
International Standard



4468

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Gear hobs — Single start — Accuracy requirements

Fraises-mères à une entrée — Tolérances

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Descriptors : milling cutters, gear hobs, accuracy, tolerances.

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4468 was developed by Technical Committee ISO/TC 60, *Gears*, and was circulated to the member bodies in June 1980.

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It has been approved by the member bodies of the following countries :

Australia	France	Romania
Austria	Germany, F.R.	South Africa, Rep. of
Belgium	Hungary	Spain
Bulgaria	India	Sweden
Canada	Italy	Switzerland
Czechoslovakia	Korea, Rep. of	United Kingdom
Egypt, Arab Rep. of	Netherlands	USSR
Finland	Poland	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Japan
USA

Gear hobs — Single start — Accuracy requirements

1 Scope and field of application

This International Standard specifies requirements for the accuracy of general purpose single start hobs of 1 to 40 module and 25 to 0,625 diametral pitch.

These hobs are intended for producing gears which conform to ISO 53 and ISO 54.

This International Standard applies to single start hobs for helical and straight spur gears. It applies to solid (monobloc) and inserted blade hobs.

The elemental features of hobs are graded as follows according to accuracy :

Grade AA, Grade A, Grade B and Grade C
where Grade AA is the highest order of precision.

NOTE — Grade D hobs are not specified in this International Standard. The values of the tolerances for Grade D are 1,32 times the value of the tolerances for Grade C, except for the bore tolerances which would be H6.

In addition to the conventional elemental tests for hobs, this International Standard gives permitted tolerances for the practical test consisting of the measurement of the position of the cutting edges along a line of action. This test requires special equipment. The two groups of tests are not equivalent and one shall choose between one or the other. If there was no previous agreement, the hob is regarded as belonging to the precision class specified, if it satisfies one or other of the two methods of inspection.

NOTE — The tolerances in this International Standard were determined for gear hobs whose dimensions conform to ISO 2490, but with certain precautions they may be applied to hobs not specified in this International Standard.

In this International Standard, the diametral pitches are given only on a provisional basis; they will be deleted after the period necessary to allow conversion to the metric system.

2 References

ISO 3, *Preferred numbers — Series of preferred numbers.*

ISO 17, *Guide to the use of preferred numbers and of series of preferred numbers.*

ISO 53, *Cylindrical gears for general and heavy engineering — Basic rack.*

ISO 54, *Cylindrical gears for general engineering and for heavy engineering — Modules and diametral pitches.*

ISO 286/1, *ISO System for limits and fits — Part 1 : General, tolerances and deviations.*¹⁾

ISO 701, *International gear notation — Symbols for geometrical data.*

ISO/R 1122, *Glossary of gears — Geometrical definitions.*

ISO 2490, *Single-start solid (monobloc) gear hobs with axial keyway, 1 to 20 module and 1 to 20 diametral pitch — Nominal dimensions.*

3 Accuracy requirements

Hobs shall conform with the requirements of tables 1 and 2 or 3 as appropriate.

4 Derivation of tolerances

(see table 2)

It should be noted that test 7 does not conform to a datum value and is not in the statements below concerning grade relationships.

With the exception of test 7, the datum from which all the values in tables 2 and 3 are derived is the value of 45 µm in test 14 Grade A module 16-25.

The ratio between Grade AA and Grade A is 1,6 except for test 9 and 9A where it is 1. The ratio between Grade A and Grade B is 1,6 for tests 1 and 2 and is 1,8 for tests 3 to 6, and 2 for tests 8 to 14. The ratio between Grade B and Grade C is 2 except in the case of tests 1, 2, 4, 5, 6, 9 and 9A. In this case the ratio adopted is 1 for practical convenience. These ratios are taken from ISO 3.

1) At present at the stage of draft. (Revision of ISO/R 286-1962.)

The ratios between the various module ranges are indicated in test 1 and this applies to all the other tests except test 7.

The metric values are to be taken as the basis of the tables. The inch units in table 3 are converted from the metric values in table 2. The values for tolerances of 12,5 µm and upwards have been rounded off in accordance with ISO 17. The values 4,5, 7,5, 8,5 and 9,5 µm have been increased by 0,5 µm on account of the smallness of the values concerned, this being allowed according to ISO 17.

Inch values of tolerance greater than 0,002 in have been rounded to the nearest 0,0005 in.

