BS EN ISO 25178-71:2012

BSI Standards Publication

Geometrical product specifications (GPS) — Surface texture: Areal

Part 71: Software measurement standards

National foreword

This British Standard is the UK implementation of EN ISO 25178-71:2012.

The UK participation in its preparation was entrusted to Technical Committee TDW/4, Technical Product Realization.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2012.

ISBN 978 0 580 66365 9

ICS 17.040.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2012.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 25178-71

December 2012

ICS 17.040.20

English Version

Geometrical product specifications (GPS) - Surface texture: Areal - Part 71: Software measurement standards (ISO 25178-71:2012)

Spécification géométrique des produits (GPS) - État de surface: Surfacique - Partie 71: Étalons logiciels (ISO 25178-71:2012)

Geometrische Produktspezifikation (GPS) - Oberflächenbeschaffenheit: Flächenhaft - Teil 71: Software-Normale (ISO 25178-71:2012)

This European Standard was approved by CEN on 10 November 2012.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN ISO 25178-71:2012: E

Foreword

This document (EN ISO 25178-71:2012) has been prepared by Technical Committee ISO/TC 213 "Dimensional and geometrical product specifications and verification" in collaboration with Technical Committee CEN/TC 290 “Dimensional and geometrical product specification and verification” the secretariat of which is held by AFNOR.

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 June 2013, and conflicting national standards shall be withdrawn at the latest by June 2013.

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 organisations 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 25178-71:2012 has been approved by CEN as a EN ISO 25178-71:2012 without any modification.

Contents

Page

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 25178-71 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

ISO 25178 consists of the following parts, under the general title *Geometrical product specifications (GPS) — Surface texture: Areal*:

— *Part 2: Terms, definitions and surface texture parameters*

— *Part 3: Specification operators*

— *Part 6: Classification of methods for measuring surface texture*

— *Part 70: Physical measurement standards*

— *Part 71: Software measurement standards*

— *Part 601: Nominal characteristics of contact (stylus) instruments*

— *Part 602: Nominal characteristics of non-contact (confocal chromatic probe) instruments*

— *Part 604: Nominal characteristics of non-contact (coherence scanning interferometry) instruments*

— *Part 605: Nominal characteristics of non-contact (point autofocus probe) instruments*

— *Part 701: Calibration and measurement standards for contact (stylus) instruments*

The following parts are under preparation:

— *Part 1: Indication of surface texture*

— *Part 603: Nominal characteristics of non-contact (phase-shifting interferometric microscopy) instruments*

— *Part 606: Nominal characteristics of non-contact (focus variation) instruments*

Introduction

This part of ISO 25178 is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences the chain link 6 of the chains of standards on surface texture.

The ISO/GPS Masterplan given in ISO/TR 14638 gives an overview of the ISO/GPS system of which this document is a part. The fundamental rules of ISO/GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document, unless otherwise indicated.

For more detailed information of the relation of this standard to the GPS matrix model, see Annex B.

This part of ISO 25178 is concerned with software gauges (Type S1) and reference software (Type S2). It also defines the SDF file format for type S1 software gauges.

The SURFACE DATA FILE (SDF) format is already used by industry in particular by instrument manufacturers and academia. The SDF file format as defined in this document is a standardized sub-set of the possibilities included in the SDF file format as initially defined in the European Surfstand project and EUR15178. It is envisaged that the SDF file format could evolve (as more experience in its usage and future requirements are identified) later in a version 2.0 with additional fields and possibilities.

Geometrical product specifications (GPS) — Surface texture: Areal —

Part 71: **Software measurement standards**

1 Scope

This part of ISO 25178 defines Type S1 and Type S2 software measurement standards (etalons) for verifying the software of measuring instruments. It also defines the file format of Type S1 software measurement standards for the calibration of instruments for the measurement of surface texture by the areal method as defined in the areal surface texture chain of standards, chain link 6.

NOTE Throughout this part of ISO 25178, the term “softgauge” is used as a substitute for “software measurement standard Type S1”.

