

SVENSK STANDARD

SS-EN ISO 20685-2:2017

Fastställt/Approved: 2017-03-08
Publicerad/Published: 2017-03-10
Utgåva/Edition: 1
Språk/Language: engelska/English
ICS: 12.050; 13.180

Ergonomi – 3-D scanningsmetoder för internationellt jämförbara antropometriska databaser – Del 2: Utvärderingsprotokoll av ytform och repeterbarhet av relativa landmärkespositioner (ISO 20685-2:2015)

Ergonomics – 3-D scanning methodologies for internationally compatible anthropometric databases – Part 2: Evaluation protocol of surface shape and repeatability of relative landmark positions (ISO 20685-2:2015)

This preview is downloaded from www.sis.se. Buy the entire standard via <https://www.sis.se/std-8025385>

Standarder får världen att fungera

SIS (Swedish Standards Institute) är en fristående ideell förening med medlemmar från både privat och offentlig sektor. Vi är en del av det europeiska och globala nätverk som utarbetar internationella standarder. Standarder är dokumenterad kunskap utvecklad av framstående aktörer inom industri, näringsliv och samhälle och befrämjar handel över gränser, bidrar till att processer och produkter blir säkrare samt effektiviserar din verksamhet.

Delta och påverka

Som medlem i SIS har du möjlighet att påverka framtida standarder inom ditt område på nationell, europeisk och global nivå. Du får samtidigt tillgång till tidig information om utvecklingen inom din bransch.

Ta del av det färdiga arbetet

Vi erbjuder våra kunder allt som rör standarder och deras tillämpning. Hos oss kan du köpa alla publikationer du behöver – allt från enskilda standarder, tekniska rapporter och standardpaket till handböcker och onlinetjänster. Genom vår webbtjänst e-nav får du tillgång till ett lättnavigerat bibliotek där alla standarder som är aktuella för ditt företag finns tillgängliga. Standarder och handböcker är källor till kunskap. Vi säljer dem.

Utveckla din kompetens och lyckas bättre i ditt arbete

Hos SIS kan du gå öppna eller företagsinterna utbildningar kring innehåll och tillämpning av standarder. Genom vår närhet till den internationella utvecklingen och ISO får du rätt kunskap i rätt tid, direkt från källan. Med vår kunskap om standarders möjligheter hjälper vi våra kunder att skapa verklig nytta och lönsamhet i sina verksamheter.

Vill du veta mer om SIS eller hur standarder kan effektivisera din verksamhet är du välkommen in på www.sis.se eller ta kontakt med oss på tel 08-555 523 00.



Standards make the world go round

SIS (Swedish Standards Institute) is an independent non-profit organisation with members from both the private and public sectors. We are part of the European and global network that draws up international standards. Standards consist of documented knowledge developed by prominent actors within the industry, business world and society. They promote cross-border trade, they help to make processes and products safer and they streamline your organisation.

Take part and have influence

As a member of SIS you will have the possibility to participate in standardization activities on national, European and global level. The membership in SIS will give you the opportunity to influence future standards and gain access to early stage information about developments within your field.

Get to know the finished work

We offer our customers everything in connection with standards and their application. You can purchase all the publications you need from us - everything from individual standards, technical reports and standard packages through to manuals and online services. Our web service e-nav gives you access to an easy-to-navigate library where all standards that are relevant to your company are available. Standards and manuals are sources of knowledge. We sell them.

Increase understanding and improve perception

With SIS you can undergo either shared or in-house training in the content and application of standards. Thanks to our proximity to international development and ISO you receive the right knowledge at the right time, direct from the source. With our knowledge about the potential of standards, we assist our customers in creating tangible benefit and profitability in their organisations.

If you want to know more about SIS, or how standards can streamline your organisation, please visit www.sis.se or contact us on phone +46 (0)8-555 523 00



Europastandarden EN ISO 20685-2:2017 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 20685-2:2017.

The European Standard EN ISO 20685-2:2017 has the status of a Swedish Standard. This document contains the official version of EN ISO 20685-2:2017.

© Copyright/Upphovsrätten till denna produkt tillhör SIS, Swedish Standards Institute, Stockholm, Sverige. Användningen av denna produkt regleras av slutanvändarlicensen som återfinns i denna produkt, se standardens sista sidor.

