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General requirements for establishing anthropometric databases

*Exigences générales pour la création de bases de données
anthropométriques*



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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15535 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 3, *Anthropometry and biomechanics*.

This third edition cancels and replaces the second edition (ISO 15535:2006), of which it constitutes a minor revision. Among other modifications, Annex I has been added to improve clarity.

Introduction

The well-being of people is very much dependent on their proportional and geometric relationship with several factors, such as growth, design principles for clothing, transportation, workplace and homes, as well as sporting and recreational activities. Implementation of databases on body dimensions of a population supports essential health and safety requirements, as well as International Standards in the field of machinery safety and personal protective equipment, and has acquired importance in the devising of computer-generated manikins of the human body.

One of the major difficulties in formulating international databases on anthropometry is that the numerous existing studies are rarely comparable in the strictest sense. Difficulties arise in comparing one study with another because either the methods used differ or they are not sufficiently well described. The anthropometric standards used for the data collection are fundamental to setting up any anthropometric databases.

This International Standard is intended to be used in close conjunction with ISO 7250-1. The ultimate goal is that a database developed by one researcher could be easily used by other researchers. This would be in a form that is readily accessible by those responsible for developing standards in support of good design and health and safety requirements (e.g. ISO 15534 and ISO 14738). To achieve this goal, it has been necessary to develop an appropriate International Standard to ensure that anthropometric databases and their associated reports are internationally compatible.

General requirements for establishing anthropometric databases

1 Scope

This International Standard specifies general requirements for anthropometric databases and their associated reports that contain measurements taken in accordance with ISO 7250-1.

It provides necessary information, such as characteristics of the user population, sampling methods, measurement items and statistics, to make international comparison possible among various population segments. The population segments specified in this International Standard are people who are able to hold the postures specified in ISO 7250-1.

NOTE The traditional anthropometry defined in ISO 7250-1 is considered to be a necessary complement to 3-D methods which are being developed in some countries. It is important that scanned data are verified according to the definitions given in ISO 7250-1 (see ISO 20685). State-of-the-art software allows integration of traditional anthropometric measures with those obtained by 3-D imaging.

2 Normative references

The following referenced documents are indispensable for the application 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 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 7250-1, *Basic human body measurements for technological design — Part 1: Body measurement definitions and landmarks*

ISO 8601, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

3 Terms and definitions

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

3.1

population segment

group of people having one or more common background characteristics that influence their anthropometric distributions

3.2

user population

population segment or segments for whom a technological design is intended

3.3

random sample

sample established by following a set of procedures to ensure that each and every individual in the population has an equal chance of being selected

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3.4

stratified sample

sample established by a procedure in which the population is divided into sub-populations (strata), each one of which contributes with a specified number of randomly selected individuals

3.5

demographic data

background information (such as sex, dwelling or working place, occupation, education) used to describe members of the user population and/or population segments

3.6

anthropometry

study and measurement of the physical dimensions and mass of the human body and its constituent (external) parts

Note 1 to entry: Taken from the Greek word *anthropos* (human being or Man) and *metron*, to measure.

3.7

anthropometric data

dimensional measurements (such as heights, lengths, depths, breadths and circumferences) of the human body and its component parts

3.8

anthropometric database

collection of individual body measurements (anthropometric data) and background information (demographic data) recorded on a group of people (the sample)

3.9

anthropometric report

technical report describing the origin, contents, methods, and statistical characteristics of an anthropometric database

4 Data collection design

4.1 General

The following methods shall be used in assembling internationally compatible anthropometric databases.

4.2 Definitions, techniques and conditions of measurement

4.2.1 The measuring methods given in ISO 7250-1 shall be used. Any deviation from this shall be indicated in the anthropometric report. It is anticipated that items other than those specified in ISO 7250-1 will be measured according to the purpose of the investigation. In such cases, definitions, methods, instruments and measurement units shall be clearly indicated in the report.

4.2.2 When a measurement can be taken on both the left and right sides of the human body, the report shall clearly indicate on which side the measurement has been taken.

4.2.3 Photographs or detailed sketches of the measurements taken should be provided and the measurement procedures should be documented.

4.2.4 The subject shall be nude or wearing minimal clothing, shall be bareheaded and without shoes. The type of clothing, if relevant, shall be coded on the anthropometric data sheet.

4.2.5 The measurement conditions shall be documented, together with the numerical results of any survey.

4.3 Sampling techniques

4.3.1 The demographic characteristics of the population shall be indicated as clearly as possible in the report. In the event that the population is divided into several subgroups, e.g. exam location and dwelling location for either sampling or statistical reporting, this shall be stated in the report.

4.3.2 It is desirable that random or stratified random sampling methods be used. However, if this is impossible, the report shall indicate the sampling method used.

4.3.3 It is desirable that the number of subjects needed for a database be established using a statistical power formula based on the accuracy of results desired by the investigator (see Annex A). However, in reality, the selection of subjects is often influenced by various factors, such as population size, number of people who agree to participate, and cost and period of time required for the investigation.

