

JIS

JAPANESE INDUSTRIAL STANDARD

Involute Serrations

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JAPANESE INDUSTRIAL STANDARD

J I S

Involute Serrations

B 1602-1961
(Reaffirmed: 1971)1. Scope

This standard specifies involute serrations, hereinafter referred to as "serrations" having the lateral profile of involute curved form and mainly used for connection between shaft and hole. Provided that, taper serrations are excluded.

2. Symbol and Definition

The meaning of symbols and terms to be used for this standard shall conform to the following (refer to Fig. 1 and Fig. 2).

α : Pressure angle (subtended angle between its radius and tangent to the serration at a point of serrated surface)

α_0 : Pressure angle on the basic pitch circle

d : Nominal diameter and basic dimension of large diameter ⁽¹⁾ are to be taken.

D : Large diameter ⁽¹⁾ of hole

Note ⁽¹⁾ The large diameter means, in the case of shaft, the diameter of the circle which is formed at the tip of serration, while in the case of hole, the diameter of circle which is formed at the bottom of serration.

D_s : Small diameter ⁽²⁾ of the hole

d_s : Small diameter ⁽²⁾ of the shaft

Note ⁽²⁾ Small diameter means, in the case of shaft, the diameter of the circle which is formed at the bottom of serration, while in the case of hole, the diameter of the circle which is formed at the tip of serration.

d_0 : Basic pitch circle diameter

d_g : Diameter of the basic circle ⁽³⁾

Note ⁽³⁾ Basic circle means a base circle from which involute teeth are formed.

D_{TIF} : Involute limit diameter ⁽⁴⁾ of hole

d_{TIF} : Involute limit diameter ⁽⁴⁾ of shaft

Reference Standards:

JIS B 0401 - Limits and Fits for Engineering

JIS B 1702 - Accuracy of Spur and Helical Gears

Note (4) Involute limit diameter means the limit diameter which is as near as possible to the tooth bottom necessary for fitting with hole and shaft.

 h_{h1} : Height of dedendum of hole serration

h_h : Height of dedendum of shaft serration

h_{f1} : Height of dedendum of hole serration

h_f : Height of dedendum of shaft serration

 m : Module

M_i : Over pin diameter ⁽⁵⁾ of hole

M_s : Over pin diameter ⁽⁵⁾ of shaft

Note (5) Over pin diameter means, in the case of hole, the distance between two pins inserted respectively in two confronting tooth grooves, while in the case of shaft, the distance between which each pin has been inserted.

R: Roundness at serration bottom of hole

r : Roundness at serration bottom of shaft

s_o : Tooth thickness (along the length of arc) over the basic pitch circle

t_0 : Basic pitch (circular pitch on the basic pitch circle)

U : Diameter of the pin to be used for measurement of over pin diameter

w_o : Width (along the length of arc) of serration grooves on the basic pitch circle

x : Shift coefficient

 z : Number of teeth

E : Ratio of variation on the thickness of serration grooves to that on the over pin diameters

F : Ratio of variation between tooth width to that of over pin diameter

Fig. 1. Illustration of Symbols

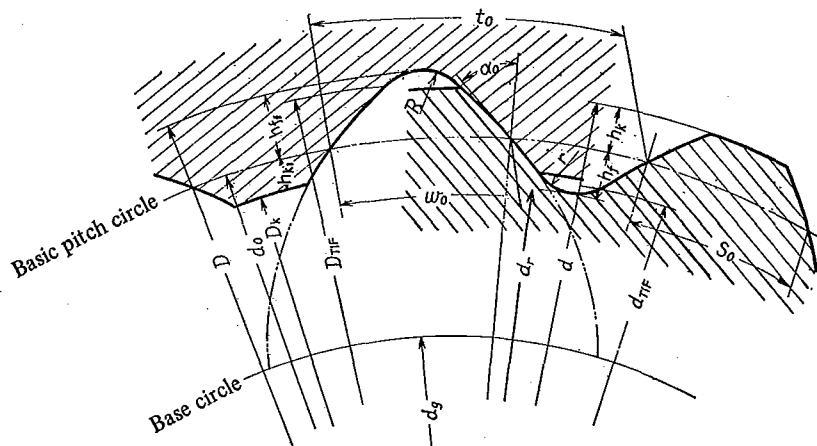
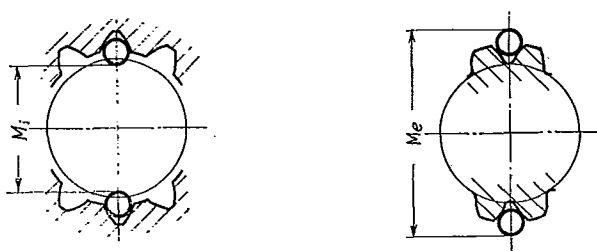


Fig. 2. Over Pin Diameter Measuring



3. Fundamental Elements of Construction

3.1 Module As the basis of tooth size the following six grades of modules shall be adopted,

0.5 0.75 1.0 1.5 2.0 2.5 (unit in mm)

3.2 Number of Teeth Numbers of teeth shall be from 10 up to 60.

3.3 Pressure Angle Pressure angle on the basic pitch circle shall be 45° .

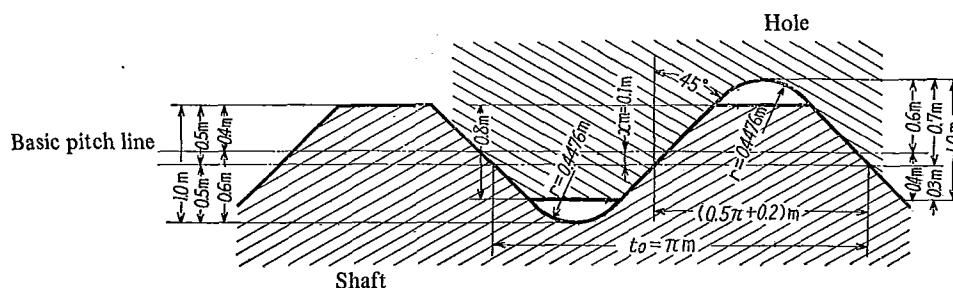
3.4 Effective Tooth Height Effective tooth height shall be 0.8 m.

3.5 Amount of Shift Amount of shift shall be 0.1 m.

4. Basic Form of Tooth

The basic rack of serration shall be as shown in Fig. 3.

Fig. 3. Basic Form of Tooth



Remarks: Basic pitch circle of serrations shall be tangential to the gear cutting pitch line of the basic rack.

5. Fundamental Formula

The fundamental formula shall be given as follows so as to enable each dimension to be calculated out.

Nominal diameter: $d=(z+0.8+2x)m=(z+1)m$

Basic pitch: $t_o=\pi m$

Base circle diameter: $d_g=d_o \cos \alpha_o$

Basic pitch circle diameter: $d_o=zm$

Hole, Large diameter: $D=(z+1.4)m=d+0.4m$

Small diameter: $D_s=(z-0.6)m=d-1.6m$

Involute limit diameter: $D_{LIF}=(z+1.1)m$

Measure of serration addendum: $h_{k1} = (0.4 - x)m = 0.3m$

Measure of serration dedendum: $h_{f1} = (0.6 + x)m = 0.7m$

Width of serration grooves on
the basic pitch circle: $w_o = \left(\frac{\pi}{2} + 2x \tan \alpha_o\right)m = (0.5\pi + 0.2)m$

Shaft, Large diameter: $d = (z + 0.8 + 2x)m = (z + 1)m$

Small diameter: $d_r = (z - 1)m = d - 2m$

Involute limit diameter: $d_{TIF} = (z - 0.7)m$

Height of serration addendum of shaft: $h_k = (0.4 + x)m = 0.5m$

Height of serration dedendum of hole: $h_f = (0.6 - x)m = 0.5m$

Tooth thickness (arc) on the basic
pitch circle: $s_o = \left(\frac{\pi}{2} + 2x \tan \alpha_o\right)m = (0.5\pi + 0.2)m$

Over pin diameter

Hole side: Let α_i be pressure angle at the centre of pin

$$\text{inv } \alpha_i = \text{inv } \alpha_o + \frac{w_o}{d_o} - \frac{U}{d_g}$$

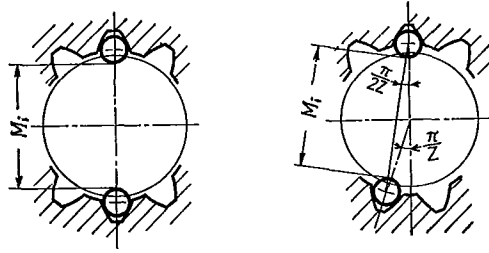
$$\text{When } Z \text{ is even, } M_i = \frac{d_g}{\cos \alpha_i} - U$$

$$\text{When } Z \text{ is odd, } M_i = \frac{d_g}{\cos \alpha_i} \cdot \cos \frac{90^\circ}{z} - U$$

$$\text{Coefficient when } Z \text{ is even is, } F = \frac{dM_i}{dw_o} = \frac{\cos \alpha_o}{\sin \alpha_i}$$

$$\text{Coefficient when } Z \text{ is odd is, } F = \frac{dM_i}{dw_o} = \frac{\cos \alpha_o}{\sin \alpha_i} \cdot \cos \frac{90^\circ}{z}$$

Fig. 4



Shaft side: If α_s be the pressure angle at the centre,

$$\text{inv } \alpha_s = \text{inv } \alpha_o + \frac{s_o}{d_o} + \frac{U}{d_g} - \frac{\pi}{z}$$

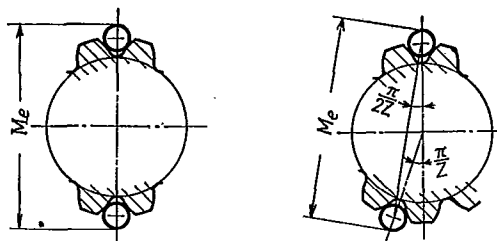
$$\text{When } z \text{ is even, } M_s = \frac{d_g}{\cos \alpha_s} + U$$

$$\text{When } z \text{ is odd, } M_s = \frac{d_g}{\cos \alpha_s} \cdot \cos \frac{90^\circ}{z} + U$$

$$\text{Coefficient when } z \text{ is even, } E = \frac{dM_s}{ds_o} = \frac{\cos \alpha_o}{\sin \alpha_s}$$

$$\text{Coefficient when } z \text{ is odd, } E = \frac{dM_s}{ds_o} = \frac{\cos \alpha_o}{\sin \alpha_s} \cdot \cos \frac{90^\circ}{z}$$

Fig. 5



6. Nominal Diameter

Relations among module, number of teeth, and the class of nominal diameters shall be as shown in the Attached Table 1. Further, nominal diameters in thick letters shall be indicated as those in general use.

7. Alignment and Fitting

7.1 Alignment shall be of tooth face to tooth face fitting.

7.2 Fitting shall be of fixed fitting only.

8. Part Dimensions and Dimensional Deviation

8.1 Dimensions of each part, and its dimensional deviation shall be as shown in Attached Tables 2 to 7.

8.2 Dimensional Deviations on Large Diameter and Small Diameter

Hole, large diameter lower deviation only, and no provision on upper deviation.

Dimensional deviations of small diameter shall be H 10.

Shaft, large diameter upper deviation shall be zero, while lower deviation⁽⁶⁾ shall be $-0.1 \times m$ (mm).

Note ⁽⁶⁾ In case of rolling, lower deviation may not conform to this standard.

Small diameter upper deviation only. Lower deviation shall not be specified.

8.3 Dimensional deviations on Over Pin Diameter Dimensional deviations on over pin diameters shall be those of actual dimensions multiplied respectively, in the case of shaft, by the coefficient E , and in the case of hole, by the coefficient F .

The coefficients E and F are shown in the Attached Tables 2 to 7. Provided that, the case with the measuring pin diameter $U=2.0$ m is shown.