© Copyright SIS, Swedish Standards Institute, Stockholm, Sweden. All rights reserved. The use of this product is governed by the end-user licence for this product. You will find the licence in the end of this document.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Belastningsergonomi, SIS/TK 380/AG 01.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

EUROPEAN STANDARD

EN ISO 20685-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2017

ICS 13.180

English Version

Ergonomics - 3-D scanning methodologies for internationally compatible anthropometric databases - Part 2: Evaluation protocol of surface shape and repeatability of relative landmark positions (ISO 20685-2:2015)

Ergonomie - Méthodologies d'exploration tridimensionnelles pour les bases de données anthropométriques compatibles au plan international - Partie 2: Protocole d'évaluation de la forme extérieure et de la répétabilité des positions relatives de repères (ISO 20685-2:2015)

Ergonomie - Scanverfahren für international kompatible anthropometrische Datenbanken - Teil 2: Prüfprotokoll für Körperoberflächen und Wiederholbarkeit relativer Messpunktpositionen (ISO 20685-2:2015)

This European Standard was approved by CEN on 8 February 2017.

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-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword	☞
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Test protocol for evaluating surface shape measurement	3
4.1 General aspects.....	3
4.2 Test sphere.....	3
4.3 Procedure.....	3
4.3.1 Measurement of test sphere.....	3
4.3.2 Calculation of quality parameters.....	4
4.3.3 Report.....	4
5 Test protocol for evaluating repeatability of landmark positions	5
5.1 General aspects.....	5
5.2 Test object.....	5
5.3 Landmarks.....	5
5.4 Procedure.....	6
5.4.1 Measurement.....	6
5.4.2 Calculation of quality parameter.....	7
5.4.3 Report.....	7
6 Evaluation of hidden area	7
6.1 General aspect.....	7
6.2 Recruitment of subjects.....	7
6.3 Posture control and measurement.....	7
6.4 Procedure to evaluate the hidden area.....	8
6.5 Report.....	8
Annex A (informative) Sample of test object	9
Annex B (informative) Example of test and report	11
Annex C (informative) Example of report of evaluation of hidden area	17
Annex D (informative) Simultaneous superimposition of landmark coordinate data from 10 scans	19
Bibliography	20

European foreword

The text of ISO 20685-2:2015 has been prepared by Technical Committee ISO/TC 159 “Ergonomics” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 20685-2:2017 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 September 2017, and conflicting national standards shall be withdrawn at the latest by September 2017.

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

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 20685-2:2015 has been approved by CEN as EN ISO 20685-2:2017 without any modification.

Introduction

Anthropometric measures are key to many International Standards. These measures can be gathered using a variety of instruments. An instrument with relatively new application to anthropometry is a three-dimensional (3-D) scanner. 3-D scanners generate a 3-D point cloud of the outside of the human body that can be used in a number of situations including clothing and automotive design, engineering and medical applications. Recently, digital human models are created from a 3-D point cloud, and used for various applications related to technological design process. Quality control of scan-extracted anthropometric data is important since required quality can differ according to applications.

There are a number of different fundamental technologies that underlie commercially available systems. These include stereophotogrammetry, ultrasound and light (laser light, white light and infrared), among others. Further, the software that is available to process data from the scan varies in its methods. Additionally, methods to extract landmark positions are different between commercially available systems. In some systems, anthropometrists decide landmark locations and paste marker stickers, and scanner system calculate locations of marker stickers and identify their names, while in other systems, landmark positions are automatically calculated from the surface shape data. Quality of landmark locations have significant effects on the quality of scan-extracted 1-D measurements as well as digital human models created based on these landmarks.

As a result of differences in fundamental technology, hardware and software, the quality of body surface shape and landmark locations from several different systems can be different for the same individual. Since 3-D scanning can be used to gather these data, it was important to develop an International Standard that allows users of such systems as well as users of scan-extracted measurements to judge whether the 3-D system is adequate for these needs.

The intent of this part of ISO 20685 is to ensure the quality control process of body scanners, especially that of surface shape and locations of landmarks as specified by ISO 7250-1.

Ergonomics — 3-D scanning methodologies for internationally compatible anthropometric databases —

Part 2: Evaluation protocol of surface shape and repeatability of relative landmark positions

1 Scope

This part of ISO 20685 addresses protocols for testing of 3-D surface-scanning systems in the acquisition of human body shape data and measurements. It does not apply to instruments that measure the motion of individual landmarks.

While mainly concerned with whole-body scanners, it is also applicable to body-segment scanners (head scanners, hand scanners, foot scanners). This International Standard applies to body scanners that measure the human body in a single view. When a hand-held scanner is evaluated, it has to be noted that the human operator can contribute to the overall error. When systems are evaluated in which the subject is rotated, movement artefacts can be introduced; these can also contribute to the overall error. This part of ISO 20685 applies to the landmark positions determined by an anthropometrist. It does not apply to landmark positions automatically calculated by software from the point cloud.

The quality of surface shape of the human body and landmark positions is influenced by performance of scanner systems and humans including measurers and subjects. This part of ISO 20685 addresses the performance of scanner systems by using artefacts rather than human subjects as test objects.

