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JAPANESE INDUSTRIAL STANDARD

Definitions and Designations of Geometrical Deviations

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Definitions and Designations of
Geometrical Deviations

B 0621-1984

1. Scope

This Japanese Industrial Standard specifies the definitions and designations of the formal deviations, orientational deviations, locational deviations, and run-outs, hereinafter generically referred to as the "geometrical deviations", of the considered objects.

Remark: The methods of designation and diagrammatical indication of geometrical tolerances which are the permissible values of geometrical deviations shall be based on JIS B 0021.

2. Definition

The definitions of the main terms used in this standard shall be as follows:

- (1) feature A point, line, axis, surface, or median surface as the object of geometrical deviations.
- (2) single feature A feature for which geometrical deviations are determined without relation to datums.
- (3) related feature A feature for which geometrical deviations are determined in relation to datums.
- (4) datum A theoretically exact geometrical reference established for determining the orientational deviation, locational deviation, run-outs, and the like of a feature. For example, where the geometrical reference is a point, straight line, axial straight line ⁽¹⁾, plane, or median plane, it is referred to as a datum point, datum straight line, datum axial straight line, datum plane, or datum median plane, respectively.

Note ⁽¹⁾ The axial straight line means an axis without any formal deviation, that is, an axis which is a geometrically exact straight line.

Remark: Details about datums shall be as specified in JIS B 0022.

Applicable Standards:

JIS B 0021-Indications of Geometrical Tolerances on Drawings

JIS B 0022-Datums and Datum-systems for Geometrical Tolerances

- (5) straight line feature A feature which is specified to be a straight line from the functional point of view. For example, a cross-sectional profile line which appears on the cross-section when a plane feature is cut with a plane normal to it, an axis, a generator of cylinder, a knife edge, or the like.
- (6) axis Among straight line features, the line connecting the centres of cross-sectional profile lines ⁽²⁾ on the respective cross-sections of a considered object specified to be a cylinder or rectangular parallelepiped.

Note ⁽²⁾ The centre of a cross-sectional profile line means, in a considered object specified to be a cylinder, the centre of the smallest circumscribed geometrically exact circle (in the case of a shaft) or that of the largest inscribed geometrically exact circle (in the case of a hole) of that cross-sectional profile line.

On the other hand, in a considered object specified as a rectangular parallelepiped, it means the centre of the smallest circumscribed geometrically exact rectangle (in the case of a shaft) or that of the largest inscribed geometrically exact rectangle (in the case of a hole) of that cross-sectional profile line.

- (7) plane feature A feature specified to be a plane from the functional point of view.
- (8) median surface Among plane features, the surface containing the median point of the straight line connecting two corresponding points on two surfaces which are specified to be symmetric with respect to the plane.
- (9) circular feature A feature specified to be a circle from the functional point of view. For example, a circle as a plane figure or a circular cross-section of a revolutional surface.
- (10) cylindrical feature A feature specified to be a cylindrical surface from the functional point of view.
- (11) profile of line The outline as an element of a surface specified to have a given form from the functional point of view.
- (12) profile of surface A surface specified to have a given form from the functional point of view.

3. Kinds of Geometrical Deviations

The kinds of geometrical deviations shall be as shown in the following Table:

Table. Kinds of Geometrical Deviations

Kind		Applicable features
Form deviations	Straightness Flatness Circularity Cylindricity	Single features
	Profile of any line Profile of any surface	Single features or related features
Orientational deviations	Parallelism Perpendicularity Angularity	Related features
Locational deviations	Positional deviation Coaxiality and concentricity Symmetricity	
Run-outs	Circular run-out Total run-out	

4. Definitions of Deviations

4.1 Straightness Straightness shall mean the size of deviation of a straight line feature from the geometrically exact straight line, hereinafter referred to as the "geometrical straight line".

4.2 Flatness Flatness shall mean the amount of deviation of a plane feature from the geometrically exact plane, hereinafter referred to as the "geometrical plane".

4.3 Circularity Circularity shall mean the amount of deviation of a circular feature from the geometrically exact circle, hereinafter referred to as the "geometrical circle".

4.4 Cylindricity Cylindricity shall mean the amount of deviation of a cylindrical feature from the geometrically exact cylinder, hereinafter referred to as the "geometrical cylinder".