8.4 Roundness of Tooth Bottom For making roundness of the tooth bottom, in the case of hole, broaches are generally used, with 0.4476 m being as standard values and in the case of shaft subjected to generating process, approximate circular are generated by the addendum of the cutting tool shall be alright just as it is.

9. Straight Line Tooth Form (Hole)

9.1 Hole tooth form shall be principally of involute form, however, when deviation from the straight line is little and it is permissible from the designing point of view, the straight line tooth may be allowed to facilitate the machining.

In this case, deviation shall preferably be 0.04 mm or below.

9.2 The straight line, in this case, shall be taken, as the curve which touches the involute curve, on the basic pitch circle and the angle of the serrations shall conform to the Attached Tables 2 to 7.

9.3 Basic dimensions and deviations on large diameters and small diameters of holes shall be the same as those of involute tooth forms.

9.4 Deviations on over pin diameters shall be such that the factor F' is to be multiplied to deviations of the actual dimension (refer to Reference 1). The factor F' shall be as shown in the Attached Tables 2 to 7. Provided that, the case of measuring pin diameter $U=2.0$ mm is shown here.

10. Designation

The shaft of serration and the hole shall be designated by nominal diameter, numbers of teeth and module.

Example: Involute serration shaft 37 x 36 x 1
 Involute serration hole 37 x 36 x 1

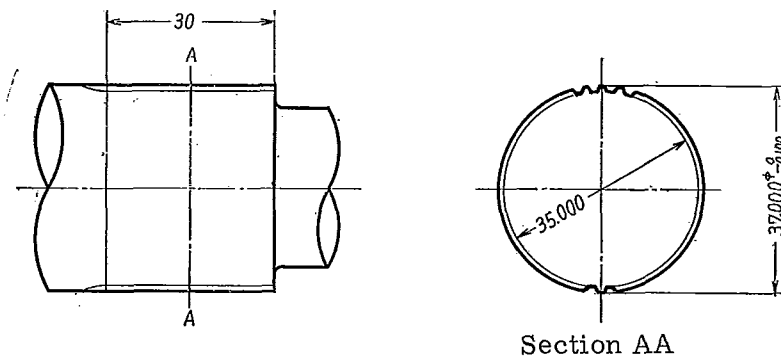
11. Drawing Indication

When details are to be indicated in the part drawings, as far as serrations are concerned, it is preferable to conform to Fig. 6. When there is no need to show details such as in the case of assembly drawing, etc., using leader line, the entry shall be given conforming to the designation of serration as shown in 10.

Fig. 6

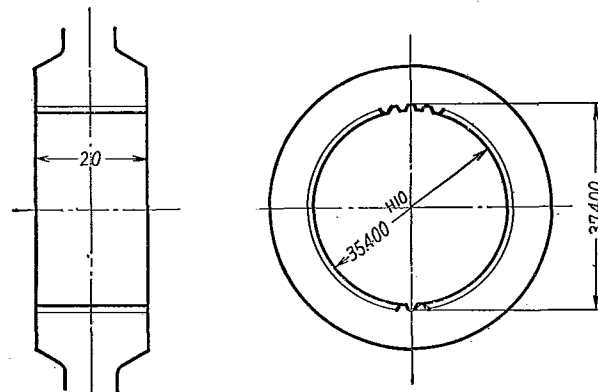
Unit: mm

Involute serration shaft 37 x 36 x 1	
Module	1
Pressure angle	45°
Numbers of teeth	36
Basic pitch circle diameter	36
Over pin diameter	39.431 - 0.028 - 0.067 (Pin diameter 2.000 ϕ)



Unit: mm

Involute serration hole 37 x 36 x 1	
Module	1
Pressure angle	45°
Numbers of teeth	36
Basic pitch circle diameter	36
Over pin diameter	32.926 + 0.092 + 0.051 (Pin diameter 2.000 ϕ)



Reference 1. Calculating Method of Fitting

1.1 Deviations in fitting expressed in effective dimension shall conform to the following:

Width of tooth groove on the basic pitch circle of the hole H 10

Thickness of tooth on the basic pitch circle of the shaft j 10

Provided that, the effective dimension means, when processing errors (error on tooth forms, error on division, error on parallelism) are to be considered, the effective dimensions which affect the fitting.

Here, j 10 shall be dimensional deviations in ISA fitting system, (refer to Reference Table 1).

1.2 Deviation in fitting expressed in actual dimension shall be specified larger of smaller than effective dimension, by the amount of allowable error, both for hole and shaft respectively. (refer to Reference Fig. 1).

Measuring of over pin diameter by means of pins, shall be performed by actual dimension and shown in the Attached Tables 2 to 7.

Upper deviation on the actual dimension of the width w_o of the tooth groove on the pitch circle of hole =

Upper deviation on w_o H 10 (effective deviation) + e (allowable error)

Lower deviation on the actual dimension of the width w_o of the tooth groove on the basic pitch circle of hole =

Lower deviation on w_o H 10 (effective deviation) (=0) + e (allowable error)

Upper deviation on the over pin diameter M_i =

$F \times$ (Upper deviation on the actual dimension of w_o)

Lower deviation on the over pin diameter M_i =

$F \times$ (Lower deviation on the actual dimension of w_o)

Upper deviation on the actual dimension of tooth thickness s_o on the basic pitch circle of shaft =

Upper deviation on s_o j 10 (effective deviation) - e (allowable error)

Lower deviation on actual dimension of tooth thickness s_o on the basic pitch circle of shaft =

Lower deviation of s_o j 10 (effective deviation) - e (allowable error)

Upper deviation on the over pin diameter M_o of shaft =

$E \times$ (Upper deviation on actual dimension of s_o)

Lower deviation on the over pin diameter M_o of shaft =

$E \times$ (Lower deviation on actual dimension of s_o)

1.3 Allowable errors shall be as shown per each module of serration in the Reference Table 1.

This is, two times as large as positive value of tooth form error of Grade 4 tooth in JIS B 1702-Accuracy of Spur and Helical Gears, accumulative pitch error, and error in the direction of tooth grooves within the length of gear engagement, the above three kinds of errors are to be summed up and 60 % of that sum shall be specified, however, when the processing condition is favourable, smaller values than 60 % and when the condition of processing is bad, values larger than 60 % may be used.

The length of engagement in the Reference Table 1 is calculated as half the diameter of basic pitch circle.

1.4 In this standard, fitting is limited to fixed fitting only. That is, when the dimension of fitting is effective dimension, deviation on tooth thickness upon the basic pitch circle being made to be j 10, but, if other fittings are to be required, it may be performed as follows:

Effective dimension;

Upper deviation of tooth groove width w_o on the basic pitch circle of hole =

Upper deviation on w_o H 10

Lower deviation of tooth groove width w_o on the basic pitch circle of hole =

Lower deviation on w_o H 10 (=0)

Upper deviation of tooth thickness s_o on the basic pitch circle of shaft = $-c$

Lower deviation of tooth thickness s_o on the basic pitch circle of shaft =

$-c - (\text{basic tolerance of Grade 10 of } s_o)$

(Here, c shall be the minimum value of clearance necessary for the working realm.)

Actual dimension;

To the tolerance on the effective dimension, taking into consideration of processing errors and adjusting with allowable errors shown in Reference Table 1, deviation on the actual dimension shall be made (Refer to Reference Fig. 2).

Upper deviation of tooth groove width w_o on the basic pitch circle of hole =

Upper deviation of w_o H 10 (effective deviation) + e (allowance error)

Lower deviation of tooth groove width w_o on the basic pitch circle of hole =

Lower deviation of w_o H 10 (effective deviation) (=0) + e (allowable error)

Upper deviation of tooth thickness s_o on the basic pitch circle =

$-c$ (effective deviation) - e (allowable errors)

Lower deviation of tooth thickness s_o on the basic pitch circle =

$[-c - (\text{basic tolerance of Grade 10 of } s_o)]$ (effective deviation) - e (allowable errors)

Upper deviation of over pin diameter M_i of hole =

$F \times$ (upper deviation of actual dimension of w_o)

Lower deviation of over pin diameter M_i of hole =

$F \times$ (lower deviation of actual dimension of w_o)

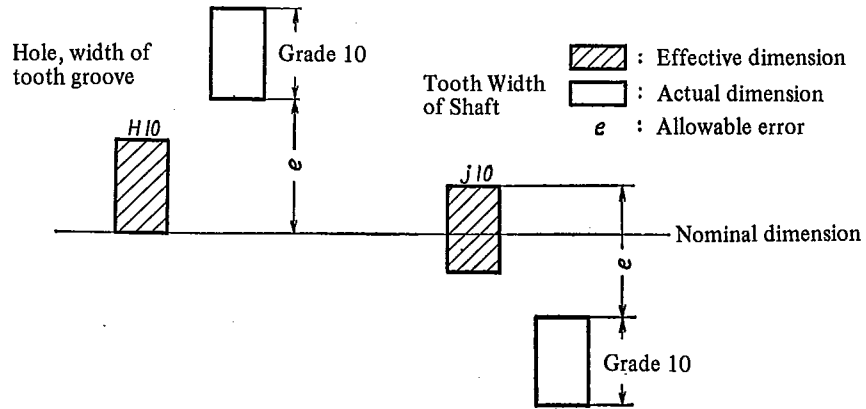
Upper deviation of over pin diameter M_o of shaft =

$E \times$ (upper deviation of actual dimension of w_o)

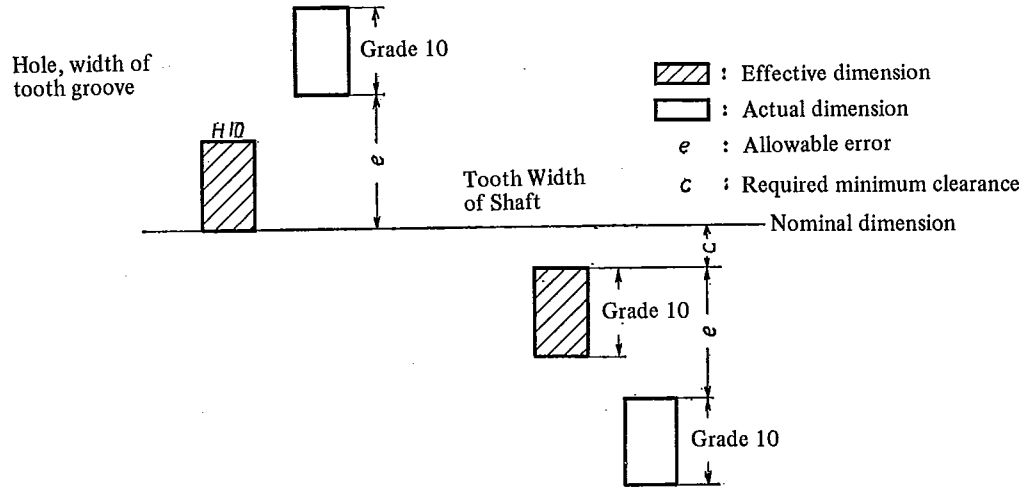
Lower deviation of over pin diameter M_o of shaft =

$E \times$ (lower deviation of actual dimension of w_o)

Reference Fig. 1. Diagram of Fitting



Reference Fig. 2



Reference Table 1. Allowable Error

Unit: $\mu = 0.001 \text{ mm}$

Module m Number of tooth z	0.5	0.75	1.0	1.5	2.0	2.5
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Cumulative Pitch Error

10	38	43	43	50	55	55
11 ~ 12	38	43	43	50	55	60
13 ~ 16	41	43	48	50	60	60
17 ~ 20	41	48	48	55	60	60
21 ~ 24	41	48	48	55	60	65
25	46	48	48	55	60	65
26 ~ 33	46	48	55	55	65	65
34 ~ 40	46	55	55	65	65	65
41 ~ 50	46	55	55	65	65	75
51 ~ 60	50	55	60	65	75	75

