TOOL BITS

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SELECTION GUIDE

B1320 B2320 B4320		**HSS, COBALT 5%, YPM ROUND TOOL BITS** HSS, 5%钴HSS, YPM（粉沫 HSS）圆刀坯	E 282
B6320		**CARBIDE ROUND TOOL BITS** 硬质合金圆刀坯	E 283

HSS, COBALT 5%, YPM(POWDER METALLURGY HSS) ROUND TOOL BITS
HSS，5%钴HSS，YPM（粉沫 HSS）圆刀坯

●B1320，B2320，B4320 Series

Unit : mm

EDP No.			Diameter D	Length L	EDP No.			Diameter D	Length L
HSS	Co5%	YPM			HSS	Co5%	YPM		
B1320030	B2320030	B4320030	3.0	60.0	B1320100	B2320100	B4320100	10.0	100.0
B1320040	B2320040	B4320040	4.0	60.0	B1320120	B2320120	B4320120	12.0	150.0
B1320050	B2320050	B4320050	5.0	60.0	B1320160	B2320160	B4320160	16.0	150.0
B1320060	B2320060	B4320060	6.0	80.0	B1320200	B2320200	B4320200	20.0	200.0
B1320080	B2320080	B4320080	8.0	80.0					

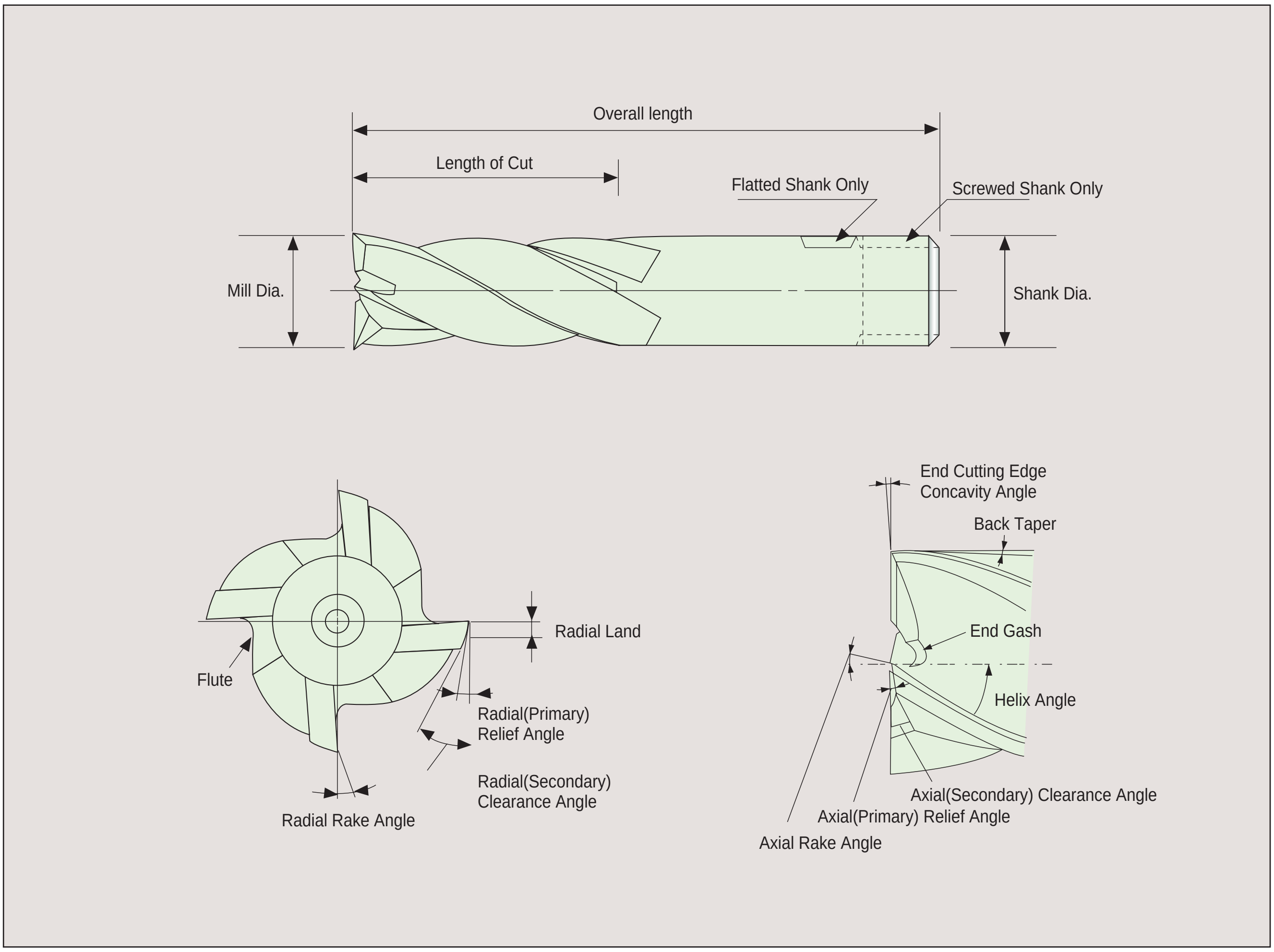
CARBIDE ROUND TOOL BITS
硬质合金圆刀坯

●B6320 Series

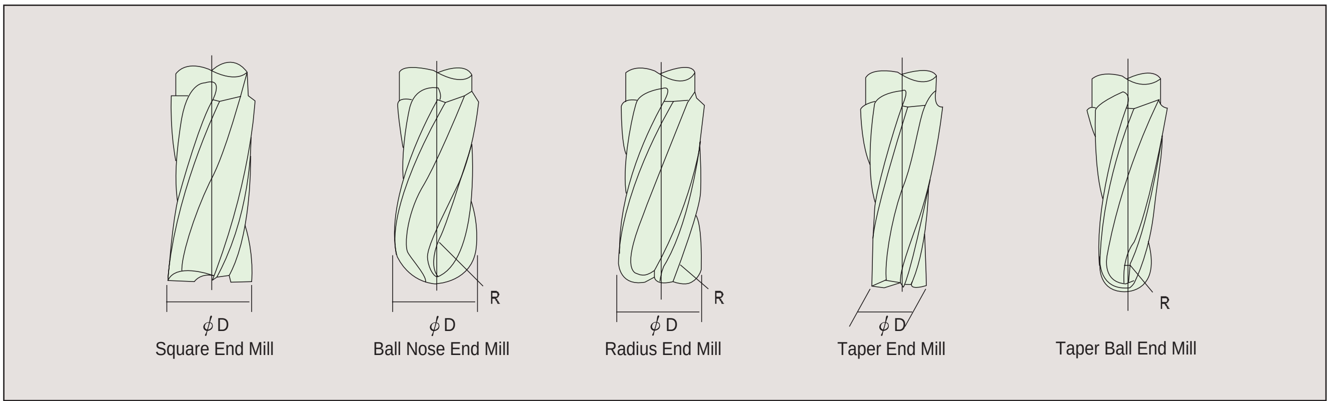
Unit : mm

