



**SLOVENSKI STANDARD**  
**SIST EN 547-2:1998+A1:2008**  
**01-december-2008**

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Safety of machinery - Human body measurements - Part 2: Principles for determining the dimensions required for access openings

Sicherheit von Maschinen - Körpermaße des Menschen - Teil 2: Grundlagen für die Bemessung von Zugangsöffnungen

Sécurité des machines - Mesures du corps humain - Partie 2: Principes de détermination des dimensions requises pour les orifices d'accès

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**Ta slovenski standard je istoveten z: EN 547-2:1996+A1:2008**

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**ICS:**

13.110	Varnost strojev	Safety of machinery
13.180	Ergonomija	Ergonomics

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EUROPEAN STANDARD

EN 547-2:1996+A1

NORME EUROPÉENNE

EUROPÄISCHE NORM

September 2008

ICS 13.110; 13.180

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English Version

## Safety of machinery - Human body measurements - Part 2: Principles for determining the dimensions required for access openings

Sécurité des machines - Mesures du corps humain - Partie  
2: Principes de détermination des dimensions requises  
pour les orifices d'accès

Sicherheit von Maschinen - Körpermaße des Menschen -  
Teil 2: Grundlagen für die Bemessung von  
Zugangsöffnungen

This European Standard was approved by CEN on 15 November 1996 and includes Amendment 1 approved by CEN on 14 August 2008.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Foreword

This document (EN 547-2:1996+A1:2008) has been prepared by Technical Committee CEN/TC 122 "Ergonomics", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by March 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-08-14.

This document supersedes EN 547-2:1996.

The start and finish of text introduced or altered by amendment is indicated in the text by tags  $\square_{A1}$   $\square_{A1}$ .

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).

$\square_{A1}$  For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document.  $\square_{A1}$

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

## Introduction

This European Standard is one of several ergonomics standards for the safety of machinery. EN 614-1 "Safety of machinery – Ergonomic design principles – Part 1: Terminology and general principles" describes the principles designers should adopt in order to take account of ergonomic factors.

This European Standard describes how these principles should be applied to the design of access openings.

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

## 1 Scope

This European Standard specifies the dimensions of openings for access as applied to machinery as defined in EN 292-1. It provides the dimensions to which the values given in EN 547-3 are applicable. Values for additional space requirements are given in annex A. This European Standard has been prepared primarily for non-mobile machinery, there may be additional specific requirements for mobile machinery.

Dimensions for access openings are based on the values for the 95<sup>th</sup> percentile, whereas reach distances are based on the values for the 5<sup>th</sup> percentile, in each case the least favourable body dimension of the expected user population being used as a basis. The same considerations apply to the location of access openings.

The anthropometric data given in EN 547-3 originate from static measurements of nude persons and do not take into account body movements, clothing, equipment, machinery operating conditions or environmental conditions.

This European Standard shows how to combine the anthropometric data with suitable allowances to take these factors into account.

Situations where people are to be prevented from reaching a hazard are dealt with in EN 294.

## 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.

EN 292-1, *Safety of Machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology.*

EN 294, *Safety of Machinery - Safety distances to prevent danger zones being reached by the upper limbs.*

EN 547-3, *Safety of Machinery – Human body measurements – Part 3: Anthropometric data.*

EN 614-1, *Safety of Machinery - Ergonomic design principles – Part 1: Terminology and general principles.*

### 3 General requirements

Operations requiring reach through minimum access openings are likely to be less efficient, less safe and less healthy than working with unrestricted access. Therefore, before installing access openings other options should be considered, e.g. possibility to open machinery, withdrawal of parts for repair. This is particularly important where the task demands frequent access.

When access openings cannot be avoided the following criteria are of particular significance:

a) Ease of access is influenced by:

- The demands of the task, e.g. posture, nature and speed of movement, lines of sight, application of force;
- The location of the access opening relative to the position of the person, e.g. convenient height above floor, within easy reach, sufficient space outside to allow adoption of a comfortable posture, sufficient space inside to allow performance of the task;
- Frequency and duration of task;
- Whether tools are being carried, e.g. for maintenance or repair purposes;
- Length of access openings e.g. through a relatively thin wall (wall of a vessel) or through a channel type opening;
- Whether additional equipment such as personal protective equipment (including protective clothing), or portable lighting, is being carried or worn;
- The type of clothing, e.g. light or heavy clothing, bare hands or thick gloves, bare headed or wearing a helmet;

b) Environmental conditions (e.g. darkness, heat, noise, moisture);

c) Level of risk during the task.

Therefore, in addition to the anthropometric data in each case, allowances shall be provided for the respective opening dimensions and reach distances, taking into account the above criteria.