Tooth Form Error

Tooth form error	10	11	11	13	15	15
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Error in Tooth Groove Direction

Length of engagement (mm)	1.5 ~ 3	3 ~ 6	6 ~ 12	12 ~ 25	25 ~ 50	50 ~ 100
Error in tooth groove direction	13	13	14	15	17	22

Module m Number of tooth z	0.5	0.75	1.0	1.5	2.0	2.5
-----------------------------------	-----	------	-----	-----	-----	-----

Allowable Error

10	37	40	40	46	50	50
11 ~ 12	37	40	40	46	50	54
13 ~ 16	38	40	44	46	54	54
17 ~ 20	38	44	44	50	54	54
21 ~ 24	38	44	44	50	54	58
25	42	44	44	50	54	58
26 ~ 33	42	44	49	50	58	58
34 ~ 40	42	49	49	57	58	58
41 ~ 48	42	49	49	57	58	67
49 ~ 50	43	49	49	57	58	67
51 ~ 59	45	49	53	57	67	67
60	45	49	53	57	67	67

Deviation on Tooth Thickness

H 10	+ 40 0	+ 40 0	+ 40 0	+ 40 0	+ 48 0	+ 48 0
j 10	± 20	± 20	± 20	± 20	± 24	± 24

Reference 2. Formulae on Straight Line Tooth Form (hole)

2.1 Calculation of Deviation on the Involute Curve of Straight Line Tooth Form (hole) As shown in this standard, hole tooth form is principally of involute curve, but when amount of deviation is so little that it is permissible from the designing point of view, so as to facilitate machining, the straight line tooth may be used and the deviation shall be generally made within 0.04 mm. The deviation is generally variable by the number of tooth and its relation is shown in the following formula, the behavior of variation being shown in Reference Figs. 3 to 4.

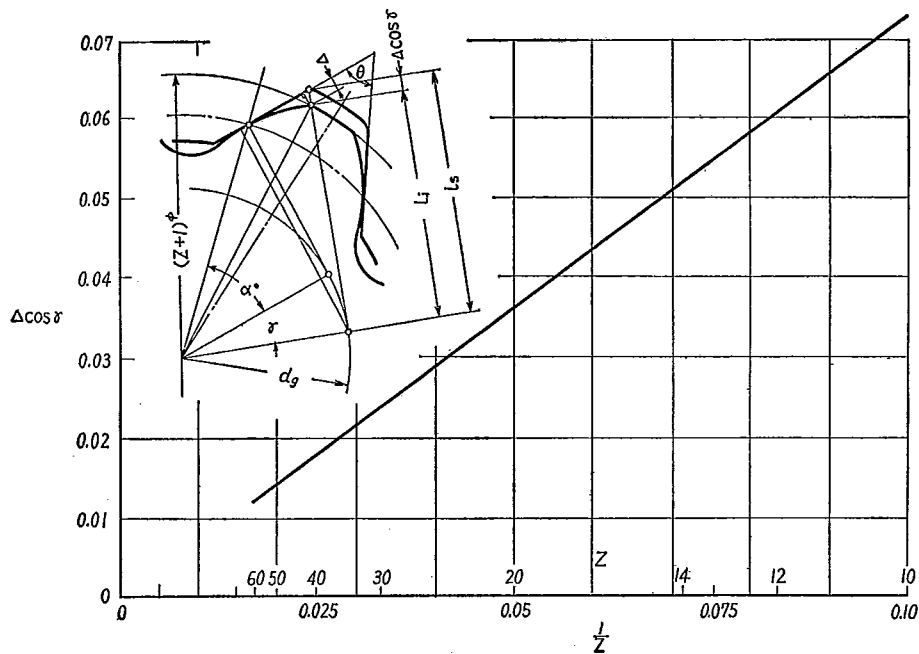
$$\Delta = \frac{z \cos \alpha_o}{2} \left\{ \frac{\sin \gamma + 1}{\cos \gamma} - \sqrt{\frac{(z+1)^2}{z^2 \cos^2 \alpha_o} - 1} \right\} \cos \gamma$$

$$= \frac{z \cos \alpha_o}{2} (1 + \sin \gamma - \cos \gamma - \gamma \cos \gamma)$$

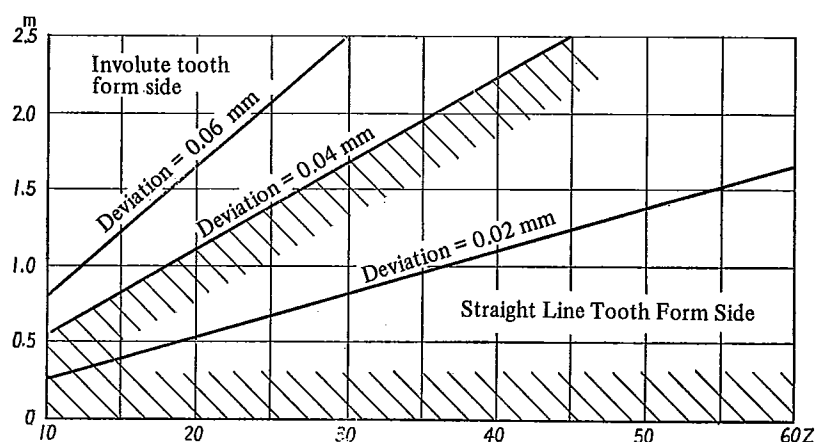
where, $\gamma = \frac{l - d_g/2}{d_g/2} = \sqrt{\frac{(z+1)^2}{z^2 \cos^2 \alpha_o} - 1} - 1$

Reference Fig. 3

Deviation of straight line tooth form from the involute curve in the case of $m = 1.0$



Reference Fig. 4. Deviation of Straight Line Tooth Form from the Involute Curve



Remarks: The shaded range by oblique hatches shows that of use for the straight lined tooth form.

2.2 Angle of Straight Line Tooth Groove (Refer to Reference Table 2)

$$\text{Angle of straight line tooth groove } \theta = 90^\circ - \left(\frac{202.918311}{z} \right)^\circ$$

Reference Table 2. Angle of Straight Line Tooth Groove (hole)

Unit: degree

z	θ	z	θ	z	θ	z	θ	z	θ
10	69.7	20	79.8	30	83.2	40	84.9	50	85.9
11	71.6	21	80.3	31	83.5	41	85.1	51	86.0
12	73.1	22	80.8	32	83.7	42	85.2	52	86.1
13	74.4	23	81.2	33	83.9	43	85.3	53	86.2
14	75.5	24	81.5	34	84.0	44	85.4	54	86.2
15	76.5	25	81.9	35	84.2	45	85.5	55	86.3
16	77.3	26	82.2	36	84.4	46	85.6	56	86.4
17	78.1	27	82.5	37	84.5	47	85.7	57	86.4
18	78.7	28	82.8	38	84.7	48	85.8	58	86.5
19	79.3	29	83.0	39	84.8	49	85.9	59	86.6
								60	86.6

2.3 Calculation of Over Pin Diameter in the Case of Straight Line Tooth Form (hole)

Over pin diameter

$$\text{when } z \text{ is even, } M_i = \frac{d_0 \sin \alpha_o - U}{\sin \frac{\theta}{2}} - U$$

$$\text{when } z \text{ is odd, } M_i = \frac{d_0 \sin \alpha_o - U}{\sin \frac{\theta}{2}} \cdot \cos \frac{90^\circ}{z} - U$$

When the width of tooth groove on the basic pitch circle subject to little variation, let the rate of variation of over pin diameter be F' ,

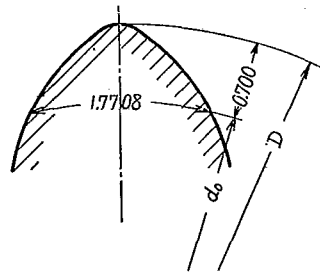
$$\text{when } z \text{ is even, } F' = \frac{\cos \alpha_s}{\sin \frac{\theta}{2}}$$

$$\text{when } z \text{ is odd, } F' = \frac{\cos \alpha_s}{\sin \frac{\theta}{2}} \cdot \cos \frac{90^\circ}{z}$$

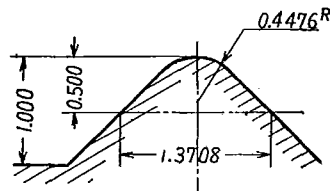
Reference 3. The Shape and Size of the Tool

Generally speaking, processing of the hole and the shaft shall be performed by means of a broach and a hob respectively and the standard tooth form (when $m=1$) of the tool in that case shall be shown in the Reference Fig. 5.

Reference Fig. 5



$m = 1$ broach tooth form



$m = 1$ hob tooth form

Attached Table 1. Nominal Diameter d

Unit: mm

No. of tooth z	Module m	0.50	0.75	1.00	1.50	2.00	2.50	Module m	No. of tooth z
10	5.50	8.25	11.00	16.50	22.00	27.50	27.50	10	10
11	6.00	9.00	12.00	18.00	24.00	30.00	30.00	11	11
12	6.50	9.75	13.00	19.50	26.00	32.50	32.50	12	12
13	7.00	10.50	14.00	21.00	28.00	35.00	35.00	13	13
14	7.50	11.25	15.00	22.50	30.00	37.50	37.50	14	14
15	8.00	12.00	16.00	24.00	32.00	40.00	40.00	15	15
16	8.50	12.75	17.00	25.50	34.00	42.50	42.50	16	16
17	9.00	13.50	18.00	27.00	36.00	45.00	45.00	17	17
18	9.50	14.25	19.00	28.50	38.00	47.50	47.50	18	18
19	10.00	15.00	20.00	30.00	40.00	50.00	50.00	19	19
20	10.50	15.75	21.00	31.50	42.00	52.50	52.50	20	20
21	11.00	16.50	22.00	33.00	44.00	55.00	55.00	21	21
22	11.50	17.25	23.00	34.50	46.00	57.50	57.50	22	22
23	12.00	18.00	24.00	36.00	48.00	60.00	60.00	23	23
24	12.50	18.75	25.00	37.50	50.00	62.50	62.50	24	24
25	13.00	19.50	26.00	39.00	52.00	65.00	65.00	25	25
26	13.50	20.25	27.00	40.50	54.00	67.50	67.50	26	26
27	14.00	21.00	28.00	42.00	56.00	70.00	70.00	27	27
28	14.50	21.75	29.00	43.50	58.00	72.50	72.50	28	28
29	15.00	22.50	30.00	45.00	60.00	75.00	75.00	29	29
30	15.50	23.25	31.00	46.50	62.00	77.50	77.50	30	30
31	16.00	24.00	32.00	48.00	64.00	80.00	80.00	31	31
32	16.50	24.75	33.00	49.50	66.00	82.50	82.50	32	32
33	17.00	25.50	34.00	51.00	68.00	85.00	85.00	33	33
34	17.50	26.25	35.00	52.50	70.00	87.50	87.50	34	34
35	18.00	27.00	36.00	54.00	72.00	90.00	90.00	35	35
36	18.50	27.75	37.00	55.50	74.00	92.50	92.50	36	36
37	19.00	28.50	38.00	57.00	76.00	95.00	95.00	37	37
38	19.50	29.25	39.00	58.50	78.00	97.50	97.50	38	38
39	20.00	30.00	40.00	60.00	80.00	100.00	100.00	39	39
40	20.50	30.75	41.00	61.50	82.00	102.50	102.50	40	40
41	21.00	31.50	42.00	63.00	84.00	105.00	105.00	41	41
42	21.50	32.25	43.00	64.50	86.00	107.50	107.50	42	42
43	22.00	33.00	44.00	66.00	88.00	110.00	110.00	43	43
44	22.50	33.75	45.00	67.50	90.00	112.50	112.50	44	44
45	23.00	34.50	46.00	69.00	92.00	115.00	115.00	45	45
46	23.50	35.25	47.00	70.50	94.00	117.50	117.50	46	46
47	24.00	36.00	48.00	72.00	96.00	120.00	120.00	47	47
48	24.50	36.75	49.00	73.50	98.00	122.50	122.50	48	48
49	25.00	37.50	50.00	75.00	100.00	125.00	125.00	49	49
50	25.50	38.25	51.00	76.50	102.00	127.50	127.50	50	50
51	26.00	39.00	52.00	78.00	104.00	130.00	130.00	51	51
52	26.50	39.75	53.00	79.50	106.00	132.50	132.50	52	52
53	27.00	40.50	54.00	81.00	108.00	135.00	135.00	53	53
54	27.50	41.25	55.00	82.50	110.00	137.50	137.50	54	54
55	28.00	42.00	56.00	84.00	112.00	140.00	140.00	55	55
56	28.50	42.75	57.00	85.50	114.00	142.50	142.50	56	56
57	29.00	43.50	58.00	87.00	116.00	145.00	145.00	57	57
58	29.50	44.25	59.00	88.50	118.00	147.50	147.50	58	58
59	30.00	45.00	60.00	90.00	120.00	150.00	150.00	59	59
60	30.50	45.75	61.00	91.50	122.00	152.50	152.50	60	60

Remarks: Nominal diameters in thick lined frames shall those in ordinary use.