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 5436-2:2001, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Measurement standards — Part 2: Software measurement standards*

ISO 16610 (all parts), *Geometrical Product Specifications (GPS) — Filtration*

ISO 17450-2:2012, *Geometrical product specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators, uncertainties and ambiguities*

ISO 25178-2, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 2: Terms, definitions and surface texture parameters*

ISO 25178-3, *Geometrical product specifications (GPS) — Surface texture: Areal — Part 3: Specification operators*

ISO/IEC Guide 98-1:2009, *Uncertainty of measurement — Part 1: Introduction to the expression of uncertainty in measurement*

ISO/IEC Guide 99:2007, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

For the purpose of this document, the terms and definitions in ISO 25178-2, ISO 25178-3, ISO 5436-2:2001, the ISO 16610 series, ISO 17250-2, ISO/IEC Guide 98-1 and ISO/IEC Guide 99, and the following apply.

3.1
software measurement standard
reference data or reference software intended to reproduce the value of a measurand with known specification uncertainty in order to verify the software used to calculate the value of a measurand

3.2
CHAR[n]
array of n ASCII characters

3.3
BYTE
1-byte (8-bit) representation of an ASCII character

3.4
UINT16
2-byte representation of an unsigned integer

NOTE 1 Unsigned integers have a minimum value of 0 and a maximum value of 65 535.

NOTE 2 The less significant bytes are stored in lower memory addresses; the more significant bytes are stored in higher memory addresses.

3.5
INT16
2-byte representation of a signed integer

NOTE 1 Short integers have a minimum value of −32 768 and a maximum value of +32 767.

NOTE 2 The less significant bytes are stored in lower memory addresses; the more significant bytes are stored in higher memory addresses.

3.6
INT32
4-byte representation of a signed integer

NOTE 1 Long integers have a minimum value of −2 147 483 648 and a maximum value of +2 147 483 647.

NOTE 2 The less significant bytes are stored in lower memory addresses; the more significant bytes are stored in higher memory addresses.

3.7
DOUBLE
8-byte representation consisting of a sign bit, an 11-bit binary exponent, and a 52-bit mantissa, plus the implied high-order 1 bit

NOTE 1 Double precision float have an approximate range of ± 2,22e-1022 to ± 2,22e+1023.

NOTE 2 The less significant bytes are stored in lower memory addresses; the more significant bytes are stored in higher memory addresses.

NOTE 3 See the IEEE 754-1985 Standard for binary floating-point arithmetic.

4 Type S software measurement standards

4.1 General

These measurement standards are designed to verify the measuring instrument's software (i.e. filter algorithms, parameter calculation, etc.).

The content of a measurement standard shall be considered a scale limited surface (i.e. an S-F surface or an S-L surface). No part of the content of a measurement standard shall be considered form and thus, no form removal shall be undertaken on a measurement standard prior to presenting it to the software being tested.

4.2 Type S1, reference data

This type of measurement standard is a computer data file that contains a digital representation of a scale limited surface in a suitable recording medium.

Type S1 reference data are used to test software by inputting them as data into the software under test/calibration and comparing the results from the software under test with the certified results from the calibration certificate of the softgauge.

NOTE The certified results for mathematically designed synthetic data can often be calculated directly without the need for certification by Type S2 measurement standards.

4.3 Type S2, reference software

These measurement standards are reference software. Reference software consists of traceable computer software against which software in a measuring instrument can be compared.

NOTE 1 Traceable here means a traceable chain of comparisons, with uncertainty, back to a mathematically designed synthetic data whose results can be calculated directly.

Type S2 reference software are used to test software by inputting a common data set into the software under test/calibration and the reference software and comparing the results from the software under test with the certified results from the reference software. Reference software values shall be traceable.

NOTE 2 Type S2 measurement standards can also be used to certify type S1 reference data.

5 File format for type S1 reference data

5.1 General

The file extension of this file protocol is SDF. The file protocol for the softgauge is divided into three separate sections or records. For implementation of the ASCII and BINARY representations of an SDF data format, see Annex A.

NOTE For the purposes of this document, a right-handed coordinate system is assumed (see ISO 25178-2). Looking from the top, the first point in the data file is in the top left corner.

5.2 Record 1 — Header

The header contains general information about each specific measurement. The record is composed of various “fields” in which the information is coded.

The BINARY format consists of fixed length fields defined in Table 1.

Except for the version number, the ASCII format, for the header, consists of a series “keyword = value of field” where the keyword is the ASCII field name given in Table 1.

5.2.1 Version number

The version of a softgauge file format is an array of 8 characters formatted the following way: “aISO-1.0” for the ASCII file format or “bISO-1.0” for the BINARY file format. Future evolutions of this format will modify the version number, such as “-2.0”.

