BRITISH STANDARD

BS 436-4:
1996
ISO 1328-1:
1995

Incorporating Amendment No. 1

Cylindrical gears — ISO system of accuracy —

Part 4: Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth

ICS 21.200

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee MCE/5, Gears, upon which the following bodies were represented:

British Engineers Cutting Tools Association
British Gear Association
British Horological Federation
British Horological Institute
Engineering Equipment and Materials Users' Association
Federation of Manufacturers of Construction Equipment and Cranes
Gauge and Tool Makers' Association
Institution of Mechanical Engineers
Lloyds Register of Shipping
London Underground Ltd.
Ministry of Defence
Power Generation Contractors Association (PGCA)(BEAMA Ltd.)

The following body was also represented in the drafting of the standard, through subcommittees and panels:

Cranfield University

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 June 1996

The following BSI references relate to the work on this standard:
Committee reference MCE/5
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Amendments issued since publication

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9588	August 1997	Indicated by a sideline in the margin

Contents

National foreword

This British Standard has been prepared by Technical Committee MCE/5 and is identical with ISO 1328 *Cylindrical gears — ISO system of accuracy —* Part 1:1995 *Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth,* published by the International Organization for Standardization (ISO).

ISO 1328 was prepared by the Technical Committee ISO/TC 60, Gears, in which the UK played an active part.

This British Standard supsersedes the following British Standards which are declared obsolescent:

BS 436, *Spur and helical gears* — Part 1:1967 *Basic rack form, pitches and accuracy (diametral pitch series).*

BS 436, *Spur and helical gears* — Part 2:1970 *Basic rack form, modules and accuracy (1 to 50 metric module).*

Additional information. Users of this British Standard should note that preferred sizes for modules should be in accordance with ISO 54:1977 *Cylindrical gears for general engineering and for heavy engineering — Modules and diametrical pitches.*

Also, the rack form should be in accordance with ISO 53:1974 *Cylindrical gears for general and heavy engineering — Basic rack.*

Cross-reference. The Technical Committee has reviewed the provisions of ISO/TR 10064-1:1992, to which normative reference is made in the text, and has decided that they are suitable for use in conjunction with this standard.

NOTE It has been found that BS 436-4:1996 contained the following errors which have been corrected in Amendment 1.

In Figure 1	the projection lines for dimension F_{pk} and p_t have been moved to coincide with the difference between the theoretical and actual tooth profile;
In note 9	“profile” has been replaced by “helix” in line 1;
In Figure 2	the shape of the actual profile has been modified in several of the diagrams;
In Figure 3	the shape of the actual helix has been modified in several of the diagrams. Also, the text for “Key iii)” has been corrected;
In Annex C	the Bibliography has been updated.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 26, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

Together with definitions and allowable values of gear element deviations, ISO 1328:1975 also provided advice on appropriate inspection methods.

In the course of revising ISO 1328:1975 and taking into account several important aspects, it was agreed that the description and advice on gear inspection methods should be published as Technical Reports and that together with parts 1 and 2 of ISO 1328, a system of standards and technical reports (listed in clause **2** and Annex C) should be established.

1 Scope

This part of ISO 1328 establishes a system of accuracy relevant to corresponding flanks of individual cylindrical involute gears.

It specifies appropriate definitions for gear tooth accuracy terms, the structure of the gear accuracy system and the allowable values of pitch deviations, total profile deviations and total helix deviations.

This part of ISO 1328 applies only to each element of a toothed wheel taken individually; it does not cover gear pairs as such.

It is strongly recommended that any user of this part of ISO 1328 be very familiar with the methods and procedures outlined in ISO/TR 10064-1. Use of techniques other than those of ISO/TR 10064-1 combined with the limits described in this part of ISO 1328 may not be suitable.

Annex A gives formulae for tolerances for tangential composite deviations which are also criterions of ISO quality, but are not mandatory inspection items.

Annex B provides values on profile and helix form and slope deviations which sometimes serve as useful information and evaluation values but are not mandatory inspection items.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 1328. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1328 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/TR 10064-1:1992, *Cylindrical gears — Code of inspection practice — Part 1: Inspection of corresponding flanks of gear teeth.*

3 Definitions

For the purposes of this part of ISO 1328, the following definitions apply.

For the symbols not explained in this clause, see clause **4**.

3.1 Pitch deviations

3.1.1
single pitch deviation (f_{pt})

algebraic difference between the actual pitch and the corresponding theoretical pitch in the transverse plane, defined on a circle concentric with the gear axis at approximately mid-depth of the tooth (See Figure 1.)

3.1.2
cumulative pitch deviation (F_{pk})

algebraic difference, over any sector of k pitches, between the actual length and the theoretical length of the relevant arc. (See Figure 1.) In theory, it is equal to the algebraic sum of the single pitch deviations of the same k pitches

NOTE 1 Unless otherwise specified, evaluation of F_{pk} is limited to sectors not larger than one-eighth of the circumference. Hence, allowable values of deviations F_{pk} apply to sectors of which the number of pitches (k) ranges from 2 to the number nearest to $z/8$. Generally, evaluation of $F_{pz/8}$ is sufficient. If for special applications (e.g. for high-speed gears) smaller sectors are also to be checked, the relevant value(s) of k should be specified.

3.1.3
total cumulative pitch deviation (F_p)

maximum cumulative pitch deviation of any sector (with $k = 1$ up to $k = z$) of the corresponding flanks of a gear. It is represented by the total amplitude of the cumulative pitch deviation curve

3.2 Profile deviations

3.2.1 Profile deviation

Amount by which an actual profile deviates from the design profile. It is in the transverse plane and normal to the involute profile.

3.2.1.1
usable length (L_{AF})

difference between the lengths of two transverse base tangents, of which one extends from the base circle to the outer limit and the other extends from the base circle to the inner limit of the usable profile

depending on the design, the usable length is limited by the tooth tip, by the start of tip chamfer or tip rounding (point A). Towards the root of the tooth, the usable length is limited either by the beginning of the root fillet or by the undercut (point F)

3.2.1.2
active length (L_{AE})

that part of the usable length which is related to the active profile. Towards the tooth tip, it has the same limit as the usable length (point A). Towards the root of the tooth, the active length extends to the endpoint E of the effective contact with the mating gear (start of the active profile). If the mating gear is unknown, point E is the start of the active profile of engagement with a rack having standard basic rack tooth proportions

3.2.1.3
profile evaluation range (L_α)

that part of the usable length to which the tolerances of the specified accuracy grade shall apply. Unless otherwise specified, its length is equal to 92 % of the active length L_{AE}, extending from point E (See Figure 2.)

NOTE 2 It is the responsibility of the gear designer to assure that the profile evaluation range is adequate for the application.

for the remaining 8 % of L_{AE}, which is the zone near the tip expressed by the difference between L_{AE} and $L\alpha$, the following evaluation rules apply for the total profile deviation and the profile form deviation:

a) excess material (plus deviation) which increase the amount of deviation shall be taken into account;

b) unless otherwise specified, for minus deviations, the tolerance shall be three times the tolerance specified for the evaluation range L_α.

NOTE 3 For analysis of the profile form deviation, evaluations a) and b) are based on the mean profile trace defined in **3.2.1.5**.

3.2.1.4
design profile

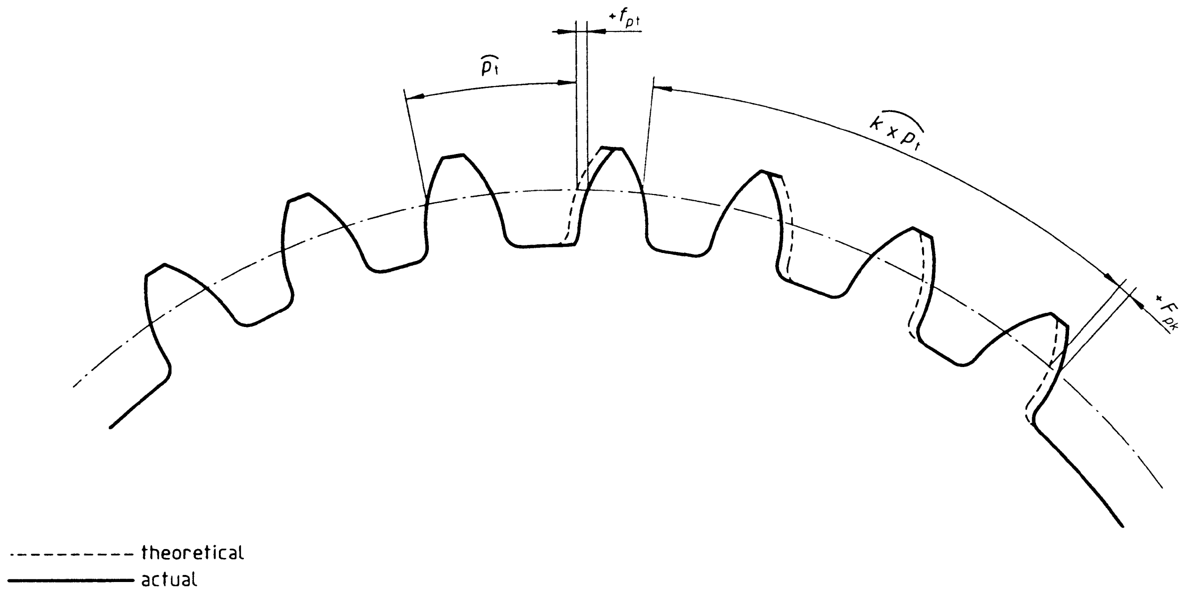
a profile consistent with the design specification. When not otherwise qualified, it is the profile in a transverse plane

NOTE 4 In a profile diagram, the profile trace of an unmodified involute generally appears as a straight line. In Figure 2, the design profile traces are shown as chain-dotted lines.

3.2.1.5
mean profile of a measured flank

a trace determined by subtracting from the ordinates of the design profile trace the corresponding ordinates of a straight-line gradient. This is to be so done that, within the evaluation range, the sum of the squares of deviations of the actual profile trace from the mean profile trace is minimal. Thus, the position and the gradient of the mean profile trace is found by the "least-squares method"

NOTE 5 This profile is an aid in the determination of $f_{f\alpha}$ [Figure 2 b)] and $f_{H\alpha}$ [Figure 2 c)].



In this example $F_{pk} = F_{p3}$

Figure 1 — Pitch deviations

3.2.2
total profile deviation (F_α)

distance between two design profile traces which enclose the actual profile trace over the evaluation range L_α, subject to the provisions of **3.2.1.3** [See Figure 2 a).]

3.2.3
profile form deviation ($f_{f\alpha}$)

distance between two facsimiles of the mean profile trace, which are each placed with constant separation from the mean profile trace, so as to enclose the actual profile trace over the evaluation range L_α, subject to the provisions of **3.2.1.3** [See Figure 2 b).]

3.2.4
profile slope deviation ($f_{H\alpha}$)

distance between two design profile traces which intersect the mean profile trace at the endpoints of the evaluation range L_α [See Figure 2 c).]

3.3 Helix deviations

3.3.1 Helix deviation

Amount, measured in the direction of the transverse base tangent, by which an actual helix deviates from the design helix.

3.3.1.1
length of trace

length proportional to the facewidth of the gear, excluding the tooth end chamfers or roundings

3.3.1.2
helix evaluation range (L_β)

unless otherwise specified, the "length of trace", shortened at each end by the smaller of the following two values: – 5 % of the facewidth, or the length equal to one module

NOTE 6 It is the responsibility of the gear designer to assure that the helix evaluation range is adequate for application.

in the relevant end zones, the following evaluation rules apply for the total helix deviation and the helix form deviation:

a) excess material (plus material deviation) which increases the amount of deviation shall be taken into account;

b) unless otherwise specified, for minus material deviations, the tolerance shall be three times the tolerance specified for the evaluation range L_β.

NOTE 7 For the analysis of helix form deviation, evaluations a) and b) are based on the mean helix trace defined in **3.3.1.4**.

3.3.1.3
design helix

a helix consistent with the design specifications

NOTE 8 In a helix diagram, the trace of an unmodified helix generally appears as a straight line. In Figure 3, the design helix traces are shown as chain-dotted lines.