2238 mm
000 mm

No. of teeth		Basic limit		Hole (nominal tooth form)		Hole (straight line tooth form)		Shaft		No. of teeth	
No.	of teeth	Basic dia. d	Pitch dia. d_p	Basic dia. d	Pitch dia. d_p	Basic dia. d	Pitch dia. d_p	Basic dia. d	Pitch dia. d_p	Basic dia. d	Pitch dia. d_p
1	5	5.50	5.70	5.50	5.70	5.50	5.70	5.50	5.70	5.50	5.70
2	6	6.00	6.30	6.00	6.30	6.00	6.30	6.00	6.30	6.00	6.30
3	7	6.50	6.90	6.50	6.90	6.50	6.90	6.50	6.90	6.50	6.90
4	8	7.00	7.50	7.00	7.50	7.00	7.50	7.00	7.50	7.00	7.50
5	9	7.50	8.10	7.50	8.10	7.50	8.10	7.50	8.10	7.50	8.10
6	10	8.00	8.70	8.00	8.70	8.00	8.70	8.00	8.70	8.00	8.70
7	11	8.50	9.30	8.50	9.30	8.50	9.30	8.50	9.30	8.50	9.30
8	12	9.00	9.90	9.00	9.90	9.00	9.90	9.00	9.90	9.00	9.90
9	13	9.50	10.50	9.50	10.50	9.50	10.50	9.50	10.50	9.50	10.50
10	14	10.00	11.10	10.00	11.10	10.00	11.10	10.00	11.10	10.00	11.10
11	15	10.50	11.70	10.50	11.70	10.50	11.70	10.50	11.70	10.50	11.70
12	16	11.00	12.30	11.00	12.30	11.00	12.30	11.00	12.30	11.00	12.30
13	17	11.50	12.90	11.50	12.90	11.50	12.90	11.50	12.90	11.50	12.90
14	18	12.00	13.50	12.00	13.50	12.00	13.50	12.00	13.50	12.00	13.50
15	19	12.50	14.10	12.50	14.10	12.50	14.10	12.50	14.10	12.50	14.10
16	20	13.00	14.70	13.00	14.70	13.00	14.70	13.00	14.70	13.00	14.70
17	21	13.50	15.30	13.50	15.30	13.50	15.30	13.50	15.30	13.50	15.30
18	22	14.00	15.90	14.00	15.90	14.00	15.90	14.00	15.90	14.00	15.90
19	23	14.50	16.50	14.50	16.50	14.50	16.50	14.50	16.50	14.50	16.50
20	24	15.00	17.10	15.00	17.10	15.00	17.10	15.00	17.10	15.00	17.10
21	25	15.50	17.70	15.50	17.70	15.50	17.70	15.50	17.70	15.50	17.70
22	26	16.00	18.30	16.00	18.30	16.00	18.30	16.00	18.30	16.00	18.30
23	27	16.50	18.90	16.50	18.90	16.50	18.90	16.50	18.90	16.50	18.90
24	28	17.00	19.50	17.00	19.50	17.00	19.50	17.00	19.50	17.00	19.50
25	29	17.50	20.10	17.50	20.10	17.50	20.10	17.50	20.10	17.50	20.10
26	30	18.00	20.70	18.00	20.70	18.00	20.70	18.00	20.70	18.00	20.70
27	31	18.50	21.30	18.50	21.30	18.50	21.30	18.50	21.30	18.50	21.30
28	32	19.00	21.90	19.00	21.90	19.00	21.90	19.00	21.90	19.00	21.90
29	33	19.50	22.50	19.50	22.50	19.50	22.50	19.50	22.50	19.50	22.50
30	34	20.00	23.10	20.00	23.10	20.00	23.10	20.00	23.10	20.00	23.10
31	35	20.50	23.70	20.50	23.70	20.50	23.70	20.50	23.70	20.50	23.70
32	36	21.00	24.30	21.00	24.30	21.00	24.30	21.00	24.30	21.00	24.30
33	37	21.50	24.90	21.50	24.90	21.50	24.90	21.50	24.90	21.50	24.90
34	38	22.00	25.50	22.00	25.50	22.00	25.50	22.00	25.50	22.00	25.50
35	39	22.50	26.10	22.50	26.10	22.50	26.10	22.50	26.10	22.50	26.10
36	40	23.00	26.70	23.00	26.70	23.00	26.70	23.00	26.70	23.00	26.70
37	41	23.50	27.30	23.50	27.30	23.50	27.30	23.50	27.30	23.50	27.30
38	42	24.00	27.90	24.00	27.90	24.00	27.90	24.00	27.90	24.00	27.90
39	43	24.50	28.50	24.50	28.50	24.50	28.50	24.50	28.50	24.50	28.50
40	44	25.00	29.10	25.00	29.10	25.00	29.10	25.00	29.10	25.00	29.10
41	45	25.50	29.70	25.50	29.70	25.50	29.70	25.50	29.70	25.50	29.70
42	46	26.00	30.30	26.00	30.30	26.00	30.30	26.00	30.30	26.00	30.30
43	47	26.50	30.90	26.50	30.90	26.50	30.90	26.50	30.90	26.50	30.90
44	48	27.00	31.50	27.00	31.50	27.00	31.50	27.00	31.50	27.00	31.50
45	49	27.50	32.10	27.50	32.10	27.50	32.10	27.50	32.10	27.50	32.10
46	50	28.00	32.70	28.00	32.70	28.00	32.70	28.00	32.70	28.00	32.70
47	51	28.50	33.30	28.50	33.30	28.50	33.30	28.50	33.30	28.50	33.30
48	52	29.00	33.90	29.00	33.90	29.00	33.90	29.00	33.90	29.00	33.90
49	53	29.50	34.50	29.50	34.50	29.50	34.50	29.50	34.50	29.50	34.50
50	54	30.00	35.10	30.00	35.10	30.00	35.10	30.00	35.10	30.00	35.10
51	55	30.50	35.70	30.50	35.70	30.50	35.70	30.50	35.70	30.50	35.70
52	56	31.00	36.30	31.00	36.30	31.00	36.30	31.00	36.30	31.00	36.30
53	57	31.50	36.90	31.50	36.90	31.50	36.90	31.50	36.90	31.50	36.90
54	58	32.00	37.50	32.00	37.50	32.00	37.50	32.00	37.50	32.00	37.50
55	59	32.50	38.10	32.50	38.10	32.50	38.10	32.50	38.10	32.50	38.10
56	60	33.00	38.70	33.00	38.70	33.00	38.70	33.00	38.70	33.00	38.70
57	61	33.50	39.30	33.50	39.30	33.50	39.30	33.50	39.30	33.50	39.30
58	62	34.00	39.90	34.00	39.90	34.00	39.90	34.00	39.90	34.00	39.90
59	63	34.50	40.50	34.50	40.50	34.50	40.50	34.50	40.50	34.50	40.50
60	64	35.00	41.10	35.00	41.10	35.00	41.10	35.00	41.10	35.00	41.10

Attached Table 3. Part Dimension

Module $m=0.75$ Basic pitch $p=2.3562$ mm Circular arc tooth thickness $s_a=1.38097$ mm Height of addendum (shaft) $h_a=0.375$ mm Height of dedendum (shaft) $h_f=0.375$ mm Roundness at the tooth tip of tool $r_t=0.3357$ mm
Pressure angle $\alpha=45^\circ$ Width of tooth groove (hole) $w_s=1.328097$ mm Height of addendum (hole) $h_{a1}=0.225$ mm Height of dedendum (hole) $h_{f1}=0.525$ mm Measuring pin diameter $U=1.500$ mm
Unit: mm

