



DPC: 24/30457665 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 09 September 2024

Origin: International

Latest date for receipt of comments: 02 November 2024

Project No. 2022/01401

Responsible committee: ICT/1/1 Information Systems development

Interested committees:

Title: Draft BS ISO/IEC 8803 Information technology - 3D Printing and scanning - Accuracy and precision evaluation process for modelling from 3D scanned data.

Please notify admin.start@bsigroup.com if you are aware of any keywords that might assist in clarifying or identifying the standard or of the content of this standard:

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD. THIS DRAFT IS NOT CURRENT BEYOND 02 November 2024

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <https://standardsdevelopment.bsigroup.com/>.

E-mail: admin.start@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/IEC DIS 8803

Information technology — 3D Printing and scanning — Accuracy and precision evaluation process for modelling from 3D scanned data

ICS: 35.020

ISO/IEC JTC 1

Secretariat: **ANSI**

Voting begins on:
2024-09-09

Voting terminates on:
2024-12-02

This document is circulated as received from the committee secretariat.

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENTS AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

Reference number
ISO/IEC DIS 8803:2024(en)

Full document details: 24/30457665 DC



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Abbreviations	4
4 Evaluation model	4
4.1 General	4
4.1.1 Background	4
4.1.2 Evaluation reference model	5
4.2 Reference model – evaluation processes	6
4.3 Stakeholders and roles	7
4.3.1 General	7
4.3.2 Provider	7
4.3.3 Producer	8
4.3.4 Customer	9
4.3.5 Partner	9
4.3.6 Policymaker	10
4.4 Quality in the 3D printing	10
4.4.1 Workflow and product quality	10
4.4.2 Workflow and related stakeholders	10
4.4.3 Modelling task	11
4.4.4 Printing task	11
4.4.5 Application task	12
4.5 Support for the evaluation	12
5 Evaluation process	12
5.1 General requirements	12
5.2 Documentation	12
5.3 Establish the evaluation requirements	13
5.3.1 General	13
5.3.2 Establish the purpose of the evaluation	13
5.3.3 Define the product quality requirements	14
5.3.4 Identify tasks and phases to be included in the evaluation	14
5.3.5 Define the stringency of the evaluation	14
5.4 Specify the evaluation	15
5.4.1 General	15
5.4.2 Select quality measures (evaluation modules)	15
5.4.3 Define decision criteria for quality measures	16
5.4.4 Define decision criteria for evaluation	16
5.5 Design the evaluation	17
5.5.1 General	17
5.5.2 Plan evaluation activities	17
5.6 Execute the evaluation	18
5.6.1 General	18
5.6.2 Make measurements	19
5.6.3 Apply decision criteria for quality measures	19
5.6.4 Apply decision criteria for evaluation	19
5.7 Conclude the evaluation	19
5.7.1 General	19
5.7.2 Review the evaluation result	19
5.7.3 Create the evaluation report	20
5.7.4 Review quality evaluation and provide feedback to the organization	21

5.7.5 Perform disposition of evaluation data 21

Annex A (informative) Tasks and Phases 22

Annex B (informative) Evaluation requirements on each phase 23

Annex C (informative) Evaluation report template 24

**Annex D (informative) Comparison between 3D printing product evaluation process and
SQuaRE evaluation process 26**

Bibliography 27

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/IEC JTC 1.

Introduction

This standard was developed in response to the needs of quality management of 3D printing and scanning technology by taking full advantage of information and communication technology (ICT). 3D scanning is the process of scanning a real-world object or environment to collect data on its shape and possibly its style attributes. The main purpose of 3D scanning is for generating high-precision digital 3D models.

A 3D scanner can be based on many different technologies, each with its own purposes and targets, limitations, and advantages. There could be many limitations in each type of target object that will be digitized. For example, optical technology may encounter many difficulties with dark, shiny, reflective, or transparent objects. Another example, as using computed tomography scanning, structured-light 3D scanners, and LiDAR technology, there is a need to use non-destructive internal scanning technology for generating digital 3D models.

Despite the rapid growth of 3D scanning applications, the accuracy, precision, and reproducibility of generated 3D models from 3D scanned data have not been thoroughly investigated. Inaccuracies are due to errors that occur during the imaging, segmentation, modelling, postprocessing, and 3D printing steps. The total accuracy, precision, and reproducibility of 3D printed models are affected by the sum of errors introduced in each step involved in the creation of the models.

For the spreading of 3D printing applications, it is necessary to review and evaluate the various factors in each step of the 3D model printing process that contribute to model inaccuracy, including the intrinsic limitations of each printing technology.

- In this context evaluation of the overall process of data processing will be critical.
- For minimization of cumulative errors of 3D printing life cycles the initial error should be assessed and corrected.

Here we are going to propose the standardized evaluation process on how to evaluate for quality-enhancing and error minimizing of generating the 3D model from 3D scanned data. 3D printing3D printing3D printing3D printing3D printingAs a general concept evaluation is the systematic determination of the extent to which an entity meets its specified criteria. The evaluation of product quality is vital to both the acquisition and development of any product. The relative importance of the various characteristics of product quality depends on the intended usage or objectives of the product. Due to the 3D printing production process is the continuous composition of various tasks, 3D printing products need to be evaluated in each task to decide whether relevant quality characteristics meet the requirements of the final product.