5.2.2 Measurement instrument manufacturer’s identifier

The identifier includes the source of the data and might also include hardware and software identifiers.

5.2.3 Original creation date and time

This twelve-character field (DDMMYYYYHHMM) stores the date and time that the measurement was completed. Redundant separator characters are not stored but clearly zero padding of fields is required (i.e. 0307 for 3 July not 37).

5.2.4 Last modification date and time

This twelve-character field (DDMMYYYYHHMM) stores the date and time that the SDF file was last modified.

5.2.5 Number of points per profile, M

The maximum number of points per profile (along the x-direction) shall not exceed one UINT16 of storage (65535).

5.2.6 Number of profiles or traces, N

The maximum number of profiles (along the y-direction) or traces shall not exceed one UINT16 of storage (65535). If $N = 1$, the data can be loaded as a profile; however, its size is limited to 65 535 points.

5.2.7 X, Y and Z axis scale factors

The three scaling factors provide scaling to the standard unit of the meter. The X-scale is the sampling interval along the x-direction, the Y-scale is the profile spacing along the y-direction, and the Z-scale is the quantisation step along the z-direction. Thus, an X-scale, Y-scale or Z-scale value of 1,00 E-6 represents a sample spacing of 1 µm.

5.2.8 Z axis resolution

The Z axis resolution specifies the quantisation steps in the z-direction in the digital data. After certain processing operations (e.g. removal of datum), the data type may have changed or have been re-scaled such that the original quantized data has been re-quantised. Thus, the inclusion of this value enables the user to be aware of the original base resolution of the measurement instrument. The units of the resolution value are in metres. If the value is unknown, this field should be set to a negative number, e.g. –1.

5.2.9 Compression type

This field normally defines the type of compression used for the data. “NO COMPRESSION” shall be used. Therefore, this field value is: 0.

5.2.10 Data type

This field defines the base data type used for storage. The field value 5 is for data type INT16; 6 is for data type INT32; 7 is for data type DOUBLE.

Other data types that may have been used in prior definitions of the SDF format are not allowed.

5.2.11 Checksum type

This field defines the type of checksum used for the data. “NO CHECKSUM” shall be used. Therefore, this field value is: 0.

Table 1 gives header description of these fields.

Table 1 — Fields for Record 1

Information	ASCII Field Name	BINARY Data Type	Binary Length (BYTES)
Version Number	N/A	CHAR[8]	8
Manufacturer's ID	ManufacID	CHAR[10]	10
Creation Date and Time	Create Date	CHAR[12]	12
Last modification Date and Time	ModDate	CHAR[12]	12
Number of points per Profile (x)	NumPoints (X)	UINT32	2
Number of Profiles (y)	NumProfiles (Y)	UINT32	2
X-Scale	X-scale	DOUBLE	8
Y-Scale	Y-scale	DOUBLE	8
Z-Scale	Z-scale	DOUBLE	8
Z-Resolution	Z-resolution	DOUBLE	8
Compression Type	Compression	BYTE	1
Data Type	Data type	BYTE	1
Checksum Type	Check Type	BYTE	1
		TOTAL	81

5.3 Record 2 — Data area

5.3.1 The data area of the data file contains the coded height information of the surface for the number of points, M, and the number of profiles, N. The actual height values (i.e. in metres) are obtained by scaling the coded values by the Z-scale factor defined in the file header. The data area contains the topographic data in a serial fashion. Profiles are stored successively in the order of their position in the y-direction.

NOTE The x-data are identified with the rows in the data file and the y-data identified with the columns in the data file.

5.3.2 The identification of bad and missing data points is achieved by setting them to the minimum value for the particular data type used, within the data range which is not allowable for any valid data points (e.g. value = −2147483648 for INT32 and value = NAN for DOUBLE). In ASCII format, the string "BAD" will be used.

Treatment of "bad" data: Certain topography measurement systems, as a consequence of the measurement process, produce data points within the complete measurement map that are invalid. These data points may be referred to as "bad" data.

Treatment of "missing" data (dropouts): Certain topography measurement systems, as a consequence of the measurement process, produce data points within the complete measurement map that have no value (i.e. the values are missing). These data points may be referred to as "missing" data.

