to the directionally selective properties of that surface

[CIE Publ. 17.4:1987; IEC 845-04-73]

**3.12  
gloss unit**

measure for quantifying the gloss of a surface

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**3.13****kyphosis**

convex curvature of the thoracic spine

**3.14****intended user population**

group of human beings for which a product or a workstation is designed

EXAMPLE Male and female workers of South-East Asian origin aged between 45 and 65 years.

**3.15****line-of-sight angle**

the angle between a horizontal line and the visual axis of the eye (the line connecting the point of fixation and the centre of the pupil)

**3.16****lordosis**

concave curvature of the spine

**3.17****lumbar**

region of the back between the thorax and the pelvis

**3.18****popliteal**

of or pertaining to the back of the knee

**3.19****posture**

overall position of the body, or body parts in relation to each other, with respect to the workplace and its components

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**3.20****reference plane**

surface designed to support the feet

NOTE If not otherwise indicated, the reference plane is the ground. Any other level higher or lower than the ground level may be used as a reference plane for the calculation of the height of support surfaces.

**3.21****static posture**

adoption of a body position which is fixed over time and where there is muscle contraction without motion

**3.22****task analysis**

analytical process employed to determine the specific behaviours required of people when operating equipment or doing work

NOTE The task analysis is not a risk assessment of the workplace according to legal requirements.

**3.23****workplace**

arrangement of workstations allocated to one person to complete a work task

**3.24****work space**

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

### 3.25 workspace

surface on which equipment and task materials are used

### 3.26 workstation

assembly comprising display equipment with or without a central processing unit, which may be provided with a keyboard and/or input device and/or software determining the operator/machine-interface, optional accessories, peripherals and the immediate work environment

## 4 Guiding principles

### 4.1 General considerations

Workplace design should be preceded by an analysis of the tasks that it is to support. Such an analysis should give information about the different tasks and sub-tasks which are performed and about the use of related equipment. It should also identify the relative priority given to different information sources within the user's task with respect to placement of displays, equipment location and job aids. For example, in many data-entry tasks, viewing of the hard copy has greater priority than viewing of the display.

The task analysis should include consideration of

- a) **major tasks and their inter-relationships:** frequency, importance, position of visual objects, duration and type of use of all associated equipment and their interrelationships, (see ISO 9241-2);
- b) **the position and use of the hands:** implications for posture, reach, and device manipulation by the relative positioning of VDT equipment and task materials, frequency, duration and complexity of movements.

For the design and selection of workplaces for VDT office tasks the following five interrelated principles apply:

- versatility-flexibility; <https://standards.iteh.ai/catalog/standards/sist/84f6903b-a716-495e-b700-f6942664b471/iso-9241-5-1998>
- fit;
- postural change;
- user information;
- maintainability-adaptability.

The statements of this clause are intended to provide general principles and guidelines underlying the requirements and recommendations given in Clause 5.

### 4.2 Versatility and flexibility

Workstations should enable the intended user population to perform a range of tasks comfortably and efficiently. In addition, workstation design should be appropriate for the range of tasks to be performed at the workstation, taking into account user characteristics (e.g. keyboard skills, anthropometric variation and user preferences). It should also be dependent upon usage times such that the longer the time spent at the VDT, the more important is the observance of good workstation design.

### 4.3 Fit

Selection and design of furniture and equipment requires a fit to be achieved between a range of task requirements and the needs of users. The concept of fit concerns the extent to which furniture and equipment (work chairs, work surfaces, visual display units, input devices, etc.) can accommodate individual users' needs.

Good fit is needed for the intended user population including users sharing workstations and users with special needs, e.g. handicapped persons. Fit can be accomplished by furniture built for a specified use (or user), or be provided in a range of sizes and forms or by adjustability and combinations thereof.

Since, except under special circumstances, workstations cannot be custom-made for individual users, some alternative forms of ensuring a good fit are required. The extent to which the workstation provides a good fit between the requirements of users and their work should be of primary consideration.

#### 4.4 Postural change

The workplace organization, the task and the furniture should encourage voluntary postural changes.

Postures adopted by users and the need for changes in posture are very markedly influenced by work organization and in particular, task requirements.

