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**Geometrical Product Specifications  
(GPS) — Indication of surface texture in  
technical product documentation**

*Spécification géométrique des produits (GPS) — Indication des états de  
surface dans la documentation technique de produits*

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 1302 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

This fourth edition cancels and replaces the third edition (ISO 1302:1992), which has been technically revised.

Annex A forms a normative part of this International Standard. Annexes B, C, D, E, F, G, H, I and J are for information only.

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## Introduction

This International Standard is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences link 1 of the chain of standards on roughness, waviness and primary profile.

For more detailed information of the relation of this International Standard to other standards and the GPS matrix model, see annex J.

This edition of ISO 1302 has been developed for use together with the new editions of the surface texture standards issued in 1996 and 1997, which introduce many radical changes compared with the content of the former surface texture standards issued in the 1980s. The changes are so radical that the drawing indications in some instances have a completely new interpretation. Annex H gives detailed information on these changes.

Drawing indications applied on technical drawings according to former editions of this International Standard refer to the rules given in the surface texture standards issued at the time of issue and can only be interpreted according to those surface texture standards. Annex I provides information on former practices.

The drawing indications given in this edition are to be used for the unambiguous reference to the new surface texture standards issued in 1996 and 1997.

Textual indications in this edition of ISO 1302 are under continuous development within ISO/TC 213 and a separate, detailed standard on this issue is under preparation. Consequently, the textual indications given may change in future editions of ISO 1302.

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# Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation

## 1 Scope

This International Standard specifies the rules for the indication of surface texture in technical product documentation (e.g. drawings, specifications, contracts, reports) by means of graphical symbols and textual indications.

It is applicable to the indication of requirements for surfaces by means of

- a) profile parameters, according to ISO 4287, related to the
  - *R*-profile (roughness parameters),
  - *W*-profile (waviness parameters), and
  - *P*-profile (structural parameters),
- b) motif parameters, according to ISO 12085, related to the
  - roughness motif, and
  - waviness motif,
- c) parameters related to the material ratio curve according to ISO 13565-2 and ISO 13565-3.

NOTE For the indication of requirements for surface imperfections (pores, scratches etc.), which cannot be specified using surface texture parameters, reference is made to ISO 8785, which covers surface imperfections.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 129-1:—<sup>1)</sup>, *Technical drawings — Indication of dimensions and tolerances — Part 1: General principles*

ISO 1101:—<sup>2)</sup>, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out*

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1) To be published. (Revision of ISO 129:1985)

2) To be published. (Revision of ISO 1101:1983)

## ISO 1302:2002(E)

ISO 3098-2:2000, *Technical product documentation — Lettering — Part 2: Latin alphabet, numerals and marks*

ISO 3274:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments*

ISO 4287:1997, *Geometrical product specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 4288:1996, *Geometrical product specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

ISO 8785:1998, *Geometrical product specifications (GPS) — Surface imperfections — Terms, definitions and parameters*

ISO 10135:—<sup>3)</sup>, *Technical drawings — Simplified representation of moulded, cast and forged parts*

ISO 10209-1:1992, *Technical product documentation — Vocabulary — Part 1: Terms relating to technical drawings: general and types of drawings*

ISO 11562:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Metrological characteristics of phase correct filters*

ISO 12085:1996, *Geometrical product specifications (GPS) — Surface texture: Profile method — Motif parameters*

ISO 13565-1:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 1: Filtering and general measurement conditions*

ISO 13565-2:1996, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 2: Height characterization using the linear material ratio curve*

ISO 13565-3:1998, *Geometrical Product Specifications (GPS) — Surface texture: Profile method; Surfaces having stratified functional properties — Part 3: Height characterization using the material probability curve*

ISO 14253-1:1998, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specification*

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

ISO 81714-1:1999, *Design of graphical symbols for use in the technical documentation of products — Part 1: Basic rules*

### 3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 3274, ISO 4287, ISO 4288, ISO 10209-1, ISO 11562, ISO 12085, ISO 13565-2, ISO 13565-3, ISO 14660-1 and the following apply.