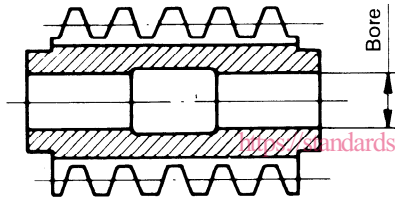
Table 1 – Tolerance on bores

Grade of hob	AA	A	B	C
Tolerance on bore diameter ¹⁾	H5	H5	H6	H6

1) In accordance with ISO 286.

Standard bores shall be finished straight and parallel, within the tolerances given in table 1, for 75 % of each bearing length for Grade AA, A and B hobs and 50 % for Grade C hobs.

A reference mandrel of nominal bore diameter shall pass through the bore as a check of alignment.



4.1 Key to table 2

The datum value for each of the tests is that for Grade A module 16 to 25. These values are derived from the datum value for test 14, which is 45 µm, in conjunction with the ratios specified below.

Test 1 : Bosses; radial run-out (Test 14/3,15).

Test 2 : Bosses; axial run-out (Test 14/4).

Test 3 : Teeth; radial run-out of tips (Test 14 × 1,6).

Test 4 : Cutting faces of gashes; straightness and radial alignment (Test 14 × 1,25).

Test 5 : Cutting faces of gashes; adjacent spacing (Test 14 × 1,6).

Test 6 : Cutting faces of gashes; cumulative spacing (Test 14 × 3).

Test 7 : Cutting faces of gashes; lead (no relationship to Test 14).

Test 8 : Tooth profile at cutting edges (Test 14/2).

Test 8A : Tooth profile at cutting edges (Test 14/1). See notes at end of table 2.

Test 9 : Tooth thickness (Test 14 × 2,24).

Test 9A* : Tooth addendum (Test 14 × 3,15).

Test 10 : Tooth lead; tooth to tooth (Test 14/2,24).

Test 11 : Tooth lead; cumulative in one convolution (cyclic) (Test 14/1,25).

Test 11A : Tooth lead; cumulative in one convolution (cyclic) (Test 14/1,12). See notes at end of table 2.

Test 12 : Tooth lead; cumulative in 3 convolutions (Test 14 × 1,4).

Test 13 : Tooth spacing along line of action; Tooth to tooth (Test 14/2,24).

Test 14 : Tooth spacing along line of action : cumulative. Datum 45 µm, m > 16 to 25 Grade A.

* The tooth addendum tolerances, test 9A, are related to tooth thickness for hobs having a normal pressure angle of 20° so that :

$$\begin{aligned} \text{Addendum tolerance} &= \frac{\text{thickness tolerance}}{2 \times \text{tangent pressure angle (20°)}} \\ &= 1,374 \times \text{tooth thickness tolerance} \end{aligned}$$

As 1,374 approximates to the preferred number 1,4, the latter has been used.

Table 2 — Accuracy requirements — Metric units

NOTE — Tests 1 to 14 may be carried out in any practicable order.

