

JAPANESE INDUSTRIAL STANDARD

JIS B 0401-1986

System of limits and fits

1995. 2.

ERRATA

Page	Position	Wrong	Correct
23	Formula, Position of tolerance zone "ef" of Shaft in Appendix 1 Table 5	Geometrical mean of values for E and F or f and g	Geometrical mean of values for E and F or e and f
23	Formula, Position of tolerance zone "fg" of Shaft in Appendix 1 Table 5	Geometrical mean of values for F and G or e and f	Geometrical mean of values for F and G or f and g

Remarks: This errata is for correcting the fourth edition of this Standard.

Japanese Standards Association

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System of Limits and Fits

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JAPANESE INDUSTRIAL STANDARD

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System of Limits and Fits

B 0401-1986

1. Scope

This Japanese Industrial Standard specifies the system of limits and fits of features having basic sizes up to 3150 mm including.

- Remarks 1. The limit system of this Standard mainly deals with the cylindrical features but also can be applied to features other than the cylinder.
2. The fit system of this Standard applies only to fits of simple geometrical forms, such as cylindrical features, or the feature containing or contained by two parallel planes, etc.
3. When there is a standard ⁽¹⁾ specifying the limit system for specific working method, that standard may be applied, or when special precision is not required for practical function, the permissible deviations without tolerance indication ⁽²⁾ may be applied.

Notes ⁽¹⁾ For example, JIS B 0415.

⁽²⁾ For example, JIS B 0405.

2. Definitions

The definitions of principal terms used in this Standard shall be as follows:

- (1) feature The portion of a mechanical part to which the system of limits and fits is applied.
- (2) internal feature Feature forming the inside of an object.
- (3) external feature Feature forming the outside of an object.

Applicable Standards, Corresponding International Standard and Reference Standards: See page 38.

- (4) hole This refers mainly to the cylindrical internal feature but also includes the internal feature with a non-cylindrical section.
- (5) shaft This refers mainly to the cylindrical external feature but also includes the external feature with a non-cylindrical section.
- (6) size Quantity expressing magnitude of a feature. For example, diameters of a hole and a shaft and it is, in general, expressed in the unit of mm.
- (7) actual size Size of feature as practically obtained.
- (8) limits of size The two extreme permissible sizes of a part determined so that the actual size should lie between them, i.e., the maximum limit of size and the minimum limit of size (Fig. 1).
- (9) maximum limit of size The largest size permissible to the feature (Fig. 1).
- (10) minimum limit of size The smallest size permissible to the feature (Fig. 1).
- (11) basic size Size to be referred to as the standard to which the upper and lower deviations are assigned to form the limits of size (Fig. 1 and Fig. 2).
 Remark: The basic size shall be expressed by integers or decimals.
 Example: 32, 15, 8.75, 0.5
- (12) deviations Algebraical difference between the size (the actual size, the limits of size, etc.) and the corresponding basic size, i.e., (size) - (basic size).
- (13) limit system System of standardized tolerances and deviations.
- (14) upper deviation Algebraical difference between the maximum limit of size and the corresponding basic size, i.e., (maximum limit of size) - (basic size) (Fig. 1 and Fig. 2).
 Remark: The upper deviation of the hole shall be indicated by symbol *ES* and that of the shaft by symbol *es* (see 4.1.4).
- (15) lower deviation Algebraical difference between the minimum limit of size and the corresponding basic size, i.e., (minimum limit of size) - (basic size) (Fig. 1 and Fig. 2).
 Remark: The lower deviation of the hole shall be indicated by symbol *EI* and that of the shaft by symbol *ei* (see 4.1.4.).
- (16) tolerance Difference between the maximum limit of size and the minimum limit of size, i.e., the difference between the upper deviation and the lower deviation (Fig. 1 and Fig. 2).
- (17) zero line In a graphical representation of limits and fits, straight line which represents the basic size, and to which the deviations are referred (Fig. 1 and Fig. 2).

