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**Geometrical Product Specifications
(GPS)—Surface texture :
Profile method—Calibration of
contact (stylus) instruments**

ICS 17.040.20; 17.040.30

Reference number : JIS B 0670 : 2002 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from the Japanese Standards Association (JSA), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Geometrical Product Specifications (GPS)— Surface texture : Profile method— Calibration of contact (stylus) instruments

Introduction This Japanese Industrial Standard has been prepared based on the first edition of **ISO 12179** *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Calibration of contact (stylus) instruments* published in 2000 with some modifications of the technical contents.

This Standard is one of the Geometrical Product Specifications (GPS), is to be regarded as a general GPS standard (see **TR B 0007**), and influences chain link 6 of the chain of standards on roughness curve, waviness curve and primary profile.

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

This Standard specifies the calibration method of contact (stylus) instruments as defined in **JIS B 0651**. The calibration is to be carried out with the aid of measurement standards.

The portions underlined with dots in this Standard are the matters in which the original International Standard has been modified.

Remarks : **TR B 0007** is identical with **ISO/TR 14638** : 1995 *Geometrical Product Specifications (GPS)—Master plan*.

1 Scope This Standard applies to the calibration of the metrological characteristics of contact (stylus) instruments for the measurement of surface texture by the profile method as defined in **JIS B 0651**. The calibration is to be carried out with the aid of measurement standards.

Annex B applies to the calibration of metrological characteristics of simplified operator contact (stylus) instruments which do not conform with **JIS B 0651**.

Remarks : The International Standard corresponding to this Standard is as follows.

In addition, 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**.

ISO 12179 : 2000 *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Calibration of contact (stylus) instruments* (MOD)

2 Normative references The following normative documents contain provisions which, through reference in this text, constitute provisions of this Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition (including amendments) of the normative document referred to applies.

JIS B 0601 *Geometrical Product Specification (GPS)—Surface texture : Profile method—Terms, definitions and surface texture parameters*

Remarks : **ISO 4287** : 1997 *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Terms, definitions and surface texture parameters* is identical with the said standard.

JIS B 0631 *Geometrical Product Specification (GPS)—Surface texture : Profile method—Motif parameters*

Remarks : **ISO 12085** : 1996 *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Motif parameters* is identical with the said standard.

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

Remarks : **ISO 3274** : 1996 *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Nominal characteristics of contact (stylus) instruments* is identical with the said standard.

JIS B 0659-1 *Geometrical Product Specifications (GPS)—Surface texture : Profile method—Measurement standards—Part 1 : Material measures*

Remarks : **ISO 5436-1** : 2000 *Geometrical Product Specifications (GPS)—Surface texture : Profile method ; Measurement standards—Part 1 : Material measures* is equivalent to the said standard.

JIS Z 8103 *Glossary of terms used in measurement*

Information : The terms used in measurement of this Standard is based on the definitions of **JIS Z 8103**, which is, therefore, added to the normative reference of this Standard.

ISO 10012-1 : 1992 *Quality assurance requirements for measuring equipment—Part 1 : Metrological confirmation system for measuring equipment*

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/TS 14253-2 : 1999 *Geometrical Product Specifications (GPS)—Inspection by measurement of workpieces and measuring equipment—Part 2 : Guide to the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

Guide to the expression of uncertainty in measurement (GUM). BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 1st edition, 1995

International vocabulary of basic and general terms used in metrology (VIM). BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 2nd edition, 1993

3 Terms and definitions For the purposes of this Standard, the terms and definitions given in **JIS B 0601**, **JIS B 0651**, **JIS Z 8103**, **ISO 14253-1**, VIM and GUM.

3.1 calibration set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards [VIM 6.11]

3.2 adjustment (of a measuring instrument) operation of bringing a measuring instrument into a state of performance suitable for its use [VIM 4.30]

3.3 (measurement) standard, etalon material measure, measuring instrument, reference material or measuring system intended to define, realize, conserve or reproduce a unit or one or more values of a quantity to serve as a reference [VIM 6.1]

Remarks : In **JIS B 0601 : 1994 (ISO 5436 : 1985)**, “measurement standards” were referred to as “calibration specimens”.

3.4 uncertainty of measurement parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand [VIM 3.9]

3.5 traceability property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties [VIM 6.10]

4 Condition of calibration

4.1 Components and configurations of the contact (stylus) instrument The contact (stylus) instrument is comprised of the basic equipment, a drive unit, a probe and a profile recorder (see **JIS B 0651**).

If the basic equipment is used with several drive units and probes, each of these instrumental combinations (configurations) shall be calibrated separately.

Information : Basic equipment is comprised of a measuring stand, a column, a fixing apparatus and so on.

4.2 Calibration of a configuration The contact (stylus) instrument shall be calibrated when a change is made to the basic elements of the system which intentionally or unintentionally modifies the measured profile/measuring result. Each configuration of the contact (stylus) instrument shall be calibrated separately.

Example : With a change of probe the contact (stylus) instrument shall be calibrated.

4.3 Place of calibration The contact (stylus) instrument should be calibrated at the place of use with environmental conditions similar to those present when in use for measurement to take into account external influence factors.

Example : Noise, temperature, vibration, air movement, etc.