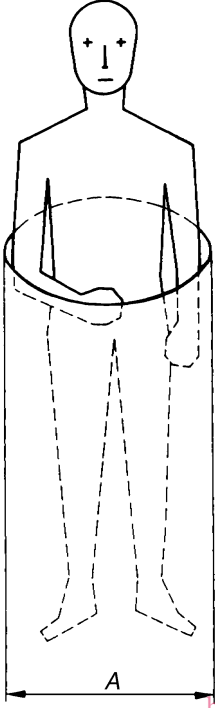
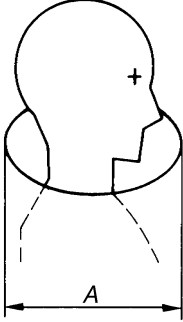
The applications on how to apply this European Standard in practice is contained in Annex A concerning allowances and in Annex B concerning position of access openings.

Annex C gives information on the use of notations for dimensions and anthropometric measurements.

### 4 Access openings

An access opening is an opening through which a person can lean forward, reach forward, or extend the upper body, head, arm, hand, a finger or several fingers, leg or foot, to be able to carry out measures during work procedures, such as operating of control actuators, repair duties or monitoring of processes or displays.

This European Standard does not specify optimum dimensions, but minimum dimensions for the size of the opening and maximum dimensions for reach. Wherever possible, the basic dimensions for the openings should be increased, and the maximum dimensions for reach should be decreased.

No		Notations	Explanation of measurement
4.1	<p>Access opening for the upper body and arms</p> 	<p>A a<sub>1</sub> x</p>	<p><math>A = a_1 (P95^{1}) + x</math></p> <p>Opening diameter</p> <p>Elbow to elbow breadth</p> <p>Allowance</p>
4.2	<p>Access opening for the head as far as the shoulders for inspection tasks</p> 	<p>A c<sub>3</sub> x</p>	<p>This type of access should be avoided wherever possible</p> <p><math>A = c_3 (P95) + x</math></p> <p>Opening diameter</p> <p>Head length from tip of nose</p> <p>Allowance</p>
4.3	<p>Access opening for both arms (either forward or downward)</p>		<p><math>A = a_1 (P95) + x</math> <math>B = d_1 (P95) + y</math> <math>C = t_1 (P5)</math></p>

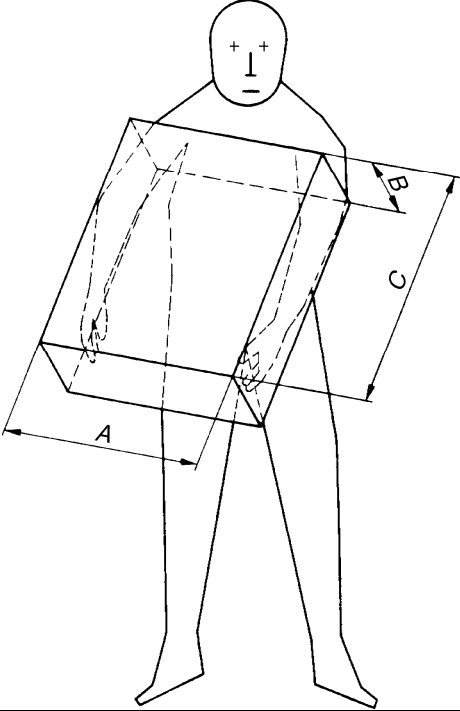
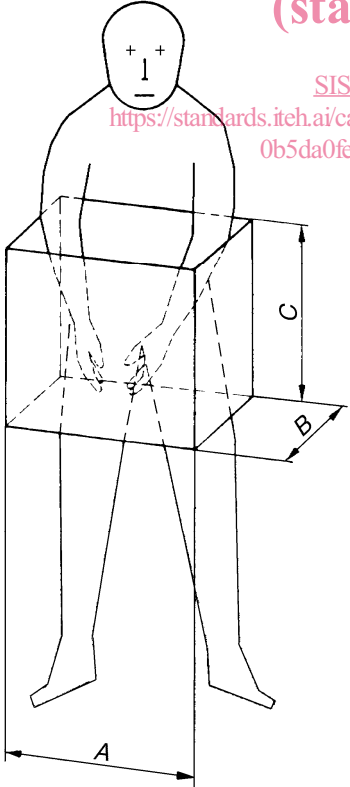
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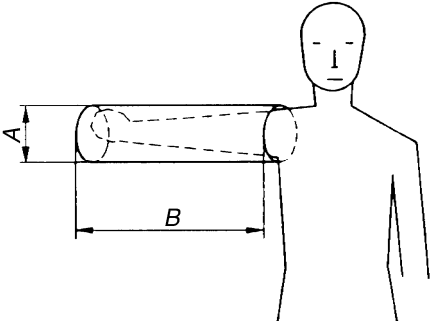
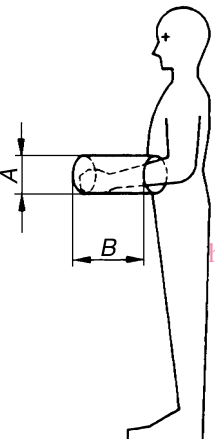
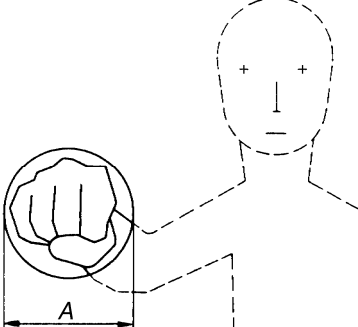
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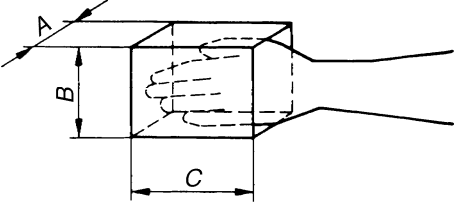
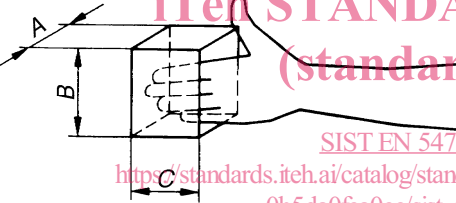
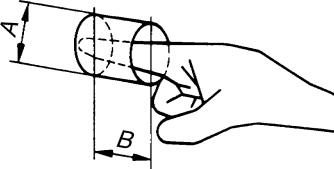
1) P95: 95<sup>th</sup> percentile of the expected user population