(18) fundamental deviation The deviation which defines the position of the tolerance zone in relation to the zero line. It is either the upper deviation or the lower deviation and ordinarily the one nearer to the zero line.

(19) standard tolerance Any tolerance belonging to this system of limits and fits.

Remark: The standard tolerance shall be indicated by symbol *IT*.

(20) grade of tolerance In this system of limits and fits, a group of tolerances belonging to the same level of accuracy for all basic sizes.

Remark: The grade of tolerance shall be indicated by the symbol *IT* followed by a number representing the grade, for example, *IT 7*.

(21) tolerance zone In a graphical representation of tolerances, zone comprised between two lines representing the maximum and minimum limits of size and defined by the magnitude of the tolerance and by its position in relation to the zero line (Fig. 2).

(22) tolerance zone class Combination of the position of a tolerance zone and the grade of the tolerance.

Fig. 1

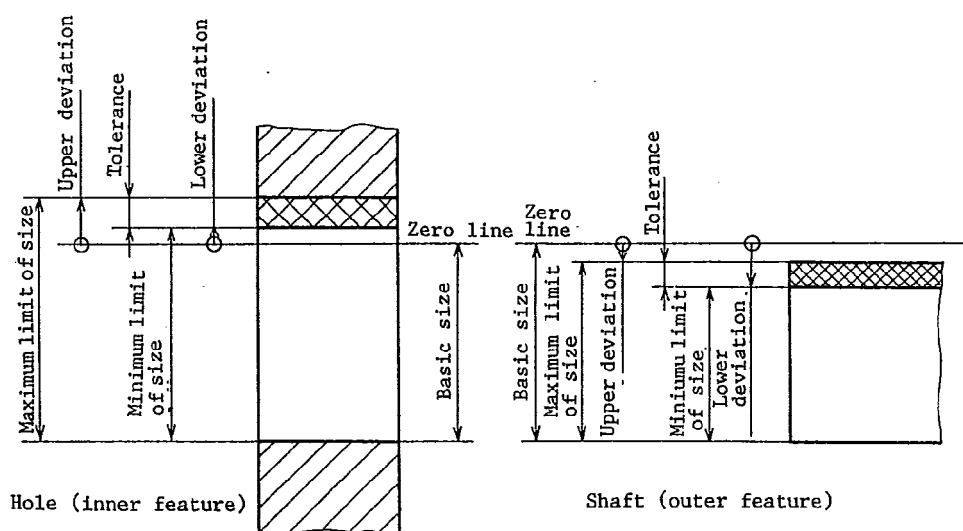
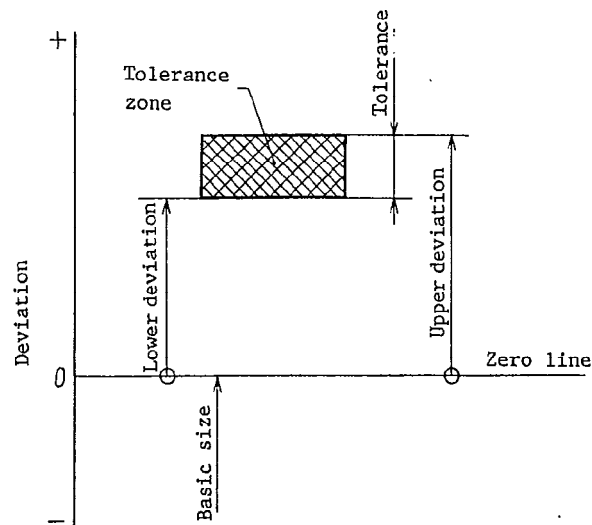


Fig. 2



Remark: This figure is simplified in order to indicate only the relation between tolerance zone, deviations and zero line. In such a simplified figure, the zero line is drawn horizontally and positive deviations are shown above and negative deviations below it.

- (23) tolerance unit Factor expressed as a function of the basic size and used as a basis for the determination of the standard tolerances.