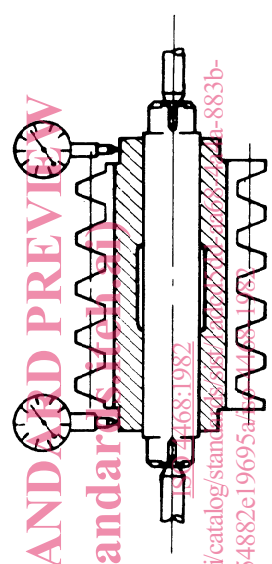
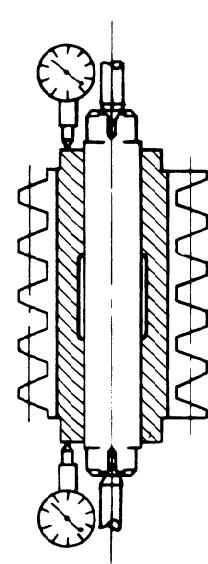
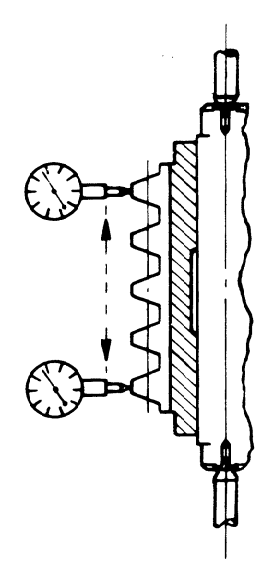
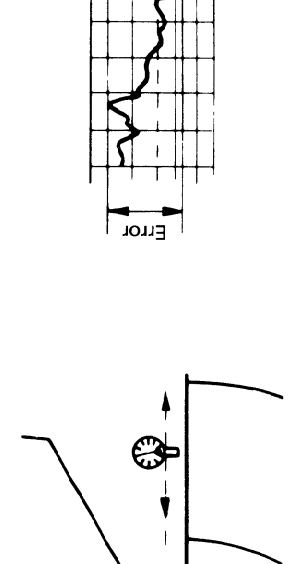
Test No.	Element	Drawing	Object of test	Tolerances μm										
				Pitch range module m			Grade							
				AA	A	B	C							
1	Boss reference surfaces https://standards.iteh.ai/catalog/standards-883b-54882e19695a-1982		Radial run-out of boss	1 to 2	3	5	7	7	1,12					
				> 2 to 3,5	3	5	8	8	1,18					
				> 3,5 to 6,3	4	6	10	10	1,25					
				> 6,3 to 10	5	8	12	12	1,32					
				> 10 to 16	6	10	16	16	1,4					
				> 16 to 25	9	14	22	22	1,5					
				> 25 to 40	13	21	34	34						
2	Boss reference surfaces		Axial run-out of boss	1 to 2	2	4	6	6						
				> 2 to 3,5	3	4	6	6						
				> 3,5 to 6,3	3	5	8	8						
				> 6,3 to 10	4	6	10	10						
				> 10 to 16	5	8	12	12						
				> 16 to 25	7	11	18	18						
				> 25 to 40	11	17	26	26						
3	Outside diameter		Radial run-out of tips of teeth	1 to 2	14	22	40	80						
				> 2 to 3,5	16	25	45	90						
				> 3,5 to 6,3	19	30	53	105						
				> 6,3 to 10	24	38	65	130						
				> 10 to 16	32	50	90	180						
				> 16 to 25	45	70	125	250						
				> 25 to 40	65	105	190	380						
4	Cutting faces of gashes		Straightness and radial alignment over cutting depth	1 to 2	11	18	32	32						
				> 2 to 3,5	12	20	36	36						
				> 3,5 to 6,3	15	24	42	42						
				> 6,3 to 10	19	30	53	53						
				> 10 to 16	25	40	70	70						
				> 16 to 25	36	55	100	100						
				> 25 to 40	53	85	150	150						

Table 2 — Accuracy requirements — Metric units (continued)

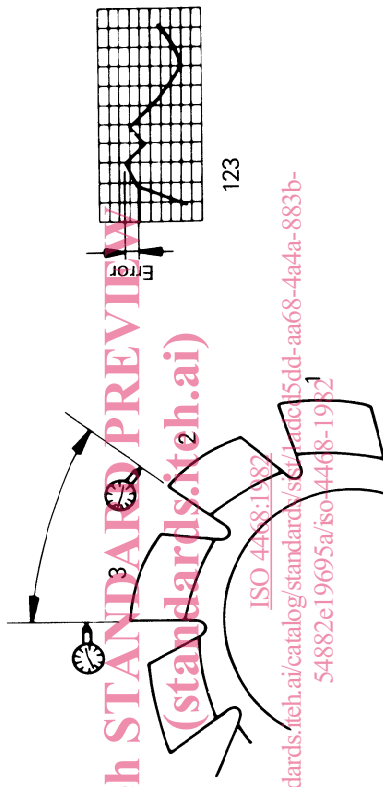
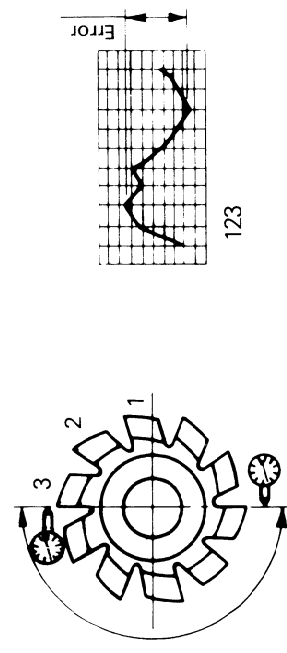
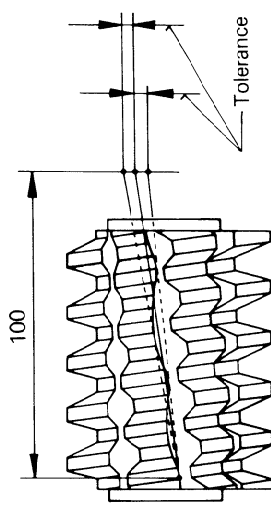
Test No.	Element	Drawing	Object of test	Tolerances μm				
				Pitch range module m	AA	A	B	C
5	Cutting faces of gashes	 <p>123</p> <p>ISO 4468:1982 https://standards.iteh.ai/catalog/standards/sist/4468-4a4a-883b-54882e19695a/iso-4468-1982</p>	Adjacent spacing	1 to 2 > 2 to 3,5 > 3,5 to 6,3 > 6,3 to 10 > 10 to 16 > 16 to 25 > 25 to 40	14 16 19 24 32 45 65	22 25 30 38 50 70 105	40 45 53 65 90 125 190	
6	Cutting faces of gashes	 <p>123</p>	Cumulative spacing	1 to 2 > 2 to 3,5 > 3,5 to 6,3 > 6,3 to 10 > 10 to 16 > 16 to 25 > 25 to 40	26 30 36 45 60 85 120	75 85 100 125 170 240 350		
7	Cutting faces of gashes	 <p>100</p> <p>Tolerance</p>	Gash lead	Per 100 mm face width	60	80	100	140