#### 3.1

##### **basic graphical symbol**

⟨surface texture⟩ graphical symbol indicating that a requirement for surface texture exists

See Figure 1.

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3) To be published. (Revision of ISO 10135:1994)



**3.2****expanded graphical symbol**

〈surface texture〉 expanded basic graphical symbol indicating that material is either to be removed or not removed in order to obtain the specified surface texture

See Figures 2 and 3.

**3.3****complete graphical symbol**

〈surface texture〉 basic or expanded graphical symbol expanded in order to facilitate the addition of complementary surface texture requirements

See Figure 4.

**3.4****surface (texture) parameter**

parameter expressing a micro-geometrical property of a surface

NOTE See annex E for examples of surface texture parameter designations.

**3.5****(surface) parameter symbol**

symbol indicating the type of surface texture parameter

NOTE The parameter symbols consist of letters and numerical values (e.g. *Ra*, *Ramax*, *Wz*, *Wz1max*, *AR*, *Rpk*, *Rpq*).

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**4 Graphical symbols for the indication of surface texture****4.1 General**

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Requirements for surface texture are indicated on technical product documentation by several variants of graphical symbols, each having its own significant meaning. The graphical symbols specified in 4.2 and 4.3 shall be supplemented with complementary surface texture requirements in the form of numerical values, graphical symbols and text (see also clauses 5, 6, 7 and 8). Attention is drawn to the fact that, in particular instances, the graphical symbols may be used alone to convey a special meaning on the technical drawing (see clause 11).

**4.2 Basic graphical symbol**

The basic graphical symbol shall consist of two straight lines of unequal length inclined at approximately 60° to the line representing the considered surface, as shown in Figure 1. The basic graphical symbol in Figure 1 should not be used alone (without complementary information). Its use shall be to provide collective indications as shown in Figures 23 and 26.

If the basic graphical symbol is used with complementary, supplemental information (see clause 5), then no further decision is required as to whether removal of material is necessary for obtaining the specified surface (see 4.3.1) or whether removal of material is not permitted for obtaining the specified surface (see 4.3.2).



**Figure 1 — Basic graphical symbol for surface texture**

### 4.3 Expanded graphical symbols

#### 4.3.1 Removal of material required

If removal of material — for example, by machining — is required for obtaining the specified surface, a bar shall be added to the basic graphical symbol, as shown in Figure 2.

The expanded graphical symbol in Figure 2 should not be used alone (without complementary information).



Figure 2 — Expanded graphical symbol indicating removal of material required

#### 4.3.2 Removal of material not permitted

If removal of material is not permitted for obtaining the specified surface, a circle shall be added to the basic graphical symbol, as shown in Figure 3. For special use of this expanded graphical symbol, see clause 10.



Figure 3 — Expanded graphical symbol indicating removal of material not permitted

### 4.4 Complete graphical symbol

When complementary requirements for surface texture characteristics have to be indicated (see clause 6), a line shall be added to the longer arm of any of the graphical symbols illustrated in Figures 1 to 3, as shown in Figure 4.

For use in the written text of — for example, reports or contracts — the textual indication for Figure 4, a) is APA<sup>4)</sup>, for b) it is MRR<sup>5)</sup> and for c) NMR<sup>6)</sup>.



- a) any manufacturing process permitted
- b) material shall be removed
- c) material shall not be removed

Figure 4 — Complete graphical symbol

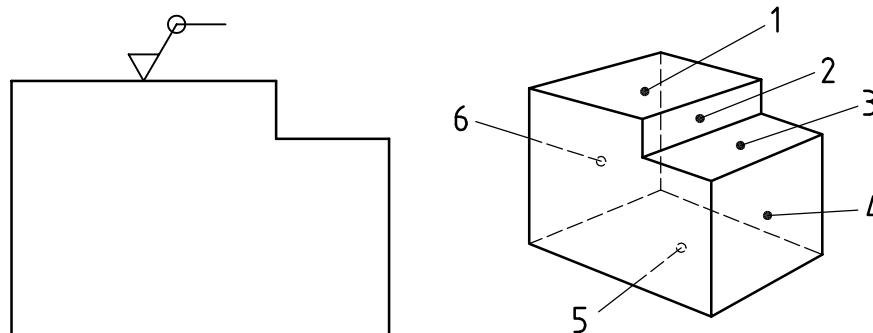
### 4.5 Graphical symbol for “all surfaces around a workpiece outline”

