1.5 Fundamental dimensions for various sizes of Tooth profile

There are three types of formulas to calculate various sizes of Tooth profile.

1. Module *m*

Reference pitch divided by π is module, which defines the size of tooth in metric gear. If value of Reference diameter d(mm) divided by Number of teeth z increases, tooth capacity increases proportionately.

$$\text{Module } m = \frac{\text{Reference diameter } d}{\text{No. of teeth } z} \quad \text{(mm)}$$ Tip (Outside) diameter is defined as d_a,

calculation formula is $m = \frac{d_a}{z+2}$. Refer to Fig. 7 for a full-scale drawing.

2. Diametral pitch *P* or *DP*

Diametral pitch is size of tooth expressed in teeth per inch of pitch diameter. Formula of calculation is given as Number of teeth z divided by Reference diameter d (inch). Capacity of tooth profile increases and decreases inversely proportional to the numerical sum.

$$DP = \frac{\text{Number of teeth } z}{\text{Reference diameter } d \text{ (inch)}} \text{(An absolute number)}$$ Tip (Outside) diameter defined as d_a,

Calculation formula of $DP = \frac{z+2}{d_a \text{ (in)}}$

There is a relationship between module and Diametral pitch. (Comparison between module and Diametral pitch)

$$DP = \frac{25.4}{m} \qquad m = \frac{25.4}{DP} \quad \text{(mm)}$$

3. Circular pitch *CP*

This is length of centre distance between adjacent teeth divided by arc circle of pitch circle. Calculated by circumference of pitch circle divided by number of teeth.

$$CP = \frac{\text{Circumference of Pitch circle } (\pi \times d)}{\text{Number of teeth } z} \quad \text{(mm)}$$

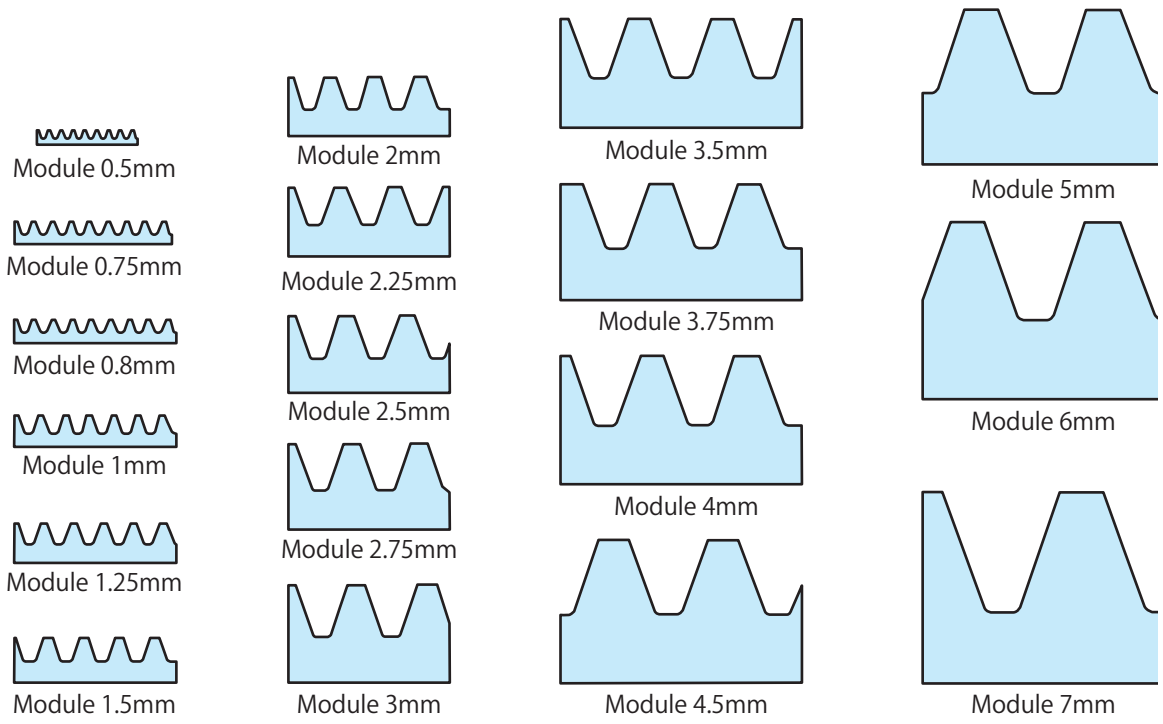

Fig. 7 Full-scale drawing of module

Note that π is ratio of the circumference of a circle to its diameter as π=3.14159 .....

