TECHNICAL REPORT

ISO/TR 7250-2

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Basic human body measurements for technological design —

Part 2: Statistical summaries of body measurements from individual ISO populations

Définitions des mesures de base du corps humain pour la conception technologique —

Partie 2: Résumés statistiques des mesurages du corps de populations ISO individuelles

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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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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/TR 7250-2 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 3, *Anthropometry and biomechanics*.

ISO/TR 7250 consists of the following parts, under the general title *Basic human body measurements for technological design*:

— *Part 1: Body measurement definitions and landmarks*

— *Part 2: Statistical summaries of body measurements from individual ISO populations*

Worldwide and regional design values for use in ISO equipment standards is to form the subject of a part 3.

Introduction

Anthropometric data used for technological design have been included in many ISO product standards. However, different review cycles make it impossible for simultaneous revision of these product standards as new anthropometric data become available. This Technical Report is intended to serve as a continually updated repository of the most current national anthropometric data. It is intended to make current and updated anthropometric data available for inclusion by reference in the various ISO product standards requiring anthropometric data.

Body dimensions of people have been increasing in many countries over the last several decades. The rate of increase differs from country to country. In the area where significant secular change is going on, statistical summaries described in this Technical Report will be outdated sooner. Therefore, it is intended that statistical summaries of human body measurements described in this Technical Report be updated as new data become available.

Basic human body measurements for technological design —

Part 2: Statistical summaries of body measurements from individual ISO populations

1 Scope

This Technical Report provides statistical summaries of body measurements together with database background information for working age people in the national populations of individual ISO member bodies. The data in this Technical Report are intended for use in conjunction with ISO standards for equipment design and safety, which require ISO 7250-1 body measurement input, wherever national specificity of design parameters is required.

NOTE 1 Users of this Technical Report who know of newly available data are encouraged to contact their ISO member bodies and the ISO TC 159/SC3 secretariat, as described in 6.2.

Body measurement data for technological design need to be reliable in terms of representing the intended population and measurement quality. To ensure the comparability of measurements, body dimensions in this Technical Report are measured according to ISO 7250-1. To ensure the reliability of statistical data, databases from which statistics are calculated adhere to ISO 15535.

This Technical Report provides body measurement data for people of working age. In order to provide practical data, the age range is not defined and the decision is left to each country, because working age differs among countries. However, the data for children under 16 years are not included.

NOTE 2 Secular change means changes in mean body dimensions of a specific group over time. The direction of change can be positive or negative.

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 7250-1:2008, *Basic human body measurements for technological design — Part 1: Body measurements definitions and landmarks*

ISO 15535:2006, *General requirements for establishing anthropometric databases*

ISO 20685:—[1)], *3-D scanning methodologies for internationally compatible anthropometric databases*

1) To be published. (Revision of ISO 20685:2005.)

3 Anthropometric measurements

Measuring conditions and definitions of measurements in this Technical Report are the same as those described in ISO 7250-1. Body measurements are described in millimetres (mm) or kilograms (kg).

Body measurements obtained from 3-D systems or obtained using instruments different from those described in ISO 7250-1 are confirmed by member bodies to be sufficiently close to those produced by the traditional methods of ISO 7250-1 according to ISO 20685:—, Clause 5.

Sometimes a measurement is not performed exactly as described in ISO 7250-1, but is very similar. In such cases, the measurement may be substituted for the ISO 7250-1 measurement if its value is adequately close. To judge closeness, the method described in ISO 20685 needs to be used. The criteria for the judgment are given in Annex A.

The measured side (right or left) is described.

When measurements not described in ISO 7250-1 are also available, the number of these measurements and the reference are provided.

Age statistics are tabulated similarly and presented together with the anthropometric measurements.

4 Statistical procedures

4.1 Data editing

Before calculating statistical values, irregular values are detected and reviewed according to ISO 15535:2006, Annex F.

4.2 Statistics

In this Technical Report, the following statistics are described for each measurement: sample size, mean, standard deviation (SD), and 1st, 5th, 50th, 95th and 99th percentile values.

