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**Geometrical Product Specifications
(GPS)—Acceptance and reverification
tests for coordinate measuring
machines (CMM)—Part 1 : Vocabulary**

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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 Japanese Standards Association (JSA), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

This Standard has been made based on **ISO 10360-1 : 2000 Geometrical Product Specifications (GPS)—Acceptance and reverification tests for coordinate measuring machines (CMM)—Part 1 : Vocabulary** for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS B 7440 consists of the following 6 parts under the general title *Geometrical Product Specifications (GPS)—Acceptance and reverification tests for coordinate measuring machines (CMM)*.

Part 1 : Vocabulary

Part 2 : CMMs used for measuring size

Part 3 : CMMs with the axis of a rotary table as the fourth axis

Part 4 : CMMs used in scanning measuring mode

Part 5 : CMMs using multiple-stylus probing systems

Part 6 : Estimation of errors in computing Gaussian associated features

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Geometrical Product Specifications (GPS)— Acceptance and reverification tests for coordinate measuring machines (CMM)— Part 1 : Vocabulary

Introduction This Standard is the Japanese Industrial Standard prepared based on **ISO 10360-1 Geometrical Product Specifications (GPS)—Part 1 : Vocabulary** published in 2000 as the first edition without modifying their technical contents.

The “information” underlined with dots are the matters not stated in the original International Standard.

This Standard is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see **TR B 0007**). It influences link 5 of the chains of standards on size, distance, radius, angle, form, orientation, location, run-out and datums.

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

1 Scope This Standard specifies a vocabulary for coordinate measuring machines (CMM), and their acceptance and reverification tests.

Remarks : The International Standards corresponding to this Standard are given below.

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 10360-1 : 2000 *Geometrical product specifications (GPS)—Acceptance and reverification tests for coordinate measuring machines (CMM)—Part 1 : Vocabulary (IDT)*

2 General terms

2.1 coordinate measuring machine (CMM) measuring system with the means to move a **probing system (2.6)** and capability to determine spatial coordinates on a workpiece surface

NOTE : For a description of some common CMMs and their physical axes, see annex A.

Information : Coordinate measuring machine is normally call as three dimensional measuring machine, although in this Standard it will be called as coordinate measuring machine taking into account its generic nature.

2.2 coordinate measurement measurement of spatial coordinates carried out by **CMM (2.1)**

2.3 measuring volume measuring range of a **CMM (2.1)**, stated as simultaneous limits on all spatial coordinates measured by the CMM

2.4 workpiece coordinate system coordinate system fixed with respect to a workpiece

2.5 machine coordinate system coordinate system fixed with respect to physical or calculated axes of a **CMM (2.1)**

NOTE : For a description of some common CMMs and their physical axes, see annex A.

2.6 probing system system consisting of a **probe (3.1)** and, where present, probe extensions, probe changing system, **stylus (4.1)**, stylus changing system and stylus extensions. See figures 1 and 2.

NOTE 1 A probing system is connected to a **ram (2.23)**.

NOTE 2 A probing system is not limited to **contacting probing systems (3.2)**.

2.7 probing (to probe), verb action which results in the determination of coordinate values

2.8 discrete-point probing particular **probing (2.7)** mode where the recording of an **indicated measured point (2.12)** is assessed directly after an **intermediate point (2.11)** has been left

2.9 scanning particular **probing (2.7)** mode for taking consecutive measured points in order to characterize lines on an inspected surface

2.10 program point any point expressed by coordinates and used for controlling the movement of a specified point of a **probing system (2.6)**

2.11 intermediate point special **program point (2.10)** where no **probing (2.7)** is made

NOTE : Intermediate points are normally used for controlling the movement of a **probing system (2.6)**, altering its speed or direction of movement, and for clearance movement.

2.12 indicated measured point specified point of a **probing system (2.6)** for which the coordinates are indicated at the instant when **probing (2.7)** occurs. See figure 3.

NOTE : The specified point is typically at or near the centre of the **stylus tip (4.2)**.

2.13 corrected measured point estimate for a point on a workpiece surface, based on an **indicated measured point (2.12)**. See figures 3 and 4.

NOTE : In the case where no **stylus system (4.4)** is attached to a **probe (3.1)** [e.g. in case of an **optical probing system (3.4)**] the **indicated measured point (2.12)** and the corrected measured point could be identical.

2.14 target contact point intended point of contact on a nominal integral feature. See figure 3.

NOTE : A nominal integral feature is a theoretically exact surface in accordance with **JIS B 0672-1**.

2.15 actual contact point point of contact between a **stylus tip (4.2)** and a real feature. See figure 3.

NOTE : A real feature is an integral feature, part of a real surface of a workpiece in accordance with **JIS B 0672-1**.

2.16 tip correction vector ($\vec{T}$) vector used to translate an **indicated measured point (2.12)** to a **corrected measured point (2.13)**. See figures 3 and 4.