EDP No. CARBIDE	Diameter D	Length L	EDP No. CARBIDE	Diameter D	Length L
B6320030	3.0	60.0	**B6320100**	10.0	100.0
B6320040	4.0	60.0	**B6320120**	12.0	150.0
B6320050	5.0	60.0	**B6320160**	16.0	100.0
B6320060	6.0	80.0	**B6320200**	20.0	200.0
B6320080	8.0	80.0			

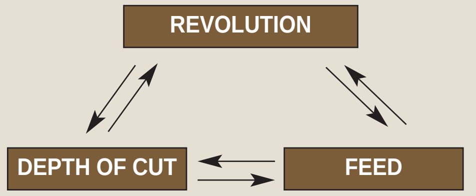
1. Names of End Mill Parts



2. Type of End Mill



Speed, feed and depth of cut are the most important factors to consider for best results in milling. Improper feeds and speeds often cause low production, poor work quality and damage to the cutter.
This section covers the basic principles of speed and feed selection for milling cutters and end mills.
It will serve as a guide in setting-up new milling jobs.



INTERRELATIONSHIP OF THREE FACTORS

3. SPEEDS

In milling, SPEED is measured in peripheral feet per minute.(revolution per minute times cutter circumference in feet)
This is frequently referred to as peripheral speed cutting speed or surface speed .