When the same surface texture is required on all surfaces around a workpiece outline (integral features), represented on the drawing by a closed outline of the workpiece, a circle shall be added to the complete graphical symbol illustrated in Figure 4, as shown in Figure 5.

Surfaces shall be indicated independently if any ambiguity may arise from the all around indication.

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4) Any process allowed.  
5) Material removal required.  
6) No material removed.



NOTE The outline on the drawing represents the six surfaces shown on the 3D-representation of the workpiece (the front and rear surfaces not included).

Figure 5 — Surface texture requirement for all six surfaces represented by outline on workpiece

## 5 Composition of complete graphical symbol for surface texture

### 5.1 General

In order to ensure that a surface texture requirement is unambiguous, it may be necessary, in addition to the indication of both a surface texture parameter and its numerical value, to specify additional requirements (e.g. transmission band or sampling length, manufacturing process, surface lay and its orientation and possible machining allowances). It may be necessary to set up requirements for several different surface texture parameters in order that the surface requirements ensure unambiguous functional properties of the surface. For more details see annex D.

### 5.2 Position of complementary surface texture requirements

The mandatory positions of the various surface texture requirements in the complete graphical symbol are shown in Figure 6.

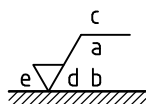


Figure 6 — Positions (a to e) for location of complementary requirements

The complementary surface texture requirements in the form of

- surface texture parameters,
- numerical values, and
- transmission band/sampling length,

shall be located at the specific positions in the complete graphical symbol in accordance with the following.

#### a) Position a — Single surface texture requirement

Indicate the surface texture parameter designation, the numerical limit value and the transmission band/sampling length according to clause 6. To avoid misinterpretation, a double space (double blank) shall be inserted between the parameter designation and the limit value.

Generally, the transmission band or sampling length shall be indicated followed by an oblique stroke (/), followed by the surface texture parameter designation, followed by its numerical value using one text string.

EXAMPLE 1 0,0025-0,8/Rz 6,8 (example with transmission band indicated).

EXAMPLE 2 -0,8/Rz 6,8 (example with only sampling length indicated).

Especially for the motif method, the transmission band shall be indicated, followed by an oblique stroke (/), followed by the value of the evaluation length, followed by another oblique stroke, followed by the surface texture parameter designation, followed by its numerical value.

EXAMPLE 3 0,008-0,5/16/R 10.

NOTE Generally, the transmission band is the wavelength range between two defined filters (see ISO 3274 and ISO 11562) and, for the motif method, the wavelength range between two defined limits (see ISO 12085).

**b) Position a and b — Two or more surface texture requirements**

Indicate the first surface texture requirement at position “a” as in a). Indicate the second surface texture requirement at position “b”. If a third requirement or more is to be indicated, the graphical symbol is to be enlarged accordingly in the vertical direction, to make room for more lines. The position “a” and “b” are to be moved upwards when the symbol is enlarged (see clause 6).

**c) Position c — Manufacturing method**

Indicate the manufacturing method, treatment, coatings or other requirements for the manufacturing process etc. to produce the surface, for example, turned, ground, plated (see also clause 7).

**d) Position d — Surface lay and orientation**

Indicate the symbol of the required surface lay and the orientation, if any, of the surface lay, for example, “=”, “X”, “M” (see also clause 8).

**e) Position e — Machining allowance**

Indicate the required machining allowance, if any, as a numerical value given in millimetres, see also clause 9.