Table 2 — Accuracy requirements — Metric units (continued)

Test No.	Element	Drawing	Object of test	Tolerances μm			
				Pitch range module m	Grade		
AA	A	B	C				
8	Tooth		Tooth profile (permissible error in the involute helicoid profile)	1 to 2 > 2 to 3,5 > 3,5 to 6,3 > 6,3 to 10 > 10 to 16 > 16 to 25 > 25 to 40	5 7 14 28 5 8 16 32 6 10 19 38 8 12 24 48 10 16 32 60 14 22 45 90 21 34 65 130		
8 A	Tooth		Tooth profile when line of action check is used. See note below table. (Permissible error in the involute profile)	1 to 2 > 2 to 3,5 > 3,5 to 6,3 > 6,3 to 10 > 10 to 16 > 16 to 25 > 25 to 40	9 14 28 55 10 16 32 60 12 19 38 75 15 24 48 95 20 32 60 125 28 45 90 180 42 65 130 260		
9	Tooth		Tooth thickness (minus only)	1 to 2 > 2 to 3,5 > 3,5 to 6,3 > 6,3 to 10 > 10 to 16 > 16 to 25 > 25 to 40	32 60 60 36 70 70 42 42 85 85 53 53 105 105 70 70 140 140 100 100 200 200 150 150 300 300		

Table 2 — Accuracy requirements — Metric units (continued)

Test No.	Element	Drawing	Object of test	Tolerances μm			
				Pitch range module m	AA	A	B
9 A	Tooth	<p>Alternative test</p> <p>ISO 4468-1982 https://standards.iteh.ai/catalog/standards/sist/4dccc4d-aa68-4a4a-883b-54882e19695a/iso-4468-1982</p>	<p>Addendum (plus only)</p> <p>NOTE — This test may be quoted instead see test 9.</p>	<p>1 to 2</p> <p>> 2 to 3,5</p> <p>> 3,5 to 6,3</p> <p>> 6,3 to 10</p> <p>> 10 to 16</p> <p>> 16 to 25</p> <p>> 25 to 40</p>	<p>45</p> <p>50</p> <p>60</p> <p>75</p> <p>100</p> <p>140</p> <p>210</p>	<p>90</p> <p>100</p> <p>120</p> <p>150</p> <p>200</p> <p>280</p> <p>420</p>	
10	Tooth lead	<p>Permissible error</p> <p>Error</p>	<p>Variation along tooth helix from tooth to tooth</p>	<p>1 to 2</p> <p>> 2 to 3,5</p> <p>> 3,5 to 6,3</p> <p>> 6,3 to 10</p> <p>> 10 to 16</p> <p>> 16 to 25</p> <p>> 25 to 40</p>	<p>4</p> <p>5</p> <p>5</p> <p>7</p> <p>9</p> <p>12</p> <p>19</p>	<p>6</p> <p>7</p> <p>9</p> <p>11</p> <p>14</p> <p>20</p> <p>30</p>	<p>12</p> <p>14</p> <p>17</p> <p>21</p> <p>28</p> <p>40</p> <p>60</p>

