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JIS B 1702-2 : 1998
(ISO 1328-2 : 1997)

**Cylindrical gears—
ISO system of accuracy—
Part 2 : Definitions and allowable
values of deviations relevant to
radial composite deviations and
runout information**

ICS 21.200

Descriptors : gear drives, cylindrical shape, accuracy, definitions, tolerances
(measurement), spur gears, dimensional tolerances

Reference number : JIS B 1702-2 : 1998 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

The traditional **JIS** and the International Standards differ in many items such as gear accuracy system and the evaluation method. Therefore, in order to conform with the International Standards, **JIS B 1702** was withdrawn and replaced with **JIS B 1702-1** *Cylindrical gears—ISO system of accuracy—Part 1 : Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth* and **JIS B 1702-2** *Cylindrical gears—ISO system of accuracy—Part 2 : Definitions and allowable values of deviations relevant to radial composite deviations and runout information*.

In addition, it is recommended that the accuracy grades in this Standard be denoted as N○ grade, prefixing “N” to avoid confusion.

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4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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

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Cylindrical gears—ISO system of accuracy— Part 2 : Definitions and allowable values of deviations relevant to radial composite deviations and runout information

0 Introduction This Japanese Industrial Standard has been prepared based on the first edition of **ISO 1328-2 Cylindrical gears—ISO system of accuracy—Part 2 : Definitions and allowable values of deviations relevant to radial composite deviations and runout information** published in 1997 without modifying the technical contents.

1 Scope This Standard establishes a system of accuracy relevant to radial composite deviations of individual cylindrical involute gears. It specifies the appropriate definitions of gear tooth accuracy terms, the structure of the gear accuracy system and the allowable values of the above mentioned deviations.

The radial measurement accuracy system has different grade ranges than elemental ranges in **JIS B 1702-1**. The diameter and module ranges for radial composite deviations and runout are also different.

The radial composite accuracy system comprises 9 accuracy grades for F_i'' or f_i'' of which grade 4 is the highest and grade 12 is the lowest. The module range extends from 0.2 mm to 10 mm and the diameter range from 5.0 mm to 1 000 mm, see clauses 6 and 7. Annex A gives tables based on the formulae in clause 7.

Runout is defined in annex B and values are not given in the standard for determining accuracy grade 6. Annex B provides information on runout for use if agreed upon between purchaser and manufacturer.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ISO 701 : 1976 *International gear notation—Symbols for geometrical data*

ISO 1122-1 : 1983 *Glossary of gear terms—Part 1 : Geometrical definitions*

JIS B 1702-1 : 1998 *Cylindrical gears—ISO system of accuracy—Part 1 : Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth*

ISO/TR 10064-2 : 1996 *Cylindrical gears—Code of inspection practice—Part 2 : Inspection related to radial composite deviations, runout, tooth thickness and backlash*

3 Definitions For the purposes of this Standard, the definitions given in **ISO 1122-1** apply.

4 Symbols, quantities and units Symbols are based on those given in **ISO 701**. Only symbols for quantities used in this Standard are given in table 1.

Table 1 Symbols used within JIS B 1702-2

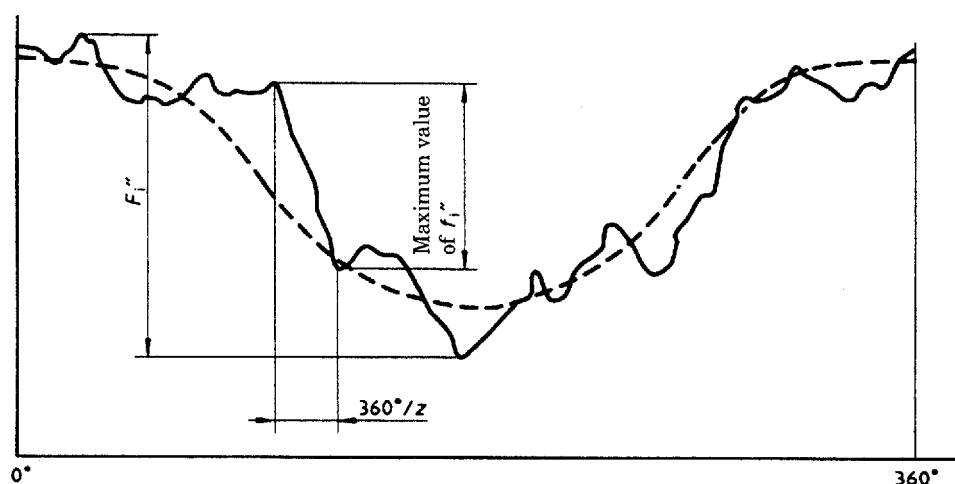
Symbol	Quantity	Unit
d	reference diameter	mm
m_n	normal module	mm
ε_β	overlap ratio	—
f_i''	tooth-to-tooth radial composite deviation	μm
F_i''	total radial composite deviation	μm
L_{AE}	active length	mm
Q	accuracy grade number	—
z	number of teeth	—
F_r	runout	μm