## **6 Indication of surface texture parameters**

### **6.1 General**

The parameter designation and the associated numerical value, which shall be indicated, includes four items of information essential for the interpretation of the requirement. These are

- which of the three surface profiles (*R*, *W* or *P*) is indicated,
- which characteristic of the profile is indicated,
- how many sampling lengths make up the evaluation length, and
- how the indicated specification limit shall be interpreted.

Three principal groups of surface texture parameters have been standardized for use in connection with the complete symbol. The definitions of the parameters may be found in ISO 4287, ISO 12085, ISO 13565-2 and ISO 13565-3, in accordance with Table 1.

Table 1 — Overview of parameter types

	Parameters							
	Profile			Motif		Material ratio curve		
	<i>R</i>	<i>W</i>	<i>P</i>	<i>R</i>	<i>W</i>	linear	probability	
						<i>R</i>	<i>R</i>	<i>P</i>
Designation	See E.2	See E.2	See E.2	See E.3	See E.3	See E.4.2	See E.4.3	See E.4.3
Evaluation length	See F.2	See F.2	See F.2	See F.3	See F.3	See F.4	See F.4	See F.4
Tolerance limit	See 6.4							
Transmission band	See G.2	See G.2	See G.2	See G.3	See G.3	See G.4	See G.4	See G.4

## 6.2 Indication of parameter designations

See annex E. If the parameter designations are indicated as in annex E, without modifiers, this means that the default definition or the default interpretation of the specification limit (“16 %-rule”, see 4.2 and 4.3 of ISO 4288:1996) is invoked. See 6.4 for an indication of the “max-rule” for the interpretation of the specification limit.

## 6.3 Indication of evaluation length, $l_n$

### 6.3.1 General

If the parameter designation is indicated as shown in annex E, without modifiers, this implies that the requirement is the default evaluation length, if it is defined in the pertinent standards.

In those cases where no default definition exists for the number of sampling lengths within the evaluation length, the number of sampling lengths shall be added to the parameter designation in order to obtain an unambiguous surface texture requirement.

### 6.3.2 Profile parameters (ISO 4287)

#### — *R*-profile

See F.2. If the number of sampling lengths within the evaluation length differs from the default number of five (see 4.4 of ISO 4288:1996), it shall be indicated adjacent to the relevant parameter designation.

EXAMPLE Rp3 or Rv3 or Rz3 or Rc3 or Rt3 or Ra3 or ..., RSm3, ... (if an evaluation length of three sampling lengths is desired).

#### — *W*-profile

See F.2. The number of sampling lengths shall always be indicated adjacent to the parameter designation of waviness.

EXAMPLE Wz5 or Wa3.

#### — *P*-profile

See F.2. The sampling length for *P* parameters is equivalent to the evaluation length (see 3.1.9 of ISO 4287:1997) and the evaluation length is equal to the length of the feature being measured (see 4.4 of ISO 4287:1997). Consequently, the indication of the number of sampling lengths in the parameter designation of structure parameters is not relevant.

6.3.3 Motif parameters (ISO 12085)

See F.3. If the evaluation length differs from the default number of 16 mm, it shall be indicated between two oblique strokes.

EXAMPLE 0,008-0,5/12/R 10

NOTE Attention is drawn to the fact that the evaluation length concept in the case of motif parameters has a meaning different from that of other surface texture parameters in that the sampling length concept does not exist. Consequently, indication of the number of sampling lengths in the parameter designation of motif parameters is not relevant.

6.3.4 Parameters based on material ratio curve (ISO 13565-2, ISO 13565-3)

— R-profile

See F.4. If the number of sampling lengths within the evaluation length differs from the default number of five (see clause 7 of ISO 13565-1:1996), it shall be indicated adjacent to the relevant parameter designation.

EXAMPLE Rk8, Rpk8, Rvk8, Rpq8, Rvq8, Rmq8 (if an evaluation length of eight sampling lengths is desired).