No. of teeth z	Basic items					Hole (Involute tooth form)										Hole (Straight line tooth form)										Shaft					No. of teeth z
	Nominal dia. d	Basic pitch circle dia. d _f	Base circle dia. d _g	Large dia. D (Min.)	Small dia. d _s	Basic dimension	Deviation (Reference)	Over pin dia. M _f	Deviation	F	Straight line tooth groove angle F'	Basic dimension	Deviation	F	Basic dimension	Deviation	Large dia. d	Small dia. d _s	Involute limit dia. d _{inv} (Reference)	Over pin dia. M _f	Deviation	F									
10	8.250	7.500	5.303	8.550	7.050	+0.058	8.325	5.150	+0.047	1.1721	69.7	5.155	+0.049	1.2373	8.250	6.750	6.975	10.033	-0.047	0.9026	10										
11	9.000	8.250	5.834	9.300	7.800	+0.058	9.075	5.831	+0.047	1.1359	71.6	5.837	+0.049	1.1972	9.000	7.500	7.725	10.693	-0.047	0.8995	11										
12	9.750	9.000	6.364	10.050	8.550	+0.058	9.825	6.662	+0.047	1.1293	73.1	6.668	+0.049	1.1875	9.750	8.250	8.475	11.541	-0.047	0.9142	12										
13	10.500	9.750	6.894	10.800	9.300	+0.058	10.575	7.351	+0.047	1.1069	74.4	7.355	+0.049	1.1611	10.500	9.000	9.225	12.216	-0.047	0.9123	13										
14	11.250	10.500	7.425	11.550	10.050	+0.058	11.325	8.170	+0.047	1.1037	75.5	8.177	+0.049	1.1549	11.250	9.750	9.975	13.047	-0.047	0.9233	14										
15	12.000	11.250	7.955	12.300	10.800	+0.058	12.075	8.666	+0.047	1.0883	76.5	8.673	+0.049	1.1363	12.000	10.500	10.725	13.732	-0.047	0.9229	15										
16	12.750	12.000	8.485	13.050	11.550	+0.058	12.825	9.676	+0.047	1.0866	77.3	9.682	+0.049	1.1319	12.750	11.250	11.475	14.652	-0.047	0.9306	16										
17	13.500	12.750	9.016	13.800	12.300	+0.058	13.575	10.377	+0.047	1.0756	78.1	10.383	+0.049	1.1180	13.500	12.000	12.225	15.245	-0.047	0.9293	17										
18	14.250	13.500	9.546	14.550	13.050	+0.058	14.325	11.180	+0.047	1.0743	78.7	11.186	+0.049	1.1149	14.250	12.750	12.975	16.056	-0.047	0.9367	18										
19	15.000	14.250	10.076	15.300	13.800	+0.058	15.075	11.885	+0.047	1.0658	79.3	11.892	+0.049	1.1044	15.000	13.500	13.725	16.765	-0.047	0.9361	19										
20	15.750	15.000	10.607	16.050	14.550	+0.058	15.825	12.683	+0.047	1.0651	79.8	12.689	+0.049	1.1017	15.750	14.250	14.475	17.599	-0.047	0.9417	20										
21	16.500	15.750	11.137	16.800	15.300	+0.058	16.575	13.392	+0.047	1.0584	80.3	13.398	+0.049	1.0932	16.500	15.000	15.225	18.263	-0.047	0.9414	21										
22	17.250	16.500	11.667	17.550	16.050	+0.058	17.325	14.185	+0.047	1.0580	80.8	14.191	+0.049	1.0913	17.250	15.750	15.975	19.062	-0.047	0.9461	22										
23	18.000	17.250	12.198	18.300	16.800	+0.058	18.075	14.898	+0.047	1.0525	81.2	14.903	+0.049	1.0843	18.000	16.500	16.725	19.770	-0.047	0.9458	23										
24	18.750	18.000	12.728	19.050	17.550	+0.058	18.825	15.687	+0.047	1.0522	81.5	15.693	+0.049	1.0828	18.750	17.250	17.475	20.564	-0.047	0.9298	24										
25	19.500	18.750	13.258	19.800	18.300	+0.058	19.575	16.403	+0.047	1.0477	81.9	16.408	+0.049	1.0769	19.500	18.000	18.225	21.276	-0.047	0.9196	25										
26	20.250	19.500	13.789	20.550	19.050	+0.058	20.325	17.189	+0.047	1.0475	82.2	17.194	+0.049	1.0757	20.250	18.750	18.975	22.066	-0.047	0.9330	26										
27	21.000	20.250	14.319	21.300	19.800	+0.058	21.075	17.907	+0.047	1.0437	82.5	17.912	+0.049	1.0703	21.000	19.500	19.725	22.781	-0.047	0.9329	27										
28	21.750	21.000	14.849	22.050	20.550	+0.058	21.825	18.690	+0.047	1.0436	82.8	18.695	+0.049	1.0697	21.750	20.250	20.475	23.568	-0.047	0.9359	28										
29	22.500	21.750	15.380	22.800	21.300	+0.058	22.575	19.410	+0.047	1.0403	83.0	19.415	+0.049	1.0655	22.500	21.000	21.225	24.285	-0.047	0.9358	29										
30	23.250	22.500	15.910	23.550	22.050	+0.058	23.325	20.192	+0.047	1.0403	83.2	20.198	+0.049	1.0647	23.250	21.750	21.975	25.069	-0.047	0.9384	30										
31	24.000	23.250	16.440	24.300	22.800	+0.058	24.075	20.913	+0.047	1.0375	83.5	20.918	+0.049	1.0632	24.000	22.500	22.725	25.789	-0.047	0.9383	31										
32	24.750	24.000	16.971	25.050	23.550	+0.058	24.825	21.693	+0.047	1.0374	83.7	21.697	+0.049	1.0603	24.750	23.250	23.475	26.571	-0.047	0.9607	32										
33	25.500	24.750	17.501	25.800	24.300	+0.058	25.575	22.416	+0.047	1.0350	83.9	22.420	+0.049	1.0571	25.500	24.000	24.225	27.292	-0.047	0.9606	33										
34	26.250	25.500	18.031	26.500	25.050	+0.058	26.325	23.193	+0.047	1.0349	84.0	23.198	+0.049	1.0564	26.250	24.750	24.975	28.072	-0.047	0.9627	34										
35	27.000	26.250	18.562	27.300	25.800	+0.058	27.075	23.918	+0.047	1.0328	84.2	23.923	+0.049	1.0536	27.000	25.500	25.725	28.795	-0.047	0.9626	35										
36	27.750	27.000	19.092	28.050	26.550	+0.058	27.825	24.694	+0.047	1.0328	84.4	24.699	+0.049	1.0531	27.750	26.250	26.475	29.573	-0.047	0.9645	36										
37	28.500	27.750	19.622	28.800	27.300	+0.058	28.575	25.420	+0.047	1.0309	84.5	25.425	+0.049	1.0506	28.500	27.000	27.225	30.298	-0.047	0.9645	37										
38	29.250	28.500	20.153	29.550	28.050	+0.058	29.325	26.195	+0.047	1.0309	84.7	26.199	+0.049	1.0501	29.250	27.750	27.975	31.074	-0.047	0.9661	38										
39	30.000	29.250	20.683	30.300	28.800	+0.058	30.075	26.922	+0.047	1.0292	84.8	26.926	+0.049	1.0478	30.000	28.500	28.725	31.800	-0.047	0.9661	39										
40	30.750	30.000	21.213	31.050	29.550	+0.058	30.825	27.696	+0.047	1.0292	84.9	27.700	+0.049	1.0474	30.750	29.250	29.475	32.575	-0.047	0.9676	40										
41	31.500	30.750	21.744	31.800	30.300	+0.100	31.575	28.424	+0.047	1.0276	85.1	28.428	+0.049	1.0454	31.500	30.000	30.225	33.302	-0.047	0.9676	41										
42	32.250	31.500	22.274	32.550	31.050	+0.100	32.325	29.196	+0.047	1.0276	85.2	29.200	+0.049	1.0450	32.250	30.750	30.975	34.016	-0.047	0.9690	42										
43	33.000	32.250	22.804	33.300	31.800	+0.100	33.075	29.925	+0.047	1.0262	85.3	29.929	+0.049	1.0432	33.000	31.500	31.725	34.684	-0.047	0.9690	43										
44	33.750	33.000	23.335	34.050	32.550	+0.100	33.825	30.697	+0.047	1.0263	85.4	30.700	+0.049	1.0428	33.750	32.250	32.475	35.376	-0.047	0.9703	44										
45	34.500	33.750	23.865	34.800	33.300	+0.100	34.575	31.427	+0.047	1.0250	85.5	31.430	+0.049	1.0412	34.500	33.000	33.225	36.006	-0.047	0.9703	45										
46	35.250	34.500	24.395	35.550	34.050	+0.100	35.325	32.197	+0.047	1.0230	85.6	32.201	+0.049	1.0409	35.250	33.750	33.975	36.707	-0.047	0.9715	46										
47	36.000	35.250	24.926	36.300	34.800	+0.100	36.075	32.928	+0.047	1.0239	85.7	32.932	+0.049	1.0393	36.000	34.500	34.725	37.407	-0.047	0.9715	47										
48	36.750	36.000	25.456	37.050	35.550	+0.100	36.825	33.698	+0.047	1.0239	85.8	33.701	+0.049	1.0390	36.750	35.250	35.475	38.078	-0.047	0.9725	48										
49	37.500	36.750	25.986	37.800	36.300	+0.100	37.575	34.429	+0.047	1.0228	85.9	34.433	+0.049	1.0377	37.500	36.000	36.225	38.709	-0.047	0.9725	49										
50	38.250	37.500	26.517	38.550	37.050	+0.100	38.325	35.198	+0.047	1.0229	85.9	35.201	+0.049	1.0374	38.250	36.750	36.975	40.078	-0.047	0.9735	50										
51	39.000	38.250	27.047	39.300	37.800	+0.100	39.075	35.930	+0.047	1.0219	86.0	35.934	+0.049	1.0361	39.000	37.500	37.725	40.810	-0.047	0.9735	51										
52	39.750	39.000	27.577	40.050	38.550	+0.100	39.825	36.698	+0.047	1.0219	86.1	36.701	+0.049	1.0359	39.750	38.250	38.475	41.579	-0.047	0.9745	52										
53	40.500	39.750	28.107	40.800	39.300	+0.100	40.575	37.431	+0.047	1.0210	86.2	37.434	+0.049	1.0347	40.500	39.000	39.225	42.311	-0.047	0.9745	53										
54	41.250	40.500	28.638	41.550	40.050	+0.100	41.325	38.198	+0.047	1.0210	86.3	38.202	+0.049	1.0344	41.250	39.750	39.975	43.079	-0.047	0.9753	54										
55	42.000	41.250	29.168	42.300	40.800	+0.100	42.075	38.932	+0.047	1.0202	86.3	38.935	+0.049	1.0334	42.000	40.500	40.725	43.812	-0.047	0.9753	55										
56	42.750	42.000	29.698	43.050	41.550	+0.100	42.825	39.699	+0.047	1.0202	86.4	39.702	+0.049	1.0332	42.750	41.250	41.475	44.580	-0.047	0.9761	56										
57	43.500	42.750	30.229	43.800	42.300	+0.100	43.575	40.433	+0.047	1.0195	86.4	40.436	+0.049	1.0332	43.500	42.000	42.225	45.313	-0.047	0.9761	57										
58	44.250																														

Attached Table 4. Part Dimension

Module $m=1.0$ Basic pitch $p_s=3.1416$ mm Circular addendum tooth thickness (shaft) $s_s=1.770796$ mm Height of addendum (shaft) $h_a=0.500$ mm Height of dedendum (shaft) $h_f=0.500$ mm Roundness at the tooth tip of tool $r_s=0.4476$ mm Pressure angle $\alpha_s=45^\circ$ Width of tooth groove (hole) $w_s=1.770796$ mm Height of addendum (hole) $h_{a1}=0.390$ mm Height of dedendum (hole) $h_{f1}=0.700$ mm Measuring pin diameter $U=2.000$ mm Unit: mm