#### 4.5 User information

The users should be informed why and how the furniture and other devices (e.g. support for the visual display unit) should be adjusted.

Where specific skills are required for achieving a comfortable and efficient workplace, for example in adjusting work chair or worksurface heights or finding a satisfactory viewing distance, adequate user information and training in such skills should be provided. It is desirable that the design of furniture should minimize the need for training and for user information.

Guidance and training on the above factors should be given to users to ensure that they are fully acquainted with the design and functioning of the workplace and feel competent and confident to use the workplace properly. In particular, training should ensure that users are familiar with the mechanisms of adjustment and how to decide when furniture adjustment for the individual user and task is needed.

#### 4.6 Maintainability-adaptability (standards.iteh.ai)

Requirements for task performance, in addition to workplace design, should also take into account factors such as maintenance, accessibility, and the ability of the workplace to adapt to changing requirements.

Workstation designers should consider that access for maintenance can be accomplished easily and that disruption to ongoing task performance is minimized.

Workstation design should also facilitate adaptation of furniture and equipment in response to changing requirements and circumstances.

### 5 Design requirements and recommendations

#### 5.1 General

This clause contains requirements and recommendations for the configuration of VDT workstations that will facilitate comfortable and efficient operation. Subclauses 5.2 to 5.7 identify the parameters aimed at accommodating an individual user in terms of performance requirements, body clearance, acceptable and preferred postures and comfort.

The main factors in determining appropriate workstation arrangements are seat and worksurface, line-of-sight angle, worksurface and keyboard height, knee clearance, forearm inclination and elbow height.

Furniture, equipment, and work environment may be designed for use in the seated or standing position and where sitting and standing alternate. Workstations need to be capable of supporting several tasks (screen viewing, keyboard input, non-keyboard input device usage, writing, etc.) and should therefore be designed with such functions in mind. The philosophy taken in this part of ISO 9241 is that work organization, job content and furniture design should encourage user movement. This means that prolonged static sitting posture is minimized and that more or less continuous voluntary adjustments of the posture can be made.

## 5.2 Postures

### 5.2.1 Design reference posture

In order to be able to articulate acceptable requirements for comfort and performance with respect to body dimensions it is important to specify a design reference posture for purposes of specifying anthropometric data. While empirical evidence has indicated that the posture so specified could be comfortable for users carrying out certain tasks over short periods, it does not represent the optimum posture or the posture to strive for.

For purposes of referring to relevant anthropometric data, the following reference posture should be used (see annex A):

- a) the thighs positioned approximately in a horizontal position and the lower legs vertical; the seat height should be at, or a little below, the popliteal height of the user;
- b) the upper arms hanging vertically with the forearms horizontal;
- c) no deviation or extension of the wrists;
- d) an erect spine;
- e) the sole of the foot making an angle of 90° with the lower leg;
- f) no twisting of the upper torso;
- g) the line-of-sight between horizontal and 60° below the horizontal.

The design reference posture is shown in figure 1.

NOTE 1 The distance between the forearms and the thighs depends on body dimensions and varies in a wide range between humans. For a substantial percentage of persons, it is smaller than the distance shown in figure 1.

The line-of-sight in the relaxed seated position is inclined approximately by 35° below the horizontal (see figure 1). The optimum position for the most important visual display is within  $\pm 15^\circ$  in the vertical and horizontal direction from the line-of-sight.

NOTE 2 Placing a visual display in this position can cause glare problems if certain types of luminaires are used.

In the standing position, the inclination of the line-of-sight is about 30° (see figure 2).

### 5.2.2 Sitting postures

The purpose of well-designed seating is to provide stable support which allows movement, comfort, and task accomplishment. The workstation design should allow dynamic sitting (see 5.5.3).

### 5.2.3 Standing and sit/stand postures

The standing posture is recommended if it can alternate with a sitting position. This can be achieved if the workplace comprises either workstations or worksurfaces for sitting and standing postures or an adjustable workstation that can accommodate the same person in the seated and standing position (see figure 3).

For chairs used at sit/stand workstations, stability aspects apply in both the seated and standing positions.