NOTE 1 The tip correction vector normally includes the physical size of the tip (e.g. radius) and a correction for the systematic errors of the **probing system (2.6)**. The translation from an **indicated measured point (2.12)** to a **corrected measured point (2.13)** is expressed by the equation:

$$\vec{M} = \vec{D} + \vec{T}$$

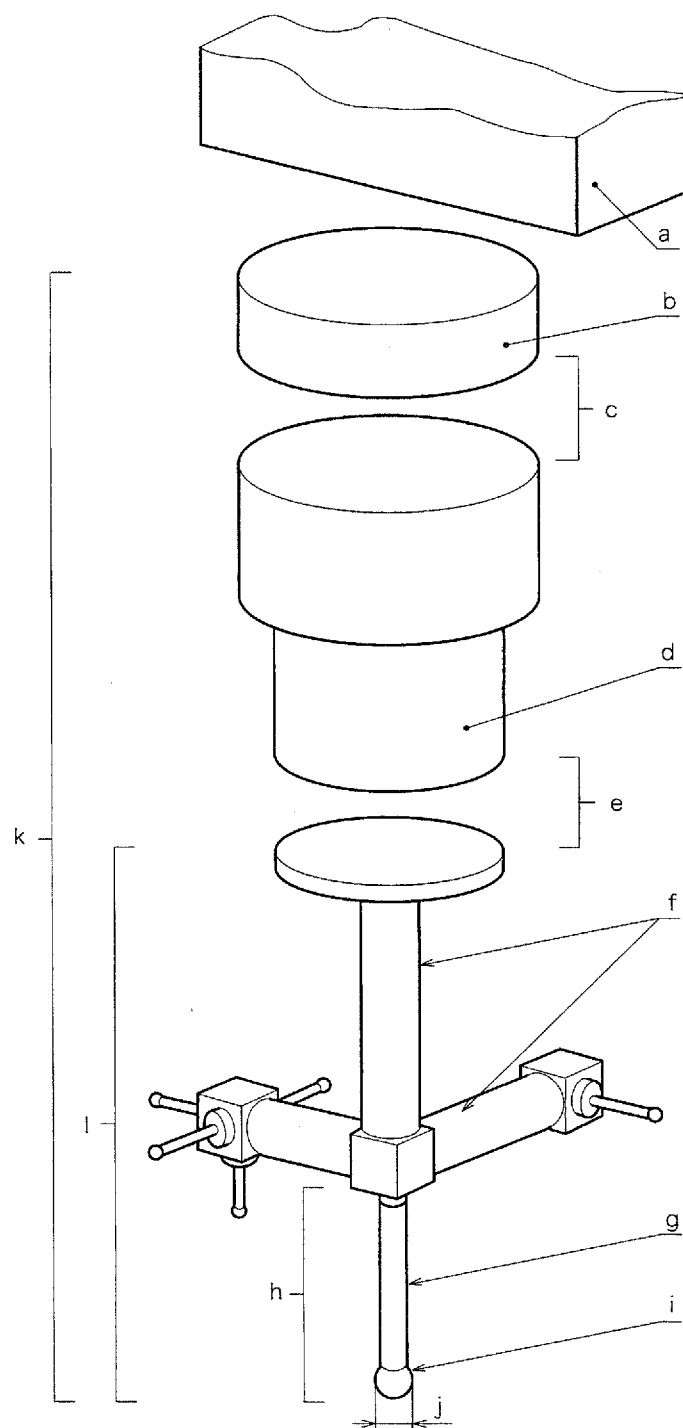
where

$\vec{M}$ is the vector of the corrected measured point;

$\vec{D}$ is the vector of the indicated measured point;

$\vec{T}$ is the tip correction vector.

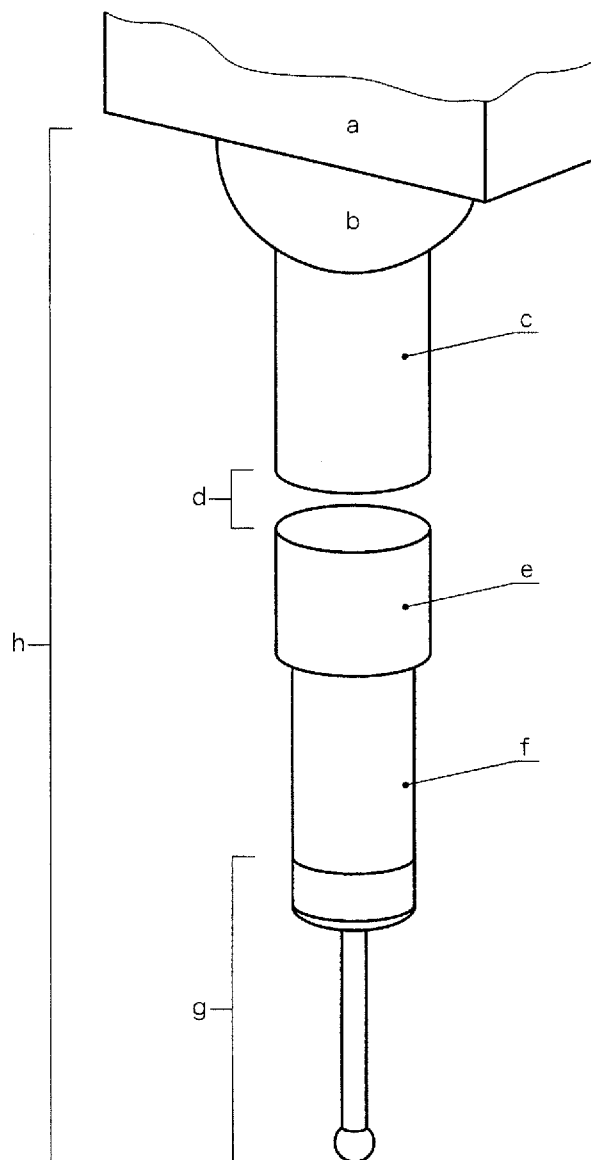
NOTE 2 The conventional practice is normally to use an approximate **stylus tip (4.2)** radius to establish the magnitude of this vector and an estimated surface normal to establish the direction. The tip diameter can include correction effects such as stylus shaft bending and is usually referred to as “effective tip diameter”.