No. of teeth <i>z</i>	Basic items				Hole (Involute tooth form)										Shaft										No. of teeth <i>z</i>	
	Nominal dia. <i>d</i>	Basic pitch circle dia. <i>d_p</i>	Base circle dia. <i>d_b</i>	Large dia. <i>D_s</i> (Min.)	Small dia. <i>d_s</i>		Involute limit dia. <i>D_{lim}</i> (Reference)		Over pin dia. <i>M₁</i>		<i>F</i>	Straight line tooth groove angle <i>θ</i>	Over pin dia. <i>M₂</i>		<i>F</i>	Large dia. <i>d</i>		Small dia. <i>d_s</i> (Max.)		Involute limit dia. <i>d_{lim}</i> (Reference)		Over pin dia. <i>M₁</i>		<i>F</i>		No. of teeth <i>z</i>
					Basic dimension	Deviation	Basic dimension	Deviation	Basic dimension	Deviation			Basic dimension	Deviation		Basic dimension	Deviation	Basic dimension	Deviation	Basic dimension	Deviation	Basic dimension	Deviation			
10	11.000	10.000	7.071	11.400	9.400	+0.050	11.100	6.866	+0.004	1.1721	69.7	6.873	+0.009	1.2373	11.000	9.000	9.300	13.372	-0.018	0.9026	10					
11	12.000	11.000	7.778	12.400	10.400	+0.050	12.100	7.775	+0.004	1.1359	71.6	7.783	+0.009	1.1972	12.000	10.000	10.300	14.257	-0.018	0.8995	11					
12	13.000	12.000	8.485	13.400	11.400	+0.050	13.100	8.883	+0.004	1.1293	73.1	8.891	+0.009	1.1875	13.000	11.000	11.300	15.338	-0.018	0.9142	12					
13	14.000	13.000	9.192	14.400	12.400	+0.050	14.100	9.802	+0.004	1.1069	74.4	9.811	+0.009	1.1611	14.000	12.000	12.300	16.287	-0.018	0.9123	13					
14	15.000	14.000	9.899	15.400	13.400	+0.050	15.100	10.893	+0.004	1.1037	75.5	10.902	+0.009	1.1549	15.000	13.000	13.300	17.396	-0.018	0.9232	14					
15	16.000	15.000	10.607	16.400	14.400	+0.050	16.100	11.821	+0.004	1.0983	76.5	11.830	+0.009	1.1363	16.000	14.000	14.300	18.310	-0.018	0.9220	15					
16	17.000	16.000	11.314	17.400	15.400	+0.050	17.100	12.901	+0.004	1.0886	77.3	12.910	+0.009	1.1319	17.000	15.000	15.300	19.403	-0.018	0.9206	16					
17	18.000	17.000	12.021	18.400	16.400	+0.050	18.100	13.836	+0.004	1.0754	78.1	13.844	+0.009	1.1180	18.000	16.000	16.300	20.327	-0.018	0.9208	17					
18	19.000	18.000	12.728	19.400	17.400	+0.050	19.100	14.906	+0.004	1.0743	78.7	14.915	+0.009	1.1149	19.000	17.000	17.300	21.408	-0.018	0.9367	18					
19	20.000	19.000	13.435	20.400	18.400	+0.050	20.100	15.847	+0.004	1.0658	79.3	15.856	+0.009	1.1044	20.000	18.000	18.300	22.340	-0.018	0.9361	19					
20	21.000	20.000	14.142	21.400	19.400	+0.050	21.100	16.910	+0.004	1.0651	79.8	16.919	+0.009	1.1017	21.000	19.000	19.300	23.412	-0.018	0.9417	20					
21	22.000	21.000	14.849	22.400	20.400	+0.050	22.100	17.856	+0.004	1.0584	80.3	17.864	+0.009	1.0932	22.000	20.000	20.300	24.351	-0.018	0.9414	21					
22	23.000	22.000	15.556	23.400	21.400	+0.050	23.100	18.913	+0.004	1.0580	80.8	18.921	+0.009	1.0913	23.000	21.000	21.300	25.416	-0.018	0.9461	22					
23	24.000	23.000	16.263	24.400	22.400	+0.050	24.100	19.864	+0.004	1.0525	81.2	19.872	+0.009	1.0843	24.000	22.000	22.300	26.369	-0.018	0.9458	23					
24	25.000	24.000	16.971	25.400	23.400	+0.050	25.100	20.916	+0.004	1.0522	81.5	20.924	+0.009	1.0828	25.000	23.000	23.300	27.419	-0.018	0.9498	24					
25	26.000	25.000	17.678	26.400	24.400	+0.050	26.100	21.870	+0.004	1.0477	81.9	21.878	+0.009	1.0769	26.000	24.000	24.300	28.363	-0.018	0.9496	25					
26	27.000	26.000	18.385	27.400	25.400	+0.050	27.100	22.919	+0.004	1.0475	82.2	22.926	+0.009	1.0757	27.000	25.000	25.300	29.421	-0.018	0.9530	26					
27	28.000	27.000	19.092	28.400	26.400	+0.050	28.100	23.876	+0.004	1.0437	82.5	23.883	+0.009	1.0708	28.000	26.000	26.300	30.375	-0.018	0.9529	27					
28	29.000	28.000	19.799	29.400	27.400	+0.050	29.100	24.920	+0.004	1.0436	82.8	24.927	+0.009	1.0697	29.000	27.000	27.300	31.424	-0.018	0.9559	28					
29	30.000	29.000	20.506	30.400	28.400	+0.050	30.100	25.880	+0.004	1.0403	83.0	25.887	+0.009	1.0655	30.000	28.000	28.300	32.380	-0.018	0.9558	29					
30	31.000	30.000	21.213	31.400	29.400	+0.050	31.100	26.922	+0.004	1.0403	83.2	26.929	+0.009	1.0647	31.000	29.000	29.300	33.426	-0.018	0.9584	30					
31	32.000	31.000	21.920	32.400	30.400	+0.050	32.100	27.884	+0.004	1.0375	83.5	27.891	+0.009	1.0633	32.000	30.000	30.300	34.385	-0.018	0.9583	31					
32	33.000	32.000	22.627	33.400	31.400	+0.050	33.100	28.923	+0.004	1.0374	83.7	28.930	+0.009	1.0603	33.000	31.000	31.300	35.428	-0.018	0.9607	32					
33	34.000	33.000	23.335	34.400	32.400	+0.050	34.100	29.888	+0.004	1.0350	83.9	29.894	+0.009	1.0571	34.000	32.000	32.300	36.389	-0.018	0.9606	33					
34	35.000	34.000	24.042	35.400	33.400	+0.050	35.100	30.925	+0.004	1.0349	84.0	30.931	+0.009	1.0564	35.000	33.000	33.300	37.429	-0.018	0.9627	34					
35	36.000	35.000	24.749	36.400	34.400	+0.050	36.100	31.891	+0.004	1.0328	84.2	31.897	+0.009	1.0536	36.000	34.000	34.300	38.393	-0.018	0.9626	35					
36	37.000	36.000	25.456	37.400	35.400	+0.050	37.100	32.926	+0.004	1.0328	84.4	32.931	+0.009	1.0531	37.000	35.000	35.300	39.431	-0.018	0.9645	36					
37	38.000	37.000	26.163	38.400	36.400	+0.050	38.100	33.894	+0.004	1.0309	84.5	33.899	+0.009	1.0506	38.000	36.000	36.300	40.397	-0.018	0.9615	37					
38	39.000	38.000	26.870	39.400	37.400	+0.050	39.100	34.927	+0.004	1.0309	84.7	34.932	+0.009	1.0501	39.000	37.000	37.300	41.432	-0.018	0.9661	38					
39	40.000	39.000	27.577	40.400	38.400	+0.050	40.100	35.896	+0.004	1.0292	84.8	35.902	+0.009	1.0478	40.000	38.000	38.300	42.409	-0.018	0.9661	39					
40	41.000	40.000	28.284	41.400	39.400	+0.050	41.100	36.927	+0.004	1.0292	84.9	36.933	+0.009	1.0474	41.000	39.000	39.300	43.433	-0.018	0.9676	40					
41	42.000	41.000	28.991	42.400	40.400	+0.050	42.100	37.899	+0.004	1.0276	85.1	37.904	+0.009	1.0454	42.000	40.000	40.300	44.403	-0.018	0.9676	41					
42	43.000	42.000	29.698	43.400	41.400	+0.050	43.100	38.928	+0.004	1.0276	85.2	38.933	+0.009	1.0450	43.000	41.000	41.300	45.434	-0.018	0.9690	42					
43	44.000	43.000	30.406	44.400	42.400	+0.050	44.100	39.901	+0.004	1.0262	85.3	39.906	+0.009	1.0432	44.000	42.000	42.300	46.405	-0.018	0.9690	43					
44	45.000	44.000	31.113	45.400	43.400	+0.050	45.100	40.929	+0.004	1.0263	85.4	40.934	+0.009	1.0428	45.000	43.000	43.300	47.435	-0.018	0.9703	44					
45	46.000	45.000	31.820	46.400	44.400	+0.050	46.100	41.902	+0.004	1.0250	85.5	41.907	+0.009	1.0412	46.000	44.000	44.300	48.407	-0.018	0.9703	45					
46	47.000	46.000	32.527	47.400	45.400	+0.050	47.100	42.930	+0.004	1.0250	85.6	42.934	+0.009	1.0408	47.000	45.000	45.300	49.435	-0.018	0.9715	46					
47	48.000	47.000	33.234	48.400	46.400	+0.050	48.100	43.904	+0.004	1.0239	85.7	43.909	+0.009	1.0393	48.000	46.000	46.300	50.409	-0.018	0.9715	47					
48	49.000	48.000	33.941	49.400	47.400	+0.050	49.100	44.930	+0.004	1.0239	85.8	44.935	+0.009	1.0390	49.000	47.000	47.300	51.437	-0.018	0.9725	48					
49	50.000	49.000	34.648	50.400	48.400	+0.050	50.100	45.906	+0.004	1.0228	85.9	45.910	+0.009	1.0377	50.000	48.000	48.300	52.411	-0.018	0.9725	49					
50	51.000	50.000	35.355	51.400	49.400	+0.050	51.100	46.931	+0.004	1.0229	85.9	46.935	+0.009	1.0374	51.000	49.000	49.300	53.433	-0.018	0.9735	50					
51	52.000	51.000	36.062	52.400	50.400	+0.050	52.100	47.907	+0.004	1.0219	86.0	47.911	+0.009	1.0361	52.000	50.000	50.300	54.413	-0.018	0.9735	51					
52	53.000	52.000	36.770	53.400	51.400	+0.050	53.100	48.932	+0.004	1.0219	86.1	48.935	+0.009	1.0359	53.000	51.000	51.300	55.438	-0.018	0.9745	52					
53	54.000	53.000	37.477	54.400	52.400	+0.050	54.100	49.908	+0.004	1.0210	86.2	49.913	+0.009	1.0347	54.000	52.000	52.300	56.415	-0.018	0.9745	53					
54	55.000	54.000	38.184	55.400	53.400	+0.050	55.100	50.932	+0.004	1.0210	86.2	50.936	+0.009	1.0345	55.000	53.000	53.300	57.439	-0.018	0.9753	54					
55	56.000	55.000	38.891	56.400	54.400	+0.050	56.100	51.910	+0.004	1.0202	86.3	51.914	+0.009	1.0334	56.000	54.000	54.300	58.416	-0.018	0.9753	55					
56	57.000	56.000	39.598	57.400	55.400	+0.050	57.100	52.932	+0.004	1.0202	86.4	52.936	+0.009	1.03												

Attached Table 5. Part Dimension

B 1602-1961

Module $m=1.5$ Basic pitch $p_s=4.7124$ mm Circular arc tooth thickness (shaft) $s_s=2.656194$ mm Height of addendum (shaft) $h_a=0.750$ mm Height of dedendum (shaft) $h_f=0.750$ mm Roundness at the tooth tip of tool $r_s=0.6714$ mm
 Pressure angle $\alpha_s=45^\circ$ Width of tooth groove (hole) $w_s=2.656194$ mm Height of addendum (hole) $h_{a1}=0.450$ mm Height of dedendum (hole) $h_{f1}=1.050$ mm Measuring pin diameter $U=3.000$ mm
 Unit: mm

