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

Part 3:

Specification operators

Spécification géométrique des produits (GPS) — État de surface: Surfacique —

Partie 3: Opérateurs de spécification

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 25178-3 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 603: Nominal characteristics of non-contact (phase-shifting interferometric microscopy) instruments*

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

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

The following parts are under preparation:

— *Part 1: Indication of surface texture*

— *Part 605: Nominal characteristics of non-contact (point autofocus probe) 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 3 of the chains of standards on areal 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 on the relation of this part of ISO 25178 to the GPS matrix model, see Annex E.

This part of ISO 25178 specifies the specification operators according to ISO 17450-2.

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

Part 3:

Specification operators

1 Scope

This part of ISO 25178 specifies the complete specification operator for surface texture (scale limited surfaces) by areal methods.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the cited editions apply. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14406:2010, *Geometrical Product Specifications (GPS) — Extraction*

ISO 14660-1:1999, *Geometrical Product Specifications (GPS) — Geometrical features — Part 1: General terms and definitions*

ISO/TS 16610-1:2006, *Geometrical Product Specifications (GPS) — Filtration — Part 1: Overview and basic concepts*

ISO 16610-21:2011, *Geometrical product specifications (GPS) — Filtration — Part 21: Linear profile filters: Gaussian filters*

ISO 17450-1:2011, *Geometrical Product Specifications (GPS) — General concepts — Part 1: Model for geometrical specification and verification*

ISO 17450-2:— [1], *Geometrical Product Specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators, uncertainties and ambiguities*

ISO 25178-2:2012, *Geometrical Product Specifications (GPS) — Surface texture: Areal — Part 2: Terms. definitions and surface texture parameters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given ISO 14660-1, ISO 16610-1, ISO/TS 14406, ISO 17450-1, ISO 17450-2 and ISO 25178-2 and the following apply.

3.1
lateral period limit
<optical> spatial period of a sinusoidal profile at which the optical response falls to 50 %

NOTE The lateral period limit depends on the heights of surface features and the optical method used to probe the surface.

1) To be published.

4 Complete specification operator

4.1 General

The complete specification operator (see ISO 17450-2) consists of all the operations required for an unambiguous specification. It consists of a full set of unambiguous specification operations in an unambiguous order. For areal surface texture, the complete specification operator defines the type of surface, method of extraction, association method and filtration for surface texture by areal methods.

If form error is to be included in the measurand, then a S-F surface shall be specified; otherwise, an S-L surface shall be specified.

4.2 Method of extraction

4.2.1 Evaluation area

4.2.1.1 General

The evaluation area consists of a rectangular portion of the surface over which an extraction is made.

The orientation of the evaluation area shall be controlled by the specification.

NOTE 1 If the nesting index is the same in orthogonal directions, then the orientation does not matter.

NOTE 2 The orientation of the evaluation area is typically influenced by the form; this means that the sides of the rectangular area are parallel/orthogonal to the nominal geometry (e.g. cylinder axis, sides of a rectangular flat, etc.).

4.2.1.2 S-F surface

For an S-F surface, if not otherwise specified, the evaluation area shall be a square.

If the F-operation is a filtration operation, then the length of the sides of the square evaluation area is the same length as the filter “nesting index”.

If the F-operation is an association operation, then the length of the side of the square evaluation area is used as a substitute for the F-operation nesting index value. This chosen value for the F-operation nesting index is used for all subsequent operations.

The value of the nesting index for the F-operation is normally chosen from the following series:

...; 0,1 mm; 0,2 mm; 0,25 mm; 0,5 mm; 0,8 mm; 1,0 mm; 2,0 mm; 2,5 mm; 5,0 mm; 8,0 mm; 10 mm; ...

NOTE 1 An example of an F-operation with a nesting index is a spline filter. The total least squares fit of the nominal form is an example of an F-operation without a predefined nesting index.

NOTE 2 The value of the F-operation nesting index is typically chosen to be five times the scale of the coarsest structure of interest.

4.2.1.3 S-L surface

For an S-L surface, if not otherwise specified, the evaluation area shall be a square whose sides are the same length as the L-filter nesting index value.