Remark: The tolerance unit i shall be used for the basic size up to 500 mm inclusive and the tolerance unit IT for the basic size above 500 mm.

- (24) maximum material size Limit of size in which the feature is in the maximum material condition of size. Namely, for the internal feature, it is the minimum limit of size and for the external feature, the maximum limit of size.
- (25) minimum material size Limit of size in which the feature is in the minimum material condition of size. Namely, for the internal feature, it is the maximum limit of size and for the external feature, the minimum limit of size.
- (26) fit Relationship resulting from the difference, before assembly, between the sizes of the hole and the shaft.
- (27) clearance Difference between the sizes of the hole and the shaft when the size of the hole is larger than the size of the shaft (Fig. 3).

- (28) minimum clearance In a clearance fit, the difference between the minimum limit of size of the hole and the maximum limit of size of the shaft (Fig. 4).
- (29) maximum clearance In a clearance fit or a transition fit, the difference between the maximum limit of size of the hole and the minimum limit of size of the shaft (Fig. 4 and Fig. 5).
- (30) interference The difference between the sizes of the hole and the shaft, before assembly, when the size of the hole is smaller than the size of the shaft (Fig. 6).
- (31) minimum interference In an interference fit, the difference between the maximum limit of size of the hole and the minimum limit of size of the shaft, before assembly (Fig. 7).
- (32) maximum interference In an interference fit or a transition fit, the difference between the minimum limit of size of the hole and the maximum limit of size of the shaft, before assembly (Fig. 5 and Fig. 7).
- (33) clearance fit Fit which always provides a clearance in assembly. Namely, in a graphical representation of this fit, the tolerance zone of the hole is entirely above that of the shaft (Fig. 8).
- (34) interference fit Fit which always provides an interference in assembly. Namely, in a graphical representation of this fit, the tolerance zone of the hole is entirely below that of the shaft (Fig. 9).
- (35) transition fit Fit which may provide either a clearance or an interference in assembly, depending on the actual sizes of the hole and the shaft. Namely, in a graphical representation of this fit, the tolerance zones of the hole and the shaft overlap completely or partially (Fig. 10).
- (36) variation of fit Algebraical sum of the tolerances of the hole and the shaft to be assembled.
- (37) fit system System of fits comprising holes and shafts belonging to a certain limit system.
- (38) hole-basis system of fits Fit system in which the necessary clearances or interferences are obtained in associating the shafts of various tolerance zone classes with the hole of single tolerance zone class. In this standard, the fit system in which the minimum limit of size of the hole is equal to the basic size, i.e., the lower deviation of the hole is zero (Fig. 11).
- (39) shaft-basis system of fits Fit system in which the necessary clearances or interferences are obtained in associating the holes of various tolerance zone classes with the shaft of a single tolerance zone class. In this standard, the fit system in which the maximum limit of size of the shaft is equal to the basic size, i.e., the upper deviation of the shaft is zero (Fig. 12).

- (40) basic hole Hole chosen as a basis for a hole-basis system of fits.
In this standard, the lower deviation of the hole is zero.
- (41) basic shaft Shaft chosen as a basis for a shaft-basis system of fits.
In this standard, the upper deviation of the shaft is zero..

3. Condition of Temperature

For the dimensions defined in this standard, the standard reference temperature is 20°C.

4. Symbols and Designation

4.1 Symbols for Grades of Tolerances and Tolerance Zone Classes

4.1.1 Grades of Tolerances The grade of tolerance shall be designated by symbol IT followed, by a number representing grade, for example, IT 7.

4.1.2 Positions of Tolerance Zones The position of the tolerance zone for holes shall be indicated by a capital letter symbol from A to ZC and the position of the tolerance zone for shafts by a small letter symbol from a to zc (Fig. 13). However, in order to prevent mistakes, the following letters shall not be used.

I, L, O, Q, W, i, l, o, q, w.

Remark: For example, the hole at the position of tolerance zone H is abridged to be called as hole H and the shaft at the position of tolerance zone h as shaft h.

