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(JSA)

**Geometrical Product Specifications
(GPS)—Surface texture: Profile
method—Terms, definitions and
surface texture parameters**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently, **JIS B 0601**:2001 is replaced with this Standard.

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Geometrical Product Specifications (GPS)—Surface texture: Profile method— Terms, definitions and surface texture parameters

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 4287** published in 1997, Amendment 1 (2009), Technical corrigendum 1 (1998), Technical corrigendum 2 (2005) without any modifications of the technical contents. However, the amendment and technical corrigenda have been compiled and integrated into this Standard. This Standard permits to use text equivalents in order to facilitate alphanumeric notation by means of computers. See Annex A for more information. Also the flowchart for surface assessment is diagramed in Annex B. Basic terms and parameter symbols used in this Standard are different from those used in 1994 edition of **JIS B 0601** and 1998 edition of **JIS B 0660**. See Annex C for more information.

The portions underlined with dots and Annexes JA and JB in this Standard are the matters not given in the corresponding International Standard.

This Standard is a Geometrical Product Specification (GPS) standard and is to be regarded as a General GPS standard (see **ISO/TR 14638**:1995). It influences chain link 2 of the chains of standards on surface texture.

For more detailed information on the relationship of this Standard to other GPS standards, see Annex D.

In this Standard, ten-point height of roughness profile which has been used in Japan and centre line average roughness specified in standards prior to **JIS B 0601**:1994 are given for information in Annex JA and Annex JB, respectively.

1 Scope

This Standard specifies terms, definitions and parameters for the determination of surface texture (roughness, waviness and primary profiles) by profiling methods.

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows:

ISO 4287:1997 *Geometrical Product Specifications (GPS)—Surface texture: Profile method—Terms, definitions and surface texture parameters*, Amendment 1:2009, Technical corrigendum 1:1998 and Technical corrigendum 2:2005 (IDT)

The symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this Standard. The most recent edition of the standard (including amendments) indicated below shall be applied.

JIS B 0651 *Geometrical Product Specifications (GPS)—Surface texture: Profile method—Nominal characteristics of contact (stylus) instruments*

NOTE : Corresponding International Standard: ISO 3274:1996 *Geometrical Product Specifications (GPS)—Surface texture: Profile method—Nominal characteristics of contact (stylus) instruments* (IDT)

3 Terms and definitions

3.1 General terms

3.1.1 profile filter

filter which separates profiles into longwave and shortwave components

NOTE : There are three filters used in instruments for measuring roughness, waviness and primary profiles as shown in **3.1.1.1** to **3.1.1.3** (see figure 1). They all have the same transmission characteristics, defined in **JIS B 0632**, but different cut-off wavelengths.

3.1.1.1 λ_s profile filter

filter which defines the intersection between the roughness and the even shorter wave components present in a surface (see figure 1)

3.1.1.2 λ_c profile filter

filter which defines the intersection between the roughness and waviness components (see figure 1)

3.1.1.3 λ_f profile filter

filter which defines the intersection between the waviness and the even longer wave components present in a surface (see figure 1)

NOTE : The domain of λ_f cut-off wavelength is not defined in **ISO 4287:1997** and does not exist. Only in **JIS B 0610:2001**, the λ_f cut-off wavelength is defined, but its domain does not conform to **ISO 4287:1997**.

3.1.2 coordinate system

that coordinate system in which surface texture parameters are defined

NOTE : It is usual to use a rectangular coordinate system in which the axes form a right-handed Cartesian set, the X-axis being the direction of tracing colinear with the mean line, the Y-axis also nominally lying on the real surface, and the Z-axis being in an outward direction (from the material to the surrounding medium). This convention is adopted throughout the rest of this Standard.

3.1.3 real surface

surface limiting the body and separating it from the surrounding medium

3.1.4 surface profile

profile that results from the intersection of the real surface by a specified plane (see figure 2)

NOTE : In practice, it is usual to choose a plane with a normal that nominally lies parallel to the real surface and in a suitable direction.

3.1.5 primary profile

total profile after application of the short wavelength filter λ_s (**JIS B 0651**)

NOTE 1 The primary profile is the basis for evaluation of the primary profile parameters.

NOTE 2 Total profile is the digital form of the traced profile relative to the reference profile, with the vertical and horizontal coordinates assigned to each other (see **JIS B 0651**).