3.3.1.4
mean helix of a measured flank

a trace, determined by subtracting from the ordinates of the design helix trace the corresponding ordinates of a straight-line gradient

this is to be so done that, within the evaluation range, the sum of the squares of the deviations of the actual helix trace from the mean helix trace is minimal. Thus, the position and the gradient of the mean helix is found by the "least-squares method"

NOTE 9 This helix is an aid in the determination of the deviations $f_{f\beta}$ [Figure 3 b)] and $f_{H\beta}$ [Figure 3 c)].

3.3.2
total helix deviation (F_β)

distance between two design helix traces which enclose the actual helix trace over the evaluation range L_β, subject to the provisions of **3.3.1.2** [See Figure 3 a).]

3.3.3
helix form deviation ($f_{f\beta}$)

distance between two facsimiles of the mean helix trace, which are each placed with constant separation from the mean helix trace, so as to enclose the actual helix trace over the evaluation range L_β, subject to the provisions of **3.3.1.2** [See Figure 3 b).]

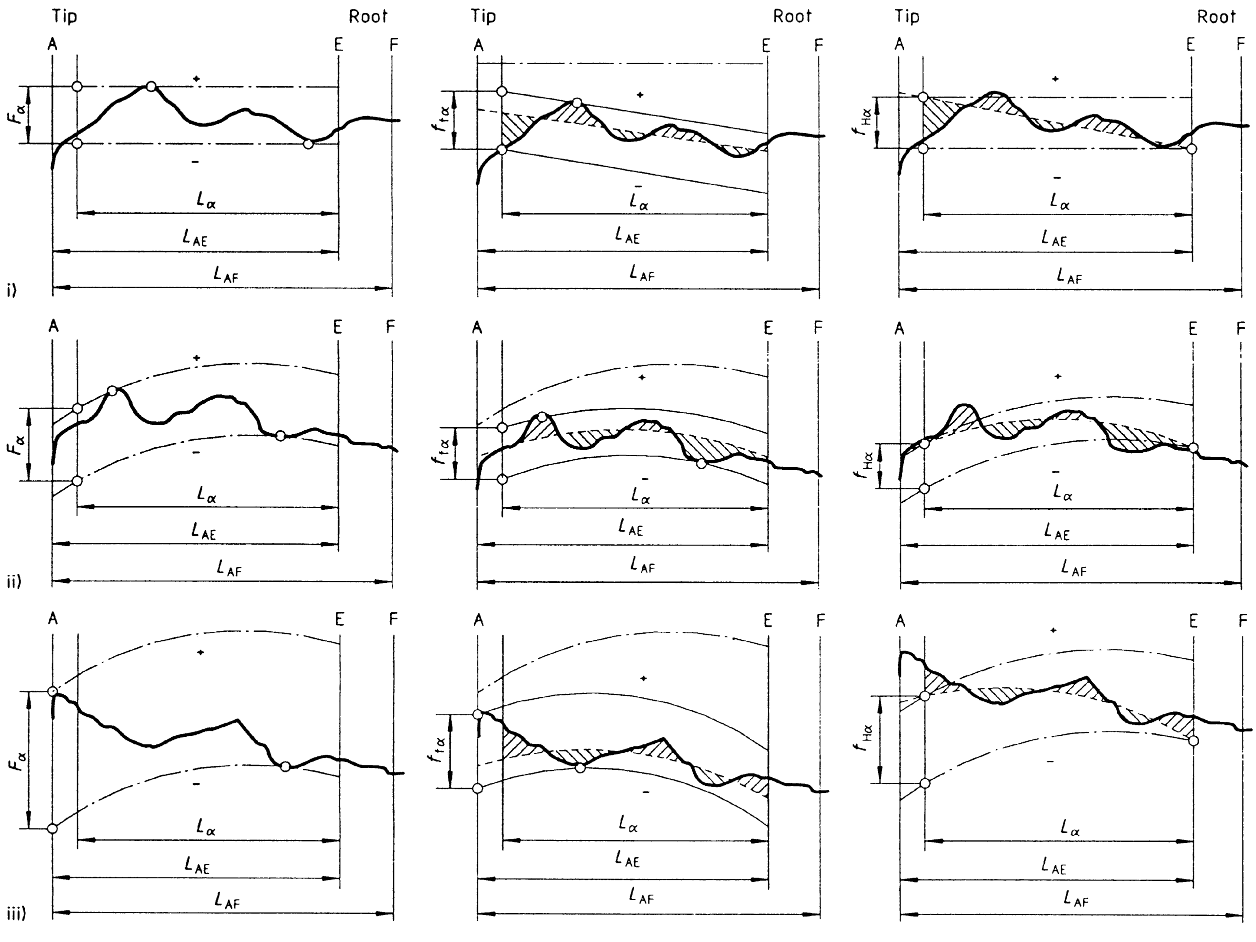
3.3.4
helix slope deviation ($f_{H\beta}$)

distance between two design helix traces which intersect the mean helix trace at the endpoints of the evaluation range L_β [See Figure 3 c).]

Key

: Design profile   : Actual profile   : Mean profile

i)	Design profile: Actual profile:	unmodified involute with minus material deviations in the reduction zone
ii)	Design profile: Actual profile:	modified involute (example) with minus material deviations in the reduction zone
iii)	Design profile: Actual profile:	modified involute (example) with excess of material in the reduction zone



a) Total profile deviation   b) Profile form deviation   c) Profile slope deviation

Figure 2 — Profile deviations

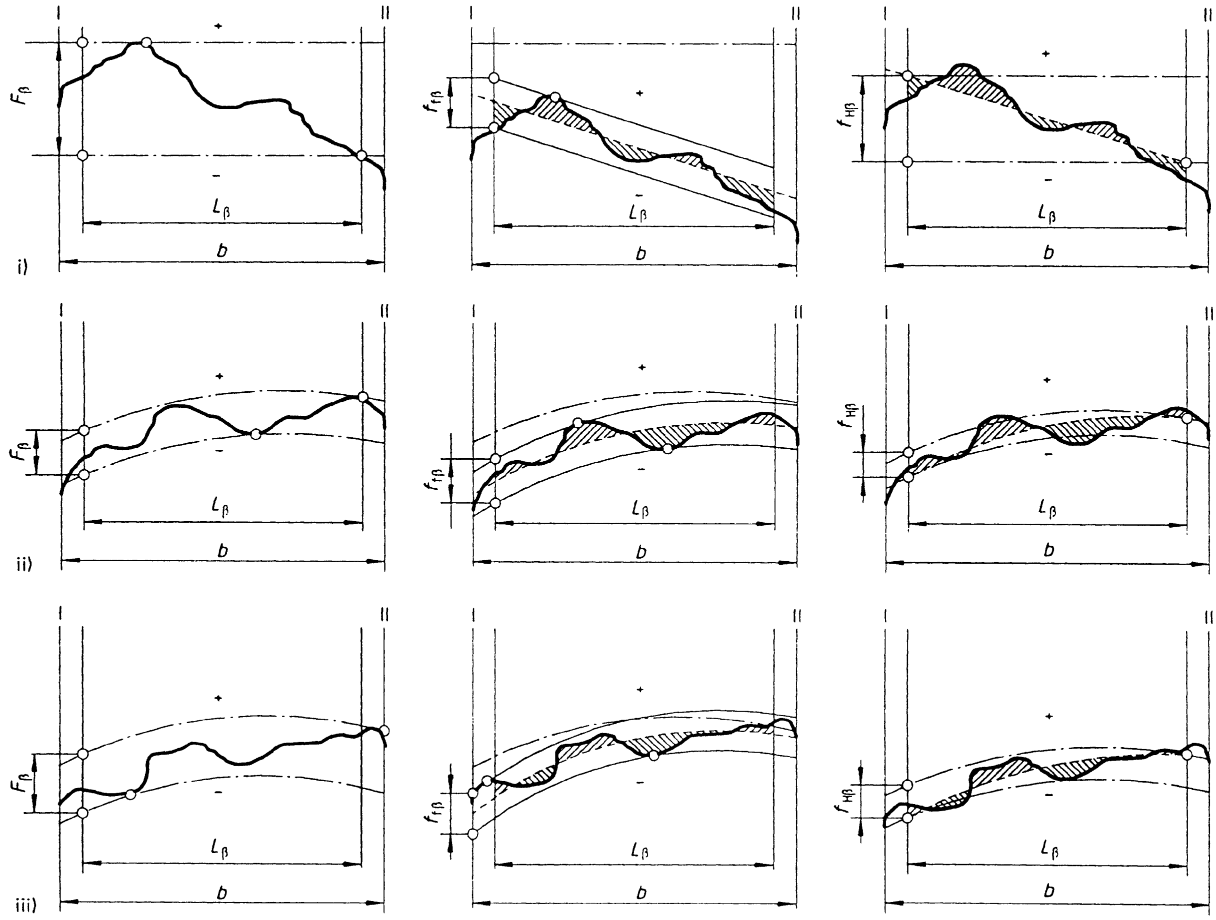
Key

—·—·—·— : Design helix   : Actual helix   - - - - - - - - : Mean helix

i) Design helix: unmodified helix
Actual helix: with minus material deviations in the reduction zone

ii) Design helix: modified helix (example)
Actual helix: with minus material deviations in the reduction zone

iii) Design helix: modified helix (example)
Actual helix: with excess of material in the reduction zone



a) Total helix deviation   b) Helix form deviation   c) Helix slope deviation

Figure 3 — Helix deviations

3.4 Tangential composite deviations

3.4.1
total tangential composite deviation (F'_i)

maximum difference between the effective and theoretical circumferential displacements at the reference circle of the gear under inspection, when meshing with a master gear, the tested product gear being turned through one complete revolution

NOTE 10 During the inspection process, contact takes place on only one set of corresponding flanks (Figure 4).

3.4.2
tooth-to-tooth tangential composite deviation (f'_i)

value of the tangential composite deviation over a displacement of one pitch (See Figure 4.)

4 Symbols and abbreviations

4.1 Gear data and gear terms (lengths in millimetres)

b Facewidth
d Reference diameter
k Number of successive pitches
m Module
p_t Transverse pitch
z Number of teeth
A Beginning point of chamfer or tip rounding
E Start of active profile
F Start of usable profile
L_{AE} Active length (of base tangent)
L_{AF} Usable length (of base tangent)
L_α Profile evaluation range
L_β Helix evaluation range
Q Accuracy grade
ε_γ Total contact ratio
I Reference face
II Non-reference face

4.2 Gear deviations (in micrometres)

$f_{f\alpha}$ Profile form deviation
$f_{f\beta}$ Helix form deviation
$f_{H\alpha}$[a] Profile slope deviation
$f_{H\beta}$[a] Helix slope deviation
f'_i Tooth-to-tooth tangential composite deviation
f_{pt}[a] Single pitch deviation
F'_i Total tangential composite deviation
F_p Total cumulative pitch deviation
F_{pk}[a] Cumulative pitch deviation
F_α Total profile deviation
F_β Total helix deviation

[a] These deviations can be plus or minus.

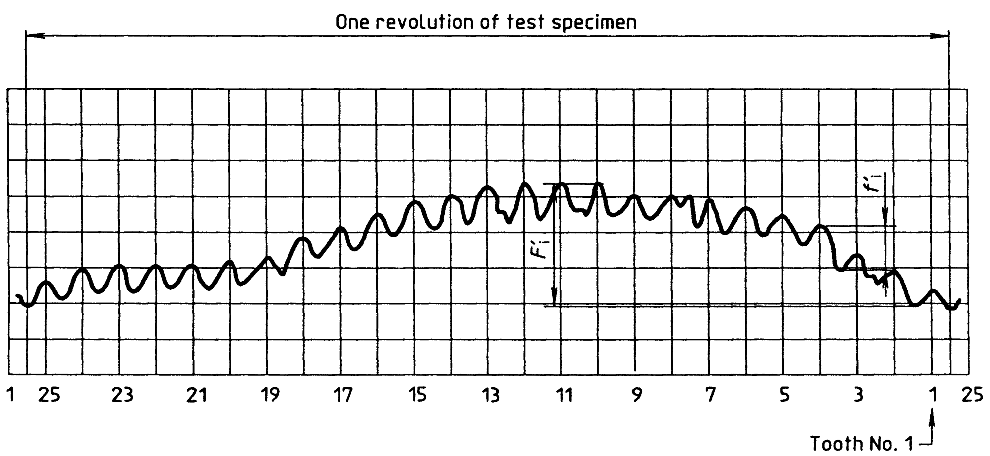


Figure 4 — Tangential composite deviations

5 Structure of the system of accuracy for gears

5.1 ISO system of accuracy

The ISO system of accuracy comprises 13 accuracy grades of which grade 0 is the highest and grade 12 is the lowest degree of accuracy.