4.1.3 Tolerance Zone Classes The tolerance zone class shall be indicated by the symbol for the position of tolerance zone followed by a number representing the grade of tolerance.

Examples: In the case of hole H 7, in the case of shaft h 7

Fig. 3

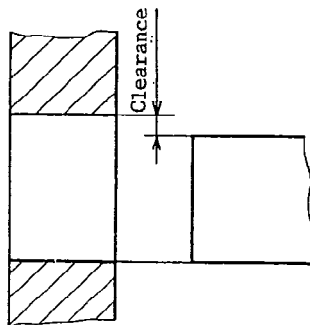


Fig. 4

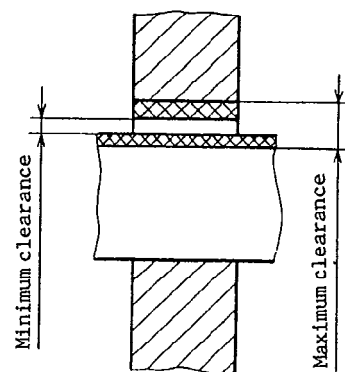


Fig. 5

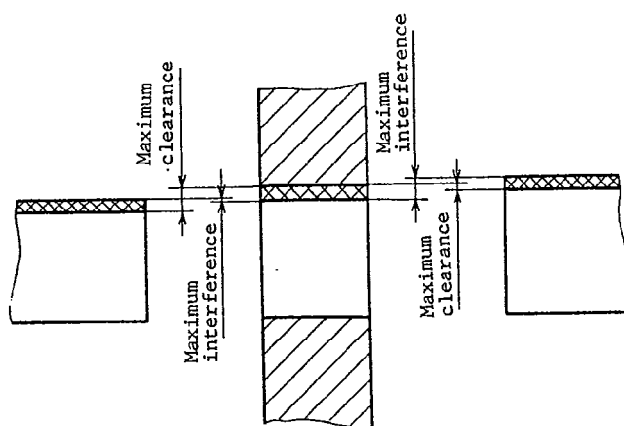


Fig. 6