5 Data collection requirements

5.1 Basic demographic description of subjects

Biographic questionnaires shall be filled out to provide information that includes sex, date of birth, date of examination, and exam location. Other demographic information may be included on the questionnaire depending upon the purposes of the study.

5.2 Detection and treatment of measurement errors

The editing of obvious anomalies during data collection should be carried out using, for example, computer software specifically written for the purpose of detecting figures that lie outside any reasonable range of data given for that dimension (see Annex F).

5.3 Instrument accuracy

Anthropometric instruments for taking linear and circumferential measures shall measure to the nearest millimetre. Instruments for measuring body mass shall weigh to the nearest 500 g.

5.4 Sample composition

The following shall always be taken into account during planning of data collection:

- age;
- sex.

5.5 Sample size

The sample size shall be sufficient to estimate the value of the given measurement in a specified group. For example, the sample size should be sufficient to estimate the true population mean of stature within ± 10 mm for women who are between 30 years and 34 years of age. A method for calculating sample size is presented in Annex A.

Where appropriate for a particular study, the following may also be taken into account for sample size determination:

- geographical location;
- socio-economic status;
- educational level;

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- occupation;
- other demographic variables that influence anthropometric distributions.

5.6 Data-storage system

All biographical and subject data should be recorded on digital media compatible with widespread digital systems, whenever possible.

5.7 Type of clothing

The type of clothing shall be coded and identified (e.g. nude = 0, underwear = 1, light clothing = 2, other clothing as specified = 3) for analysis purposes.

5.8 Measurer training and quality control

Frequent and regular measurer training and quality control shall be carried out by persons experienced in anthropometry, in order to ensure acceptable standards of accuracy. Repeated measurement data should be recorded. Inter- and intra-measurer standard error of measurement, or mean absolute difference, shall be calculated and recorded for all anthropometric variables, in order that random checks can be carried out on the measuring teams during the survey.

6 Database format

6.1 The ASCII code, according to ISO/IEC 8859-1, shall be used. For analytical purposes, other data storage formats may be used in addition to ASCII.

6.2 Each data item shall be separated by a tab.

6.3 The contents of rows in the database are given in 6.3.1 to 6.3.3.

6.3.1 The data shall be entered in English.

6.3.2 The name of each data item shall be shown in the first row of the database using the designated English words and appropriate labels in other language(s), if needed. Item code numbers and acronyms should not be used in row 1 instead of English names, as they may cause confusion.

6.3.3 The second and subsequent rows of the database shall contain actual data from subjects with each data item in the same order as its name is listed in row 1.

EXAMPLE

Subject number	Sex	Exam location	Exam date	...	Body mass	Stature	...
0001	M	GB/London	2000-05-23	...	78,5	1756	...

6.4 All body measurements shall be recorded in millimetres (mm) or kilograms (kg) (SI units).

6.5 Missing data shall be recorded as 9999.

6.6 An example of database format from an anthropometric survey using the sample data sheet (Annex C) is presented in Annex I. The example shows the format of a database when some, but not all, dimensions according to ISO 7250-1 are measured.

7 Database contents

The following data items shall be included in the database.

7.1 Required background data

7.1.1 Item 1 Subject number.

7.1.2 Item 2 Sex: M for male subjects, F for female subjects.

7.1.3 Item 3 Exam location: country, ISO 3166-1 and location.

7.1.4 Item 4 Exam date: ISO 8601 method yyyy-mm-dd (for example, 2003-05-23 for 23rd of May, 2003).

7.1.5 Item 5 Birth date: ISO 8601 method yyyy-mm-dd (for example, 2003-04-05 for 5th of April, 2003).

7.1.6 Item 6 Decimal age: subject's age calculated after the exam in accordance with the method described in Annex D.

7.2 Recommended background data

Additional background data items such as birthplace, school, occupation or population segment may also be included, depending upon the purposes of the study.

7.3 Anthropometric data

Anthropometric data, according to ISO 7250-1, shall be recorded as Items 11 to 56. In the event that some variables in ISO 7250-1 are not measured, or if there are missing data, these shall be recorded as 9999.

7.4 Complementary data

In the event that additional body measurements not present in ISO 7250-1 are measured, these data shall be recorded as data items 57 and higher, in alphabetical order.

8 Anthropometric data sheets

Biographical data and measurements of each subject shall be recorded on electronic forms or data sheets (see Annex C).

9 Statistical processing

9.1 Before calculating statistical values, irregular values shall be detected and reviewed (see Annex F).

9.2 The age of each subject shall be calculated by decimal notation (see Annex D).

9.3 In the event that subjects are in the growth period, their measurements shall be tabulated for each one-year age interval, as given in Table E.1.

9.4 It is recommended that the data be tabulated for adult subjects in 5-year divisions (see Annex E). If that is impossible, for example when sample sizes are small, 10-year divisions or 20-year divisions, as given in Table E.2, shall be used. It is desirable to tabulate data for the adult male and adult female samples. If a combined sex sample is also reported, and the sample sizes of male and female data are unequal, the data shall be weighted to account for unequal sample sizes.