No. of teeth <i>z</i>	Basic items				Hole (Involute tooth form)										Hole (Straight line tooth form)										Shaft						No. of teeth <i>z</i>
	Nominal dia. <i>d</i>	Basic pitch circle dia. <i>d_s</i>	Base circle dia. <i>d_b</i>	Large <i>d</i> (Min.)	Small dia. <i>d_s</i> (Basic dimension)	Deviation (Hole)	Involute limit dia. <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> <i>d_{lim}</i> 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Basic Items		Hole (Involute tooth form)										Hole (Straight line tooth form)										Shaft										Unit: mm	
No. of teeth <i>z</i>	Nominal dia. <i>d</i>	Basic pitch dia. <i>d_p</i>	Base circle dia. <i>d_b</i>	Large dia. <i>D</i> (Min.)	Small dia. <i>d_s</i>	Basic dimension <i>D₁</i> (H10)	Involute involute <i>d_{f1}</i> (Reference)	Over pin dia. <i>d_f</i>	Deviation <i>f</i>	<i>F</i>	Basic dimension <i>d_{f1}</i>	Deviation <i>f</i>	<i>F</i>	Large dia. <i>d</i>	Deviation <i>f</i>	Small dia. <i>d_s</i> (Max.)	Involute involute <i>d_{f1}</i> (Reference)	Over pin dia. <i>d_f</i>	Deviation <i>f</i>	<i>F</i>	No. of teeth <i>z</i>												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22												
10	22.000	20.000	14.142	22.800	18.800	+0.084	22.200	15.733	+0.115	1.1721	69.7	33.747	+0.121	1.2373	22.000	-0.000	18.000	18.600	26.755	-0.020	0.9026	10											
11	24.000	22.000	15.556	24.800	20.800	+0.084	24.200	17.650	+0.115	1.1359	71.6	35.566	+0.121	1.1972	24.000	-0.000	20.000	20.600	28.514	-0.020	0.8995	11											
12	26.000	24.000	16.971	26.800	22.800	+0.084	26.200	17.766	+0.115	1.1293	73.1	37.783	+0.121	1.1875	26.000	-0.000	22.000	22.600	30.776	-0.020	0.9142	12											
13	28.000	26.000	18.385	28.800	24.800	+0.084	28.200	19.604	+0.115	1.1069	74.4	39.621	+0.121	1.1611	28.000	-0.000	24.000	24.600	32.574	-0.020	0.9123	13											
14	30.000	28.000	19.799	30.800	26.800	+0.084	30.200	21.787	+0.115	1.1037	75.5	41.804	+0.121	1.1549	30.000	-0.000	26.000	26.600	34.792	-0.020	0.9233	14											
15	32.000	30.000	21.213	32.800	28.800	+0.084	32.200	23.642	+0.115	1.0883	76.5	43.660	+0.121	1.1363	32.000	-0.000	28.000	28.600	36.619	-0.020	0.9220	15											
16	34.000	32.000	22.627	34.800	30.800	+0.100	34.200	25.801	+0.115	1.0866	77.5	45.819	+0.121	1.1319	34.000	-0.000	30.000	30.600	38.805	-0.020	0.9306	16											
17	36.000	34.000	24.042	36.800	32.800	+0.100	36.200	27.672	+0.115	1.0756	78.1	47.689	+0.121	1.1180	36.000	-0.000	32.000	32.600	40.633	-0.020	0.9298	17											
18	38.000	36.000	25.456	38.800	34.800	+0.100	38.200	29.812	+0.115	1.0743	78.7	49.829	+0.121	1.1149	38.000	-0.000	34.000	34.600	42.815	-0.020	0.9367	18											
19	40.000	38.000	26.870	40.800	36.800	+0.100	40.200	31.694	+0.115	1.0658	79.3	51.711	+0.121	1.1044	40.000	-0.000	36.000	36.600	44.681	-0.020	0.9361	19											
20	42.000	40.000	28.284	42.800	38.800	+0.100	42.200	33.821	+0.115	1.0551	79.8	53.737	+0.121	1.1017	42.000	-0.000	38.000	38.600	46.824	-0.020	0.9417	20											
21	44.000	42.000	29.698	44.800	40.800	+0.100	44.200	35.713	+0.115	1.0584	80.3	55.729	+0.121	1.0932	44.000	-0.000	40.000	40.600	48.702	-0.020	0.9414	21											
22	46.000	44.000	31.111	46.800	42.800	+0.100	46.200	37.827	+0.115	1.0580	80.8	57.843	+0.121	1.0913	46.000	-0.000	42.000	42.600	50.831	-0.020	0.9458	22											
23	48.000	46.000	32.527	48.800	44.800	+0.100	48.200	39.728	+0.115	1.0525	81.2	59.743	+0.121	1.0843	48.000	-0.000	44.000	44.600	52.721	-0.020	0.9461	23											
24	50.000	48.000	33.941	50.800	46.800	+0.100	50.200	41.833	+0.115	1.0522	81.5	61.848	+0.121	1.0828	50.000	-0.000	46.000	46.600	54.837	-0.020	0.9498	24											
25	52.000	50.000	35.355	52.800	48.800	+0.100	52.200	43.741	+0.115	1.0437	81.9	63.755	+0.121	1.0769	52.000	-0.000	48.000	48.600	56.736	-0.020	0.9496	25											
26	54.000	52.000	36.770	54.800	50.800	+0.130	54.200	45.837	+0.115	1.0475	82.2	65.851	+0.121	1.0757	54.000	-0.000	50.000	50.600	58.843	-0.020	0.9530	26											
27	56.000	54.000	38.184	56.800	52.800	+0.130	56.200	47.751	+0.115	1.0437	82.5	67.765	+0.121	1.0708	56.000	-0.000	52.000	52.600	60.749	-0.020	0.9529	27											
28	58.000	56.000	39.598	58.800	54.800	+0.130	58.200	49.841	+0.115	1.0436	82.8	69.854	+0.121	1.0697	58.000	-0.000	54.000	54.600	62.847	-0.020	0.9559	28											
29	60.000	58.000	41.012	60.800	56.800	+0.130	60.200	51.761	+0.115	1.0403	83.0	71.774	+0.121	1.0655	60.000	-0.000	56.000	56.600	64.760	-0.020	0.9558	29											
30	62.000	60.000	42.426	62.800	58.800	+0.130	62.200	53.844	+0.115	1.0403	83.2	73.857	+0.121	1.0647	62.000	-0.000	58.000	58.600	66.852	-0.020	0.9584	30											
31	64.000	62.000	43.841	64.800	60.800	+0.130	64.200	55.769	+0.115	1.0375	83.5	75.781	+0.121	1.0632	64.000	-0.000	60.000	60.600	68.770	-0.020	0.9583	31											
32	66.000	64.000	45.255	66.800	62.800	+0.130	66.200	57.847	+0.115	1.0374	83.7	77.859	+0.121	1.0603	66.000	-0.000	62.000	62.600	70.855	-0.020	0.9607	32											
33	68.000	66.000	46.669	68.800	64.800	+0.130	68.200	59.776	+0.115	1.0350	83.9	79.788	+0.121	1.0571	68.000	-0.000	64.000	64.600	72.779	-0.020	0.9606	33											
34	70.000	68.000	48.083	70.800	66.800	+0.130	70.200	61.849	+0.115	1.0349	84.0	81.681	+0.121	1.0564	70.000	-0.000	66.000	66.600	74.758	-0.020	0.9627	34											
35	72.000	70.000	49.497	72.800	68.800	+0.130	72.200	63.782	+0.115	1.0328	84.2	83.794	+0.121	1.0536	72.000	-0.000	68.000	68.600	76.786	-0.020	0.9626	35											
36	74.000	72.000	50.912	74.800	70.800	+0.130	74.200	65.851	+0.115	1.0328	84.4	85.863	+0.121	1.0531	74.000	-0.000	70.000	70.600	78.861	-0.020	0.9645	36											
37	76.000	74.000	52.326	76.800	72.800	+0.130	76.200	67.788	+0.115	1.0309	84.5	87.799	+0.121	1.0506	76.000	-0.000	72.000	72.600	80.793	-0.020	0.9645	37											
38	78.000	76.000	53.740	78.800	74.800	+0.130	78.200	69.853	+0.115	1.0309	84.7	89.864	+0.121	1.0501	78.000	-0.000	74.000	74.600	82.864	-0.020	0.9661	38											
39	80.000	78.000	55.154	80.800	76.800	+0.130	80.200	71.793	+0.115	1.0292	84.8	91.803	+0.121	1.0478	80.000	-0.000	76.000	76.600	84.860	-0.020	0.9661	39											
40	82.000	80.000	56.569	82.800	78.800	+0.130	82.200	73.855	+0.115	1.0292	84.9	93.865	+0.121	1.0474	82.000	-0.000	78.000	78.600	86.866	-0.020	0.9676	40											
41	84.000	82.000	57.983	84.800	80.800	+0.140	84.200	75.797	+0.115	1.0276	85.1	95.807	+0.121	1.0454	84.000	-0.000	80.000	80.600	88.865	-0.020	0.9714	41											
42	86.000	84.000	59.397	86.800	82.800	+0.140	86.200	77.856	+0.115	1.0276	85.2	97.866	+0.121	1.0450	86.000	-0.000	82.000	82.600	90.868	-0.020	0.9690	42											
43	88.000	86.000	60.811	88.800	84.800	+0.140	88.200	79.801	+0.115	1.0262	85.3	99.811	+0.121	1.0432	88.000	-0.000	84.000	84.600	92.810	-0.020	0.9690	43											
44	90.000	88.000	62.225	90.800	86.800	+0.140	90.200	81.858	+0.115	1.0263	85.4	101.868	+0.121	1.0428	90.000	-0.000	86.000	86.600	94.870	-0.020	0.9703	44											
45	92.000	90.000	63.640	92.800	88.800	+0.140	92.200	83.865	+0.115	1.0250	85.5	103.814	+0.121	1.0412	92.000	-0.000	88.000	88.600	96.815	-0.020	0.9703	45											
46	94.000	92.000	65.054	94.800	90.800	+0.140	94.200	85.859	+0.115	1.0250	85.6	105.868	+0.121	1.0408	94.000	-0.000	90.000	90.600	98.872	-0.020	0.9715	46											
47	96.000	94.000	66.468	96.800	92.800	+0.140	96.200	87.898	+0.115	1.0239	85.7	107.818	+0.121	1.0399	96.000	-0.000	94.000	94.600	100.874	-0.020	0.9715	47											
48	98.000	96.000	67.882	98.800	94.800	+0.140	98.200	89.860	+0.115	1.0228	85.8	109.869	+0.121	1.0390	98.000	-0.000	96.000	96.600	102.874	-0.020	0.9725	48											
49	100.000	98.000	69.296	100.800	96.800	+0.140	100.200	91.811	+0.115	1.0228	85.9	111.820	+0.121	1.0377	100.000	-0.000	98.000	98.600	104.823	-0.020	0.9725	49											
50	102.000	100.000	70.711	102.800	98.800	+0.140	102.200	93.861	+0.115	1.0219	85.9	113.870	+0.121	1.0374	102.000	-0.000	100.000	100.600	106.875	-0.020	0.9735	50											
51	104.000	102.000	72.125	104.800	100.800	+0.140	104.200	95.814	+0.115	1.0219	86.0	115.823	+0.121	1.0361	104.000	-0.000	102.000	102.600	108.826	-0.020	0.9735	51											
52	106.000	104.000	73.539	106.800	102.800	+0.140	106.200	97.863	+0.115	1.0219	86.1	117.871	+0.121	1.0359	106.000	-0.000	104.000	104.600	110.877	-0.020	0.9745	52											
53	108.000	106.000	74.953	108.800	104.800	+0.140	108.200	99.817	+0.115	1.0210	86.2	119.820	+0.121	1.0347	108.000	-0.000	106.000	106.600	112.830	-0.020	0.9745	53											
54	110.000	108.000	76.368	110.800	106.800	+0.140	110.200	101.863	+0.115	1.0210	86.2	121.871	+0.121	1.0345	110.000	-0.000	108.000	108.600	114.878	-0.020	0.9753	54											
55	112.000	110.000	77.782	112.800	108.800	+0.140	112.200	103.819	+0.115	1.0202	86.3	123.828	+0.121	1.0334	112.000	-0.000	110.000	110.600	116.833	-0.020	0.9753	55											
56	114.000	112.000	79.196	114.800	110.800	+0.140	114.200	105.864	+0.115	1.0202	86.4	125.877	+0.121	1.0332	114.000	-0.000	112.000	112.600	118.877	-0.020	0.9761	56											
57	116.000	114.000	80.610	116.800	112.800	+0.140	116.200	107.822	+0.115	1.0195	86.4	127.830	+0.121	1.0322	116.000	-0.000	114.000	114.600	120.835	-0.020	0.9761	57											
58	118.000	116.000	82.024	118.800	114.800	+0.140																											

Attached Table 7. Part Dimension

B 1602-1961

Module $m=2.5$ Basic pitch $p=7.8540$ mm Circular arc tooth thickness (shaft) $s_a=4.426991$ mm Height of addendum (shaft) $h_a=1.25d$ mm Height of dedendum (shaft) $h_f=1.250$ mm Roundness at the tooth tip of tool $r_s=1.1190$ mm
 Pressure angle $\alpha_s=45^\circ$ Width of tooth groove (hole) $w_s=4.426991$ mm Height of addendum (hole) $h_{a1}=0.75d$ mm Height of dedendum (hole) $h_{f1}=1.750$ mm Measuring pin diameter $U=5.000$ mm
 Unit: mm