Traditional instruments are required to be accurate to millimetre. Their accuracy can be verified by comparing the instrument with a scale calibrated according to an international standard of length. To verify or specify the accuracy of body scanners, a calibrated test object with known form and size is used.

The intended audience is those who use 3-D body scanners to create 3-D anthropometric databases including 3-D landmark locations, the users of these data, and scanner designers and manufacturers. This part of ISO 20685 intends to provide the basis for the agreement on the performance of body scanners between scanner users and scanner providers as well as between 3-D anthropometric database providers and data users.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *Basic human body measurements for technological design — Part 1: Body measurement definitions and landmarks*

ISO 10360-8, *Geometrical product specifications (GPS) — Acceptance and reverification tests for coordinate measuring systems (CMS) — Part 8: CMMs with optical distance sensors*

ISO 20685, *3-D scanning methodologies for internationally compatible anthropometric databases*

3 Terms and definitions

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

SS-EN ISO 20685-2:2017 (E)

3.1 error of spherical form measurement

error within the range of the Gaussian radial distance, determined by a least-squares fit of measured data points on a test sphere

Note 1 to entry: Error of spherical form measurement is associated with the performance of the body scanner and the sphericity of the test sphere.

3.2 spherical form dispersion value

smallest width of a spherical shell that includes n % of all the measured data points

Note 1 to entry: See [Figure 1](#), right.

Note 2 to entry: n should be 90 %.

3.3 standard deviation of radial distances

standard deviation of radial distances from measured data points and best-fit sphere

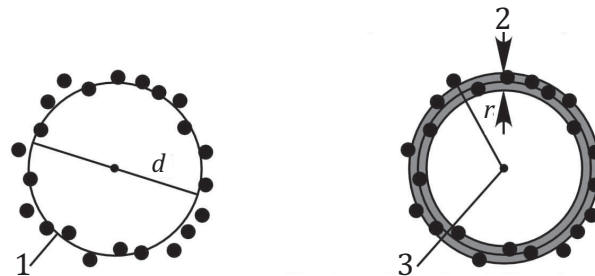
Note 1 to entry: Standard deviation of radial distances is an indicator of error of spherical form measurement and is highly correlated with error of spherical form measurement (90 %).

3.4 error of diameter measurement

error of the diameter of a least-squares fit of measured data points on a test sphere

Note 1 to entry: See [Figure 1](#), left.

Note 2 to entry: It is calculated as the measured diameter minus the calibrated diameter.



Key

- 1 best-fit sphere
- 2 spherical form dispersion value (n)
- 3 centre of the best-fit sphere
- d diameter of the best-fit sphere
- r radial distance of a measured data point from the centre of the best-fit sphere

NOTE Spherical form dispersion value (n), in which n % of the measured data points are located, is shown as the radial thickness of the shaded area of the right figure. Spherical form dispersion value (n) is calculated as the $100 - n/2$ percentile value minus $n/2$ percentile value of the radial distances of the measured data points from the centre of the best-fit sphere.

Figure 1 — Error of diameter measurement and spherical form dispersion value

4 Test protocol for evaluating surface shape measurement

4.1 General aspects

The environmental conditions shall correspond to the operating conditions of the 3-D body scanner. When operation mode needs to be modified to measure the test object, it shall be specified in the report.

4.2 Test sphere

Sphere made of steel, ceramic, or other suitable materials with diffusely reflecting surface are used to determine the quality parameter spherical form dispersion value and error of diameter measurement. It is desirable that the diameter of the sphere should be larger than 10 % of the largest dimension of a rectangular parallelepiped scanning volume.

The diameter and form of the test sphere shall be calibrated, and a calibration certificate shall be available. Since the form deviation and the roughness of the test sphere influence the test results, error of spherical form measurement in the certificate shall be smaller than one fifth of the maximum permissible error determined by the body scanner manufacturer.

The surface properties of the test sphere may significantly affect the test results. The material of test sphere shall be reported.

The reference sphere supplied with the body scanner for the calibration purposes shall not be used for this test.

Example of sphere is shown in [Annex A](#).

4.3 Procedure

4.3.1 Measurement of test sphere

The sphere shall be measured at least nine different positions within the scanning volume. Measurement positions shall include the following nine positions ([Figure 2](#)): position 1 is the centre of the scanning volume on the floor; position 2 to position 5 are 500 mm, 1 000 mm, 1 500 mm, and 2 000 mm off the floor, above position 1; position 6 and position 7 are 250 mm anterior to or posterior to the centre position and 1 000 mm off the floor; position 8 and position 9 are 400 mm right or left to the centre position and 1 000 mm off the floor.

When the sphere cannot be measured at positions described above due to a smaller scanning volume, measure the sphere at a position closest to the intended position, and record the exact position.