The value of the nesting index for the L-filter is normally chosen from the following series:

...., 0,1 mm; 0,2 mm; 0,25 mm; 0,5 mm; 0,8 mm; 1,0 mm; 2,0 mm;2,5 mm; 5,0 mm; 8,0 mm; 10 mm; ...

NOTE The value of the L-filter nesting index is typically five times the scale of the coarsest structure of interest.

4.2.2 Type of surface

The default surface is the mechanical surface (see ISO 14406) obtained with a radius chosen in accordance with the F-operation or L-filter and S-filter nesting index values given in Tables 1 and 2.

Table 1 — Relationships between the F-operation or L-filter and S-filter nesting index values and the bandwidth ratio

F-operation or L-filter nesting index value mm	S-filter nesting index value mm	Approximate bandwidth ratio between the F-operation or L-filter and S-filter nesting index values
…	…	…
0,1	0,001	100:1
	0,000 5	200:1
	0,000 2	500:1
	0,000 1	1 000:1
0,2	0,002	100:1
	0,001	200:1
	0,000 5	400:1
	0,000 2	1 000:1
0,25	0,002 5	100:1
	0,000 8	300:1
	0,000 25	1 000:1
0,5	0,005	100:1
	0,002	250:1
	0,001	500:1
	0,000 5	1 000:1
0,8	0,008	100:1
	0,002 5	300:1
	0,000 8	1 000:1
1	0,01	100:1
	0,005	200:1
	0,002	500:1
	0,001	1 000:1
2	0,02	100:1
	0,01	200:1
	0,005	400:1
	0,002	1 000:1
2,5	0,025	100:1
	0,008	300:1
	0,002 5	1 000:1
5	0,05	100:1
	0,02	250:1
	0,01	500:1
	0,005	1 000:1
8	0,08	100:1
	0,025	300:1
	0,008	1 000:1
…	…	…

4.2.3 S-filter

4.2.3.1 General

The default S-filter is an areal Gaussian filter. The value of the S-filter nesting index (cut-off) (see ISO/TS 16610-1) in the x-direction/y-direction is normally chosen from the following series:

...., 0,000 5 mm; 0,000 8 mm; 0,001 mm; 0,002 mm; 0,002 5 mm; 0,005 mm; 0,008 mm; 0,01 mm; ...

4.2.3.2 S-filter relationships for mechanical surfaces

For mechanical surfaces, the maximum values for the sampling distance and sphere radius are calculated from the value of the S-filter nesting index, as given in Table 2.

Table 2 — Relationships between S-filter nesting index value, sampling distance and sphere radius for mechanical surface

S-filter nesting index value mm	Maximum sampling distance mm	Maximum sphere radius mm
...	...	...
0,000 1	0,000 02	0,000 07
0,000 2	0,000 04	0,000 14
0,000 25	0,000 05	0,000 2
0,000 5	0,000 1	0,000 35
0,000 8	0,000 15	0,000 5
0,001	0,000 2	0,000 7
0,002	0,000 4	0,001 4
0,002 5	0,000 5	0,002
0,005	0,001	0,003 5
0,008	0,001 5	0,005
0,01	0,002	0,007
0,02	0,004	0,014
0,025	0,005	0,02
0,050	0,01	0,035
0,08	0,015	0,05
0,1	0,02	0,07
0,2	0,04	0,14
0,25	0,05	0,2
...	...	...

NOTE 1 Starting with the value of the S-filter nesting index, the maximum sampling distance is calculated as a 5:1 ratio; the maximum sphere ratio is calculated as an approximately 1,4:1 ratio with the S-filter nesting index value. These ratios are consistent with those contained in ISO 3274:1996.

NOTE 2 The maximum sampling distances in Table 2 are considered ideal and may not be attainable for a given surface and instrument type combination.

4.2.3.3 S-filter relationships for optical surfaces

For optical surfaces (electromagnetic surfaces), the maximum values for the sampling distance and lateral period limit are related to the value of the S-filter nesting index as given in Table 3.