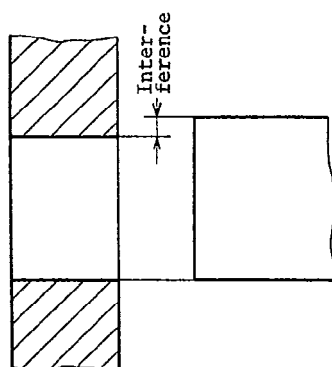


Fig. 7

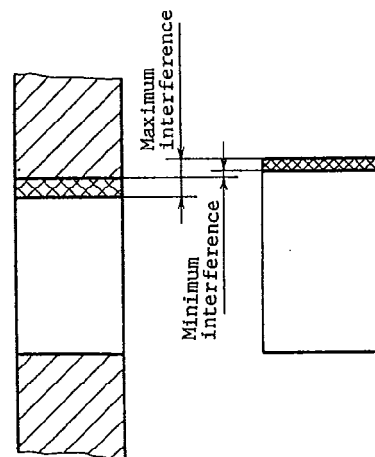


Fig. 8

Clearance fit

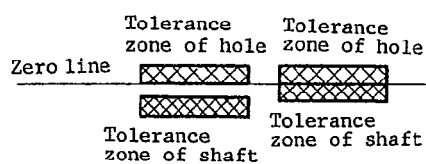


Fig. 9

Interference fit

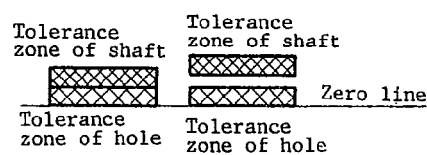


Fig. 10

Transition fit

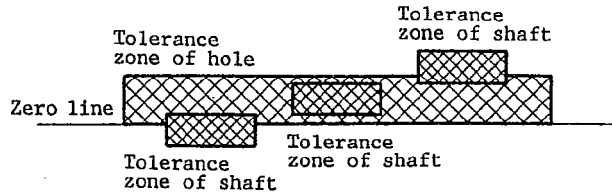


Fig. 11

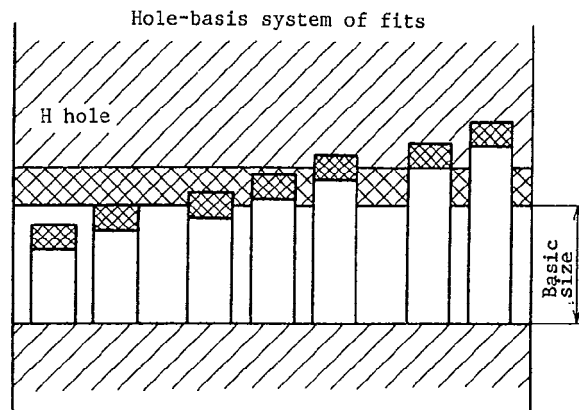


Fig. 12

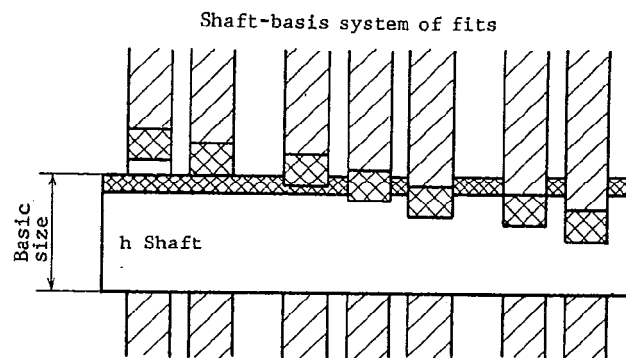
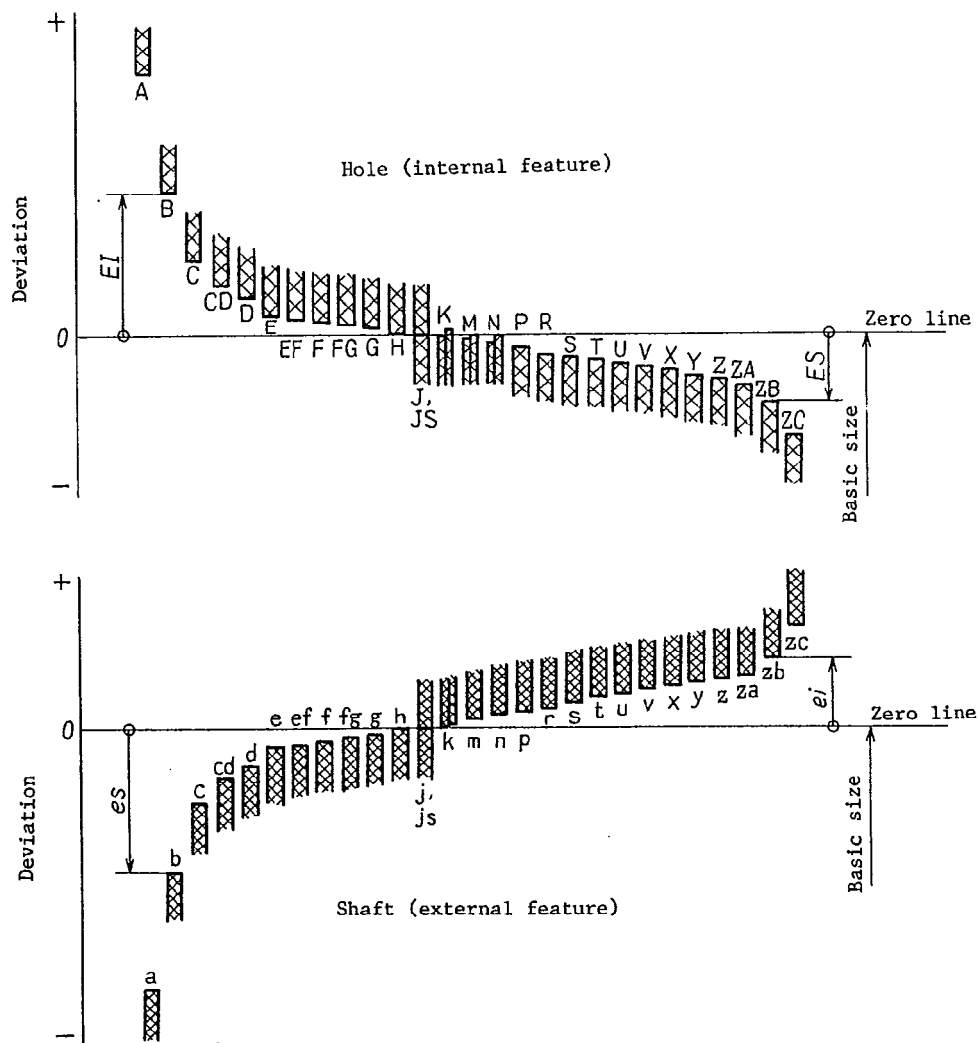