Unit: mm																								No. of teeth	
No. of teeth <i>z</i>	Basic items				Hole (Involute tooth form)										Shaft										No. of teeth <i>z</i>
	Nominal dia. <i>d</i>	Basic pitch circle dia. <i>d_p</i>	Basic circle dia. <i>d_f</i>	Large dia. <i>D</i> (Min.)	Small dia. <i>D₁</i>	Basic dimension	Deviation (H10)	Involute limit dia. <i>D_{lim}</i> (Reference)	Over pin dia. <i>A_{f1}</i>	<i>F</i>	Small tooth groove <i>g₁</i>	Over pin dia. <i>A_{f1}</i>	<i>F'</i>	Large dia. <i>d</i>	Small dia. <i>d₁</i> (Max.)	Involute limit dia. <i>d_{lim}</i> (Reference)	Over pin dia. <i>M_e</i>	<i>E</i>	Basic dimension	Deviation	Basic dimension	Deviation	Basic dimension	Deviation	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
10	27.500	25.000	17.678	28.500	23.500	+0.084 0		27.750	17.166	+0.119 +0.059	1.1721	69.7	17.184	+0.121 +0.061	1.2373	27.500	-0.029 0	22.500	23.250	33.443	-0.029 -0.067	0.9025	10		
11	30.000	27.500	19.445	31.000	26.000	+0.084 0		30.250	19.438	+0.119 +0.061	1.1359	71.6	19.457	+0.121 +0.061	1.1972	30.000	-0.029 0	25.000	25.750	35.642	-0.029 -0.067	0.8995	11		
12	32.500	30.000	21.213	33.500	28.500	+0.084 0		32.750	22.207	+0.119 +0.061	1.1293	73.1	22.228	+0.121 +0.061	1.1875	32.500	-0.029 0	27.500	28.250	38.470	-0.029 -0.067	0.9142	12		
13	35.000	32.500	22.981	36.000	31.000	+0.100 0		35.250	24.505	+0.119 +0.061	1.1069	74.4	24.527	+0.121 +0.061	1.1611	35.000	-0.029 0	30.000	30.750	40.718	-0.029 -0.067	0.9123	13		
14	37.500	35.000	24.749	38.500	33.500	+0.100 0		37.750	27.233	+0.119 +0.061	1.1037	75.5	27.256	+0.121 +0.061	1.1549	37.500	-0.029 0	32.500	33.250	43.490	-0.029 -0.067	0.9233	14		
15	40.000	37.500	26.517	41.000	36.000	+0.100 0		40.250	29.553	+0.119 +0.061	1.0883	76.5	29.575	+0.121 +0.061	1.1363	40.000	-0.029 0	35.000	35.750	45.774	-0.029 -0.067	0.9220	15		
16	42.500	40.000	28.284	43.500	38.500	+0.100 0		42.750	32.252	+0.119 +0.061	1.0866	77.3	32.274	+0.121 +0.061	1.1319	42.500	-0.029 0	37.500	38.250	48.506	-0.029 -0.067	0.9306	16		
17	45.000	42.500	30.052	46.000	41.000	+0.100 0		45.250	34.590	+0.119 +0.061	1.0756	78.1	34.611	+0.121 +0.061	1.1180	45.000	-0.029 0	40.000	40.750	50.817	-0.029 -0.067	0.9298	17		
18	47.500	45.000	31.820	48.500	43.500	+0.100 0		47.750	37.265	+0.119 +0.061	1.0743	78.7	37.287	+0.121 +0.061	1.1149	47.500	-0.029 0	42.500	43.250	53.519	-0.029 -0.067	0.9367	18		
19	50.000	47.500	33.588	51.000	46.000	+0.100 0		50.250	39.618	+0.119 +0.061	1.0658	79.3	39.639	+0.121 +0.061	1.1044	50.000	-0.029 0	45.000	45.750	55.851	-0.029 -0.067	0.9361	19		
20	52.500	50.000	35.356	53.500	48.500	+0.100 0		52.750	42.276	+0.119 +0.061	1.0651	79.8	42.296	+0.121 +0.061	1.1017	52.500	-0.029 0	47.500	48.250	58.530	-0.029 -0.067	0.9417	20		
21	55.000	52.500	37.123	56.000	51.000	+0.120 0		55.250	44.641	+0.119 +0.061	1.0584	80.3	44.661	+0.121 +0.061	1.0932	55.000	-0.029 0	50.000	50.750	60.878	-0.029 -0.067	0.9414	21		
22	57.500	55.000	38.891	58.500	53.500	+0.120 0		57.750	47.284	+0.119 +0.061	1.0580	80.8	47.304	+0.121 +0.061	1.0913	57.500	-0.029 0	52.500	53.250	63.539	-0.029 -0.067	0.9461	22		
23	60.000	57.500	40.659	61.000	56.000	+0.120 0		60.250	49.660	+0.119 +0.061	1.0525	81.2	49.679	+0.121 +0.061	1.0843	60.000	-0.029 0	55.000	55.750	65.901	-0.029 -0.067	0.9458	23		
24	62.500	60.000	42.426	63.500	58.500	+0.120 0		62.750	52.291	+0.119 +0.061	1.0522	81.6	52.309	+0.121 +0.061	1.0828	62.500	-0.029 0	57.500	58.250	68.547	-0.029 -0.067	0.9498	24		
25	65.000	62.500	44.194	66.000	61.000	+0.120 0		65.250	54.676	+0.119 +0.061	1.0477	81.9	54.694	+0.121 +0.061	1.0769	65.000	-0.029 0	60.000	60.750	70.920	-0.029 -0.067	0.9496	25		
26	67.500	65.000	45.962	68.500	63.500	+0.120 0		67.750	57.296	+0.119 +0.061	1.0475	82.2	57.314	+0.121 +0.061	1.0757	67.500	-0.029 0	62.500	63.250	73.553	-0.029 -0.067	0.9530	26		
27	70.000	67.500	47.730	71.000	66.000	+0.120 0		70.250	59.689	+0.119 +0.061	1.0437	82.5	59.707	+0.121 +0.061	1.0708	70.000	-0.029 0	65.000	65.750	75.936	-0.029 -0.067	0.9529	27		
28	72.500	70.000	49.497	73.500	68.500	+0.120 0		72.750	62.301	+0.119 +0.061	1.0436	82.8	62.318	+0.121 +0.061	1.0697	72.500	-0.029 0	67.500	68.250	78.559	-0.029 -0.067	0.9559	28		
29	75.000	72.500	51.265	76.000	71.000	+0.120 0		75.250	64.701	+0.119 +0.061	1.0403	83.0	64.717	+0.121 +0.061	1.0655	75.000	-0.029 0	70.000	70.750	80.950	-0.029 -0.067	0.9558	29		
30	77.500	75.000	53.033	78.500	73.500	+0.120 0		77.750	67.305	+0.119 +0.061	1.0403	83.2	67.321	+0.121 +0.061	1.0647	77.500	-0.029 0	72.500	73.250	83.564	-0.029 -0.067	0.9584	30		
31	80.000	77.500	54.801	81.000	76.000	+0.120 0		80.250	69.711	+0.119 +0.061	1.0375	83.5	69.727	+0.121 +0.061	1.0632	80.000	-0.029 0	75.000	75.750	85.963	-0.029 -0.067	0.9583	31		
32	82.500	80.000	56.569	83.500	78.500	+0.120 0		82.750	72.309	+0.119 +0.061	1.0374	83.7	72.324	+0.121 +0.061	1.0603	82.500	-0.029 0	77.500	78.250	88.569	-0.029 -0.067	0.9607	32		
33	85.000	82.500	58.336	86.000	81.000	+0.120 0		85.250	74.720	+0.119 +0.061	1.0350	83.9	74.735	+0.121 +0.061	1.0571	85.000	-0.029 0	80.000	80.750	90.973	-0.029 -0.067	0.9606	33		
34	87.500	85.000	60.104	88.500	83.500	+0.120 0		87.750	77.312	+0.119 +0.061	1.0349	84.0	77.326	+0.121 +0.061	1.0564	87.500	-0.029 0	82.500	83.250	93.573	-0.029 -0.067	0.9627	34		
35	90.000	87.500	61.872	91.000	86.000	+0.120 0		90.250	79.727	+0.119 +0.061	1.0328	84.2	79.742	+0.121 +0.061	1.0536	90.000	-0.029 0	85.000	85.750	95.983	-0.029 -0.067	0.9626	35		
36	92.500	90.000	63.640	93.500	88.500	+0.120 0		92.750	82.314	+0.119 +0.061	1.0328	84.4	82.328	+0.121 +0.061	1.0531	92.500	-0.029 0	87.500	88.250	98.577	-0.029 -0.067	0.9645	36		
37	95.000	92.500	65.407	96.000	91.000	+0.120 0		95.250	84.734	+0.119 +0.061	1.0309	84.5	84.748	+0.121 +0.061	1.0506	95.000	-0.029 0	90.000	90.750	100.992	-0.029 -0.067	0.9645	37		
38	97.500	95.000	67.175	98.500	93.500	+0.120 0		97.750	87.317	+0.119 +0.061	1.0309	84.7	87.330	+0.121 +0.061	1.0501	97.500	-0.029 0	92.500	93.250	103.589	-0.029 -0.067	0.9661	38		
39	100.000	97.500	68.943	101.000	96.000	+0.120 0		100.250	89.741	+0.119 +0.061	1.0292	84.8	89.754	+0.121 +0.061	1.0478	100.000	-0.029 0	95.000	95.750	105.999	-0.029 -0.067	0.9661	39		
40	102.500	100.000	70.711	103.500	98.500	+0.120 0		102.750	92.319	+0.119 +0.061	1.0292	84.9	92.332	+0.121 +0.061	1.0474	102.500	-0.029 0	97.500	98.250	108.583	-0.029 -0.067	0.9676	40		
41	105.000	102.500	72.478	106.000	101.000	+0.120 0		105.250	94.734	+0.119 +0.061	1.0276	85.1	94.759	+0.121 +0.061	1.0454	105.000	-0.029 0	100.000	100.750	111.066	-0.029 -0.067	0.9676	41		
42	107.500	105.000	74.246	108.500	103.500	+0.120 0		107.750	97.321	+0.119 +0.061	1.0276	85.2	97.333	+0.121 +0.061	1.0450	107.500	-0.029 0	102.500	103.250	113.586	-0.029 -0.067	0.9690	42		
43	110.000	107.500	76.014	111.000	106.000	+0.120 0		110.250	99.751	+0.119 +0.061	1.0262	85.3	99.764	+0.121 +0.061	1.0432	110.000	-0.029 0	105.000	105.750	116.013	-0.029 -0.067	0.9690	43		
44	112.500	110.000	77.782	113.500	108.500	+0.120 0		112.750	102.322	+0.119 +0.061	1.0263	85.4	102.334	+0.121 +0.061	1.0428	112.500	-0.029 0	107.500	108.250	118.588	-0.029 -0.067	0.9703	44		
45	115.000	112.500	79.550	116.000	111.000	+0.120 0		115.250	104.755	+0.119 +0.061	1.0250	85.5	104.768	+0.121 +0.061	1.0412	115.000	-0.029 0	110.000	110.750	121.018	-0.029 -0.067	0.9703	45		
46	117.500	115.000	81.317	118.500	113.500	+0.120 0		117.750	107.324	+0.119 +0.061	1.0250	85.6	107.336	+0.121 +0.061	1.0408	117.500	-0.029 0	112.500	113.250	123.590	-0.029 -0.067	0.9715	46		
47	120.000	117.500	83.085	121.000	116.000	+0.120 0		120.250	109.760	+0.119 +0.061	1.0239	85.7	109.772	+0.121 +0.061	1.0399	120.000	-0.029 0	115.000	115.750	126.024	-0.029 -0.067	0.9715	47		
48	122.500	120.000	84.853	123.500	118.500	+0.120 0		122.750	112.325	+0.119 +0.061	1.0239	85.8	112.337	+0.121 +0.061	1.0390	122.500									