5.4 Record 3 — Trailer

The trailer part of the data file contains historical information that is associated with a particular measurement. For example, when a measurement is made, information such as the operator's name, measurement conditions, and sample specification might be stored with the data file. Also operator information applied to the data file such as filtering, data inversion, and other process parameters may be attached to the data file. Any other information which the owner of the data believes would be of use and which is not already stored in the header could also be written in the trailer. In order to maintain flexibility of extendibility, it is important that the trailer be of variable length and, for simplicity, exist at the end of the data file. The trailer is thus stored at the end of the files as a series of CHARACTER values.

NOTE It is suggested that a tagged format be used (as XML format) for information stored in this section.

6 Software measurement standard certificate

After each software measurement standard has been individually calibrated, it shall be accompanied by at least the following information:

a) title, for example, "Calibration certificate" (for both S1 and S2 types);

b) name and address of the software measurement standard supplier (for both S1 and S2 types);

c) unique identification of the certificate (such as the serial number) and of each page, as well as the total number of pages (for both S1 and S2 types);

d) the actual specification operator [see ISO 17450-2 for each relevant metrological characteristic (for both S1 and S2 types)];

e) the calibrated value with its estimated uncertainty, U [see ISO/IEC Guide 98-3 (GUM)] for each relevant metrological characteristic (for both S1 and S2 types)[1)];

f) details of calibration, including whether the certified results for mathematically designed synthetic data have been calculated directly without the need for certification by Type S2 measurement standards, and, where a type S2 measurement standard has been used, information on which particular Type S2 measurement standard has been used together with its uncertainty values[2)] (for both S1 and S2 types);

g) any other reference conditions to which each calibration applies, for example, the basis of digital evaluation (lateral and vertical quantization) for both S1 and S2 types;

h) a statement that the values declared refer to direct measurement or are derived synthetically; where direct measurement is used, relevant detail of the probe shall be provided (for S1 types);

i) identification of the hardware/operating systems on which the reference software has been developed, checked or verified (for S2 types)[2)].

As far as possible, this required information shall be marked on the media containing each measurement standard; but if there is insufficient space, the values may be stated separately and uniquely identified with the measurement standard, for example, by means of a serial number.

NOTE A nominal value is used as an aid to identification. The difference between the nominal value and the calibrated value does not constitute an error.

---

1) For reference software it may not be possible to give a closed form equation for the uncertainty of some values of metrological characteristics. In these cases all relevant information should be given to allow the user to calculate the uncertainty for themselves.

2) This identification applies to the whole chain from measuring instrument to calculation/computers.

Annex A
(informative)

Examples

A.1 Example of an ASCII SDF Representation

— The data file consists of a series of lines terminated with CR (ASCII #13), LF (ASCII #10) or CR+LF.

— Additional ‘white space’ characters (ASCII #9, ASCII #10, ASCII #32) are ignored (including those in the data section).

— The three records of the file (i.e. header, data, and trailer) are terminated with a single line containing the character ‘*’ (ASCII #42). Thus, the final line ‘*’ identifies the end of the data file.

— All three records for the ASCII representation are of variable length.

— Elements of the header are given as separate fields for readability and for the ease of use of file I/O.

— The first field of the data file shall contain the version number.

— All the other fields pertaining to the header may be placed in any order in the header section.

— Each field contains 3 parts: (i) the field name (see Table 1; note that field names are not case sensitive); (ii) a field separator ‘ = ’ (ASCII #61); (iii) the value.

— The elements of the data area may be separated by any number and type of ‘white space’ characters.

NOTE Often it is helpful to use a fixed field width and separate (using CR/LF characters) a number of elements (depending on the data type) such that they fit onto a line width of 80 characters. This enables the files to be typed on the screen for verification.

Figure A.1 gives an example of relevant details to illustrate the layout of the ASCII representation of an SDF file and Figure A.2 an illustration of data given in Figure A.1.

```
aISO-1.0 < CR >  < LF >
ManufacID = ISOTC213 < CR >  < LF >
CreateDate = 040120100853 < CR >  < LF >
ModDate = 050320101353 < CR >  < LF >
NumPoints = 251 < CR >  < LF >
NumProfiles = 251 < CR >  < LF >
Xscale  = 1.0E-6 < CR >  < LF >
Yscale  = 1.0E-6 < CR >  < LF >
Zscale  = 1.0E-6 < CR >  < LF >
Zresolution = 1.0E-9 < CR >  < LF >
Compression = 0 < CR >  < LF >
DataType = 7 < CR >  < LF >
CheckType = 0 < CR >  < LF >
* < CR >  < LF >
1.00000 0.99874 0.99495 0.98865 0.97986 0.96858 …… 1.00000 < CR >  < LF >
0.99874 0.99748 0.99369 0.98740 0.97862 0.96736 …… 0.99874 < CR >  < LF >
0.99495 0.99369 0.98993 0.98366 0.97491 0.96369 …… 0.99495 < CR >  < LF >
0.97986 0.97862 0.97491 0.96874 0.96012 0.94907 …… 0.97986 < CR >  < LF >
……
* < CR >  < LF >
< OperatorName > Tom Jones < / OperatorName >
< PartName > S2 Softgauges Example < /PartName >
*
```