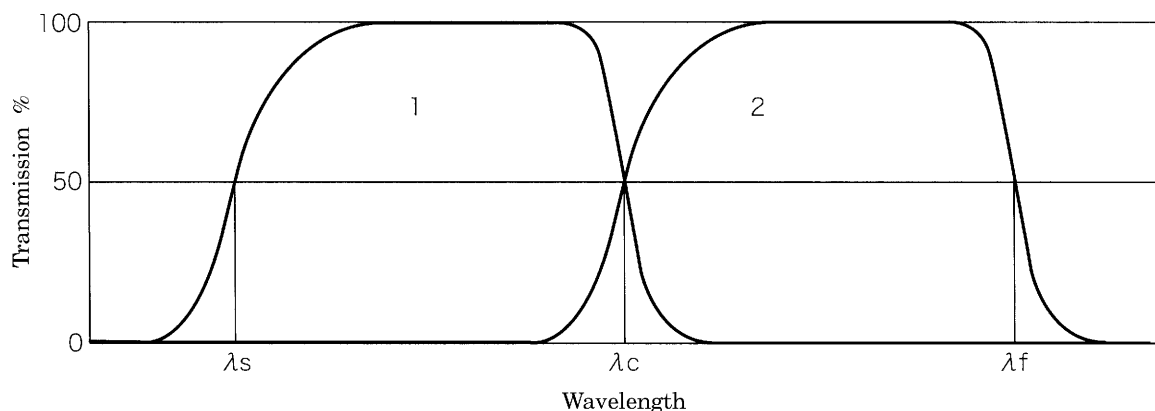
3.1.6 roughness profile

profile derived from the primary profile by suppressing the longwave component using the profile filter λ_c ; this profile is intentionally modified (see figure 1)

NOTE 1 The transmission band for roughness profiles is defined by the λ_s and λ_c profile filters (see **JIS B 0632**, **2.6** and **3.2**).

NOTE 2 The roughness profile is the basis for evaluation of the roughness profile parameters.

NOTE 3 The default relationship between λ_c and λ_s is given in **JIS B 0651**, **4.4**.



Key

- 1 roughness profile
- 2 waviness profile

Figure 1 Transmission characteristics of roughness and waviness profiles

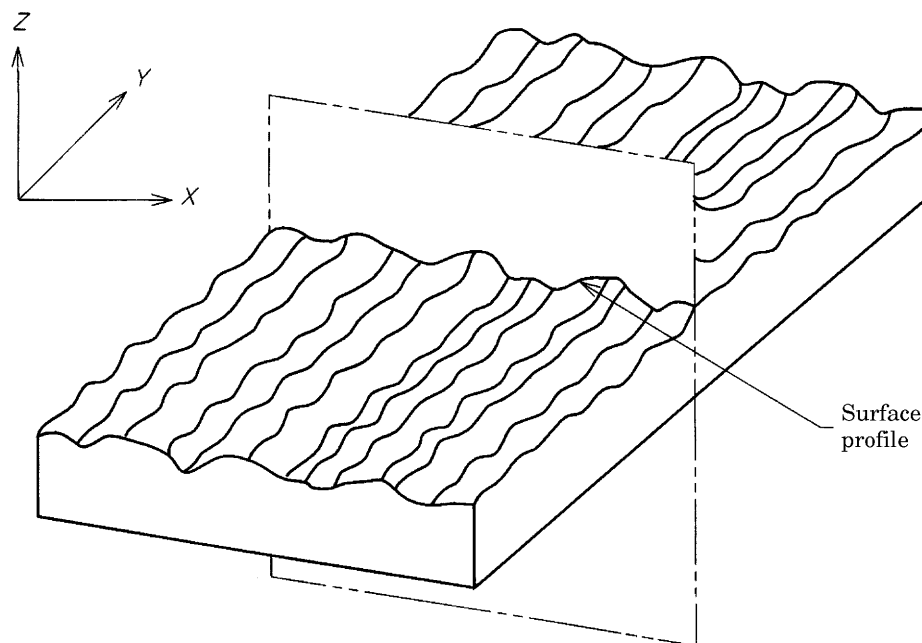


Figure 2 Surface profile

3.1.7 waviness profile

profile derived by subsequent application of the profile filter λ_f and the profile filter λ_c to the primary profile, suppressing the longwave component using the profile filter λ_f , and suppressing the shortwave component using the profile filter λ_c ; this profile is intentionally modified

NOTE 1 The nominal form should first be removed from the total profile by best-fit least-squares methods, before applying the λ_f profile filter for separating the waviness profile. For circular nominal form, it is recommended that the radius should also be included in the least-squares optimization and not held fixed to the nominal value. This procedure for separating the waviness profile defines the ideal waviness operator.