		<p>A B C</p> <p><math>a_1</math> <math>d_1</math> <math>t_1</math></p> <p>x y</p>	<p>Opening breadth Opening width Opening depth</p> <p>Elbow-to-elbow breadth Upper arm diameter Operating arm length</p> <p>Breadth allowance Width allowance</p>
<p>4.4</p>	<p>Access opening for both lower arms up to elbow (either forward or downward)</p> 	<p>A B C</p> <p><math>d_2</math> <math>t_2</math></p> <p>x y</p>	<p><math>A = 2d_2 (P95) + x</math> <math>B = d_2 (P95) + y</math> <math>C = t_2 (P5)</math></p> <p>Opening breadth Opening width Opening depth</p> <p>Lower arm diameter Forearm reach</p> <p>Breadth allowance Width allowance</p>

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No		Notations	Explanation of measurement
4.5	Opening for access to the side for one arm up to shoulder joint 	A B  $d_1$ $t_3$  x	$A = d_1 (P95) + x$ $B = t_3 (P5)$  Opening diameter Opening depth  Upper arm diameter Arm reach to the side  Allowance
4.6	Access opening for one lower arm up to the elbow 	A B  $a_3$ $t_2$  x	$A = a_3 (P95) + x$ $B = t_2 (P5)$  Opening diameter Opening depth  Hand breadth at thumb Forearm reach  Allowance
4.7	Access opening for fist 	A  $d_3$  x	$A = d_3 (P95) + x$  Opening diameter  Fist diameter  Allowance

No		Notations	Explanation of measurement
4.8	Access opening for flat hand to wrist, including thumb 	A B C  $a_3$ $b_4$ $t_4$  x y	$A = b_4 (P95) + x$ $B = a_3 (P5) + y$ $C = t_4 (P5)$  Opening width Opening height Opening depth  Hand breadth with thumb Hand depth at thumb Hand length  Width allowance Height allowance
4.9	Access opening for flat hand (four fingers) to base of thumb 	A B C  $a_4$ $b_3$ $t_5$  x y	$A = b_3 (P95) + x$ $B = a_4 (P95) + y$ $C = t_5 (P5)$  Opening width Opening height Opening depth  Hand breadth at metacarpals Hand depth at palm Hand length to thumb  Width allowance Height allowance
4.10	Access opening for index finger, restricted by the other fingers 	A B  $a_5$ $t_6$  x	$A = a_5 (P95) + x$ $B = t_6 (P5)$  Opening diameter Opening depth  Index finger breadth, proximal Index finger length  Allowance
4.11	Access opening for one foot to ankle bone		$A = a_6 (P95) + x$ $B = c_2 (P95) + y$