5 Gear tooth accuracy terms relevant to radial composite deviations

5.1 Product gear In this Standard, the “product gear” is the gear which is being measured or evaluated.

5.2 Radial composite deviations Measured values of radial composite deviations are affected by the accuracy of the master gear and the total contact ratio of the product gear with the master gear (refer to **ISO/TR 10064-2**).

5.3 Total radial composite deviation, F_i'' Total radial composite deviation, F_i'' , is the difference between the maximum and minimum values of centre distance which occur during a radial (double-flank) composite test, when the product gear with its right and left flank simultaneously in contact with those of the master gear, is turned through one complete revolution. Figure 1 shows an example of a relevant diagram.

**Figure 1 Radial composite deviation diagram**

5.4 Tooth-to-tooth radial composite deviation, f_i'' Tooth-to-tooth radial composite deviation, f_i'' , is the value of the radial composite deviation corresponding to one pitch, $360^\circ/z$, during the complete cycle of engagement of all the product gear teeth (see figure 1). The maximum value f_i'' of all the product gear teeth should not exceed the specified allowable value.

5.5 Master gear The master gear for a radial composite test should engage the product gear over the "active length", L_{AE} , as defined in **JIS B 1702-1**.

The tolerances have been established for spur gears and can be used to determine an accuracy grade. Since the overlap ratio, ε_β , may influence the results of radial composite measurements of helical gears, the master gear used shall be subject to agreement between purchaser and manufacturer. When used for helical gears, the master gear facewidth should be such that ε_β is less than or equal to 0.5 with the product gear.

6 Structure of the gear accuracy system Determination of the accuracy grade by measurement of radial composite deviations in accordance with **JIS B 1702-1** does not imply that the elemental deviations (e.g. pitch, profile, lead, etc.) will conform to the same grade. Statements in documents concerning required accuracy shall include reference to the relevant standard, **JIS B 1702-1** or this Standard as appropriate.

The tolerances for radial composite deviation apply only to the inspection of a gear running with a master gear. They do not apply to the measurement of two product gears running together.

6.1 Gear accuracy Gear accuracy is evaluated by comparing measured deviations against the numerical values determined according to clause 7. In this Standard, the values calculated using the formulae apply to accuracy grade 5. The step factor between two consecutive grades is equal to $\sqrt{2}$; i.e., values of each next higher (lower) grade are determined by multiplying (dividing) by $\sqrt{2}$. The required value for any accuracy grade can be determined by multiplying the un-rounded calculated value for accuracy grade 5 by 2 to exponent $[0.5(Q - 5)]$, where Q is the accuracy grade of the required value.

When gear geometry is not within the specified ranges of clause 1, use of the formulae shall be agreed upon between purchaser and manufacturer.

6.2 Validity of radial composite deviation When tolerance values are small, particularly when less than 5 μm , the measuring apparatus including the master gear shall be of sufficiently high precision as to ensure that values can be measured and repeated with the required accuracy.

The tolerances have been established for spur gears and can be used to determine an accuracy grade. However, subject to agreement between purchaser and manufacturer they can similarly be used for helical gears. See also 5.5.

7 Formulae for grade 5 accuracy tolerances for radial composite deviations Use the actual values of module and diameter in the following formulae.

a) Total radial composite deviation, F_i''

$$F_i'' = 3.2m_n + 1.01\sqrt{d} + 6.4$$