Revolutions per Minute $$N = \frac{1000V}{\pi \times D}$$

V : Cutting Speed(m/min)
D : Diameter of Tool(mm)
N : Revolution per minute(rev/min)
π : 3.1416

They will have to be tempered to suit the conditons ON THE JOB. For example:

Use Lower Speed Ranges For	Use Higher Speed Ranges For
Hard materials	Softer materials
Tough materials	Better finishes
Abrasive materials	Smaller diameter cutters
Heavy cuts	Light cuts
Minimum tool wear	Frail work pieces or set-ups
Maximum cutter life	Hand feed operations
	Maximum production rates
	Non-metallics

4. FEEDS

Feed is usually measured in milimeters per minute. It is the product of feed per tooth times revolution per minute times the number of teeth in the cutter. Due to variation in cutter sizes, numbers of teeth and revolutions per minute, all feed rates should be calculated from feed per tooth.
Feed per tooth is the basis of all feed rates per minute, whether the cutters are large or small, fine or coarse tooth, and are run at high or low peripheral speed. Because feed per tooth affects chip thickness. It is a very important factor in cutter life.
Highest possible feed per tooth will usually give longer cutter life between grinds and greater production per grind. Excessive feeds may over load the cutter teeth and cause breakage or chipping of the cutting edges. The following factors should be kept in mind when using the recommended starting feed per tooth.

Feed in inches
per Minute F.M = F.R.×R.P.M

F.R. : Feed per Revolutions in milimeters
R.P.M. : Revolutions per Minutes

The following factors should be kept in mind when using the recommended stating feed per tooth.

Use Higher Feeds For

- Heavy, roughing cuts
- Rigid set-ups
- Easy-to-machine work materials
- Rugged cutters
- Slab milling cuts
- Low tensile strength materials
- Coarse tooth cutters
- Abrasive materials

Use Lower Feeds For

- Light, and finishing cuts
- Frail set-ups
- Hard to machine work materials
- Frail and small cutters
- Deep slots
- High tensile strength materials
- Fine tooth cutters

SPEED AND FEED CALCULATIONS FOR MILLING CUTTERS AND OTHER ROTATING TOOLS

TO FIND	HAVING		FORMULA
Surface(or Periphery) Speed in meter Per Minute=S.F.M.	Diameter of Tool in milimeters Revolutions per Minute	=D =R.P.M.	$V=\dfrac{D\times 3.1416\times R.P.M.}{1000}$
Revolutions Per Minute=R.P.M.	Surface Speed in meter per Minute Diameter of Tool in milimeters	=S.F.M. =D	$R.P.M.=\dfrac{V\times 1{,}000}{D\times 3.1416}$
Feed per Revolution in milimeters=F.R.	Feed in milimeters per Minute Revolution per Minute	=F.M. =R.P.M.	$F.R.=\dfrac{F.M.}{R.P.M.}$
Feed in milimeters Per Minute=F.M.	Feed per Revolution in milimeters Revolution per Minute	=F.R. =R.P.M.	F.M.= F.R.×R.P.M.
Number of Cutting Teeth per Minute=T.M.	Number of Teeth in Tool Revolution per Minute	=T =R.P.M.	T.M=T×R.P.M.
Feed per tooth=F.T.	Number of Teeth in Tool Feed per Revolution in milimeters	=T =R.P.M.	$F.T.=\dfrac{F.R.}{T}$
Feed per Tooth=F.T.	Number of Teeth in Tool Feed in milimeters per Minute Speed in Revolution per Minute	=T =F.M. =R.P.M.	$F.T.=\dfrac{F.M.}{T\times R.P.M.}$

5. CASE OF RESHARPENING

When the product finish become worse, the cutting edge must get dulled, chips become smaller and the cutting sound gets louder. In such cases, a end mill must be resharpened. The following are the damages of end mills when the resharpening is required.

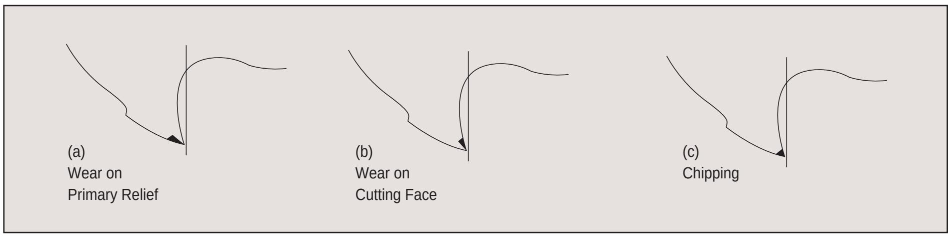


Fig. 1. Damages of Cutting Edge

6.SHARPEN AT PREDETERMINED WEAR LAND

Cutters should be sharpened as soons as the wear land(Fig. 2.) reaches a predetermined width. This width should permit sharpening without excessive loss of tool life. It may vary from a few thousandth to 1/16 inch, depending on the type of cutter and the finish required on the product. This method is used on production runs where uneven amounts of stock is removed or where the material varies in machinability. It is also used on small quantity product lots.