4.5 Profile of Any Line Profile of any line shall mean the amount of deviation of a line profile from the geometrically exact profile, hereinafter referred to as the "geometrical profile", determined by theoretically exact dimensions.

This deviation may be related or not related to a datum.

4.6 Profile of Any Surface Profile of any surface shall mean the amount of deviation of a surface profile from the geometrical profile specified by theoretically exact dimensions.

This deviation may be related or not related to a datum.

4.7 Parallelism Parallelism shall mean the amount of deviation of a straight line feature or plane feature, which is supposed to be parallel to the datum straight line or datum plane, from the geometrical straight line or geometrical plane parallel to the datum straight line or datum plane.

4.8 Perpendicularity Perpendicularity shall mean the amount of deviation of a straight line feature or plane feature, which is supposed to be perpendicular to the datum straight line or datum plane, from the geometrical straight line or geometrical plane perpendicular to the datum straight line or datum plane.

4.9 Angularity Angularity shall mean the amount of deviation of a straight line feature or plane feature, which is supposed to have a theoretically exact angle against the datum straight line or datum plane, from the geometrical straight line or geometrical plane having the theoretically exact angle against the datum straight line or datum plane.

4.10 Positional Deviation Positional deviation shall mean the amount of deviation of a point, straight line feature, or plane feature from the theoretically exact position specified in relation to a datum or other feature.

4.11 Coaxiality Coaxiality shall mean the amount of deviation of an axis, which is supposed to be on the same straight line as the datum axial straight line, from the datum axial straight line.

Remark: In the case of a plane figure, the amount of deviation of the position of the centre of another circular feature from the centre of the datum circle is termed concentricity.

4.12 Symmetricity Symmetricity shall mean the amount of deviation of features, which are supposed to be symmetrical to each other with respect to the datum axial straight line or datum median plane, from the positions of symmetry.

4.13 Circular Run-Out Circular run-out shall mean the amount of displacement of the surface of the considered object at a specified position or any position in the specified direction ⁽³⁾ when the considered object, which is supposed to have a surface of revolution about the datum axial straight line or which is supposed to be a circular plane perpendicular to the datum axial straight line, is rotated about the datum axial straight line.

Note (³) The specified direction shall mean either the direction of a straight line intersecting the datum axial straight line and normal to the datum axial straight line (radial direction), the direction parallel to the datum axial straight line (axial direction), or the direction of a straight line intersecting the datum axial straight line and oblique to the datum axial straight line (normal direction to the feature and specified direction, but obliquely to the datum axis, respectively).

4.14 Total Run-Out Total run-out shall mean the amount of displacement of the surface of the considered object in the specified direction (⁴) when the considered object, which is supposed to have a cylindrical surface with respect to the datum axial straight line or which is supposed to be a circular plane normal to the datum axial straight line, is rotated around the datum axial straight line.

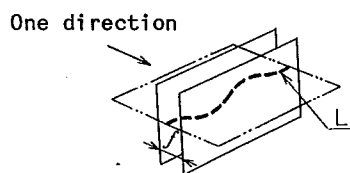
Note (⁴) The specified direction shall mean a direction normal to the datum axial straight line (radial direction) or the direction parallel to the datum axial straight line (axial direction).

5. Indication

5.1 Straightness Straightness shall be represented as "straightness mm" or "straightness μm " by the following methods according to the size of the region occupied by a straight line feature.

- (1) Straightness in One Direction Straightness in one direction shall be represented by the distance (f) between the two planes in the case where the distance between the two parallel planes becomes minimum when the considered straight line feature (L) is held between the two geometrically exact parallel planes, hereinafter referred to as the "two geometrical parallel planes", normal to that direction (Fig. 1).

Fig. 1



Remark: Where the said direction is, for example, a horizontal direction or vertical direction, the straightness shall be referred to as "straightness in horizontal direction" or "straightness in vertical direction", respectively.

- (2) Straightness in Two Directions Normal to Each Other Straightness in two directions normal to each other [for example, the horizontal and vertical directions referred to in the Remark of 5.1 (1)] shall be represented by the distances (f_1 , f_2) between two planes (that is, the lengths of two sides of the rectangular parallelepiped defined by two sets of two parallel planes) in the case