When a statement concerning required accuracy is made in documents, reference to ISO 1328-1 or ISO 1328-2, as appropriate, shall be included.

5.2 Allowable values for deviations

The accuracy grade of a gear is evaluated by comparing measured deviations against the numerical values given in Table 1 to Table 4. These values are calculated with the formulae given in clause **6**, which apply for 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 unrounded calculated value for accuracy grade 5 by $2^{0,5\,(Q-5)}$, where Q is the accuracy grade number of the required value.

Allowable values for the cumulative pitch deviation F_{pk} for which no tables with numerical values are provided are to be calculated on the basis of **3.1.2**, **5.2** to **5.4**, **6.1** and **6.2**.

With reference to the formulae in clause **6** and Table 1 to Table 4, module m and facewidth b are, if not otherwise specified, understood to be nominal values, without taking into account tooth tip and tooth end chamfers.

5.3 Ranges of parameters

The lower and upper range limits areas follows (values are in millimetres):

a) **for the reference diameter,** d

5/20/50/125/280/560/1 000/1 600/2 500/4 000/6 000/8 000/10 000

b) **for the module (normal module),** m

0,5/2/3,5/6/10/16/25/40/70

c) **for the facewidth,** b

4/10/20/40/80/160/250/400/650/1 000

When applying the formulae given in clause **6**, the parameters m, d and b are to be introduced as the geometrical mean values of the relevant range limits and not as the actual values. If, for example, the actual module is 7, the range limits are $m = 6$ and $m = 10$, and allowable deviations are calculated with

$$m = \sqrt{6 \times 10} = 7,746$$

When gear data are not within the specified ranges or when agreed between purchaser and supplier, actual gear data may be substituted in the formulae.

5.4 Rounding rules

Values given in Table 1 to Table 4 are rounded versions of values calculated using the formulae in clause **6**. If greater than 10 µm, they are rounded to the nearest integer number. If less than 10 µm, they are rounded to the nearest 0,5 µm value or integer number. If less than 5 µm, they are rounded to the nearest 0,1 µm value or integer number.

5.5 Validity

When in procurement documents the required gear accuracy grade corresponding ISO 1328-1 is stated without other indication, that grade applies to deviations of all elements in accordance with **6.1** to **6.5** of this part of ISO 1328. However, by agreement, working and non-working flanks of different accuracy grades may be specified and/or different accuracy grades may be specified for different deviations. Alternatively, the required accuracy grade may be specified for the working flanks only.

Unless otherwise specified, measurements are carried out at approximately mid-tooth depth and/or mid-facewidth, as appropriate. When tolerance values are small, particularly when less than 5 µm, the measuring equipment shall be of sufficient accuracy to insure that the measurements of size can be repeated with the required accuracy.

Unless otherwise specified, profile and helix deviations are to be evaluated on both flanks of a minimum of three teeth approximately equally spaced around the gear. Measurements of the single pitch deviation, f_{pt}, are required on both flanks of all teeth.

6 Formulae for allowable values of gear deviations of accuracy grade 5

NOTE 11 Symbols are as defined in clause 4.

6.1 Single pitch deviation, f_{pt}, is calculated from

$$f_{pt} = 0,3\left(m + 0,4\sqrt{d}\right) + 4$$

6.2 Cumulative pitch deviation, F_{pk}, is calculated from

$$F_{pk} = f_{pt} + 1,6\sqrt{(k-1)m}$$

6.3 Total cumulative pitch deviation, F_p, is calculated from

$$F_p = 0,3m + 1,25\sqrt{d} + 7$$

6.4 Total profile deviation, F_α, is calculated from

$$F_\alpha = 3{,}2\sqrt{m} + 0{,}22\sqrt{d} + 0{,}7$$

6.5 Total helix deviation, F_β, is calculated from

$$F_\beta = 0{,}1\sqrt{d} + 0{,}63\sqrt{b} + 4{,}2$$

6.6 Parameters m, d and b are introduced into the formulae as geometrical mean values of relevant range limits as defined in **5.3** and **5.4**.

Formulae for tolerances for tangential composite deviations, and for recommended tolerances for profile and helix form and slope deviations, are given in Annex A and Annex B respectively.

7 Allowable values of gear deviations relevant to corresponding flanks

See Table 1 to Table 4.

Table 1 — Single pitch deviation, $\pm f_{pt}$

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	$\pm f_{pt}$ µm												
$5 \leqslant d \leqslant 20$	$0{,}5 \leqslant m \leqslant 2$	0,8	1,2	1,7	2,3	3,3	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0
	$2 < m \leqslant 3{,}5$	0,9	1,3	1,8	2,6	3,7	5,0	7,5	10,0	15,0	21,0	29,0	41,0	59,0
$20 < d \leqslant 50$	$0{,}5 \leqslant m \leqslant 2$	0,9	1,2	1,8	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0
	$2 < m \leqslant 3{,}5$	1,0	1,4	1,9	2,7	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0
	$3{,}5 < m \leqslant 6$	1,1	1,5	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0
	$6 < m \leqslant 10$	1,2	1,7	2,5	3,5	4,9	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0
$50 < d \leqslant 125$	$0{,}5 \leqslant m \leqslant 2$	0,9	1,3	1,9	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0
	$2 < m \leqslant 3{,}5$	1,0	1,5	2,1	2,9	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0
	$3{,}5 < m \leqslant 6$	1,1	1,6	2,3	3,2	4,6	6,5	9,0	13,0	18,0	26,0	36,0	52,0	73,0
	$6 < m \leqslant 10$	1,3	1,8	2,6	3,7	5,0	7,5	10,0	15,0	21,0	30,0	42,0	59,0	84,0
	$10 < m \leqslant 16$	1,6	2,2	3,1	4,4	6,5	9,0	13,0	18,0	25,0	35,0	50,0	71,0	100,0
	$16 < m \leqslant 25$	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	63,0	89,0	125,0
$125 < d \leqslant 280$	$0{,}5 \leqslant m \leqslant 2$	1,1	1,5	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	67,0
	$2 < m \leqslant 3{,}5$	1,1	1,6	2,3	3,2	4,6	6,5	9,0	13,0	18,0	26,0	36,0	51,0	73,0
	$3{,}5 < m \leqslant 6$	1,2	1,8	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0
	$6 < m \leqslant 10$	1,4	2,0	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	90,0
	$10 < m \leqslant 16$	1,7	2,4	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	107,0
	$16 < m \leqslant 25$	2,1	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	47,0	66,0	93,0	132,0
	$25 < m \leqslant 40$	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0	86,0	121,0	171,0
$280 < d \leqslant 560$	$0{,}5 \leqslant m \leqslant 2$	1,2	1,7	2,4	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0
	$2 < m \leqslant 3{,}5$	1,3	1,8	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	57,0	81,0
	$3{,}5 < m \leqslant 6$	1,4	1,9	2,7	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0
	$6 < m \leqslant 10$	1,5	2,2	3,1	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	99,0
	$10 < m \leqslant 16$	1,8	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	81,0	115,0
	$16 < m \leqslant 25$	2,2	3,1	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0	140,0
	$25 < m \leqslant 40$	2,8	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0	90,0	127,0	180,0
	$40 < m \leqslant 70$	3,9	5,5	8,0	11,0	16,0	22,0	31,0	45,0	63,0	89,0	126,0	178,0	252,0

Table 1 — Single pitch deviation, $\pm f_{pt}$

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	$\pm f_{pt}$ µm												
$560 < d \leqslant 1\,000$	$0,5 \leqslant m \leqslant 2$	1,3	1,9	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0	86,0
	$2 < m \leqslant 3,5$	1,4	2,0	2,9	4,0	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	91,0
	$3,5 < m \leqslant 6$	1,5	2,2	3,1	4,3	6,0	8,5	12,0	17,0	24,0	35,0	49,0	69,0	98,0
	$6 < m \leqslant 10$	1,7	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	109,0
	$10 < m \leqslant 16$	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	63,0	89,0	125,0
	$16 < m \leqslant 25$	2,3	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	106,0	150,0
	$25 < m \leqslant 40$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	47,0	67,0	95,0	134,0	190,0
	$40 < m \leqslant 70$	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	93,0	131,0	185,0	262,0
$1\,000 < d \leqslant 1\,600$	$2 \leqslant m \leqslant 3,5$	1,6	2,3	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0	72,0	103,0
	$3,5 < m \leqslant 6$	1,7	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	55,0	77,0	109,0
	$6 < m \leqslant 10$	1,9	2,6	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	85,0	120,0
	$10 < m \leqslant 16$	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	97,0	136,0
	$16 < m \leqslant 25$	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	40,0	57,0	81,0	114,0	161,0
	$25 < m \leqslant 40$	3,1	4,4	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	100,0	142,0	201,0
	$40 < m \leqslant 70$	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	97,0	137,0	193,0	273,0
$1\,600 < d \leqslant 2\,500$	$3,5 \leqslant m \leqslant 6$	1,9	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0	86,0	122,0
	$6 < m \leqslant 10$	2,1	2,9	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	94,0	132,0
	$10 < m \leqslant 16$	2,3	3,3	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	74,0	105,0	149,0
	$16 < m \leqslant 25$	2,7	3,8	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	123,0	174,0
	$25 < m \leqslant 40$	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	107,0	151,0	213,0
	$40 < m \leqslant 70$	4,5	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	101,0	143,0	202,0	286,0
$2\,500 < d \leqslant 4\,000$	$6 \leqslant m \leqslant 10$	2,3	3,3	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	74,0	105,0	148,0
	$10 < m \leqslant 16$	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0	165,0
	$16 < m \leqslant 25$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	33,0	47,0	67,0	95,0	134,0	189,0
	$25 < m \leqslant 40$	3,6	5,0	7,0	10,0	14,0	20,0	29,0	40,0	57,0	81,0	114,0	162,0	229,0
	$40 < m \leqslant 70$	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	106,0	151,0	213,0	301,0
$4\,000 < d \leqslant 6\,000$	$6 \leqslant m \leqslant 10$	2,6	3,7	5,0	7,5	10,0	15,0	21,0	29,0	42,0	59,0	83,0	118,0	167,0
	$10 < m \leqslant 16$	2,9	4,0	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	92,0	130,0	183,0
	$16 < m \leqslant 25$	3,3	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	74,0	104,0	147,0	208,0
	$25 < m \leqslant 40$	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	88,0	124,0	175,0	248,0
	$40 < m \leqslant 70$	5,0	7,0	10,0	14,0	20,0	28,0	40,0	57,0	80,0	113,0	160,0	226,0	320,0
$6\,000 < d \leqslant 8\,000$	$10 \leqslant m \leqslant 16$	3,1	4,4	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	101,0	142,0	201,0
	$16 < m \leqslant 25$	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	57,0	80,0	113,0	160,0	226,0
	$25 < m \leqslant 40$	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	94,0	133,0	188,0	266,0
	$40 < m \leqslant 70$	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	84,0	119,0	169,0	239,0	338,0
$8\,000 < d \leqslant 10\,000$	$10 \leqslant m \leqslant 16$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	108,0	153,0	217,0
	$16 < m \leqslant 25$	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	121,0	171,0	242,0
	$25 < m \leqslant 40$	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0	140,0	199,0	281,0
	$40 < m \leqslant 70$	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	125,0	177,0	250,0	353,0