Table 2 — Accuracy requirements — Metric units (continued)

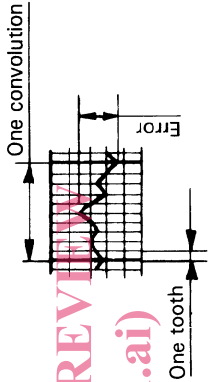
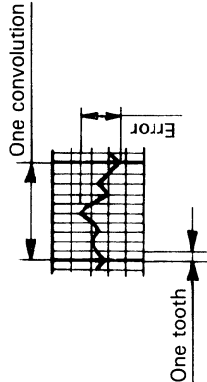
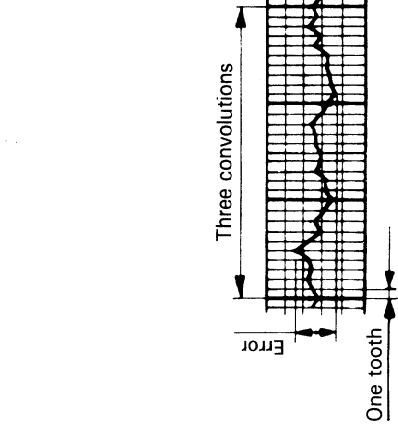
Test No.	Element	Drawing	Object of test	Tolerances μm				
				Pitch range module m	Grade			
AA	A	B	C					
11	Tooth lead	 <p>One convolution</p> <p>One tooth</p> <p>Error</p> <p>One convolution</p>	Variation along tooth helix in one convolution (cyclic pitch error)	<p>1 to 2</p> <p>> 2 to 3,5</p> <p>> 3,5 to 6,3</p> <p>> 6,3 to 10</p> <p>> 10 to 16</p> <p>> 16 to 25</p> <p>> 25 to 40</p>	<p>7</p> <p>8</p> <p>10</p> <p>12</p> <p>16</p> <p>22</p> <p>34</p>	<p>11</p> <p>12</p> <p>15</p> <p>19</p> <p>25</p> <p>36</p> <p>53</p>	<p>22</p> <p>25</p> <p>30</p> <p>38</p> <p>50</p> <p>70</p> <p>105</p>	<p>45</p> <p>50</p> <p>60</p> <p>75</p> <p>100</p> <p>140</p> <p>210</p>
11 A	Tooth lead	 <p>One convolution</p> <p>One tooth</p> <p>Error</p> <p>One convolution</p>	Variation along tooth helix, cumulative in one convolution (cyclic pitch error) when line of action check is used. See note below table.	<p>1 to 2</p> <p>> 2 to 3,5</p> <p>> 3,5 to 6,3</p> <p>> 6,3 to 10</p> <p>> 10 to 16</p> <p>> 16 to 25</p> <p>> 25 to 40</p>	<p>8</p> <p>9</p> <p>11</p> <p>13</p> <p>18</p> <p>25</p> <p>38</p>	<p>12</p> <p>14</p> <p>17</p> <p>21</p> <p>28</p> <p>40</p> <p>60</p>	<p>25</p> <p>28</p> <p>34</p> <p>42</p> <p>55</p> <p>80</p> <p>120</p>	<p>50</p> <p>55</p> <p>65</p> <p>85</p> <p>110</p> <p>160</p> <p>240</p>
12	Tooth lead	 <p>Three convolutions</p> <p>One convolution</p> <p>Three convolutions</p> <p>One tooth</p> <p>Error</p>	Variation along tooth helix in any three consecutive convolutions (cumulative pitch error)	<p>1 to 2</p> <p>> 2 to 3,5</p> <p>> 3,5 to 6,3</p> <p>> 6,3 to 10</p> <p>> 10 to 16</p> <p>> 16 to 25</p> <p>> 25 to 40</p>	<p>12</p> <p>14</p> <p>17</p> <p>21</p> <p>28</p> <p>40</p> <p>60</p>	<p>20</p> <p>22</p> <p>26</p> <p>34</p> <p>45</p> <p>60</p> <p>95</p>	<p>40</p> <p>45</p> <p>53</p> <p>65</p> <p>90</p> <p>125</p> <p>190</p>	<p>80</p> <p>90</p> <p>105</p> <p>130</p> <p>180</p> <p>250</p> <p>380</p>

