SLOVENSKI STANDARD
SIST EN ISO 14738:2003

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Varnost strojev - Antropometriļ ne zahteve za naļ rtovanje delovnih mest pri strojih (ISO 14738:2002)

Safety of machinery - Anthropometric requirements for the design of workstations at machinery (ISO 14738:2002)

Sicherheit von Maschinen - Anthropometrische Anforderungen an die Gestaltung von Maschinenarbeitsplätzen (ISO 14738:2002)

Sécurité des machines - Prescriptions anthropométriques relatives a la conception des postes de travail sur les machines (ISO 14738:2002)

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ICS:

13.110	Varnost strojev	Safety of machinery
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English version

Safety of machinery - Anthropometric requirements for the design of workstations at machinery (ISO 14738:2002)

Sécurité des machines - Prescriptions anthropométriques relatives à la conception des postes de travail sur les machines (ISO 14738:2002)

Sicherheit von Maschinen - Anthropometrische Anforderungen an die Gestaltung von Maschinenarbeitsplätzen (ISO 14738:2002)

This European Standard was approved by CEN on 21 April 2001.

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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 Management Centre 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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This document (EN ISO 14738:2002) has been prepared by Technical Committee CEN/TC 122 "Ergonomics", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 159 "Ergonomics".

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of an identical text or by endorsement, at the latest by March 2003, and conflicting national standards shall be withdrawn at the latest by March 2003.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

0 Introduction

This International Standard is one of several ergonomics standards for the safety of machinery. EN 614-1 describes the principles designers should adopt in order to take account of ergonomic factors.

This International Standard describes how these principles should be applied by using anthropometric requirements for the design of workstations at machinery.

In addition it is recommended that the postures and movements that are imposed by the machinery design are evaluated as described in ISO 11226 and prEN 1005-4.

This International Standard has been prepared to be a harmonized standard in the sense of the Machinery Directive and associated EFTA regulations.

1 Scope

This International Standard establishes principles for deriving dimensions from anthropometric measurements and applying them to the design of workstations at non-mobile machinery. It is based on current ergonomic knowledge and anthropometric measurements.

This International Standard specifies the body's space requirements for equipment during normal operation in sitting and standing positions. This International Standard does not specifically include space demands for maintenance, repairing and cleaning work.

This International Standard does not give recommendations specifically for visual display terminal workstations at machinery. For this purpose ISO 9241-5 can be used in conjunction with this International Standard.

Situations where people are to be prevented from reaching a hazard are dealt with in ISO 13852.

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 references, 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).

ISO 13852
Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs

ISO 15534-3
Ergonomic design for the safety of machinery - Part 3: Anthropometric data

ISO 7250 : 1996
Basic human body measurements for technological design

3 Task requirements

Design of workstations at machinery shall be based on an analysis of task requirements (see EN 614-1 and EN 614-2) including at least the following elements:

- time aspects e.g. duration of work at the machinery (see ISO 11226 and prEN 1005-4);
- size of working area;
- size of objects to be handled;
- force demands (see prEN 1005-2 and prEN 1005-3);
- action demands (e.g. for feeding and/or removing items from the machinery);

- dynamic body measurements (see Annex B);
- co-ordination demands;
- stability demands;
- visual demands;
- need for communication;
- frequency and duration of body, head and limb movements (see ISO 11226 and prEN 1005-4);
- need to move between workstations;
- the possibility for adopting different postures (see also ISO 11226 and prEN 1005-4).

Machinery and workstations shall be designed to ensure the best postures and movement patterns taking into account technical and economic constraints.

4 Determination of main work posture

Figure 1 shows an analysis method for determining the main work posture at a machine and shows how some of the different factors described in clause 3 should be used. The design of the machine, workstation, task and equipment shall encourage a certain amount of movement and shifting of posture. The design should also allow the operator to change freely between the sitting and standing posture during the working day. When the designer chooses the main work posture, sitting is generally to be preferred. The standing postures are less recommended. Kneeling, crowling and lying down should be avoided as working postures. Figure 1 also indicates how factors can be modified to allow a sitting posture.