Table 2 — Total cumulative pitch deviation, F_p

Reference diameter	Module	Accuracy grade												
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
d mm	m mm	F_p µm												
$5 \leqslant d \leqslant 20$	$0,5 \leqslant m \leqslant 2$	2,0	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	90,0	127,0
	$2 < m \leqslant 3,5$	2,1	2,9	4,2	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	94,0	133,0
$20 < d \leqslant 50$	$0,5 \leqslant m \leqslant 2$	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	57,0	81,0	115,0	162,0
	$2 < m \leqslant 3,5$	2,6	3,7	5,0	7,5	10,0	15,0	21,0	30,0	42,0	59,0	84,0	119,0	168,0
	$3,5 < m \leqslant 6$	2,7	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	87,0	123,0	174,0
	$6 < m \leqslant 10$	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	93,0	131,0	185,0
$50 < d \leqslant 125$	$0,5 \leqslant m \leqslant 2$	3,3	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	74,0	104,0	147,0	208,0
	$2 < m \leqslant 3,5$	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	76,0	107,0	151,0	214,0
	$3,5 < m \leqslant 6$	3,4	4,9	7,0	9,5	14,0	19,0	28,0	39,0	55,0	78,0	110,0	156,0	220,0
	$6 < m \leqslant 10$	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	82,0	116,0	164,0	231,0
	$10 < m \leqslant 16$	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	88,0	124,0	175,0	248,0
	$16 < m \leqslant 25$	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	193,0	273,0
$125 < d \leqslant 280$	$0,5 \leqslant m \leqslant 2$	4,3	6,0	8,5	12,0	17,0	24,0	35,0	49,0	69,0	98,0	138,0	195,0	276,0
	$2 < m \leqslant 3,5$	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	100,0	141,0	199,0	282,0
	$3,5 < m \leqslant 6$	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	102,0	144,0	204,0	288,0
	$6 < m \leqslant 10$	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	75,0	106,0	149,0	211,0	299,0
	$10 < m \leqslant 16$	4,9	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	112,0	158,0	223,0	316,0
	$16 < m \leqslant 25$	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	120,0	170,0	241,0	341,0
	$25 < m \leqslant 40$	6,0	8,5	12,0	17,0	24,0	34,0	47,0	67,0	95,0	134,0	190,0	269,0	380,0
$280 < d \leqslant 560$	$0,5 \leqslant m \leqslant 2$	5,5	8,0	11,0	16,0	23,0	32,0	46,0	64,0	91,0	129,0	182,0	257,0	364,0
	$2 < m \leqslant 3,5$	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	92,0	131,0	185,0	261,0	370,0
	$3,5 < m \leqslant 6$	6,0	8,5	12,0	17,0	24,0	33,0	47,0	66,0	94,0	133,0	188,0	266,0	376,0
	$6 < m \leqslant 10$	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	97,0	137,0	193,0	274,0	387,0
	$10 < m \leqslant 16$	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	101,0	143,0	202,0	285,0	404,0
	$16 < m \leqslant 25$	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	107,0	151,0	214,0	303,0	428,0
	$25 < m \leqslant 40$	7,5	10,0	15,0	21,0	29,0	41,0	58,0	83,0	117,0	165,0	234,0	331,0	468,0
	$40 < m \leqslant 70$	8,5	12,0	17,0	24,0	34,0	48,0	68,0	95,0	135,0	191,0	270,0	382,0	540,0
$560 < d \leqslant 1\,000$	$0,5 \leqslant m \leqslant 2$	7,5	10,0	15,0	21,0	29,0	41,0	59,0	83,0	117,0	166,0	235,0	332,0	469,0
	$2 < m \leqslant 3,5$	7,5	10,0	15,0	21,0	30,0	42,0	59,0	84,0	119,0	168,0	238,0	336,0	475,0
	$3,5 < m \leqslant 6$	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	120,0	170,0	241,0	341,0	482,0
	$6 < m \leqslant 10$	7,5	11,0	15,0	22,0	31,0	44,0	62,0	87,0	123,0	174,0	246,0	348,0	492,0
	$10 < m \leqslant 16$	8,0	11,0	16,0	22,0	32,0	45,0	64,0	90,0	127,0	180,0	254,0	360,0	509,0
	$16 < m \leqslant 25$	8,5	12,0	17,0	24,0	33,0	47,0	67,0	94,0	133,0	189,0	267,0	378,0	534,0
	$25 < m \leqslant 40$	9,0	13,0	18,0	25,0	36,0	51,0	72,0	101,0	143,0	203,0	287,0	405,0	573,0
	$40 < m \leqslant 70$	10,0	14,0	20,0	29,0	40,0	57,0	81,0	114,0	161,0	228,0	323,0	457,0	646,0
$1\,000 < d \leqslant 1\,600$	$2 \leqslant m \leqslant 3,5$	9,0	13,0	18,0	26,0	37,0	52,0	74,0	105,0	148,0	209,0	296,0	418,0	591,0
	$3,5 < m \leqslant 6$	9,5	13,0	19,0	26,0	37,0	53,0	75,0	106,0	149,0	211,0	299,0	423,0	598,0
	$6 < m \leqslant 10$	9,5	13,0	19,0	27,0	38,0	54,0	76,0	108,0	152,0	215,0	304,0	430,0	608,0
	$10 < m \leqslant 16$	10,0	14,0	20,0	28,0	39,0	55,0	78,0	111,0	156,0	221,0	313,0	442,0	625,0
	$16 < m \leqslant 25$	10,0	14,0	20,0	29,0	41,0	57,0	81,0	115,0	163,0	230,0	325,0	460,0	650,0
	$25 < m \leqslant 40$	11,0	15,0	22,0	30,0	43,0	61,0	86,0	122,0	172,0	244,0	345,0	488,0	690,0
	$40 < m \leqslant 70$	12,0	17,0	24,0	34,0	48,0	67,0	95,0	135,0	190,0	269,0	381,0	539,0	762,0

Table 2 — Total cumulative pitch deviation, F_p

Reference diameter d mm	Module m mm	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
		F_p µm												
$1\,600 < d \leqslant 2\,500$	$3{,}5 \leqslant m \leqslant 6$	11,0	16,0	23,0	32,0	45,0	64,0	91,0	129,0	182,0	257,0	364,0	514,0	727,0
	$6 < m \leqslant 10$	12,0	16,0	23,0	33,0	46,0	65,0	92,0	130,0	184,0	261,0	369,0	522,0	738,0
	$10 < m \leqslant 16$	12,0	17,0	24,0	33,0	47,0	67,0	94,0	133,0	189,0	267,0	377,0	534,0	755,0
	$16 < m \leqslant 25$	12,0	17,0	24,0	34,0	49,0	69,0	97,0	138,0	195,0	276,0	390,0	551,0	780,0
	$25 < m \leqslant 40$	13,0	18,0	26,0	36,0	51,0	72,0	102,0	145,0	205,0	290,0	409,0	579,0	819,0
	$40 < m \leqslant 70$	14,0	20,0	28,0	39,0	56,0	79,0	111,0	158,0	223,0	315,0	446,0	603,0	891,0
$2\,500 < d \leqslant 4\,000$	$6 \leqslant m \leqslant 10$	14,0	20,0	28,0	40,0	56,0	80,0	113,0	159,0	225,0	318,0	450,0	637,0	901,0
	$10 < m \leqslant 16$	14,0	20,0	29,0	41,0	57,0	81,0	115,0	162,0	229,0	324,0	459,0	649,0	917,0
	$16 < m \leqslant 25$	15,0	21,0	29,0	42,0	59,0	83,0	118,0	167,0	236,0	333,0	471,0	666,0	942,0
	$25 < m \leqslant 40$	15,0	22,0	31,0	43,0	61,0	87,0	123,0	174,0	245,0	347,0	491,0	694,0	982,0
	$40 < m \leqslant 70$	16,0	23,0	33,0	47,0	66,0	93,0	132,0	186,0	264,0	373,0	525,0	745,0	1 054,0
$4\,000 < d \leqslant 6\,000$	$6 \leqslant m \leqslant 10$	17,0	24,0	34,0	48,0	68,0	97,0	137,0	194,0	274,0	387,0	548,0	775,0	1 095,0
	$10 < m \leqslant 16$	17,0	25,0	35,0	49,0	69,0	98,0	139,0	197,0	278,0	393,0	556,0	786,0	1 112,0
	$16 < m \leqslant 25$	18,0	25,0	36,0	50,0	71,0	100,0	142,0	201,0	284,0	402,0	568,0	804,0	1 137,0
	$25 < m \leqslant 40$	18,0	26,0	37,0	52,0	74,0	104,0	147,0	208,0	294,0	416,0	588,0	832,0	1 176,0
	$40 < m \leqslant 70$	20,0	28,0	39,0	55,0	78,0	110,0	156,0	221,0	312,0	441,0	624,0	883,0	1 249,0
$6\,000 < d \leqslant 8\,000$	$10 \leqslant m \leqslant 16$	20,0	29,0	41,0	57,0	81,0	115,0	162,0	230,0	325,0	459,0	650,0	919,0	1 299,0
	$16 < m \leqslant 25$	21,0	29,0	41,0	59,0	83,0	117,0	166,0	234,0	331,0	468,0	662,0	936,0	1 324,0
	$25 < m \leqslant 40$	21,0	30,0	43,0	60,0	85,0	121,0	170,0	241,0	341,0	482,0	682,0	964,0	1 364,0
	$40 < m \leqslant 70$	22,0	32,0	45,0	63,0	90,0	127,0	179,0	254,0	359,0	508,0	718,0	1 015,0	1 436,0
$8\,000 < d \leqslant 10\,000$	$10 \leqslant m \leqslant 16$	23,0	32,0	46,0	65,0	91,0	129,0	182,0	258,0	365,0	516,0	730,0	1 032,0	1 460,0
	$16 < m \leqslant 25$	23,0	33,0	46,0	66,0	93,0	131,0	186,0	262,0	371,0	525,0	742,0	1 050,0	1 485,0
	$25 < m \leqslant 40$	24,0	34,0	48,0	67,0	95,0	135,0	191,0	269,0	381,0	539,0	762,0	1 078,0	1 524,0
	$40 < m \leqslant 70$	25,0	35,0	50,0	71,0	100,0	141,0	200,0	282,0	399,0	564,0	798,0	1 129,0	1 596,0

Table 3 — Total profile deviation, F_α

Reference diameter	Module	Accuracy grade												
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
d mm	m mm	F_α µm												
$5 \leqslant d \leqslant 20$	$0,5 \leqslant m \leqslant 2$	0,8	1,1	1,6	2,3	3,2	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0
	$2 < m \leqslant 3,5$	1,2	1,7	2,3	3,3	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	75,0
$20 < d \leqslant 50$	$0,5 \leqslant m \leqslant 2$	0,9	1,3	1,8	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0
	$2 < m \leqslant 3,5$	1,3	1,8	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	40,0	57,0	81,0
	$3,5 < m \leqslant 6$	1,6	2,2	3,1	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0
	$6 < m \leqslant 10$	1,9	2,7	3,8	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	123,0
$50 < d \leqslant 125$	$0,5 \leqslant m \leqslant 2$	1,0	1,5	2,1	2,9	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0
	$2 < m \leqslant 3,5$	1,4	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	63,0	89,0
	$3,5 < m \leqslant 6$	1,7	2,4	3,4	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	108,0
	$6 < m \leqslant 10$	2,0	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	92,0	131,0
	$10 < m \leqslant 16$	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0	159,0
	$16 < m \leqslant 25$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	192,0
$125 < d \leqslant 280$	$0,5 \leqslant m \leqslant 2$	1,2	1,7	2,4	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	55,0	78,0
	$2 < m \leqslant 3,5$	1,6	2,2	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	101,0
	$3,5 < m \leqslant 6$	1,9	2,6	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	84,0	119,0
	$6 < m \leqslant 10$	2,2	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	101,0	143,0
	$10 < m \leqslant 16$	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	121,0	171,0
	$16 < m \leqslant 25$	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	102,0	144,0	204,0
	$25 < m \leqslant 40$	3,8	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	123,0	174,0	246,0
$280 < d \leqslant 560$	$0,5 \leqslant m \leqslant 2$	1,5	2,1	2,9	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	94,0
	$2 < m \leqslant 3,5$	1,8	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0
	$3,5 < m \leqslant 6$	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	67,0	95,0	135,0
	$6 < m \leqslant 10$	2,5	3,5	4,9	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0	158,0
	$10 < m \leqslant 16$	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	47,0	66,0	93,0	132,0	186,0
	$16 < m \leqslant 25$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	55,0	78,0	110,0	155,0	219,0
	$25 < m \leqslant 40$	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	92,0	131,0	185,0	261,0
	$40 < m \leqslant 70$	5,0	7,0	10,0	14,0	20,0	28,0	40,0	57,0	80,0	113,0	160,0	227,0	321,0
$560 < d \leqslant 1\,000$	$0,5 \leqslant m \leqslant 2$	1,8	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0
	$2 < m \leqslant 3,5$	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	67,0	95,0	135,0
	$3,5 < m \leqslant 6$	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	109,0	154,0
	$6 < m \leqslant 10$	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	125,0	177,0
	$10 < m \leqslant 16$	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0	72,0	102,0	145,0	205,0
	$16 < m \leqslant 25$	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	59,0	84,0	119,0	168,0	238,0
	$25 < m \leqslant 40$	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	99,0	140,0	198,0	280,0
	$40 < m \leqslant 70$	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	85,0	120,0	170,0	240,0	339,0
$1\,000 < d \leqslant 1\,600$	$2 \leqslant m \leqslant 3,5$	2,4	3,4	4,9	7,0	9,5	14,0	19,0	27,0	39,0	55,0	78,0	110,0	155,0
	$3,5 < m \leqslant 6$	2,7	3,8	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	123,0	174,0
	$6 < m \leqslant 10$	3,1	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	99,0	139,0	197,0
	$10 < m \leqslant 16$	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	80,0	113,0	159,0	225,0
	$16 < m \leqslant 25$	4,0	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	91,0	129,0	183,0	258,0
	$25 < m \leqslant 40$	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	106,0	150,0	212,0	300,0
	$40 < m \leqslant 70$	5,5	8,0	11,0	16,0	22,0	32,0	45,0	64,0	90,0	127,0	180,0	254,0	360,0