Key

a	Ram	g	Stylus shaft
b	Probe extension	h	Stylus
c	Probe changing system	i	Stylus tip
d	Probe	j	Tip diameter
e	Stylus changing system	k	Probing system
f	Stylus extension	l	Stylus system (composed of stylus system components)

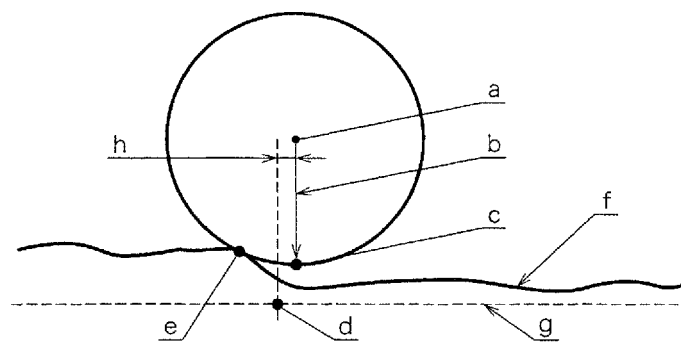
Figure 1 Probing system



Key

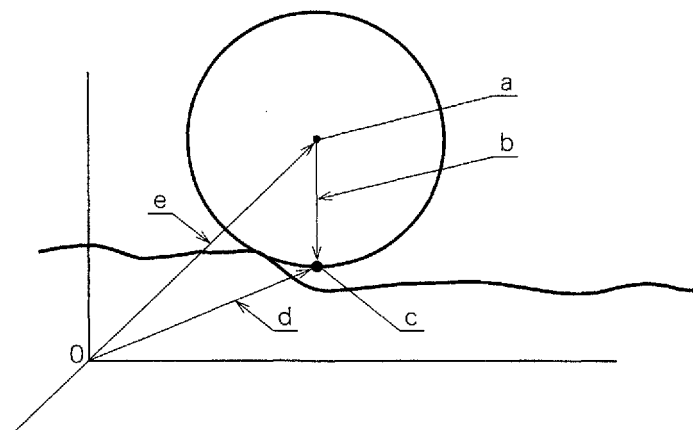
- | | |
|-------------------------|------------------------------|
| a Ram | e Probe |
| b Articulation system | f Stylus extension |
| c Probe extension | g Stylus |
| d Probe changing system | h Articulated probing system |

Figure 2 Articulating probing system



- | | | | |
|---|----------------------------------|---|-----------------------------------|
| a | Indicated measured point | e | Actual contact point |
| b | Tip correction vector, $\vec{T}$ | f | Real feature |
| c | Corrected measured point | g | Nominal feature, target scan line |
| d | Target contact point | h | Positional error |

Figure 3 Naming of points (simplified representation)



- | | | | |
|---|----------------------------------|---|---|
| a | Indicated measured point | d | Vector of the corrected measured point, $\vec{M}$ |
| b | Tip correction vector, $\vec{T}$ | e | Vector of the indicated measured point, $\vec{D}$ |
| c | Corrected measured point | | |

Figure 4 Tip correction vector (simplified representation)

2.17 acceptance test (of a CMM) set of operations agreed upon by the **CMM (2.1)** manufacturer and the user to verify that the performance of a CMM is as stated by the manufacturer

2.18 reverification test (of a CMM) test to verify that the performance of a **CMM (2.1)** is as stated by the user and executed according to the same procedures as those of the **acceptance test (2.17)**

2.19 interim check (of a CMM) test specified by the user and executed between revivifications to maintain the level of confidence in the measurements taken on the **CMM (2.1)**

2.20 Gaussian radial distance (R) distance between the centre of a Gaussian (least squares) sphere that is the associated feature based on a finite number of **corrected measured points (2.13)** on a spherical **material standard of size (8.2)**, and a corrected measured point on the same spherical material standard of size