Operator is a series of measuring principle, measuring method, measuring condition, data processing, etc. which are necessary for obtaining geometrical feature in the order for the purpose of introducing the concept of uncertainty. The ideal is a theoretically correct operator which has no error in measuring instrument and digitalized data, and has infinitively large number of discrete data.

The meaning of “the radius should be included in the least-squares optimization” is to obtain the radius of circular form optimally applicable to the data, by the least-squares optimization.

NOTE 2 The transmission band for waviness profiles is defined by the λ_c and λ_f profile filters (see **JIS B 0632, 2.6** and **3.2**).

NOTE 3 The waviness profile is the basis for evaluation of the waviness profile parameters.

3.1.8 Mean lines

3.1.8.1 mean line for the roughness profile

line corresponding to the longwave profile component suppressed by the profile filter λ_c (see **JIS B 0632, 3.2**)

3.1.8.2 mean line for the waviness profile

line corresponding to the longwave profile component suppressed by the profile filter λ_f (see **JIS B 0632, 3.2**)

3.1.8.3 mean line for the primary profile

line determined by fitting a least-squares line of nominal form through the primary profile

3.1.9 sampling length, l_p , l_r , l_w

length in the direction of the X-axis used for identifying the irregularities characterizing the profile under evaluation

NOTE : The sampling length for the roughness l_r and waviness profiles l_w is numerically equal to the characteristic wavelength of the profile filters λ_c and λ_f , respectively. The sampling length for primary profile, l_p , is equal to the evaluation length l_n .

3.1.10 evaluation length, l_n

length in the direction of the X-axis used for assessing the profile under evaluation

NOTE 1 The evaluation length may contain one or more sampling lengths.

NOTE 2 For default evaluation lengths, see **JIS B 0633, 4.4**. **JIS B 0633** does not give default evaluation length for W-parameters.

3.2 Geometrical parameter terms

3.2.1 P-parameter

parameter calculated from the primary profile

3.2.2 R-parameter

parameter calculated from the roughness profile

3.2.3 W-parameter

parameter calculated from the waviness profile

NOTE : The parameters defined in clause 4 can be calculated from any profile. The first capital letter in the parameter symbol designates the type of the profile evaluated. For example, R_a is calculated from the roughness profile and P_t is calculated from the primary profile.

3.2.4 profile peak

an outwardly directed (from material to surrounding medium) portion of the assessed profile connecting two adjacent points of the intersection of the profile with the X-axis

3.2.5 profile valley

an inwardly directed (from surrounding medium to material) portion of the assessed profile connecting two adjacent points of the intersection of the assessed profile with the X-axis

3.2.6 height and/or spacing discrimination

minimum height and minimum spacing of profile peaks and profile valleys of the assessed profile which should be taken into account

NOTE : The minimum height of the profile peaks and valleys are usually specified as a percentage of P_z , R_z , W_z or another amplitude parameter, and the minimum spacing as a percentage of the sampling length.

3.2.7 profile element

profile peak and the adjacent profile valley (see figure 3)

NOTE : The positive or negative portion of the assessed profile at the beginning or end of the sampling length should always be considered as a profile peak or as a profile valley. When determining a number of profile elements over several successive sampling lengths, the peaks and valleys of the assessed profile at the beginning or end of each sampling length are taken into account once only at the beginning of each sampling length.

3.2.8 ordinate value, $Z(x)$

height of the assessed profile at any position x

NOTE : The height is regarded as negative if the ordinate lies below the X-axis, and positive otherwise.

3.2.9 local slope, $\frac{dZ(x)}{dx}$

slope of the assessed profile at a position x_i (see figure 4)

NOTE 1 The numerical value of the local slope, and thus the parameters $P\Delta q$, $R\Delta q$ and $W\Delta q$, depends critically on the ordinate spacing ΔX .

NOTE 2 A formula for estimating the local slope is

$$\frac{dZ(x_i)}{d(x)} = \frac{1}{60\Delta X} \{ Z(x_{i+3}) - 9Z(x_{i+2}) + 45Z(x_{i+1}) - 45Z(x_{i-1}) + 9Z(x_{i-2}) - Z(x_{i-3}) \}$$

where, x_i : the position of the i th profile point

$Z(x_i)$: the height of the i th profile point

ΔX : the spacing between adjacent profile points

The above formula should be used for the sample spacing stipulated in **JIS B 0651** for the filter used.

NOTE 3 The formula for obtaining a local slope is based on seven-point formula of numeric differential.