Table 3 — Total profile deviation, F_α

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	F_α µm												
$1\ 600 < d \leqslant 2\ 500$	$3,5 \leqslant m \leqslant 6$	3,1	4,3	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	98,0	139,0	197,0
	$6 < m \leqslant 10$	3,4	4,9	7,0	9,5	14,0	19,0	27,0	39,0	55,0	78,0	110,0	156,0	220,0
	$10 < m \leqslant 16$	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	88,0	124,0	175,0	248,0
	$16 < m \leqslant 25$	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0	141,0	199,0	281,0
	$25 < m \leqslant 40$	5,0	7,0	10,0	14,0	20,0	29,0	40,0	57,0	81,0	114,0	161,0	228,0	323,0
	$40 < m \leqslant 70$	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	135,0	191,0	271,0	383,0
$2\ 500 < d \leqslant 4\ 000$	$6 \leqslant m \leqslant 10$	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	124,0	176,0	249,0
	$10 < m \leqslant 16$	4,3	6,0	8,5	12,0	17,0	24,0	35,0	49,0	69,0	98,0	138,0	196,0	277,0
	$16 < m \leqslant 25$	4,8	7,0	9,5	14,0	19,0	27,0	39,0	55,0	77,0	110,0	155,0	219,0	310,0
	$25 < m \leqslant 40$	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	124,0	176,0	249,0	351,0
	$40 < m \leqslant 70$	6,5	9,0	13,0	18,0	26,0	36,0	51,0	73,0	103,0	145,0	206,0	291,0	411,0
$4\ 000 < d \leqslant 6\ 000$	$6 \leqslant m \leqslant 10$	4,4	6,5	9,0	13,0	18,0	25,0	35,0	50,0	71,0	100,0	141,0	200,0	283,0
	$10 < m \leqslant 16$	4,9	7,0	9,5	14,0	19,0	27,0	39,0	55,0	78,0	110,0	155,0	220,0	311,0
	$16 < m \leqslant 25$	5,5	7,5	11,0	15,0	22,0	30,0	43,0	61,0	86,0	122,0	172,0	243,0	344,0
	$25 < m \leqslant 40$	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	193,0	273,0	386,0
	$40 < m \leqslant 70$	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	111,0	158,0	223,0	315,0	445,0
$6\ 000 < d \leqslant 8\ 000$	$10 \leqslant m \leqslant 16$	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0	86,0	122,0	172,0	243,0	344,0
	$16 < m \leqslant 25$	6,0	8,5	12,0	17,0	24,0	33,0	47,0	67,0	94,0	113,0	189,0	267,0	377,0
	$25 < m \leqslant 40$	6,5	9,5	13,0	19,0	26,0	37,0	52,0	74,0	105,0	148,0	209,0	296,0	419,0
	$40 < m \leqslant 70$	7,5	11,0	15,0	21,0	30,0	42,0	60,0	85,0	120,0	169,0	239,0	338,0	478,0
$8\ 000 < d \leqslant 10\ 000$	$10 \leqslant m \leqslant 16$	6,0	8,0	12,0	16,0	23,0	33,0	47,0	66,0	93,0	132,0	186,0	263,0	372,0
	$16 < m \leqslant 25$	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	101,0	143,0	203,0	287,0	405,0
	$25 < m \leqslant 40$	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0	158,0	223,0	316,0	447,0
	$40 < m \leqslant 70$	8,0	11,0	16,0	22,0	32,0	45,0	63,0	90,0	127,0	179,0	253,0	358,0	507,0

Table 4 — Total helix deviation, F_β

Reference diameter	Facewidth	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	b mm	F_β µm												
$5 \leqslant d \leqslant 20$	$4 \leqslant b \leqslant 10$	1,1	1,5	2,2	3,1	4,3	6,0	8,5	12,0	17,0	24,0	35,0	49,0	69,0
	$10 \leqslant b \leqslant 20$	1,2	1,7	2,4	3,4	4,9	7,0	9,5	14,0	19,0	28,0	39,0	55,0	78,0
	$20 \leqslant b \leqslant 40$	1,4	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	45,0	63,0	89,0
	$40 \leqslant b \leqslant 80$	1,6	2,3	3,3	4,6	6,5	9,5	13,0	19,0	26,0	37,0	52,0	74,0	105,0
$20 < d \leqslant 50$	$4 \leqslant b \leqslant 10$	1,1	1,6	2,2	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0
	$10 < b \leqslant 205$	1,3	1,8	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	40,0	57,0	81,0
	$20 < b \leqslant 40$	1,4	2,0	2,9	4,1	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	92,0
	$40 < b \leqslant 80$	1,7	2,4	3,4	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	107,0
	$80 < b \leqslant 160$	2,0	2,9	4,1	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	92,0	130,0
$50 < d \leqslant 125$	$4 \leqslant b \leqslant 10$	1,2	1,7	2,4	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	76,0
	$10 < b \leqslant 20$	1,3	1,9	2,6	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	84,0
	$20 < b \leqslant 40$	1,5	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	95,0
	$40 < b \leqslant 80$	1,7	2,5	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	111,0
	$80 < b \leqslant 160$	2,1	2,9	4,2	6,0	8,5	12,0	17,0	24,0	33,0	47,0	67,0	94,0	133,0
	$160 < b \leqslant 250$	2,5	3,5	4,9	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0	158,0
	$250 < b \leqslant 400$	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	92,0	130,0	184,0
$125 < d \leqslant 280$	$4 \leqslant b \leqslant 10$	1,3	1,8	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	40,0	57,0	81,0
	$10 < b \leqslant 20$	1,4	2,0	2,8	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0	90,0
	$20 < b \leqslant 40$	1,6	2,2	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	101,0
	$40 < b \leqslant 80$	1,8	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	117,0
	$80 < b \leqslant 160$	2,2	3,1	4,3	6,0	8,5	12,0	17,0	25,0	35,0	49,0	69,0	98,0	139,0
	$160 < b \leqslant 250$	2,6	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	82,0	116,0	164,0
	$250 < b \leqslant 400$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	47,0	67,0	95,0	134,0	190,0
	$400 < b \leqslant 650$	3,5	4,9	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0	158,0	224,0
$280 < d \leqslant 560$	$10 \leqslant b \leqslant 20$	1,5	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	97,0
	$20 < b \leqslant 40$	1,7	2,4	3,4	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	108,0
	$40 < b \leqslant 80$	1,9	2,7	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	87,0	124,0
	$80 < b \leqslant 160$	2,3	3,2	4,6	6,5	9,0	13,0	18,0	26,0	36,0	52,0	73,0	103,0	146,0
	$160 < b \leqslant 250$	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	121,0	171,0
	$250 < b \leqslant 400$	3,1	4,3	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	98,0	139,0	197,0
	$400 < b \leqslant 650$	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	82,0	115,0	163,0	231,0
	$650 < b \leqslant 1\,000$	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	193,0	272,0
$560 < d \leqslant 1\,000$	$10 \leqslant b \leqslant 20$	1,6	2,3	3,3	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	74,0	105,0
	$20 < b \leqslant 40$	1,8	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0
	$40 < b \leqslant 80$	2,1	2,9	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	93,0	132,0
	$80 < b \leqslant 160$	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	55,0	77,0	109,0	154,0
	$160 < b \leqslant 250$	2,8	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0	90,0	127,0	179,0
	$250 < b \leqslant 400$	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0	73,0	103,0	145,0	205,0
	$400 < b \leqslant 650$	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	85,0	120,0	169,0	239,0
	$650 < b \leqslant 1\,000$	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0	140,0	199,0	281,0

Table 4 — Total helix deviation, F_{β}

Reference diameter	Facewidth	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	b mm	F_{β} μm												
1 000 < d ⩽ 1 600	20 ⩽ b ⩽ 40	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	63,0	89,0	126,0
	40 < b ⩽ 80	2,2	3,1	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	71,0	100,0	141,0
	80 < b ⩽ 160	2,6	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	82,0	116,0	164,0
	160 < b ⩽ 250	2,9	4,2	6,0	8,5	12,0	17,0	24,0	33,0	47,0	67,0	94,0	133,0	189,0
	250 < b ⩽ 400	3,4	4,7	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	107,0	152,0	215,0
	400 < b ⩽ 650	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	124,0	176,0	249,0
	650 < b ⩽ 1 000	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0	73,0	103,0	145,0	205,0	290,0
1 600 < d ⩽ 2 500	20 ⩽ b ⩽ 40	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0
	40 < b ⩽ 80	2,4	3,4	4,7	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	107,0	152,0
	80 < b ⩽ 160	2,7	3,8	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	123,0	174,0
	160 < b ⩽ 250	3,1	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0	141,0	199,0
	250 < b ⩽ 400	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	80,0	112,0	159,0	225,0
	400 < b ⩽ 650	4,0	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	92,0	130,0	183,0	259,0
	650 < b ⩽ 1 000	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	106,0	150,0	212,0	300,0
2 500 < d ⩽ 4 000	40 ⩽ b ⩽ 80	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0	165,0
	80 < b ⩽ 160	2,9	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	93,0	132,0	187,0
	160 < b ⩽ 250	3,3	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	75,0	106,0	150,0	212,0
	250 < b ⩽ 400	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	59,0	84,0	119,0	168,0	238,0
	400 < b ⩽ 650	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	192,0	272,0
	650 < b ⩽ 1 000	4,9	7,0	10,0	14,0	20,0	28,0	39,0	55,0	78,0	111,0	157,0	222,0	314,0
4 000 < d ⩽ 6 000	80 ⩽ b ⩽ 160	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	101,0	143,0	203,0
	160 < b ⩽ 250	3,6	5,0	7,0	10,0	14,0	20,0	28,0	40,0	57,0	80,0	114,0	161,0	228,0
	250 < b ⩽ 400	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0	90,0	127,0	179,0	253,0
	400 < b ⩽ 650	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	102,0	144,0	203,0	288,0
	650 < b ⩽ 1 000	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0	165,0	233,0	329,0
6 000 < d ⩽ 8 000	80 ⩽ b ⩽ 160	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	109,0	154,0	218,0
	160 < b ⩽ 250	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0	86,0	121,0	171,0	242,0
	250 < b ⩽ 400	4,2	6,0	8,5	12,0	17,0	24,0	34,0	47,0	67,0	95,0	134,0	190,0	268,0
	400 < b ⩽ 650	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	76,0	107,0	151,0	214,0	303,0
	650 < b ⩽ 1 000	5,5	7,5	11,0	15,0	22,0	30,0	43,0	61,0	86,0	122,0	172,0	243,0	344
8 000 < d ⩽ 10 000	80 ⩽ b ⩽ 160	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	81,0	115,0	163,0	230,0
	160 < b ⩽ 250	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	90,0	128,0	181,0	255,0
	250 < b ⩽ 400	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0	141,0	199,0	281,0
	400 < b ⩽ 650	4,9	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	112,0	158,0	223,0	315,0
	650 < b ⩽ 1 000	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0	89,0	126,0	178,0	252,0	357,0

Annex A (normative) Tolerances for tangential composite deviations

A.1 General

Unless otherwise specified in procurement documents, the measurement of tangential composite deviations is not mandatory. Tolerances for these deviations are therefore not included in the main body of this part of ISO 1328.