This document uses ISO/IEC 25040 – Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Evaluation process as a normative reference. This document is intended to be used in connection with ISO/IEC 25040. Whenever this document extends the guidance given in ISO/IEC 25040, an appropriate reference to the clauses of ISO/IEC 25040 is made followed by 3D printing specific guidance, if applicable. To make the relationship between this document and ISO/IEC 25040 more explicit, the clause structure of ISO/IEC 25040 is mirrored in this document and amended by sub-clauses if needed (See [Annex D](#)).

ISO/IEC 25040 and therefore this document is divided into two main parts:

[Clause 5](#): Evaluation model - This clause describes the underlying principles of evaluation. The use of 3D printing requires specific considerations with regard to some of these principles as described in the companion [Clause 5](#) of this document.

Clause 6: Evaluation process - This clause describes the process of evaluation. Evaluation processes involve the systematic application of policies, procedures, and practices to the activities of communicating, establishing the context, assessing, reviewing, and reporting evaluated results. A specialization of such processes to 3D printing is described in the companion Clause 6 of this document.

Information technology — 3D Printing and scanning — Accuracy and precision evaluation process for modelling from 3D scanned data

1 Scope

This document defines a standardized accuracy and precision evaluation process for modelling from 3D scanned data. The set of processes, activities and tasks described in this document provides a common framework for evaluating quality factors such as accuracy and precision for the modelling from 3D scanned data.

This document is not intended to evaluate the 3D printed product itself.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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/IEC 3532-1:2023, *Information technology — Medical image-based modelling for 3D printing — Part 1: General requirements*

ISO/IEC 3532-2:2024, *Information technology — Medical image-based modelling for 3D printing — Part 2: Segmentation*

3 Terms, definitions and abbreviated terms

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 Terms and definitions

3.1.1

evaluation

systematic determination of the extent to which an entity meets its specified criteria

[SOURCE: ISO/IEC 12207:2008, 4.12]

3.1.3

evaluation level

rigour to be applied during the evaluation that defines the depth or thoroughness of the evaluation in terms of evaluation techniques to be applied and evaluation results to be achieved

[SOURCE: ISO/IEC 25040:2011, 4.18]

3.1.4

evaluation method

procedure describing actions to be performed by the evaluator in order to obtain results for the specified measurement applied to the specified product components or on the product as a whole

[SOURCE: ISO/IEC 25040:2011, 4.19]

3.1.5

evaluation records

documented objective evidence of all activities performed and of all results achieved within the evaluation process

[SOURCE: ISO/IEC 25040:2011, 4.21]

3.1.6

evaluation requester

person or organization that requests an evaluation

[SOURCE: ISO/IEC 25040:2011, 4.22]

3.1.7

evaluation tool

instrument that can be used during evaluation to collect data, to perform interpretation of data or to automate part of the evaluation

[SOURCE: ISO/IEC 25040:2011, 4.23]

Note 1 to entry: Examples of such tools are source code analysers to compute code metrics, CASE tools to produce formalized models, test environments to run the executable programs, checklists to collect inspection data or spreadsheets to produce syntheses of measures.

3.1.8

measure

variable to which a value is assigned as the result of measurement

Note 1 to entry: The term “measures” is used to refer collectively to base measures, derived measures, and indicators.

Note 2 to entry: Adapted from ISO/IEC 14598-1:1999.

[SOURCE: ISO/IEC 25040:2011, 4.38]

3.1.9

measure

make a measurement

[SOURCE: ISO/IEC 25040:2011, 4.39]

3.1.10

measurement

set of operations having the object of determining a value of a measure

[SOURCE: ISO/IEC 25040:2011, 4.40]

Note 1 to entry: Adapted from the *International Vocabulary of Basic and General Terms in Metrology*, 1993.

Note 2 to entry: Measurement can include assigning a qualitative category such as the language of a source program (ADA, C, COBOL, etc.).

3.1.11

measurement function

algorithm or calculation performed to combine two or more base measures

[SOURCE: ISO/IEC 25040:2011, 4.41]

3.1.12

measurement method

logical sequence of operations, described generically, used in quantifying an attribute with respect to a specified scale

[SOURCE: ISO/IEC 25040:2011, 4.42]

Note 1 to entry: Adapted from the *International Vocabulary of Basic and General Terms in Metrology*, 1993.

3.1.13

measurement procedure

set of operations, described specifically, used in the performance of a particular measurement according to a given method

[SOURCE: ISO/IEC 25040:2011, 4.43]

Note 1 to entry: Adapted from the *International Vocabulary of Basic and General Terms in Metrology*, 1993.

3.1.15

measurement process

process for establishing, planning, performing and evaluating software measurement within an overall project or organizational measurement structure

Note 1 to entry: Adapted from ISO/IEC 15939:2007.

[SOURCE: ISO/IEC 25040:2011, 4.44]

3.1.16

process

system of activities, which uses resources to transform inputs into outputs

Note 1 to entry: Adapted from ISO 9000:2005.

[SOURCE: ISO/IEC 25040:2011, 4.47]

3.1.17

quality model

defined set of characteristics, and of relationships between them, which provides a framework for specifying quality requirements and evaluating quality

[SOURCE: ISO/IEC 25040:2011, 4.50]

3.1.19

validation

confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

Note 1 to entry: “Validated” is used to designate the corresponding status.

[SOURCE: ISO/IEC 25040:2011, 4.68]

Note 2 to entry: In design and development, validation concerns the process of examining a product to determine conformity with user needs.

Note 3 to entry: Validation is normally performed on the final product under defined operating conditions. It can be necessary in earlier stages.

Note 4 to entry: Multiple validations can be carried out if there are different intended uses.

3.1.20

verification

confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

Note 1 to entry: “Verified” is used to designate the corresponding status.