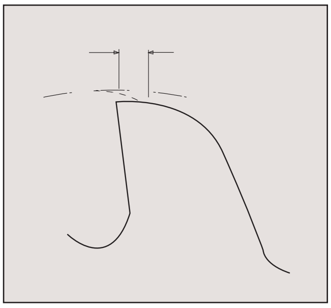


Fig. 2. Wear Land

7. RESHARPENING PERIPHERAL CUTTING EDGE

1) RESHARPENING PRIMARY LAND

The geometry of relief angle in an end mill consist of three methods as shown in Fig.3 concave, flat, and eccentric. Recently, most end mills have the eccentric relief(eccenrtic sharpening). In this method, since the relief is formed an eccentric are surface in cylindrical grinding method, the roughness of the finished surface of the relief improves and the strength of cutting edge increase at the same time.(Fig.4) As a result, the tool life is improved.

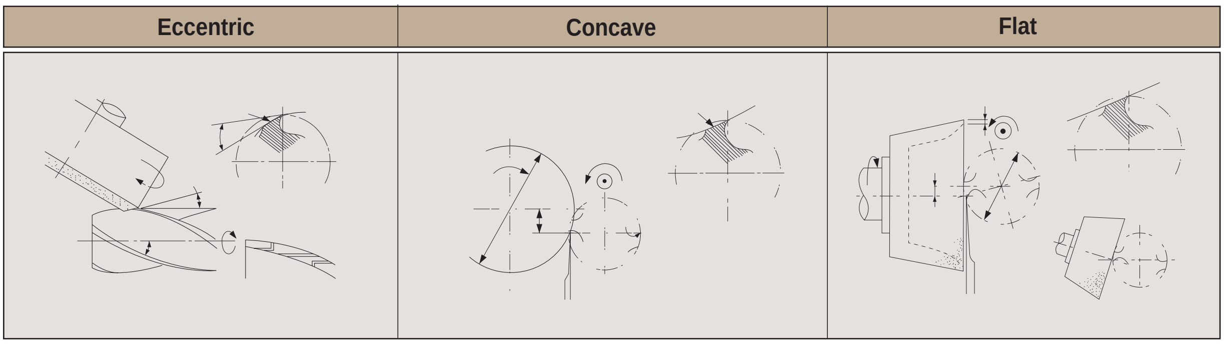


Fig. 3. Three Types of Primary Relief

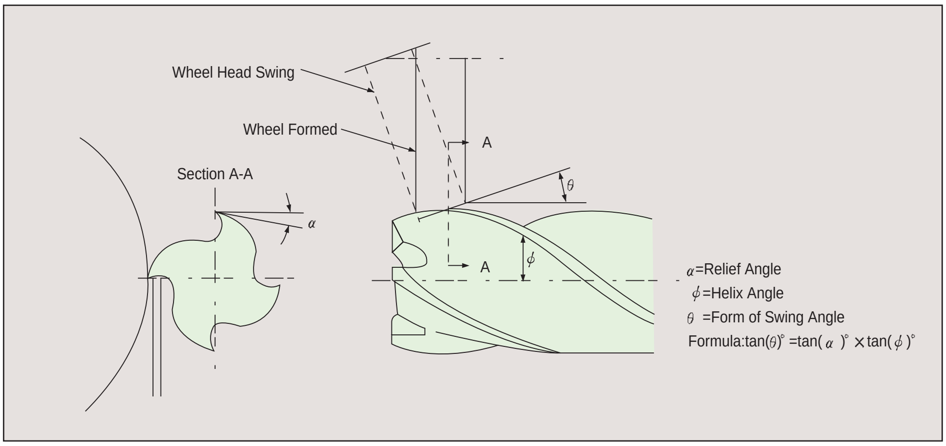


Fig. 4. Toothing of Eccentric Relief Angle

2) ANGLE OF WHEEL INCLINATION

Eccentric relief is produced with a plain wheel positioned with its axis parallel or at a slight angle with the cutter axis. The degree of relief is varied by changing the angle of wheel inclination.

Table 1. RECOMMENDED RELIEF ON

Mill Diameter (mm)	Eccentric relief indicator drop for relief Angles shown		Checking Distance	Wheel Angles(Deg.) θ			Radial Relief Angles(α_1)	Clearance Angles(α_2)
				15 Helix	30 Helix	60 Helix		
	Min	Max.		*Angle	*Angle	*Angle	*Angle	*Angle
3.0	0.100	0.130	0.40	4° 24′	9° 25′	26° 28′	16° 02′	25°
6.0	0.090	0.125	0.50	3° 18′	7° 05′	20° 25′	12° 08′	25°
12.0	0.100	0.135	0.65	2° 46′	5° 46′	17° 23′	10° 15′	25°
25.0	0.095	0.140	0.80	2° 15′	4° 15′	14° 16′	8° 21′	25°
40.0	0.085	0.125	0.80	2° 01′	4° 33′	12° 48′	7° 29′	25°
50.0	0.085	0.125	0.80	2° 01′	4° 33′	12° 48′	7° 29′	25°

The actual at the radial relief angle is normally kept within the range shown but may be varied to suit the cutter material, the work material and the operating conditions.