However, when agreed between the supplier and purchaser, the method, preferably accompanied by a check of tooth contact, can sometimes be applied to replace some of the other inspection processes. Definitions of the tooth-to-tooth tangential composite deviation and of the total tangential composite deviation are given in **3.4**.

Tolerance values for tooth-to-tooth tangential composite deviations f'_i are calculated either by multiplying the numerical values f'_i/K given in Table A.1 by the factor K (K is as defined in **A.2.1**) or with the formulae given in **A.2.1** for accuracy grade 5 and, for any other accuracy grade, by applying the same calculation rules as those stated in clause **5**. For rounding the deviation values, the rules stated in clause **5** shall apply for $(f'_i/K) \times K$.

Tolerance values for total tangential composite deviations F'_i for accuracy grade 5 are calculated with the formula given in **A.2.2**. Rules for calculating the values of different accuracy grades and for rounding of deviation values are the same as those stated in clause **5**.

When checking the tangential composite deviation accuracy grade, the gear to be inspected shall mesh with a master gear at an appropriate centre distance (i.e. with a certain backlash) whilst contact is restricted to only one set of corresponding flanks, by applying a light but sufficient load.

A.2 Formulae for tolerances of accuracy grade 5

NOTE 12 The symbols used are as defined in clause **4**.

A.2.1 Tooth-to-tooth tangential composite deviation, f'_i, is calculated as follows:

$$f'_i = K(4{,}3 + f_{pt} + F_\alpha)$$

i.e.

$$f'_i = K\left(9 + 0{,}3m + 3{,}2\sqrt{m} + 0{,}34\sqrt{d}\right)$$

where

$$K = 0{,}2\left(\frac{\varepsilon_\gamma + 4}{\varepsilon_\gamma}\right) \text{ for } \varepsilon_\gamma < 4$$

$$K = 0{,}4 \text{ for } \varepsilon_\gamma \geqslant 4$$

If the facewidths of the product gear and master gear are different, the calculation of ε_γ is to be carried out using the smaller facewidth.

If the profile and/or the helix of the teeth are extensively modified, the effective values of ε_γ and K under test conditions can be so strongly affected that these must be taken into account when assessing the results of measurement. In these cases, special agreements on test conditions and evaluation on recorded diagrams are advisable.

A.2.2 Total tangential composite deviation, F'_i, is calculated as follows:

$$F'_i = F_p + f'_i$$

Table A.1 — Values of the quotient f'_i/K

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	f'_i/K µm												
$5 \leqslant d \leqslant 20$	$0,5 \leqslant m \leqslant 2$	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	109,0	154,0
	$2 < m \leqslant 3,5$	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	91,0	129,0	182,0
$20 < d \leqslant 50$	$0,5 \leqslant m \leqslant 2$	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	82,0	115,0	163,0
	$2 < m \leqslant 3,5$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	135,0	191,0
	$3,5 < m \leqslant 6$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	108,0	153,0	217,0
	$6 < m \leqslant 10$	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	63,0	89,0	125,0	177,0	251,0
$50 < d \leqslant 125$	$0,5 \leqslant m \leqslant 2$	2,7	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	124,0	176,0
	$2 < m \leqslant 3,5$	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	102,0	144,0	204,0
	$3,5 < m \leqslant 6$	3,6	5,0	7,0	10,0	14,0	20,0	29,0	40,0	57,0	81,0	115,0	162,0	229,0
	$6 < m \leqslant 10$	4,1	6,0	8,0	12,0	16,0	23,0	33,0	47,0	66,0	93,0	132,0	186,0	263,0
	$10 < m \leqslant 16$	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	109,0	154,0	218,0	308,0
	$16 < m \leqslant 25$	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	91,0	129,0	183,0	259,0	366,0
$125 < d \leqslant 280$	$0,5 \leqslant m \leqslant 2$	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	49,0	69,0	97,0	137,0	194,0
	$2 < m \leqslant 3,5$	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	111,0	157,0	222,0
	$3,5 < m \leqslant 6$	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	88,0	124,0	175,0	247,0
	$6 < m \leqslant 10$	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	100,0	141,0	199,0	281,0
	$10 < m \leqslant 16$	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	82,0	115,0	163,0	231,0	326,0
	$16 < m \leqslant 25$	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	192,0	272,0	384,0
	$25 < m \leqslant 40$	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0	165,0	233,0	329,0	465,0
$280 < d \leqslant 560$	$0,5 \leqslant m \leqslant 2$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	54,0	77,0	109,0	154,0	218,0
	$2 < m \leqslant 3,5$	3,8	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	87,0	123,0	174,0	246,0
	$3,5 < m \leqslant 6$	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	192,0	271,0
	$6 < m \leqslant 10$	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	108,0	153,0	216,0	305,0
	$10 < m \leqslant 16$	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	88,0	124,0	175,0	248,0	350,0
	$16 < m \leqslant 25$	6,5	9,0	13,0	18,0	26,0	36,0	51,0	72,0	102,0	144,0	204,0	289,0	408,0
	$25 < m \leqslant 40$	7,5	11,0	15,0	22,0	31,0	43,0	61,0	86,0	122,0	173,0	245,0	346,0	489,0
	$40 < m \leqslant 70$	9,5	14,0	19,0	27,0	39,0	55,0	78,0	110,0	155,0	220,0	311,0	439,0	621,0
$560 < d \leqslant 1\,000$	$0,5 \leqslant m \leqslant 2$	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	87,0	123,0	174,0	247,0
	$2 < m \leqslant 3,5$	4,3	6,0	8,5	12,0	17,0	24,0	34,0	49,0	69,0	97,0	137,0	194,0	275,0
	$3,5 < m \leqslant 6$	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	106,0	150,0	212,0	300,0
	$6 < m \leqslant 10$	5,0	7,5	10,0	15,0	21,0	30,0	42,0	59,0	84,0	118,0	167,0	236,0	334,0
	$10 < m \leqslant 16$	6,0	8,5	12,0	17,0	24,0	33,0	47,0	67,0	95,0	134,0	189,0	268,0	379,0
	$16 < m \leqslant 25$	7,0	9,5	14,0	19,0	27,0	39,0	55,0	77,0	109,0	154,0	218,0	309,0	437,0
	$25 < m \leqslant 40$	8,0	11,0	16,0	23,0	32,0	46,0	65,0	92,0	129,0	183,0	259,0	366,0	518,0
	$40 < m \leqslant 70$	10,0	14,0	20,0	29,0	41,0	57,0	81,0	115,0	163,0	230,0	325,0	460,0	650,0
$1\,000 < d \leqslant 1\,600$	$2 \leqslant m \leqslant 3,5$	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	108,0	153,0	217,0	307,0
	$3,5 < m \leqslant 6$	5,0	7,5	10,0	15,0	21,0	29,0	41,0	59,0	83,0	117,0	166,0	235,0	332,0
	$6 < m \leqslant 10$	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	91,0	129,0	183,0	259,0	366,0
	$10 < m \leqslant 16$	6,5	9,0	13,0	18,0	26,0	36,0	51,0	73,0	103,0	145,0	205,0	290,0	410,0
	$16 < m \leqslant 25$	7,5	10,0	15,0	21,0	29,0	41,0	59,0	83,0	117,0	166,0	234,0	331,0	468,0
	$25 < m \leqslant 40$	8,5	12,0	17,0	24,0	34,0	49,0	69,0	97,0	137,0	194,0	275,0	389,0	550,0
	$40 < m \leqslant 70$	11,0	15,0	21,0	30,0	43,0	60,0	85,0	120,0	170,0	241,0	341,0	482,0	682,0

Table A.1 — Values of the quotient f'_i/K

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	f'_i/K µm												
$1\,600 < d \leqslant 2\,500$	$3{,}5 \leqslant m \leqslant 6$	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	92,0	130,0	183,0	259,0	367,0
	$6 < m \leqslant 10$	6,5	9,0	13,0	18,0	25,0	35,0	50,0	71,0	100,0	142,0	200,0	283,0	401,0
	$10 < m \leqslant 16$	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	111,0	158,0	223,0	315,0	446,0
	$16 < m \leqslant 25$	8,0	11,0	16,0	22,0	31,0	45,0	63,0	89,0	126,0	178,0	252,0	356,0	504,0
	$25 < m \leqslant 40$	9,0	13,0	18,0	26,0	37,0	52,0	73,0	103,0	146,0	207,0	292,0	413,0	585,0
	$40 < m \leqslant 70$	11,0	16,0	22,0	32,0	45,0	63,0	90,0	127,0	179,0	253,0	358,0	507,0	717,0
$2\,500 < d \leqslant 4\,000$	$6 \leqslant m \leqslant 10$	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	111,0	157,0	223,0	315,0	445,0
	$10 < m \leqslant 16$	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	122,0	173,0	245,0	346,0	490,0
	$16 < m \leqslant 25$	8,5	12,0	17,0	24,0	34,0	48,0	68,0	97,0	137,0	194,0	274,0	387,0	548,0
	$25 < m \leqslant 40$	10,0	14,0	20,0	28,0	39,0	56,0	79,0	111,0	157,0	222,0	315,0	445,0	629,0
	$40 < m \leqslant 70$	12,0	17,0	24,0	34,0	48,0	67,0	95,0	135,0	190,0	269,0	381,0	538,0	761,0
$4\,000 < d \leqslant 6\,000$	$6 \leqslant m \leqslant 10$	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	125,0	176,0	249,0	352,0	498,0
	$10 < m \leqslant 16$	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	192,0	271,0	384,0	543,0
	$16 < m \leqslant 25$	9,5	13,0	19,0	27,0	38,0	53,0	75,0	106,0	150,0	212,0	300,0	425,0	601,0
	$25 < m \leqslant 40$	11,0	15,0	21,0	30,0	43,0	60,0	85,0	121,0	170,0	241,0	341,0	482,0	682,0
	$40 < m \leqslant 70$	13,0	18,0	25,0	36,0	51,0	72,0	102,0	144,0	204,0	288,0	407,0	576,0	814,0
$6\,000 < d \leqslant 8\,000$	$10 \leqslant m \leqslant 16$	9,5	13,0	19,0	26,0	37,0	52,0	74,0	105,0	148,0	210,0	297,0	420,0	594,0
	$16 < m \leqslant 25$	10,0	14,0	20,0	29,0	41,0	58,0	81,0	115,0	163,0	230,0	326,0	461,0	652,0
	$25 < m \leqslant 40$	11,0	16,0	23,0	32,0	46,0	65,0	92,0	130,0	183,0	259,0	366,0	518,0	733,0
	$40 < m \leqslant 70$	14,0	19,0	27,0	38,0	54,0	76,0	108,0	153,0	216,0	306,0	432,0	612,0	865,0
$8\,000 < d \leqslant 10\,000$	$10 \leqslant m \leqslant 16$	10,0	14,0	20,0	28,0	40,0	56,0	80,0	113,0	159,0	225,0	319,0	451,0	637,0
	$16 < m \leqslant 25$	11,0	15,0	22,0	31,0	43,0	61,0	87,0	123,0	174,0	246,0	348,0	492,0	695,0
	$25 < m \leqslant 40$	12,0	17,0	24,0	34,0	49,0	69,0	97,0	137,0	194,0	275,0	388,0	549,0	777,0
	$40 < m \leqslant 70$	14,0	20,0	28,0	40,0	57,0	80,0	114,0	161,0	227,0	321,0	454,0	642,0	909,0

NOTE The tolerances for f'_i are calculated from the values given in the table multiplied by K.

Annex B (informative) Values of profile and helix form and slope deviations

B.1 General

Since the form and slope deviations of profiles and helices are not individually subject to mandatory tolerances, none are provided as normative elements in this part of ISO 1328. However, as form and slope deviations have a substantial influence on the performance characteristics of the gear, relevant values are given in Table B.1 to Table B.3. Definitions of profile and helix form and slope deviations are given in **3.2.3** and **3.2.4** and in **3.3.3** and **3.3.4**.