Fig. 13



Remark: In general, the fundamental deviation is the deviation defining the limit of size nearer to the zero line.

4.1.4 Deviations The symbols for deviations shall be as follows:

- (1) Upper Deviation The upper deviation of a hole shall be indicated by symbol ES and the upper deviation of a shaft by symbol es .
- (2) Lower Deviation The lower deviation of a hole shall be indicated by symbol EI and the lower deviation of a shaft by symbol ei .

4.2 Indication of Permissible Limits of Size The permissible limits of size shall be indicated by the basic size followed by the symbol of tolerance zone class, hereinafter referred to as the "tolerance symbol" or the values of deviations.

Examples: 32 H 7 80 js 15 100 g 6 100 $\begin{smallmatrix} -0.012 \\ -0.034 \end{smallmatrix}$

Remarks 1. In the case where the communication is conducted by a device with a limited number of characters such as telex, in order to discriminate a hole from a shaft, the basic size shall be preceded by H or h for holes and S or s for shafts.

Examples: 50 H 5 shall be indicated as H 50 H 5 or h 50 h 5, and 50 h 6 as S 50 H 6 or s 50 h 6.

2. Permissible limits of size are, on occasion, indicated directly by limits of size. In this case, the maximum limit of size is indicated in the upper position and the minimum limit of size is placed in the lower position.

Example: 99.988
99.966

4.3 Indication of Fits A fit is indicated by the basic size common to the hole and the shaft, followed by the tolerance symbols of the hole and of the shaft successively.

Example: 52 H 7/g 6 52 H 7—g 6 or 52 $\frac{H 7}{g 6}$

Remark: In the case where the communication is conducted by a device with a limited number of characters such as telex, in order to discriminate a hole from a shaft, the basic size shall be indicated separately for the hole and the shaft and at the same time, it shall be preceded by H or h for the hole and by S or s for the shaft.

Example: 52 H 7/g 6 shall be replaced by H 52 H 7/S 52 G 6 or h 52 h 7/s 52 g 6.

5. Indication of Permissible Limits of Size and Form Deviations

5.1 In the Case of No Special Indication The indication of the permissible limits of size of the feature having no special indication does not regulate its form deviations ⁽³⁾. In this case, the size shall, in general, be determined by the two-point measurement.

Note ⁽³⁾ See JIS Z 8310 and JIS Z 8318.

5.2 In the Case Where Condition of Envelopment Is Indicated A feature for which condition of envelopment ⁽⁴⁾ is specified shall not exceed the envelope of the complete form with a maximum material size. The condition of envelopment shall be indicated by symbol $\ominus$.

Note ⁽⁴⁾ See JIS Z 8318.

Remark: In such a case where the features to be assembled are required to be fit, the condition of envelopment is occasionally necessary.