*Angle is calculated from the basic mean at the radical angle.

8. RESHARPENING END TEETH

The three necessary operations and one option feature, along with setup suggestions are shown in Fig.5 A to D in each drawing, the shaded area indicates the surface being ground.

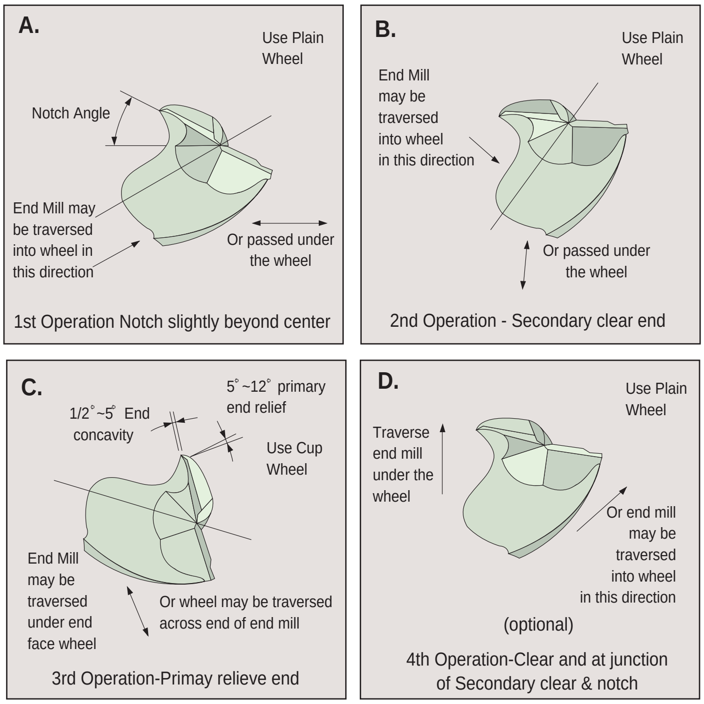


Fig 5. PROCEDURE FOR SHARPENING END OF 2 FLUTE SQUARE END MILLS

9. INSPECTION

The inspection is caculated by using the formula shown in Table1.

Procedure To Check
Radial Relief Angles
With Indicators.

1- Mount the cutter to rotate freely with no end movement.
2- Adjust the sharp pointed indicator to bear at the very tip of the cutting edge, pointing in a radial line, shown in Figure6
3- Roll the outter the tabuleted amount gives under checking distance ± using the second indicator as control.
4- Consult chart for amount of drop for the particular diameter and relief angle.

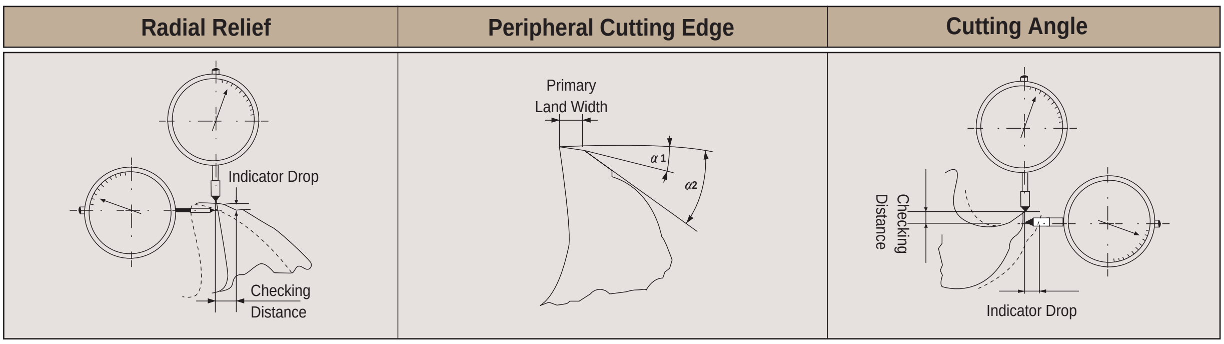


Fig. 6. Indicator Set-Up for Checking