B.2 Formulae for values of accuracy grade 5

B.2.1 Profile form deviation, $f_{f\alpha}$, is calculated from

$$f_{f\alpha} = 2{,}5\sqrt{m} + 0{,}17\sqrt{d} + 0{,}5$$

B.2.2 Profile slope deviation, $f_{H\alpha}$, is calculated from

$$f_{H\alpha} = 2\sqrt{m} + 0{,}14\sqrt{d} + 0{,}5$$

B.2.3 Helix form deviation, $f_{f\beta}$, and helix slope deviation, $f_{H\beta}$, are calculated from

$$f_{f\beta} = f_{H\beta} = 0{,}07\sqrt{d} + 0{,}45\sqrt{b} + 3$$

B.2.4 Rules for the calculation of form and slope deviation values of different accuracy grades and for rounding these values are the same as those stated in clause **5**.

Table B.1 — Profile form deviation, $f_{f\alpha}$

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	$f_{f\alpha}$ µm												
$5 \leqslant d \leqslant 20$	$0,5 \leqslant m \leqslant 2$	0,6	0,9	1,3	1,8	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0
	$2 < m \leqslant 3,5$	0,9	1,3	1,8	2,6	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0
$20 < d \leqslant 50$	$0,5 \leqslant m \leqslant 2$	0,7	1,0	1,4	2,0	2,8	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0
	$2 < m \leqslant 3,5$	1,0	1,4	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0
	$3,5 < m \leqslant 6$	1,2	1,7	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	54,0	77,0
	$6 < m \leqslant 10$	1,5	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	67,0	95,0
$50 < d \leqslant 125$	$0,5 \leqslant m \leqslant 2$	0,8	1,1	1,6	2,3	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0
	$2 < m \leqslant 3,5$	1,1	1,5	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	49,0	69,0
	$3,5 < m \leqslant 6$	1,3	1,8	2,6	3,7	5,0	7,5	10,0	15,0	21,0	29,0	42,0	59,0	83,0
	$6 < m \leqslant 10$	1,6	2,2	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	101,0
	$10 < m \leqslant 16$	1,9	2,7	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	87,0	123,0
	$16 < m \leqslant 25$	2,3	3,3	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	75,0	106,0	149,0
$125 < d \leqslant 280$	$0,5 \leqslant m \leqslant 2$	0,9	1,3	1,9	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0
	$2 < m \leqslant 3,5$	1,2	1,7	2,4	3,4	4,9	7,0	9,5	14,0	19,0	28,0	39,0	55,0	78,0
	$3,5 < m \leqslant 6$	1,4	2,0	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	93,0
	$6 < m \leqslant 10$	1,7	2,4	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	55,0	78,0	111,0
	$10 < m \leqslant 16$	2,1	2,9	4,0	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	94,0	133,0
	$16 < m \leqslant 25$	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0	158,0
	$25 < m \leqslant 40$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	135,0	191,0
$280 < d \leqslant 560$	$0,5 \leqslant m \leqslant 2$	1,1	1,6	2,3	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0	72,0
	$2 < m \leqslant 3,5$	1,4	2,0	2,8	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	64,0	90,0
	$3,5 < m \leqslant 6$	1,6	2,3	3,3	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	74,0	104,0
	$6 < m \leqslant 10$	1,9	2,7	3,8	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	123,0
	$10 < m \leqslant 16$	2,3	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0	72,0	102,0	145,0
	$16 < m \leqslant 25$	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	121,0	170,0
	$25 < m \leqslant 40$	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	101,0	144,0	203,0
	$40 < m \leqslant 70$	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	125,0	177,0	250,0
$560 < d \leqslant 1\,000$	$0,5 \leqslant m \leqslant 2$	1,4	1,9	2,7	3,8	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0
	$2 < m \leqslant 3,5$	1,6	2,3	3,3	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	74,0	104,0
	$3,5 < m \leqslant 6$	1,9	2,6	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	59,0	84,0	119,0
	$6 < m \leqslant 10$	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	97,0	137,0
	$10 < m \leqslant 16$	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0	159,0
	$16 < m \leqslant 25$	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	92,0	131,0	185,0
	$25 < m \leqslant 40$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	109,0	154,0	217,0
	$40 < m \leqslant 70$	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	93,0	132,0	187,0	264,0
$1\,000 < d \leqslant 1\,600$	$2 \leqslant m \leqslant 3,5$	1,9	2,7	3,8	5,5	7,5	11,0	15,5	21,0	30,0	42,0	60,0	85,0	120,0
	$3,5 < m \leqslant 6$	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	67,0	95,0	135,0
	$6 < m \leqslant 10$	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	76,0	108,0	153,0
	$10 < m \leqslant 16$	2,7	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	87,0	124,0	175,0
	$16 < m \leqslant 25$	3,1	4,4	6,5	9,0	13,0	18,0	25,0	35,0	50,0	71,0	100,0	142,0	201,0
	$25 < m \leqslant 40$	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	117,0	165,0	233,0
	$40 < m \leqslant 70$	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	99,0	140,0	198,0	280,0

Table B.1 — Profile form deviation, $f_{f\alpha}$

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	$f_{f\alpha}$ µm												
$1\ 600 < d \leqslant 2\ 500$	$3,5 \leqslant m \leqslant 6$	2,4	3,4	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	108,0	152,0
	$6 < m \leqslant 10$	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	120,0	170,0
	$10 < m \leqslant 16$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	192,0
	$16 < m \leqslant 25$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	55,0	77,0	109,0	154,0	218,0
	$25 < m \leqslant 40$	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	63,0	89,0	125,0	177,0	251,0
	$40 < m \leqslant 70$	4,6	6,5	9,5	13,0	19,0	26,0	37,0	53,0	74,0	105,0	149,0	210,0	297,0
$2\ 500 < d \leqslant 4\ 000$	$6 \leqslant m \leqslant 10$	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	193,0
	$10 < m \leqslant 16$	3,4	4,7	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	107,0	152,0	214,0
	$16 < m \leqslant 25$	3,8	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	85,0	120,0	170,0	240,0
	$25 < m \leqslant 40$	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	136,0	193,0	273,0
	$40 < m \leqslant 70$	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	80,0	113,0	160,0	226,0	320,0
$4\ 000 < d \leqslant 6\ 000$	$6 \leqslant m \leqslant 10$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	55,0	77,0	109,0	155,0	219,0
	$10 < m \leqslant 16$	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	120,0	170,0	241,0
	$16 < m \leqslant 25$	4,2	6,0	8,5	12,0	17,0	24,0	33,0	47,0	67,0	94,0	133,0	189,0	267,0
	$25 < m \leqslant 40$	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	75,0	106,0	150,0	212,0	299,0
	$40 < m \leqslant 70$	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	122,0	173,0	245,0	346,0
$6\ 000 < d \leqslant 8\ 000$	$10 \leqslant m \leqslant 16$	4,2	6,0	8,5	12,0	17,0	24,0	33,0	47,0	67,0	94,0	133,0	188,0	266,0
	$16 < m \leqslant 25$	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	73,0	103,0	146,0	207,0	292,0
	$25 < m \leqslant 40$	5,0	7,0	10,0	14,0	20,0	29,0	41,0	57,0	81,0	115,0	162,0	230,0	325,0
	$40 < m \leqslant 70$	6,0	8,0	12,0	16,0	23,0	33,0	46,0	66,0	93,0	131,0	186,0	263,0	371,0
$8\ 000 < d \leqslant 10\ 000$	$10 \leqslant m \leqslant 16$	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	102,0	144,0	204,0	288,0
	$16 < m \leqslant 25$	4,9	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	111,0	157,0	222,0	314,0
	$25 < m \leqslant 40$	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	87,0	123,0	173,0	245,0	347,0
	$40 < m \leqslant 70$	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	98,0	139,0	197,0	278,0	393,0

Table B.2 — Profile slope deviation, $\pm f_{H\alpha}$

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	$\pm f_{H\alpha}$ µm												
$5 \leqslant d \leqslant 20$	$0,5 \leqslant m \leqslant 2$	0,5	0,7	1,0	1,5	2,1	2,9	4,2	6,0	8,5	12,0	17,0	24,0	33,0
	$2 < m \leqslant 3,5$	0,7	1,0	1,5	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	47,0
$20 < d \leqslant 50$	$0,5 \leqslant m \leqslant 2$	0,6	0,8	1,2	1,6	2,3	3,3	4,6	6,5	9,5	13,0	19,0	26,0	37,0
	$2 < m \leqslant 3,5$	0,8	1,1	1,6	2,3	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0
	$3,5 < m \leqslant 6$	1,0	1,4	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0
	$6 < m \leqslant 10$	1,2	1,7	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	55,0	78,0
$50 < d \leqslant 125$	$0,5 \leqslant m \leqslant 2$	0,7	0,9	1,3	1,9	2,6	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0
	$2 < m \leqslant 3,5$	0,9	1,2	1,8	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	57,0
	$3,5 < m \leqslant 6$	1,1	1,5	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0
	$6 < m \leqslant 10$	1,3	1,8	2,6	3,7	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	83,0
	$10 < m \leqslant 16$	1,6	2,2	3,1	4,4	6,5	9,0	13,0	18,0	25,0	35,0	50,0	71,0	100,0
	$16 < m \leqslant 25$	1,9	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	86,0	121,0
$125 < d \leqslant 280$	$0,5 \leqslant m \leqslant 2$	0,8	1,1	1,6	2,2	3,1	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0
	$2 < m \leqslant 3,5$	1,0	1,4	2,0	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0
	$3,5 < m \leqslant 6$	1,2	1,7	2,4	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0
	$6 < m \leqslant 10$	1,4	2,0	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	90,0
	$10 < m \leqslant 16$	1,7	2,4	3,4	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	108,0
	$16 < m \leqslant 25$	2,0	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	91,0	129,0
	$25 < m \leqslant 40$	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	55,0	77,0	109,0	155,0
$280 < d \leqslant 560$	$0,5 \leqslant m \leqslant 2$	0,9	1,3	1,9	2,6	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0
	$2 < m \leqslant 3,5$	1,2	1,6	2,3	3,3	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	74,0
	$3,5 < m \leqslant 6$	1,3	1,9	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0	86,0
	$6 < m \leqslant 10$	1,6	2,2	3,1	4,4	6,5	9,0	13,0	18,0	25,0	35,0	50,0	71,0	100,0
	$10 < m \leqslant 16$	1,8	2,6	3,7	5,0	7,5	10,0	15,0	21,0	29,0	42,0	59,0	83,0	118,0
	$16 < m \leqslant 25$	2,2	3,1	4,3	6,0	8,5	12,0	17,0	24,0	35,0	49,0	69,0	98,0	138,0
	$25 < m \leqslant 40$	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0	164,0
	$40 < m \leqslant 70$	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	101,0	143,0	202,0
$560 < d \leqslant 1\,000$	$0,5 \leqslant m \leqslant 2$	1,1	1,6	2,2	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0
	$2 < m \leqslant 3,5$	1,3	1,9	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0	86,0
	$3,5 < m \leqslant 6$	1,5	2,2	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	49,0	69,0	97,0
	$6 < m \leqslant 10$	1,7	2,5	3,5	4,9	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0
	$10 < m \leqslant 16$	2,0	2,9	4,0	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	92,0	129,0
	$16 < m \leqslant 25$	2,3	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	106,0	150,0
	$25 < m \leqslant 40$	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	125,0	176,0
	$40 < m \leqslant 70$	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	76,0	107,0	151,0	214,0
$1\,000 < d \leqslant 1\,600$	$2 \leqslant m \leqslant 3,5$	1,5	2,2	3,1	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	99,0
	$3,5 < m \leqslant 6$	1,7	2,4	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	55,0	78,0	110,0
	$6 < m \leqslant 10$	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	125,0
	$10 < m \leqslant 16$	2,2	3,1	4,5	6,5	9,0	13,0	18,0	25,0	36,0	50,0	71,0	101,0	142,0
	$16 < m \leqslant 25$	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	82,0	115,0	163,0
	$25 < m \leqslant 40$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	33,0	47,0	67,0	95,0	134,0	189,0
	$40 < m \leqslant 70$	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	57,0	80,0	113,0	160,0	227,0