Figure A.1 — An example of a typical SDF file

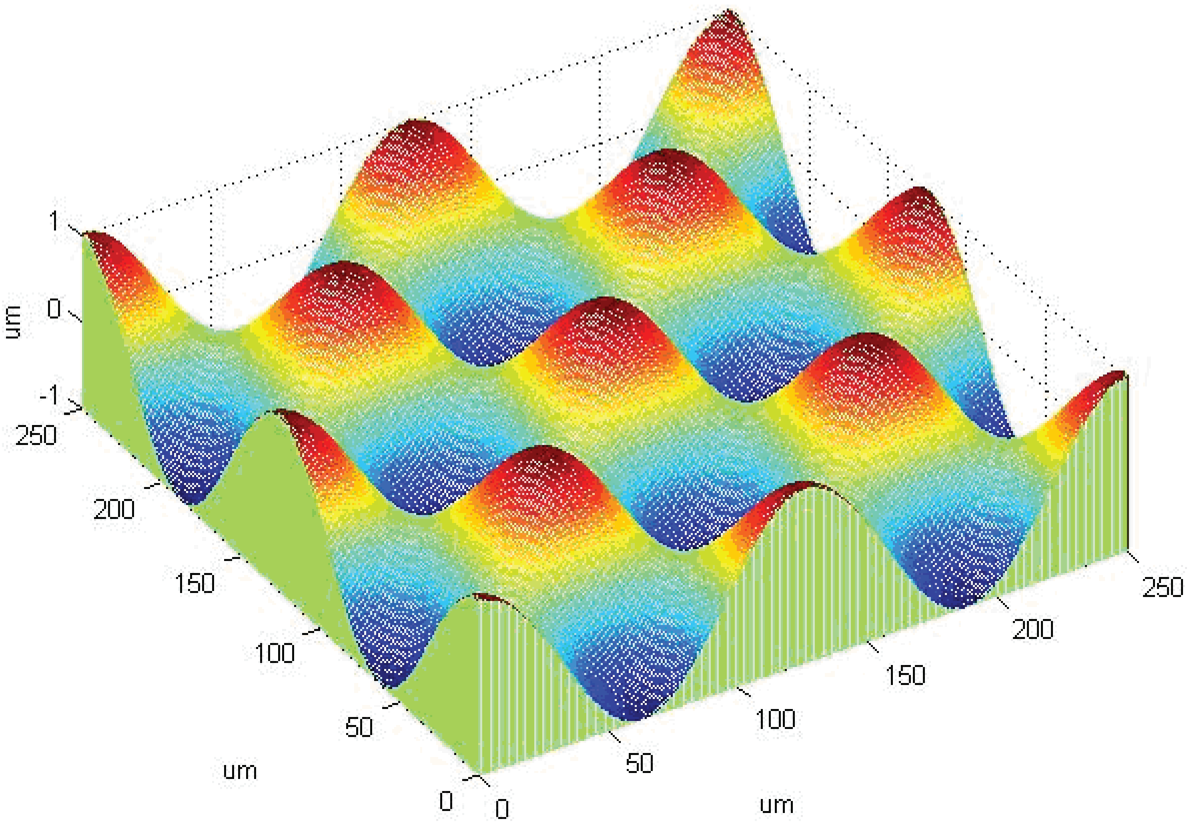

Figure A.2 — Illustration of data given in the Figure A.1 example

A.2 Implementation of the BINARY SDF Representation

The following information pertains to the implementation of the BINARY representation of the SDF file.

— The header shall conform exactly to the sequence of record fields and types given in Table 1. Subsequent revisions of the file format may alter the composition and length of the header section, thus, the version number should be read prior to the header (obviously, the header section is of a fixed length for a given file format version as given in Table 1).