Where Tip(outside) diameter da, calculation of $CP = \frac{\pi \times da}{z+2}$ (mm)

The 3 categories for size of Tooth profile mentioned above are widely used. In particular, Circular pitch CP is used to control traveling distance and positioning.

The standardization of module is shown by the following classification. Introduced in

JIS B 1701-2: 1999 Cylindrical gear- Involute tooth profile and Article 2-Module and Appendix of the same standard (stipulation). Also shown below is classification not stipulated for Involute tooth profile cylindrical gear below module 1 in **ISO 54**.

Table 4. Standard value for module of Cylindrical gear.

Unit : mm

I	II	I	II	I	II	I	II
0.1		1			5.5	25	
	0.15		1.125	6			28
0.2		1.25			(6.5)	32	
	0.25		1.375		7		36
0.3		1.5		8		40	
	0.35		1.75		9		45
0.4		2		10		50	
	0.45		2.25		11		
0.5		2.5		12			
	0.55		2.75		14		
0.6		3		16			
	0.7		3.5		18		
	0.75	4		20			
0.8			4.5		22		
	0.9	5					

It is advisable to select column-*I* of module (priority selection) as far as possible.

It is not advisable to select the module 6.5 as seen in column-II.

The standardization of module for Bevel gear is shown by the following classification. Introduced in

JIS B 1706-2: 1999 Straight bevel gear- Article 2-Module and Diametral pitch and Appendix of the same standard (stipulation). Also shown below is classification not stipulated for Straight bevel gear below module 1 in **ISO 678**. However the Diametral pitch is omitted here.

Table 5. Standard value for module of straight bevel gear.

Unit : mm

I	II	I	II	I	II
0.3		1			3.5
	0.35		1.125	4	
0.4		1.25			4.5
	0.45		1.375	5	
0.5		1.5			5.5
	0.55		1.75	6	
0.6		2			(6.5)
	0.7		2.25		7
	0.75	2.5		8	
0.8			2.75		9
	0.9	3		10	

It is advisable to select column-I of module (priority selection) as far as possible.

It is not advisable to select the module 6.5 as seen in column-II.

Table 6. Comparison tables between module and Diametral pitch.

Unit : mm

Module	9	8.467	8	7.257	7	6.35	6	5.08	5	4.233	4
Diametral pitch	2.822	3	3.175	3.5	3.629	4	4.233	5	5.08	6	6.35
Tooth depth	20.25	19.05	18.00	16.33	15.75	14.29	13.50	11.43	11.25	9.52	9.00
Pitch	28.27	26.60	25.13	22.80	21.99	19.95	18.85	15.96	15.71	13.30	12.57

Module	3.629	3.5	3.175	3	2.822	2.54	2.5	2.309	2.25	2.117	2
Diametral pitch	7	7.257	8	8.47	9	10	10.16	11	11.289	12	12.70
Tooth depth	8.17	7.88	7.14	6.75	6.35	5.72	5.63	5.20	5.06	4.76	4.50
Pitch	11.40	11.00	9.98	9.43	8.87	7.98	7.85	7.25	7.07	6.65	6.28

Module	1.814	1.75	1.588	1.5	1.411	1.27	1.25	1	0.8	0.75	0.5
Diametral pitch	14	14.514	16	16.933	18	20	20.32	25.4	31.75	33.867	50.8
Tooth depth	4.08	3.94	3.57	3.38	3.17	2.86	2.81	2.25	1.80	1.69	1.13
Pitch	5.70	5.50	4.99	4.71	4.43	3.99	3.93	3.14	2.51	2.36	1.57

Note that Tooth depth is calculated with Bottom clearance as C = 0.25 mm.