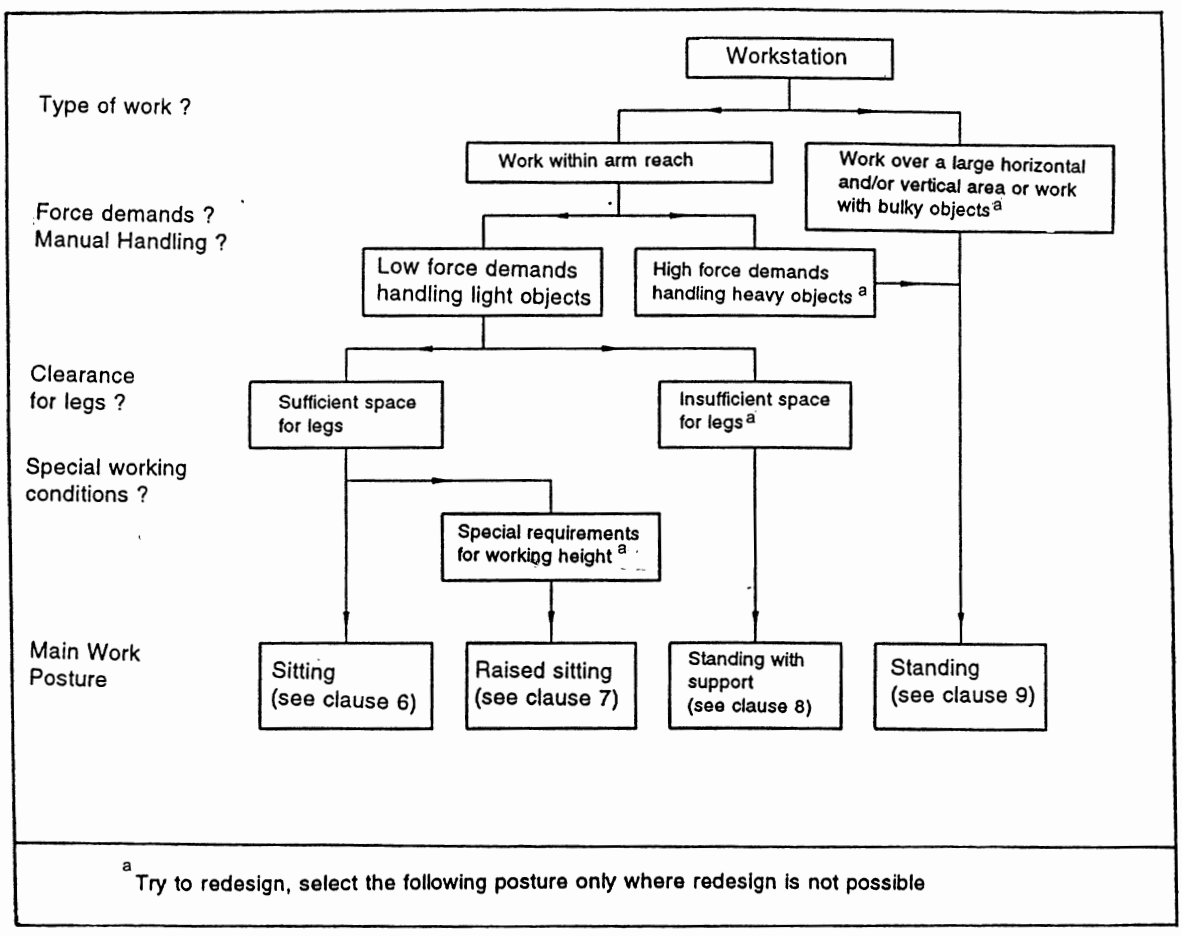


Figure 1 - Analysis method for determining main work posture

5 Dimensional data for workstation design

For each working posture described in this International Standard several dimensions for workstation design are given. These dimensions are based on anthropometric data. The anthropometric data originate from static measurements of nude persons and do not take into account body movements, clothing, equipment, machinery operating conditions or environmental conditions.

Annex A, table A.1, gives the human body measurements necessary to calculate the dimensions of workstations taking account of the known range of body sizes within Europe. Table A.2 is provided to allow the incorporation of anthropometric data from other regional areas of the world (for example from East Asia, South East Asia and North America). The notations used in this International Standard and its annexes are common to ISO 15534 Parts 1 to 3. Physical dimensions associated with the workstation are denoted by the capital letters A, B, C etc. in tables 4 to 8. These tables give dimensions calculated from human body measurements for European countries. Anthropometric measurements are denoted by lower case letters with indices. When a specific percentile of a body measurement is referred to, this is denoted by the actual percent figure preceeded by the letter 'P' within brackets after the index (e.g. a_2(P5) denotes the 5th percentile of body measurement a_2, shoulder breadth).

The dimensions given in table 1 are based on practical experience, and supplement the anthropometric measurements specified in Annex A. Together these data are used to specify the dimensions for the workstations at machinery.

The dimensions calculated will be the minimum for clearance dimensions and the maximum for reach dimensions. Wherever possible, the dimensions for clearance should be increased and the dimensions for reach should be decreased.