4.3 Population stratification

Population can be stratified by gender, age, location, occupation or education. To keep this Technical Report at a reasonable size, statistics are presented for females, males, and females and males combined, but not for other strata.

4.4 Age stratification

In order to provide practical data and to keep the Technical Report at a reasonable size, only one age group, including all working age people, is considered.

4.5 Body measurements for representative body forms

Measurements for body forms representing large, medium and small types are useful for technological design. While medium type can be represented by P50 values for all measurements, fixed percentile options are problematic for extreme body forms, such as those derived from all P5 or P95 values. When sitting height and leg length are P5, height is smaller than P5. Though such a problem is well recognized, there is no consensus on the method for obtaining measurements for body forms statistically representing the variation in a population. Considering this lack of consensus, it was decided not to present such data in this Technical Report.

5 Background information

5.1 General

Statistics of body dimensions are described together with the following information for users to judge their reliability and context.

5.2 Background of database

5.2.1 Time period of examination

Year(s) of measurement.

5.2.2 Location of examination

Name of the country and city.

5.2.3 Demographic data

For demographic data (gender, age, etc.), information on the following items is provided:

a) definition of the working age;

b) description of subjects;

c) number of subjects by gender;

d) ten-year age groups.

When more than one subgroup based on criteria other than the age and gender is involved, the percentage of each subgroup is provided, if necessary.

5.2.4 Publication on the anthropometric research

The author, publication year, title of the publication and the name of publisher are provided when the data have been published.

5.3 Representativeness of the sample

5.3.1 Sampling method

A description is given of the grounds on which the sample was judged to be representative of the intended population. These include an examination of the sampling method and may also include the comparison of height and weight in the measured sample data with those from a large sample representing the intended population. If the data need to be weighted in order to be representative, then the weighting method is described.

5.3.2 Information on secular change

When significant secular changes are going on, information on the rate of change over the last several decades is presented, when available, and appropriate references are given.

5.4 Accuracy and reliability of measurements

5.4.1 Skill of measurers

The number of measurers and information on the skill of each measurer, such as intra-observer mean absolute difference or technical error of measurement or repeated measurements, are shown when such data are available. When more than one measurer is involved, the methods used to control the quality of the measurement technique are documented. When the research is continued for more than one month, the method of quality control during the research period is documented.

5.4.2 Measurements from 3-D scanners

When measurements are extracted from 3-D scans, the results are compared to measurements obtained by traditional methods using the procedures in ISO 20685:—, Clause 5. Similarly, measurements taken using instruments not described in ISO 7250-1 are compared to those obtained by traditional methods.

6 Procedure for presenting member body statistics

6.1 General

This clause describes how the working group gathers and presents the statistics given in this Technical Report.

6.2 Submission of data

Users of this Technical Report and ISO member bodies are encouraged to submit anthropometric data for this Technical Report. Users with knowledge of additional anthropometric data should contact their ISO member body, and copy the ISO/TC 159/SC 3 secretariat on the communication (e-mail addresses can be found on the ISO website: http://www.iso.org/). Member bodies should contact the ISO/TC 159/SC 3 secretariat. When information is received, it will be processed as described below.

6.3 One data set from each member body

In the case of countries with more than one possible database, the member body has the responsibility to determine which of the databases is to be used. If more than one set of statistics is submitted, it is the responsibility of the working group to ask the member body to choose only one data set.

6.4 Meeting the criteria outlined in 4.2, 4.3 and 4.4

The working group requests that member bodies provide summary statistics that meet the criteria outlined in 4.2, 4.3 and 4.4. If the criteria are not met on the first submission, it is the responsibility of the working group to ask the member body to re-submit the statistics according to the criteria.

6.5 Examination of possible errors

6.5.1 General

Recognizing that errors can accidentally occur in any data set, it is the responsibility of the working group to examine the submitted summary statistics for reasonableness. The steps used are the following.

6.5.2 Minima and maxima

The minima and maxima for each dimension should be examined, comparing them to minima and maxima from other member body submissions. If, in the professional judgment of the working group, minima or

maxima are likely to be the result of errors, it is the responsibility of the working group to contact the member body to verify the submission.