For the R-profile parameters based on the linear material ratio curve according to ISO 13565-2 and ISO 12085 — i.e. the parameters *Rke*, *Rpke*, *Rvke*, etc. — the indication of the evaluation length shall be according to 6.3.3.

— P-profile

See F.4. The sampling length for P parameters is equivalent to the evaluation length (see 3.1.9 of ISO 4287:1997) and the evaluation length is equal to the length of the feature being measured (see 4.4 of ISO 4287:1997). Consequently, the indication of the number of sampling lengths in the parameter designation of structure parameters is not relevant.

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6.4 Indication of tolerance limits

6.4.1 General

There are two different ways of indicating and interpreting the specification limits of surface texture:

- a) the “16 % rule”;
- b) the “max-rule”.

See 5.2 and 5.3 of ISO 4288:1996, respectively.

The “16 %-rule” is defined as the default rule for all indications of surface texture requirements. This means that the “16 %-rule” applies to a surface texture requirement when a parameter designation as shown in Annex E is applied (see Figure 7). If the “max-rule” is to be applied to a surface texture requirement, “max” shall be added to the parameter designation (see Figure 8). The “max-rule” does not apply to motif parameters.

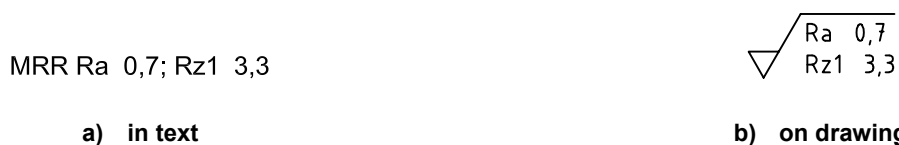
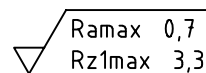


Figure 7 — Parameter indication where “16 %-rule” applies (default transmission band)

MRR Ramax 0,7; Rz1max 3,3



a) in text

b) on drawing

**Figure 8 — Parameter indication where “max-rule” applies (default transmission band)**

#### 6.4.2 Profile parameters (ISO 4287)

The “16 %-rule” and the “max-rule” are both applicable to profile parameters defined in ISO 4287.

#### 6.4.3 Motif parameters (ISO 12085)

The motif parameters are defined using only the “16 %-rule” (see 5.4 of ISO 12085:1996).

#### 6.4.4 Parameters based on material ratio curve (ISO 13565-2, ISO 13565-3)

The “16 %-rule” and the “max-rule” are both applicable to parameters related to the material ratio curve defined in ISO 13565-2 and ISO 13565-3.

### 6.5 Indication of transmission band and sampling length

#### 6.5.1 General

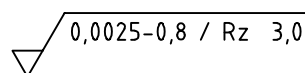
Where no transmission band is indicated in connection with the parameter designation, the default transmission band applies to the surface texture requirement (see annex G for the definition of default transmission bands; see the surface texture requirements in Figures 7 and 8 for no transmission band indicated).

Certain surface texture parameters do not have a defined default transmission band, a default short-wave filter or a default sampling length (long-wave filter). Consequently, the surface texture indication shall specify transmission band, short-wave filter or long-wave filter to ensure that the surface texture requirement is unambiguous.

To provide assurance that the surface is controlled unambiguously by the surface texture requirement, the transmission band shall be indicated in front of the parameter designation separated from it by an oblique stroke (/).

The transmission band shall be indicated by the inclusion of the cut-off values of the filters (in millimetres), separated by a hyphen (“-”), the short-wave filter indicated first, and the long-wave filter second. See Figure 9.

MRR 0,0025-0,8 / Rz 3,0



a) in text

b) on drawing

**Figure 9 — Indication of transmission band in connection with surface texture requirement**

In some cases, it may be relevant to indicate only one of the two filters in the transmission band. The second filter then has its default value, if it exists. If only one filter is indicated, the hyphen is maintained to indicate whether the indication is of the short-wave or the long-wave filter.

EXAMPLE 1    0,008-                    (short-wave filter indication).

EXAMPLE 2    -0,25                            (long-wave filter indication).