5 Measurement standards The following measurement standards are applicable to the calibration in clause 6:

- optical flat;
- depth measurement standard (see Figure 1): type A according to **JIS B 0659**;
- spacing measurement standard (see Figure 2): type C according to **JIS B 0659**;
- inclined optical flat (see Figure 3);

- profile co-ordinate measurement standard (consisting of a sphere or hemisphere and trapezium prism): type E according to **JIS B 0659**;
- roughness measurement standard (see Figure 4): type D according to **JIS B 0659**.

Remarks : It is recommended that a profile co-ordinate measurement standard be used on contact (stylus) instruments where the stylus rotates plus and minus one and half of a degree when moving through its full range.

6 Contact (stylus) instrument metrological characteristics Only those task-related contact (stylus) instrument metrological characteristics which are relevant for the intended measurements should be selected for calibration. For example, for the measurement of horizontal parameters, the vertical profile component need not be calibrated.

6.1 Residual profile calibration The scratch-free optical flat reproduces the residual profile. For task-related calibrations use the appropriate profile and parameters [for example: the roughness profile with Ra (arithmetical mean roughness), Rq (root mean square roughness) or Rt (maximum profile of roughness curve); the waviness profile with Wq (root mean square waviness) or Wt (maximum profile of waviness curve)].

Remarks : By using this approach the effects of external guide straightness, environmental conditions and instrument noise can be established.

6.2 Vertical profile component calibration The depth measurement standard reproduces the profile depth in order to measure the error of indication of the vertical profile component.

Remarks : If no depth measurement standards are available gauge blocks may be used. Care must be taken concerning the uncertainty of the height difference when using gauge blocks.

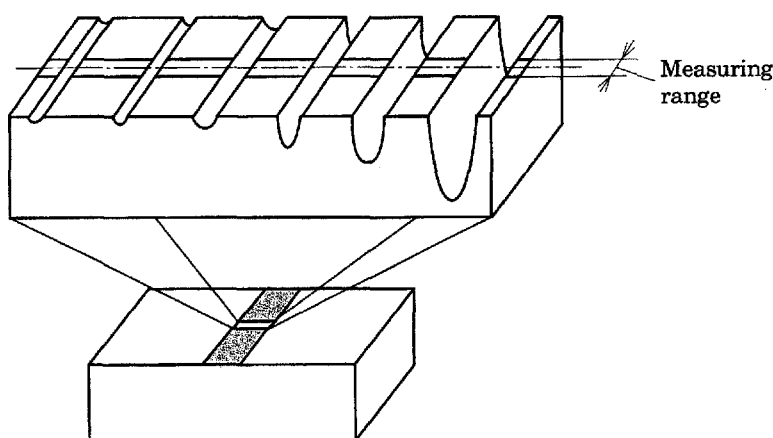


Figure 1 Example of a depth measurement standard (type A2)

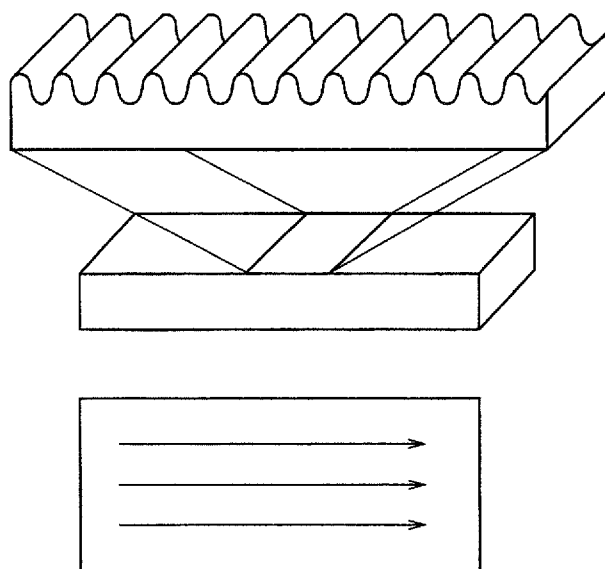


Figure 2 Example of a spacing measurement standard (type C)

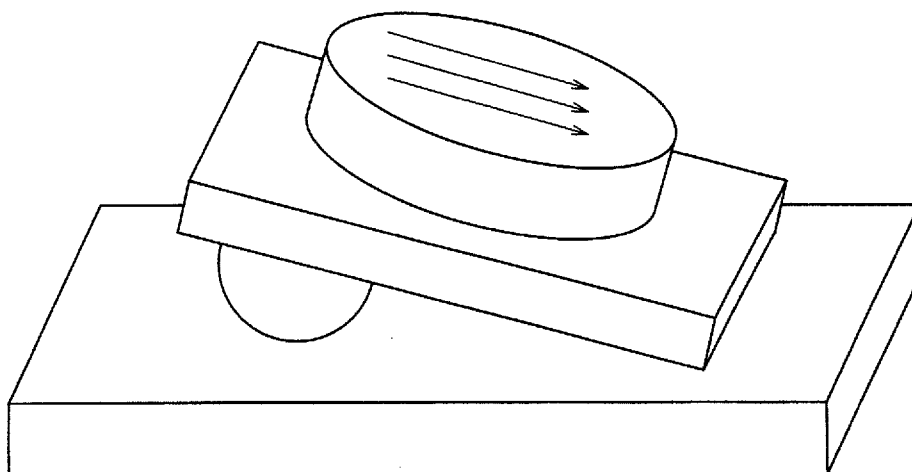


Figure 3 Example of an inclined optical flat and a measuring plan