6.5.3 Percentile values

The distance of the P1 and P99, P5 and P95 from the P50 percentile value should be examined. If the distant percentiles are, in the professional judgment of the working group, unusually distant from the P50, it is the responsibility of the working group to contact the member body to verify the submission.

6.5.4 Standard deviation

The standard deviation (SD) compared to the standard deviation submitted by other member bodies should be examined. If the standard deviation is, in the professional judgment of the working group, unusually large or unusually small, it is the responsibility of the working group to contact the member body to verify the submission.

6.5.5 Comparison of mean or P50 values from member bodies

The mean or P50 values with respect to mean or P50 values from other member bodies should be examined to make sure that the dimension being reported is that described in ISO 7250-1. If it appears, in the professional judgment of the working group, that a different measuring technique, or different measurement definition, has been used, it is the responsibility of the working group to contact the member body to verify the measurement procedure.

6.6 Marks on values likely to be in error

If resubmitted summary statistics are still, in the professional judgment of the working group, likely to be in error, the published values are marked with a footnote.

7 Statistics for ISO member bodies

7.1 ISO member body: Austria

Organization: Austrian Standards Institute

URL: http://www.on-norm.at/

Name of study: —

Austria adopts anthropometric data from DIN 33402-2:2005.

7.2 ISO member body: Germany

Organization: Deutsches Institut für Normung - German Standardization Institute (DIN)

URL: http://www.din.de/cmd?level=tpl-home&contextid=din

Name of study: —

Table 1 — Germany — Database

1 Measurement		
1.1	Measured side (right/left)	Right
1.2	Measurement definitions different from those described in ISO 7250-1	None
1.3	Substituted measurements	
1.4	Number of measurements not described in ISO 7250-1	
2 Age range		
2.1	Working age	18 to 65
2.2	Age range of subjects	18 to 65
3 Background data		
3.1	Time period of examination	1999 to 2002
3.2	Location of examination	Different areas of Germany
3.3	Survey sample	Representative (regional, social, ethnic)
3.4	Publication	DIN 33402-2:2005
4 Representativeness of the sample		
4.1	Sampling method	
4.2	Information on secular change	The secular trend in Germany has stopped.
5 Accuracy and reliability of measurements		
5.1	Intra- and inter-observer error rates	Exist
5.2	Measurements from 3-D scanners	None
5.3	Other measurement not taken using instruments described in ISO 7250-1	None
5.4	Type of clothing	Without shoes, minimal clothing

Table 2 — Germany — Statistical summary

No.	ISO 7250-1 measurement			Sample size n	Mean	SD	P1	P5	P50	P95	P99
		Age	Male								
			Female								
			Total								
1	4.1.1	Body mass (weight), kg	Male					64	79	100	
			Female					52	66	87	
			Total								
2	4.1.2	Stature (body height)	Male					1 650	1 750	1 855	
			Female					1 535	1 625	1 720	
			Total								
3	4.1.3	Eye height	Male					1 530	1 630	1 735	
			Female					1 430	1 515	1 605	
			Total								
4	4.1.4	Shoulder height	Male					1 345	1 450	1 550	
			Female					1 260	1 345	1 425	
			Total								
5	4.1.5	Elbow height	Male					1 025	1 100	1 175	
			Female					960	1 020	1 080	
			Total								
6	4.1.6	Iliac spine height, standing	Male								
			Female								
			Total								
7	4.1.7	Crotch height	Male					760	830	905	
			Female					710	775	830	
			Total								
8	4.1.8	Tibial height	Male					430	460	480	
			Female					400	425	450	
			Total								
9	4.1.9	Chest depth, standing	Male					195	225	270	
			Female					165	190	235	
			Total								
10	4.1.10	Body depth, standing	Male					260	285	380	
			Female					245	290	345	
			Total								
11	4.1.11	Chest breadth, standing	Male								
			Female								
			Total								
12	4.1.12	Hip breadth, standing	Male					340	360	385	
			Female					340	365	400	
			Total								
13	4.2.1	Sitting height (erect)	Male					855	910	965	
			Female					810	860	910	
			Total								
14	4.2.2	Eye height, sitting	Male					740	795	855	
			Female					705	755	805	
			Total								
15	4.2.3	Cervicale height, sitting	Male								
			Female								
			Total								

