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Principles for selecting and using test persons for testing anthropometric aspects of industrial products and designs

Principes de choix et d'utilisation de sujets d'essai pour l'essai des aspects anthropométriques des produits industriels et leur conception

Reference number
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 3, *Anthropometry and biomechanics*, 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 15537:2004), which has been technically revised.

The main changes are as follows:

— the context has been broadened to include testing by computer-aided design (CAD);

— European values in tables have been replaced by global values.

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.

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Introduction

An investigation into how far ergonomic requirements are taken into consideration with regard to industrial products and designs is often performed using test equipment that permits only one or a few parameters (e.g. body height) to be registered. With regard to the concurrent multifunctional testing and/or determination of product characteristics for which no technical testing procedures have been established, one or more people are often designated as test persons and are observed and/or questioned during or after product testing.

The reliability of any findings established in this way is very much dependent on the extent to which the test persons represent the intended user group in different aspects. How well a product or design is adjusted to the anthropometrics of the intended user population is dealt with in this document.

According to ISO 14738, workstations at machinery has to be designed with proper regard to the body dimensions of the intended user population. One means to verify that a product or a design fulfils this requirement is to set up a panel of test persons and let them test the product in different ways.

An example of the use of this document is given in Annex A.

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Principles for selecting and using test persons for testing anthropometric aspects of industrial products and designs

1 Scope

This document establishes methods for determining the composition of groups of persons whose anthropometric characteristics are to be representative of the intended user population of any specific object under test.

This document is applicable to the testing of anthropometric aspects of industrial products and designs having direct contact with the human body or dependent on human body measurements, such as machinery, work equipment, personal protective equipment (PPE), consumer goods, working spaces, architectural details or transportation equipment.

This document is also applicable to the testing of such safety aspects of products that are dependent on human body measurements. It does not deal with other aspects of the task or other requirements, such as perception of information (except geometrical arrangement of the viewing targets) and the use of controls (except their geometrical placement).

Although this document deals with selecting test persons from an anthropometric perspective, similar general principles can be applied for other test variables, e.g. biomechanical aspects.

2 Normative references

There are no normative references in this document.

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
critical dimension
dimension estimated to cause a major limitation for the usage from an anthropometrical point of view, for the whole body or body parts, depending on the function of the product in question

Note 1 to entry: Critical dimension is related to reach, clearance, posture, contact pressure, vision or other factors which may result in difficulties of use, discomfort or health risks.

Note 2 to entry: A product to be tested can have more than one critical dimension, for example a combination of a reach dimension and a clearance dimension.

EXAMPLE The critical dimension for an access opening can be the width, or a combination of two dimensions, for example the width and the opening height.

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3.2
critical anthropometric measurement
anthropometric measurement which is most affected by the critical dimensions of the product

Note 1 to entry: For instance, the critical anthropometric measurement for a person entering an opening for whole body access is the one with the greatest constraint (e.g. the body height and/or the body width, depending on the form of the access opening).

3.3
worst-case combination of critical dimensions and anthropometric measurements
combination of critical dimensions of the product, additional equipment and the critical anthropometric measurement imposing the biggest restriction on a person who is able to use the product or design as intended

3.4
slim body type
person for whom at least two width measurements (preferably shoulder width and hip breadth) and two depth measurements (preferably chest depth and abdominal depth) are smaller than the figure representing the 25th percentile or, where this figure is not available, the average value of the 5th and the 50th (mean) percentile for the population in question

3.5
corpulent body type
person for whom at least two breadth measurements (preferably shoulder breadth and hip breadth) and two depth measurements (preferably chest depth and abdominal depth) are bigger than the figure representing the 75th percentile or, where this figure is not available, the average value of the 50th percentile (mean) and the 95th percentile for the population in question

3.6
medium body type
person who is neither a slim body type nor a corpulent body type

4 Types of tests

4.1 General

Testing may be done with living humans or with virtual humans, sometimes known as computer manikins. Current design processes often involve computer-aided design (CAD) systems, where it is possible to insert virtual humans into the CAD design process. See ISO 15536-1 and ISO 15536-2 for information on computer manikins. The tests described in this subclause can be done with living humans in a physical mock-up or with virtual humans in a CAD environment. If virtual humans are used, users are cautioned to assess the validity of the models before assuming accurate test results.

Test participants – virtual or human – are specified by anthropometry. The simplest designs require anthropometric information on only a few dimensions. In such cases, defining test participants using population percentiles may be appropriate. For more complex designs, using percentiles on many dimensions can give a false sense of accommodation, because persons who are accommodated by one or two dimensions might not be accommodated by the next three dimensions, while persons accommodated by the third and fourth dimensions might not be accommodated on the first one or two. The reason for this is that many design-critical dimensions are often not well correlated with each other. For these more complex design problems, a good solution is a multivariate anthropometric approach. Unfortunately, multivariate solutions generally require access to raw anthropometric data, which are often proprietary or otherwise not publicly available.

Depending on the accuracy of the test results required and the availability of test persons or manikins, either a screening or a detailed test can be performed. In addition to critical dimensions of the product, at least the following shall be taken into account as selection criteria:

— the geographic or ethnic origin of the user population (global, regional or a specific population);

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