— There are no separator characters to distinguish sections of the data file. The sequence that should be followed is

  — read the version number;

  — read the header corresponding to the version number (i.e. in this case that given in Table 1);

  — using information given in the header (data type, number of points, number of profiles, compression type, and checksum type), read the data section.

  The remaining information in the file, if any, contains the trailer.

— Strings (unsigned character arrays with more than one character) are assumed to contain valid data for the length of the string. If the valid string data are shorter than the allocated space then the string shall be filled with spaces (ASCII #32).

— Single unsigned char values in the header (i.e. compression type, data type, and checksum type) are byte representations (i.e. 0 to 255) For example, a compression value of NONE is represented by a value of 0 NOT 48 (i.e. the ASCII code for character ‘0’).

Annex B
(informative)

Relation to the GPS matrix model

B.1 General

For full details about the GPS matrix model, see ISO/TR 14638.

The ISO/GPS Masterplan given in ISO/TR 14638 gives an overview of the ISO/GPS system of which this document is a part. The fundamental rules of ISO/GPS given in ISO 8015 apply to this document and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document, unless otherwise indicated.

B.2 Information about this part of ISO 25178 and its use

This part of ISO 25178 defines Type S1 and Type S2 software measurement standards (etalons), as well as the file format of Type S1 software measurement standards for the calibration of instruments for the measurement of surface texture by the areal method as defined in chain links 5 and 6 of the areal surface texture chain of standards.

B.3 Position in the GPS matrix model

This part of ISO 25178 is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences the chain link 6 of the chains of standards on surface texture, as graphically illustrated in Figure B.1.

Fundamental GPS standards

Global GPS standards

General GPS standards						
Chain link number	**1**	**2**	**3**	**4**	**5**	**6**
Size						
Distance						
Radius						
Angle						
Form of a line independent of datum						
Form of a line dependent on datum						
Form of a surface independent of datum						
Form of a surface dependent on datum						
Orientation						
Location						
Circular run-out						
Total run-out						
Datums						
Roughness profile						X
Waviness profile						X
Primary profile						X
Surface imperfections						
Edges						
Areal surface textures						X

Figure B.1 — Position in the GPS matrix model

B.4 Related International Standards

The related International Standards are those of the chain of standards indicated in Figure B.1.

Bibliography

[1] BCR Report EUR 15178N, *The development of methods for the characterisation of roughness in three dimensions* – K.J. STOUT *et al*. – DG XII – E.C. Brussels

[2] ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*

[3] ISO 14253-1, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specifications*

[4] ISO/TR 14638:1995, *Geometrical Product Specifications (GPS) — Masterplan*

[5] ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

[6] IEEE 754-1985, *IEEE Standard for Binary Floating-Point Arithmetic*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the independent national body responsible for preparing British Standards and other standards-related publications, information and services. It presents the UK view on standards in Europe and at the international level.

BSI is incorporated by Royal Charter. British Standards and other standardisation products are published by BSI Standards Limited.

Revisions

British Standards and PASs are periodically updated by amendment or revision. Users of British Standards and PASs should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using British Standards would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Similary for PASs, please notify BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001

BSI offers BSI Subscribing Members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of British Standards and PASs.

Tel: +44 (0)20 8996 7669 Fax: +44 (0)20 8996 7001
Email: plus@bsigroup.com

Buying standards

You may buy PDF and hard copy versions of standards directly using a credit card from the BSI Shop on the website **www.bsigroup.com/shop.** In addition all orders for BSI, international and foreign standards publications can be addressed to BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001
Email: orders@bsigroup.com

In response to orders for international standards, BSI will supply the British Standard implementation of the relevant international standard, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Knowledge Centre.

Tel: +44 (0)20 8996 7004 Fax: +44 (0)20 8996 7005
Email: knowledgecentre@bsigroup.com

BSI Subscribing Members are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.

Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001
Email: membership@bsigroup.com

Information regarding online access to British Standards and PASs via British Standards Online can be found at **www.bsigroup.com/BSOL**

Further information about British Standards is available on the BSI website at **www.bsi-group.com/standards**

Copyright

Tel: +44 (0)20 8996 7070
Email: copyright@bsigroup.com

BSI

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
www.bsigroup.com/standards

raising standards worldwide™