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General requirements for establishing anthropometric databases

Exigences générales pour la création de bases de données anthropométriques

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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*.

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, International Standards in the field of machinery safety and personal protective equipment, and has acquired importance in devising computer-generated manikins of the human body.

One of the major difficulties in formulating international databases on anthropometry is that the numerous existing studies of peoples 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 used in close conjunction with ISO 7250. The ultimate goal is that a database developed by one researcher would 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.

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.

NOTE The traditional anthropometry defined in ISO 7250 is considered to be a necessary complement to 3D methods which are developing in some countries. It is important that scanned data are verified according to the definitions given in ISO 7250. State-of-the-art software allows integration of traditional anthropometric measures with those obtained by 3D 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 3166-1:1997, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 7250:1996, *Basic human body measurements for technological design*

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

ISO/IEC 8859-1:1998, *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 segments
groups of people having some common biological or cultural heritage, environment or activity

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

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 age, sex, race or ethnicity, nationality, occupation and education) used to describe members of user populations

3.6
anthropometry
study and measurement of the physical dimensions and mass of the human body and its constituent (external) parts

NOTE 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 in ISO 7250 shall be used. Any deviation from this shall be indicated in the anthropometric report. It is anticipated that other items than those specified by ISO 7250 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 is 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 wear 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, such as nationality, ethnic group and occupation, 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 which sampling method is used.

4.3.3 It is desirable to establish the number of subjects needed for a database by 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 date of birth, date of examination (decimal years), sex, ethnic identity, occupation, geographical location and dwelling area (rural or urban).

5.2 Detection and treatment of measurement errors

The editing of obvious anomalies during data collection should be carried out by, 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 1 mm. 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 30 to 34 years old.

Where appropriate, the following should also be taken into account:

— race and/or ethnicity;

— geographical regions of the country;

— socio-economic/occupation status;

— mix of rural and urban populations.

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, 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.

5.9 Diurnal variation

Diurnal variation occurs as a result of gravitational effects which apply to reduce stature during the normal course of a day. The time of measurement should be recorded.

6 Database format

6.1 The ASCII code, according to ISO/IEC 8859-1:1998, shall be used.

6.2 Each data item shall be separated by a tab.

6.3 The contents of rows in the database is 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 data	Body mass	Stature
0001	M	UK/London	2000-05-23	78,5	1756

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

6.5 Missing data shall be recorded as 9999.

7 Database contents

The following data items shall be included in the database.

7.1 Required background data

7.1.1 Item 1 Number of the subject

7.1.2 Item 2 Sex: M for male subjects and 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

7.1.7 Item 7 Birthplace: record the subject's birthplace (ISO 3166-1 country code and location)

7.2 Recommended background data

7.2.1 Item 8 School: record a type of present or final school: B for basic, S for secondary school, H for high school, and U for university (see Annex B).

7.2.2 Item 9 Occupation: record occupation (see Annex B).

7.2.3 Item 10 Race or ethnicity: record the subject's biological population affiliation (see Annex B).

7.3 Anthropometric data

In accordance with ISO 7250, anthropometric data shall be recorded as Items 11 to 56. In the event that some variables in ISO 7250 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 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).