Table 2 — Accuracy requirements — Metric units (continued)

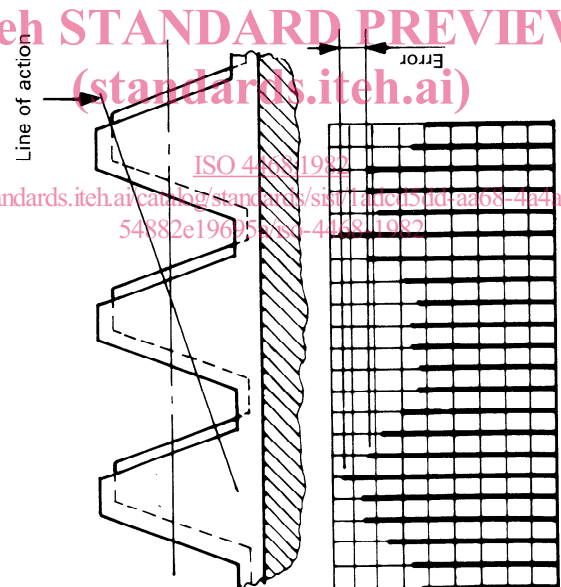
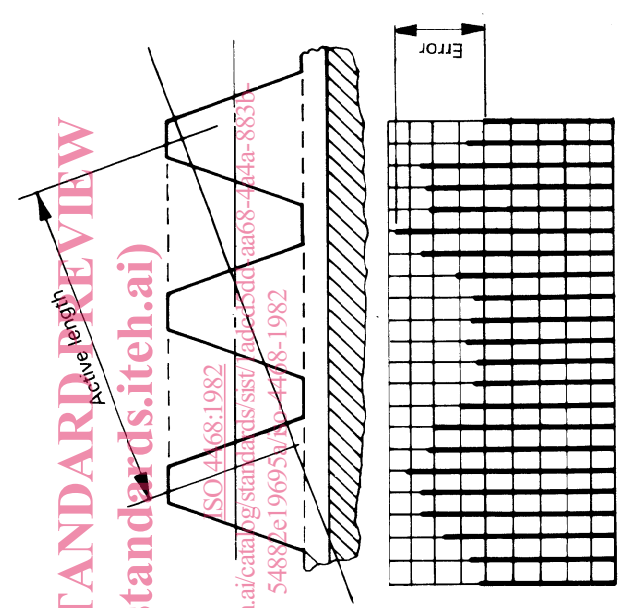
Test No.	Element	Drawing	Object of test	Tolerances μm				
				Pitch range module m	AA	A	B	C
13	<p>Tooth spacing along line of action</p> 	<p>Variation along line of action from tooth to tooth measured at cutting edge</p>	<p>1 to 2 > 2 to 3,5 > 3,5 to 6,3 > 6,3 to 10 > 10 to 16 > 16 to 25 > 25 to 40</p>	<p>4 5 5 7 9 12 19</p>	<p>6 7 9 11 14 20 30</p>	<p>12 14 17 21 28 40 60</p>	<p>25 28 34 42 55 80 120</p>	

Table 2 — Accuracy requirements — Metric units (concluded)

Test No.	Element	Drawing	Object of test	Tolerances μm			
				Pitch range module m	Grade		
			AA		A	B	C
14	Tooth spacing along line of action 	Cumulative variation of involute helicoid over active length	1 to 2 > 2 to 3,5 > 3,5 to 6,3 > 6,3 to 10 > 10 to 16 > 16 to 25 > 25 to 40	9 10 12 15 20 28 42	14 16 19 24 32 45* 65	28 32 38 48 60 90 130	55 60 75 95 125 180 260

* Datum referred to in clause 4.

NOTE — Line of action tests.

If the manufacturer does not have the facility to apply an over-riding line of action test, the tolerances on tooth profile and tooth lead elements are as given under the headings, Test 8, Test 10, Test 11 and Test 12 respectively. However, it is permissible to increase the tolerances on tooth profile and tooth lead to the values given for Test 8A and 11A and not to carry out Test 12, providing the tolerances specified for the tooth spacing along the line of action (Tests 13 and 14) are met. The reason for this is that a hob manufacturer can compensate for errors in one element by adjustment to the other element, without detriment to the tooth geometry accuracy of the resulting gear. When this is done, the final accuracy of the hob can only be monitored by the generative line of action test, for which special hob testing equipment is required.