Table 1 - Allowances and additional dimensions

Height allowances (x)[1])	x_1- for shoes add 30 mm x_2- for shoes and foot movements add 130 mm x_3- for shoes and possibility to cross legs or for seat with forward sloping adjustment add 130 mm
Width allowances (y)	y - for movement of legs add at least 350 mm.
Depth allowances (z)	z_1- for movements at knee height add at least 50 mm z_2- for movements for the feet add at least 100 mm.
Other dimensions which are of importance:	- worksurface thickness as thin as possible, preferred maximum at front edge 30 mm (see clause 6.1) - width of footrest, preferred at least 700 mm - depth of footrest, preferred 700 mm.
[1]) For access to and use of pedal add pedal height plus sufficient space according to force demands see prEN 1005-3.	

Annex B provides additional information on body movements and associated space requirements.

6 Sitting

The advantages of the sitting posture include:

- the physiological energy cost and fatigue are reduced,
- it provides the body with a stable support,
- it allows precision work to be done.

The disadvantages include:

- the working area is limited,
- the possibilities for applying forces are limited,
- the possible risk of being constrained in a fixed posture for a long time.

Workstation dimensions shall accommodate the anthropometric variation in the user groups and the different work tasks, e.g. by being adjustable (see EN 614-1).

The best method of fitting the workstation to the user and the task is to make both the working surface and the seat easily adjustable.

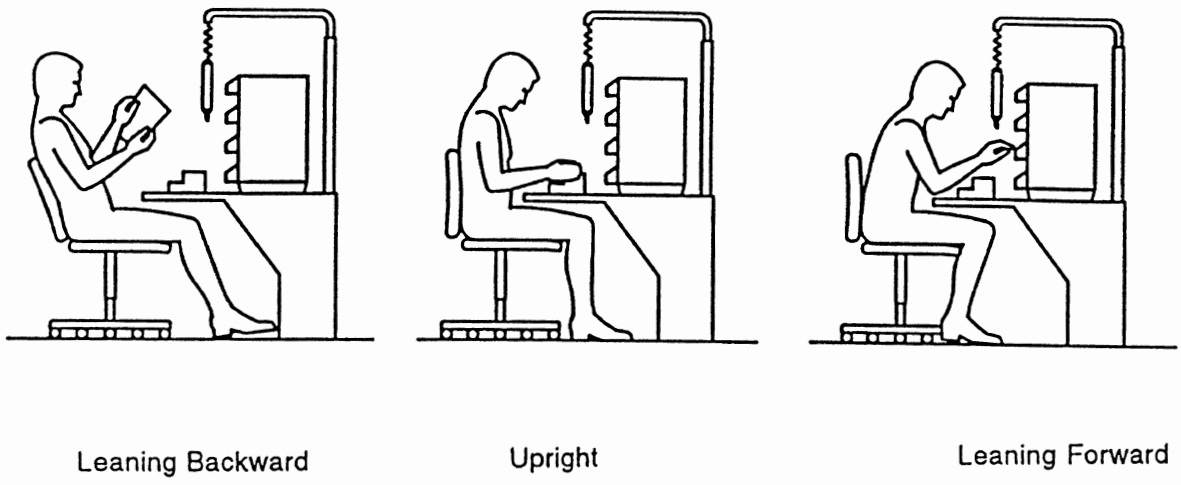


Figure 2 - Examples of variations in sitting posture

In order to avoid discomfort caused by sitting for a long time in a fixed position the workstation design shall allow variations in postures. This shall be done by adding sufficient allowances, as given in clause 5 (see also Annex B), to the relevant anthropometric dimensions when calculating the space requirements according to tables 4 and 5. Figure 2 shows variations in sitting postures ranging from slightly leaning backward to slightly leaning forward and illustrates how movements of the legs and upper body are interdependent.

In order to obtain appropriate sitting postures sufficient space for free body movements shall be provided, especially for the legs and feet. The working area for the arms shall be within appropriate distances according to the intended frequency and duration of movements of the body, head and limbs. For example, the placement of loading and unloading points on a machine shall be selected so that operation can be carried out in the preferred working area.

Account shall also be taken of the visual demands of the tasks which affect the position and movement of the head and body. The need for additional space for associated body movements should be assessed, tables 2 and 3 give information on the angles of movement of the head and body when seated. The influence of body movement on the effective field of vision is also shown (see also Annex B).

