



ESGI

GEAR CUTTING TOOLS

CATALOGUE



High Precision Gear Cutting Tools Since 1991

Profile

ESGI Tools Pvt Ltd - a leading tool manufacturing company set up in 1991 is renowned for its products in the precision Gear Cutting Tools industry, provides a comprehensive range of quality gear cutting tools to its customers with additional facilities of coating and re-sharpening. Here at ESGI the utmost importance is given to the quality of the product which lends an optimized performance and protracted life. Company's prime focus is to look into the needs of entire automobile industry and therefore ESGI caters to all the mobility segments namely two wheelers, cars, commercial vehicles, tractors, agriculture and construction equipment, gear box, defense, railways, etc. and have developed tooling for most of the world's best companies falling in the earlier defined segments.

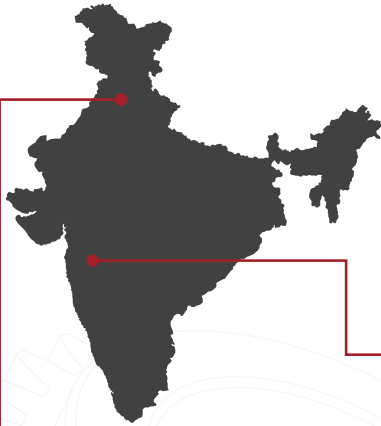
Product Range

- Gear Hobs
- ES-Cut Hobs
- Gear Shaving Cutters
- Master Gears
- Rack Milling Cutters
- Rotary Cutters
- Spline Rollers
- Gear Shaper Cutters



Our Plants

ESGI is proudly nested in two geographical locations catering to the complete life cycle of gear cutting tools. Our head office complete with a 40,000 Sq feet state-of-the-art manufacturing facility is nested in Patiala, Punjab & our resharpener unit is located in Pune, the hub of automotive manufacturing in India.



Pune, Maharashtra
Re-Sharpener Centre



Patiala, Punjab.
Head Office & Plant



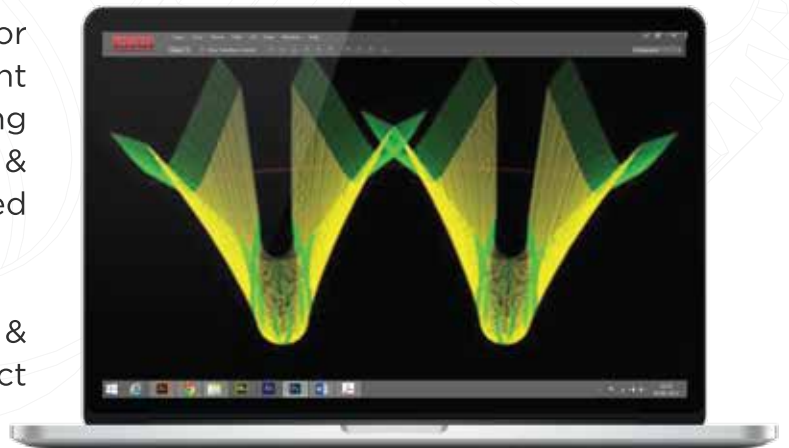
40,000 Sq.Feet Manufacturing



Software

ESGI has developed its own software's for designing tools with their abundant experience in manufacturing gear cutting tools for over two decades. We design & produce the tools to meet the varied requirements of customers.

We use simulation process for hobbing & shaving profiles to visualize the exact output.



Infrastructure

- 9 Axis CNC Shaving Cutter Grinding Machine
- CNC Hob Profile Grinding Machine
- CNC Hob Sharpening Machine
- CNC Gear Analyzer



We at ESGI deploy state of the art manufacturing facilities backed by our fully equipped in-house metallurgical laboratory, quality control cell with state of art inspection machines and equipments, manned by qualified personnel to check at every stage of manufacturing process of all products especially with a view to ensure adherence to our very strict specifications of quality standards.



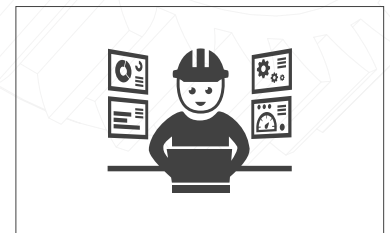
We import raw material from the worlds best companies combined with our strict incoming material inspection process which ensure consistent quality standards.



