International Standard

ISO 9241-5

Second edition
2024-08

Ergonomics of human-system interaction —

Part 5: Workstation layout and postural requirements

Ergonomie de l'interaction homme-système —

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

Reference number
ISO 9241-5:2024(en)

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Published in Switzerland

Contents

Page

Foreword

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This document was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 122, *Ergonomics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 9241-5:1998), which has been technically revised.

The main changes are as follows:

— Expansion and correction of Clause 3.

— Additional information added to Clause 4.

— Additional requirements and recommendations given in Clause 5.

— Revision of Annex A.

A list of all parts in the ISO 9241 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to promote and enhance performance and comfort while minimizing risks to users' safety and health. Users of interactive systems typically adopt a range of postures, such as 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 document is intended for use by product and workstation designers and implementers.

Ergonomics of human-system interaction —

Part 5: Workstation layout and postural requirements

1 Scope

This document specifies ergonomic guiding principles which apply to the user requirements, design and procurement of workstation equipment for using interactive systems with visual displays.

In particular, the general principles and requirements specified in this document apply to the standards specifying technical design of furniture and equipment constituting the workplace. They are intended for use by product and workstation designers and implementers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9241-11:2018, *Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts*

ISO 9241-302:2008, *Ergonomics of human-system interaction — Part 302: Terminology for electronic visual displays*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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

[SOURCE: ISO 9241-302:2008, 3.3.5, modified — Definition revised.]

3.2
anthropometric data
data relating to the 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 (e.g. a workstation)

3.9
extension
movement that increases the angle between two adjacent bones

Note 1 to entry: Dorsal pertains to the back of the hand, and palmar pertains to the palm.

Note 2 to entry: Hand extension is the movement of the hand in the dorsal direction.

Note 3 to entry: Neck extension (cervical extension) is the movement of the head backward.

3.10
flexion
movement that decreases the angle between two adjacent bones

Note 1 to entry: Palmar pertains to the palm of the hand.

Note 2 to entry: Hand flexion is the movement of the hand in the palmar direction.

Note 3 to entry: Neck flexion is the movement of lowering the chin down to the chest.

3.11
gloss
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

[SOURCE: CIE S 017:2020, 17-24-080]

3.12
gloss unit
measure for quantifying the gloss of a surface

3.13
intended user population
people for whom the design is intended, specified according to relevant characteristics

Note 1 to entry: Relevant characteristics include, for example, the skill level or physical characteristics, such as anthropometric dimensions, of these people. Gender and age can be related to variations in these characteristics. In addition to these intrinsic characteristics, extrinsic factors (e. g. cultural differences) can also be relevant.

3.14
interactive system
combination of hardware and/or software and/or services and/or people that users interact with in order to achieve specific goals

Note 1 to entry: This includes, where appropriate, packaging, user documentation, online and human help, support and training.

[SOURCE: ISO 9241-11:2018, 3.1.5]

3.15
kyphosis
convex curvature of the thoracic spine

3.16
line-of-sight angle
angle between a horizontal line and the visual axis of the eye

Note 1 to entry: The visual axis of the eye is the line connecting the point of fixation and the centre of the pupil.

3.17
lordosis
concave curvature of the spine

3.18
lumbar
region of the back between the thorax and the pelvis

3.19
popliteal
of or pertaining to the back of the knee

3.20
posture
overall position of the body, or body parts in relation to each other, with respect to the workplace and its components

3.21
reference plane
surface designed to support the feet

Note 1 to entry: If not otherwise indicated, the reference plane is the ground. Any other level higher or lower than ground level may be used as a reference plane for the calculation of the height of support surfaces.

3.22
static posture
adoption of a body position which is fixed over time and where there is muscle contraction without motion

3.23
task analysis
analytical process employed to determine the specific behaviours required of people when operating equipment or doing work, including the identification of the information and controls required to accomplish those behaviours or tasks

Note 1 to entry: The task analysis is not a risk assessment of the workplace according to legal requirements.

3.24
workplace
arrangement of resources allocated to one person to complete a task

3.25
workspace
volume of space allocated to one or more persons in the work system to complete a work task

3.26
worksurface
surface on which equipment and task materials are used

3.27
workstation
assembly comprising display equipment, with or without a central processing unit, which can be provided with either or all of the following:

— keyboard;

— input device;

— software determining the operator–machine-interface

and includes optional accessories, peripherals and the immediate work environment

4 Guiding principles

4.1 General considerations

Workplace design should be based on the task requirements. Therefore, it 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 subtasks 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. For many other tasks, the visual display is the main source of information and needs to be placed accordingly.

The task analysis should take into account:

a) major tasks and their interrelationships: frequency, importance, position of visual objects, duration and type of use of all associated equipment and their interrelationships;

b) the position and use of the hands: implications for posture, reach and device manipulation by the relative positioning of the equipment and task materials, frequency, duration and complexity of movements.

Task analysis should also reference type of work, for example individual or collaborative, as well as whether it is a shared workspace.

For the design and selection of workplaces, the following five interrelated principles apply:

— versatility-flexibility;

— fit;

— postural change;

— user information;

— maintainability-adaptability.

Clause 4 provides 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 interactive system, the more important is the observance of good workstation design.

4.3 Fit

Selection and design of furniture and equipment necessitates 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 (e.g. work chairs, worksurfaces, visual display units, input devices) can accommodate individual users' needs.

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

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

There is an important limitation regarding the fit estimates achieved when using percentile values to define workspace parameters; for example, the use of 5^{th} to 95^{th} percentile anthropometric values as suggested in 5.4.2. The range between the minimal 5^{th} percentile value and the maximal 95^{th} percentile value always accommodates at least 90 % of the intended users for that single dimension. However, combining two or more dimensions defined by percentile values generally reduces the percentage of users accommodated. For example, a chair seat has dimensions of height, length and width. Each dimension can accommodate 90 % of the users separately, but the actual fit or accommodation on all three variables at the same time is almost always less than 90 %, theoretically ranging approximately between 70 % and 90 %. For further discussion of the limitations of percentile values in multivariate designs, see Reference [11]. For an introduction to some multivariate techniques used to estimate multivariate fit, see ISO/TR 9241-514.

4.4 Postural change

Postural change concerns the extent to which the user can move between various postures.

Postural change facilitates user performance and comfort and avoids biomechanical stress and fatigue.

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

The organization of the workspace and the furniture utilised should encourage active postural changes and movement.

4.5 User information

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, adequate user information and training in such skills should be provided. For example, in adjusting work chair or worksurface heights or finding a satisfactory viewing distance. The design of furniture should be intuitive and minimize the need for training and for user information.

Guidance and training on these 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 is needed for the individual user and task.

4.6 Maintainability-adaptability

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 take into account whether access for maintenance can be accomplished easily and how disruption to ongoing task performance can be minimized.