The angles α, β, γ and δ shown in tables 2 and 3 are guidelines for use in design. However, the actual values are highly variable and certain populations, e.g. younger or older people may have, respectively, much enlarged or restricted abilities to move parts of the body. Wearing spectacles or personal protective equipment, which restrict the field of vision, can increase the need for body movement. Factors, such as frequency and duration will also affect the acceptability of such movements (see also ISO 9355-2, ISO 11226 and prEN 1005-4).

Table 2 - Horizontal working areas taking account of eye, head and body movement

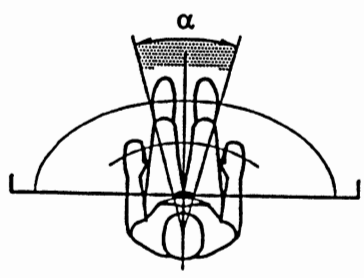
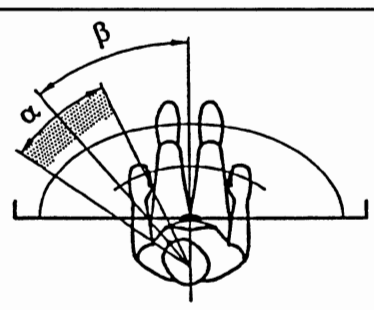
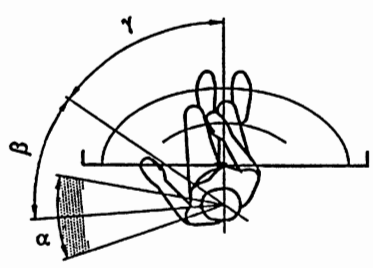
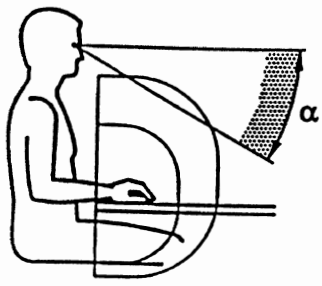
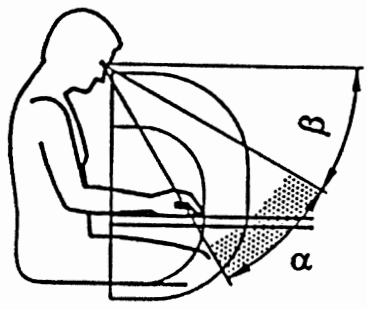
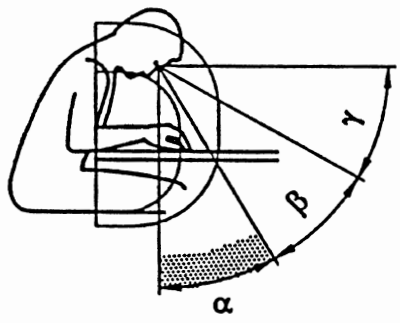
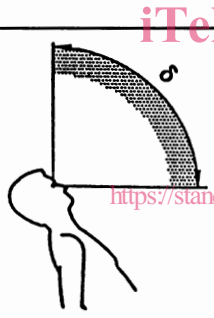
Posture	Notation	Value	Explanation of measurement
	α	30°	α = field of vision for frequent handling and observation without requiring head and body movement (see ISO 9355-2 for further information)
	α β	30° 40° 55°	α = field of vision (eye movements) β = head movement angle (left) α/2 + β = field of vision (left) for occasional handling and observation with head movement but without requiring body movement.
	α β γ	30° 40° 55° 110°	α = field of vision (eye movements) β = head movement angle (left) γ = angle for extended head and body movement (left) α/2+β+γ = field of vision (left) only for occasional observation and light handling where turning the head and body is permissible.
Such postures should not be maintained for any length of time.			
NOTE 1: Only movement to the left is shown. Movements to the right are symmetrical. NOTE 2: According to table 4, the working areas are designated by curved lines.			

Table 3 - Vertical working areas taking account of eye, head and body movement

Posture	Notation	Value	Explanation of measurement
	α	30°	α = field of vision for frequent handling and observation without requiring head and body movement (see ISO 9355-2 for further information)
	α β	30° 30°	α = field of vision (eye movements) β = head movement angle without downward body movement
		60°	α+β = field of vision for handling and visual detection where downward head movement is permissible
	α β γ	30° 30° 30°	α = field of vision (eye movements) β = head movement angle without downward body movement γ = angle for extended head movement or head and body movement (downwards)
		90°	α+β+γ = field of vision only for occasional handling and observation where downward head and body movement is permissible
 Such postures should not be maintained for any length of time.	δ	90°	δ = field of vision upwards, only for occasional handling and observation where head and body movement is permissible
NOTE: According to table 4, the working areas are designated by curved lines.			