Table B.2 — Profile slope deviation, $\pm f_{H\alpha}$

Reference diameter	Module	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	m mm	$\pm f_{H\alpha}$ µm												
$1\,600 < d \leqslant 2\,500$	$3{,}5 \leqslant m \leqslant 6$	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0	125,0
	$6 < m \leqslant 10$	2,2	3,1	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	99,0	139,0
	$10 < m \leqslant 16$	2,5	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	55,0	78,0	111,0	157,0
	$16 < m \leqslant 25$	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	63,0	89,0	126,0	178,0
	$25 < m \leqslant 40$	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	102,0	144,0	204,0
	$40 < m \leqslant 70$	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	121,0	170,0	241,0
$2\,500 < d \leqslant 4\,000$	$6 \leqslant m \leqslant 10$	2,5	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	112,0	158,0
	$10 < m \leqslant 16$	2,7	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	88,0	124,0	175,0
	$16 < m \leqslant 25$	3,1	4,3	6,0	8,5	12,0	17,0	24,0	35,0	49,0	69,0	98,0	139,0	196,0
	$25 < m \leqslant 40$	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	55,0	78,0	111,0	157,0	222,0
	$40 < m \leqslant 70$	4,1	5,5	8,0	11,0	16,0	23,0	32,0	46,0	65,0	92,0	130,0	183,0	259,0
$4\,000 < d \leqslant 6\,000$	$6 \leqslant m \leqslant 10$	2,8	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0	90,0	127,0	179,0
	$10 < m \leqslant 16$	3,1	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	98,0	139,0	197,0
	$16 < m \leqslant 25$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0	109,0	154,0	218,0
	$25 < m \leqslant 40$	3,8	5,5	7,5	11,0	15,0	22,0	30,0	43,0	61,0	86,0	122,0	172,0	244,0
	$40 < m \leqslant 70$	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0	141,0	199,0	281,0
$6\,000 < d \leqslant 8\,000$	$10 \leqslant m \leqslant 16$	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	54,0	77,0	109,0	154,0	218,0
	$16 < m \leqslant 25$	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	84,0	119,0	169,0	239,0
	$25 < m \leqslant 40$	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	94,0	132,0	187,0	265,0
	$40 < m \leqslant 70$	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	76,0	107,0	151,0	214,0	302,0
$8\,000 < d \leqslant 10\,000$	$10 \leqslant m \leqslant 16$	3,7	5,0	7,5	10,0	15,0	21,0	29,0	42,0	59,0	83,0	118,0	167,0	236,0
	$16 < m \leqslant 25$	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	91,0	128,0	181,0	257,0
	$25 < m \leqslant 40$	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	71,0	100,0	141,0	200,0	283,0
	$40 < m \leqslant 70$	5,0	7,0	10,0	14,0	20,0	28,0	40,0	57,0	80,0	113,0	160,0	226,0	320,0

Table B.3 — Helix form deviation, $f_{f\beta}$, and helix slope deviation, $f_{H\beta}$

Reference diameter	Facewidth	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	b mm	$f_{f\beta}$ and $f_{H\beta}$ µm												
$5 \leqslant d \leqslant 20$	$4 \leqslant b \leqslant 10$	0,8	1,1	1,5	2,2	3,1	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0
	$10 \leqslant b \leqslant 20$	0,9	1,2	1,7	2,5	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	56,0
	$20 \leqslant b \leqslant 40$	1,0	1,4	2,0	2,8	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	64,0
	$40 \leqslant b \leqslant 80$	1,2	1,7	2,3	3,3	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	75,0
$20 < d \leqslant 50$	$4 \leqslant b \leqslant 10$	0,8	1,1	1,6	2,3	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0
	$10 < b \leqslant 20$	0,9	1,3	1,8	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0
	$20 < b \leqslant 40$	1,0	1,4	2,0	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0
	$40 < b \leqslant 80$	1,2	1,7	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0
	$80 < b \leqslant 160$	1,4	2,0	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	93,0
$50 < d \leqslant 125$	$4 \leqslant b \leqslant 10$	0,8	1,2	1,7	2,4	3,4	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0
	$10 < b \leqslant 20$	0,9	1,3	1,9	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0
	$20 < b \leqslant 40$	1,1	1,5	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0
	$40 < b \leqslant 80$	1,2	1,8	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0
	$80 < b \leqslant 160$	1,5	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	67,0	95,0
	$160 < b \leqslant 250$	1,8	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	80,0	113,0
	$250 < b \leqslant 400$	2,1	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	66,0	93,0	132,0
$125 < d \leqslant 280$	$4 \leqslant b \leqslant 10$	0,9	1,3	1,8	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0
	$10 < b \leqslant 20$	1,0	1,4	2,0	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0
	$20 < b \leqslant 40$	1,1	1,6	2,2	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0
	$40 < b \leqslant 80$	1,3	1,8	2,6	3,7	5,0	7,5	10,0	15,0	21,0	29,0	42,0	59,0	83,0
	$80 < b \leqslant 160$	1,5	2,2	3,1	4,4	6,0	8,5	12,0	17,0	25,0	35,0	49,0	70,0	99,0
	$160 < b \leqslant 250$	1,8	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	83,0	117,0
	$250 < b \leqslant 400$	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0	135,0
	$400 < b \leqslant 650$	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	56,0	80,0	113,0	160,0
$280 < d \leqslant 560$	$10 \leqslant b \leqslant 20$	1,1	1,5	2,2	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	49,0	69,0
	$20 < b \leqslant 40$	1,2	1,7	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	38,0	54,0	77,0
	$40 < b \leqslant 80$	1,4	1,9	2,7	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	62,0	88,0
	$80 < b \leqslant 160$	1,6	2,3	3,2	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	73,0	104,0
	$160 < b \leqslant 250$	1,9	2,7	3,8	5,5	7,5	11,0	15,0	22,0	30,0	43,0	61,0	86,0	122,0
	$250 < b \leqslant 400$	2,2	3,1	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	99,0	140,0
	$400 < b \leqslant 650$	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0	165,0
	$650 < b \leqslant 1\,000$	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	49,0	69,0	97,0	137,0	194,0
$560 < d \leqslant 1\,000$	$10 \leqslant b \leqslant 20$	1,2	1,7	2,3	3,3	4,7	6,5	9,5	13,0	19,0	26,0	37,0	53,0	75,0
	$20 < b \leqslant 40$	1,3	1,8	2,6	3,7	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	83,0
	$40 < b \leqslant 80$	1,5	2,1	2,9	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	94,0
	$80 < b \leqslant 160$	1,7	2,4	3,4	4,9	7,0	9,5	14,0	19,0	27,0	39,0	55,0	78,0	110,0
	$160 < b \leqslant 250$	2,0	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	90,0	128,0
$560 < d \leqslant 1\,000$	$250 < b \leqslant 400$	2,3	3,2	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	73,0	103,0	146,0
	$400 < b \leqslant 650$	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	60,0	85,0	121,0	171,0
	$650 < b \leqslant 1\,000$	3,1	4,4	6,5	9,0	13,0	18,0	25,0	35,0	50,0	71,0	100,0	142,0	200,0

Table B.3 — Helix form deviation, $f_{f\beta}$, and helix slope deviation, $f_{H\beta}$

Reference diameter	Facewidth	Accuracy grade												
		0	1	2	3	4	5	6	7	8	9	10	11	12
d mm	b mm	$f_{f\beta}$ and $f_{H\beta}$ µm												
$1\,000 < d \leqslant 1\,600$	$20 \leqslant b \leqslant 40$	1,4	2,0	2,8	3,9	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0	89,0
	$40 < b \leqslant 80$	1,6	2,2	3,1	4,4	6,5	9,0	13,0	18,0	25,0	35,0	50,0	71,0	100,0
	$80 < b \leqslant 160$	1,8	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	82,0	116,0
	$160 < b \leqslant 250$	2,1	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	47,0	67,0	95,0	134,0
	$250 < b \leqslant 400$	2,4	3,4	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	108,0	153,0
	$400 < b \leqslant 650$	2,8	3,9	5,5	8,0	11,0	16,0	22,0	31,0	44,0	63,0	89,0	125,0	177,0
	$650 < b \leqslant 1\,000$	3,2	4,6	6,5	9,0	13,0	18,0	26,0	37,0	52,0	73,0	103,0	146,0	207,0
$1\,600 < d \leqslant 2\,500$	$20 \leqslant b \leqslant 40$	1,5	2,1	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	96,0
	$40 < b \leqslant 80$	1,7	2,4	3,4	4,8	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	108,0
	$80 < b \leqslant 160$	1,9	2,7	3,9	5,5	7,5	11,0	15,0	22,0	31,0	44,0	62,0	87,0	124,0
	$160 < b \leqslant 250$	2,2	3,1	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	71,0	100,0	141,0
	$250 < b \leqslant 400$	2,5	3,5	5,0	7,0	10,0	14,0	20,0	28,0	40,0	57,0	80,0	113,0	160,0
	$400 < b \leqslant 650$	2,9	4,1	6,0	8,0	12,0	16,0	23,0	33,0	46,0	65,0	92,0	130,0	184,0
	$650 < b \leqslant 1\,000$	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	76,0	107,0	151,0	214,0
$2\,500 < d \leqslant 4\,000$	$40 \leqslant b \leqslant 80$	1,8	2,6	3,6	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	83,0	117,0
	$80 < b \leqslant 160$	2,1	2,9	4,1	6,0	8,5	12,0	17,0	23,0	33,0	47,0	66,0	94,0	133,0
	$160 < b \leqslant 250$	2,4	3,3	4,7	6,5	9,5	13,0	19,0	27,0	38,0	53,0	75,0	106,0	150,0
	$250 < b \leqslant 400$	2,6	3,7	5,5	7,5	11,0	15,0	21,0	30,0	42,0	60,0	85,0	120,0	169,0
	$400 < b \leqslant 650$	3,0	4,3	6,0	8,5	12,0	17,0	24,0	34,0	48,0	68,0	97,0	137,0	193,0
	$650 < b \leqslant 1\,000$	3,5	4,9	7,0	10,0	14,0	20,0	28,0	39,0	56,0	79,0	112,0	158,0	223,0
$4\,000 < d \leqslant 6\,000$	$80 \leqslant b \leqslant 160$	2,2	3,2	4,5	6,5	9,0	13,0	18,0	25,0	36,0	51,0	72,0	101,0	144,0
	$160 < b \leqslant 250$	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	40,0	57,0	81,0	114,0	161,0
	$250 < b \leqslant 400$	2,8	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	64,0	90,0	127,0	180,0
	$400 < b \leqslant 650$	3,2	4,5	6,5	9,0	13,0	18,0	26,0	36,0	51,0	72,0	102,0	144,0	204,0
	$650 < b \leqslant 1\,000$	3,7	5,0	7,5	10,0	15,0	21,0	29,0	41,0	58,0	83,0	117,0	165,0	234,0
$6\,000 < d \leqslant 8\,000$	$80 \leqslant b \leqslant 160$	2,4	3,4	4,8	7,0	9,5	14,0	19,0	27,0	39,0	54,0	77,0	109,0	154,0
	$160 < b \leqslant 250$	2,7	3,8	5,5	7,5	11,0	15,0	21,0	30,0	43,0	61,0	86,0	122,0	172,0
	$250 < b \leqslant 400$	3,0	4,2	6,0	8,5	12,0	17,0	24,0	34,0	48,0	67,0	95,0	135,0	190,0
	$400 < b \leqslant 650$	3,4	4,7	6,5	9,5	13,0	19,0	27,0	38,0	54,0	76,0	107,0	152,0	215,0
	$650 < b \leqslant 1\,000$	3,8	5,5	7,5	11,0	15,0	22,0	31,0	43,0	61,0	86,0	122,0	173,0	244,0
$8\,000 < d \leqslant 10\,000$	$80 \leqslant b \leqslant 160$	2,5	3,6	5,0	7,0	10,0	14,0	20,0	29,0	41,0	58,0	81,0	115,0	163,0
	$160 < b \leqslant 250$	2,8	4,0	5,5	8,0	11,0	16,0	23,0	32,0	45,0	64,0	90,0	128,0	181,0
	$250 < b \leqslant 400$	3,1	4,4	6,0	9,0	12,0	18,0	25,0	35,0	50,0	70,0	100,0	141,0	199,0
	$400 < b \leqslant 650$	3,5	4,9	7,0	10,0	14,0	20,0	28,0	40,0	56,0	79,0	112,0	158,0	224,0
	$650 < b \leqslant 1\,000$	4,0	5,5	8,0	11,0	16,0	22,0	32,0	45,0	63,0	90,0	127,0	179,0	253,0

Annex C (informative) Bibliography

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List of references

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