Table 2 (*continued*)

No.	ISO 7250-1 measurement			Sample size *n*	Mean	SD	P1	P5	P50	P95	P99
16	4.2.4	Shoulder height, sitting	Male					570	625	670	
			Female					540	590	630	
			Total								
17	4.2.5	Elbow height, sitting	Male					210	240	285	
			Female					185	230	275	
			Total								
18	4.2.6	Shoulder-elbow length	Male					330	365	400	
			Female					290	320	350	
			Total								
19	4.2.7	Elbow-wrist length	Male								
			Female								
			Total								
20	4.2.8	Shoulder (biacromial) breadth	Male					370	405	435	
			Female					345	370	400	
			Total								
21	4.2.9	Shoulder (bideltoid) breadth	Male					440	480	525	
			Female					395	435	485	
			Total								
22	4.2.10	Elbow-to-elbow breadth	Male					415	480	555	
			Female					395	485	555	
			Total								
23	4.2.11	Hip breadth, sitting	Male					350	375	420	
			Female					360	390	460	
			Total								
24	4.2.12	Lower leg length (popliteal height)	Male					410	450	490	
			Female					375	415	450	
			Total								
25	4.2.13	Thigh clearance	Male					130	150	180	
			Female					125	145	175	
			Total								
26	4.2.14	Knee height	Male					495	535	585	
			Female					460	500	545	
			Total								
27	4.2.15	Abdominal depth, sitting	Male					200	280	330	
			Female					205	250	325	
			Total								
28	4.2.16	Thorax depth at the nipple	Male								
			Female								
			Total								
29	4.2.17	Buttock-abdomen depth sitting	Male								
			Female								
			Total								
30	4.3.1	Hand length	Male					175	189	207	
			Female					162	177	193	
			Total								
31	4.3.2	Palm length perpendicular	Male					104	111	121	
			Female					92	100	108	
			Total								

Table 2 (*continued*)

No.	ISO 7250-1 measurement			Sample size *n*	Mean	SD	P1	P5	P50	P95	P99
32	4.3.3	Hand breadth at metacarpals	Male					80	87	94	
			Female								
			Total								
33	4.3.4	Index finger length	Male					68	75	83	
			Female					62	69	77	
			Total								
34	4.3.5	Index finger breadth, proximal	Male					19	21	23	
			Female					17	19	21	
			Total								
35	4.3.6	Index finger breadth, distal	Male					17	18	20	
			Female					14	16	18	
			Total								
36	4.3.7	Foot length	Male					245	265	285	
			Female					225	245	260	
			Total								
37	4.3.8	Foot breadth	Male					92	101	111	
			Female					83	92	102	
			Total								
38	4.3.9	Head length	Male					185	195	205	
			Female					170	185	195	
			Total								
39	4.3.10	Head breadth	Male					145	155	165	
			Female					140	150	160	
			Total								
40	4.3.11	Face length (nasion-menton)	Male					105	115	130	
			Female					95	110	125	
			Total								
41	4.3.12	Head circumference	Male					545	570	600	
			Female					520	545	570	
			Total								
42	4.3.13	Sagittal arc	Male					330	350	375	
			Female					310	330	360	
			Total								
43	4.3.14	Bitragion arc	Male					340	365	385	
			Female					320	335	360	
			Total								
44	4.4.1	Wall-acromion distance	Male								
			Female								
			Total								
45	4.4.2	Grip reach; forward reach	Male					685	740	815	
			Female					625	690	750	
			Total								
46	4.4.3	Elbow-grip length	Male					325	350	390	
			Female					295	315	350	
			Total								
47	4.4.4	Fist (grip axis) height	Male					730	765	825	
			Female					670	715	760	
			Total								