Industry Leading Raw Material Sourcing



State Of The Art Quality Control Cell



In-House Metallurgical Laboratory

Re-Sharpener Services



We at ESGI understand the importance of re-sharpening of tools to consistently obtain the desired results for the complete tool life.

We undertake the re-sharpening of Shaving Cutters at our mother plant and also at a dedicated facility put up in Pune. Our mother plant serves customers based in Northern, Eastern and Central India and our Pune plant serves the customers based in Western and Southern region.

PVD Coatings

Our tools are supplied with latest PVD coatings to enhance the life. We provide coatings as per customer requirement or application.

PVD Coating increase the tool surface (and cutting edge) hardness, thus increase the cutting life obtained in each sharpening.

Types of PVD Coatings

TiN

Used for conventional hobbing machines

AlCrNA

For high speed wet cutting CNC hobbing machine

AlCrNA pro

For high speed dry & wet cutting CNC hobbing machine



Market Segments



Our Customers Supply To



And Many More



Hobs

Types

- Standard gear hobs
- Pre shaving hobs
- Pre grinding hobs
- Pre skiving hobs
- Shank type hobs
- Stub and fellow stub hobs
- Involute spline hobs
- Parallel / Straight spline hobs
- Chain sprocket hobs
- Serration hobs
- Timing pulley hobs
- Worm hobs
- Chamfer hobs and cutters
- Special hobs
- Hurth milling cutters
- Worm milling cutters

Features

Accuracy Class Upto AAA As Per DIN 3968

Range: From 0.4 Module To 25 Module

Shoulder Clearance Type

Bore & Shank Type

Multi-gashes

Multi-start

Materials

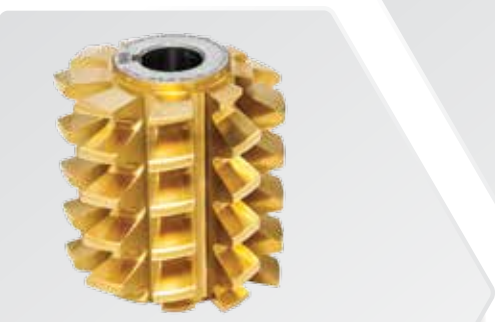
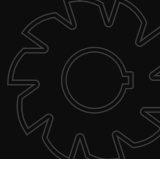
M35

ASP2030

ASP2052

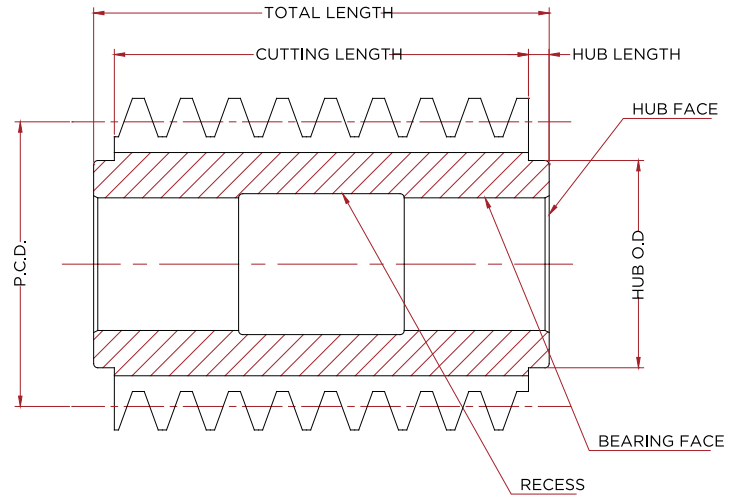
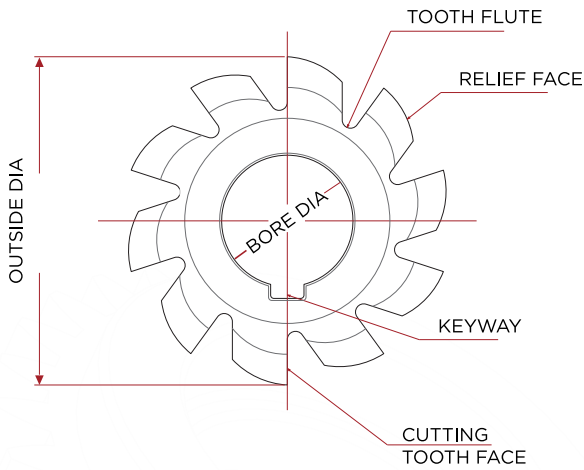
S390



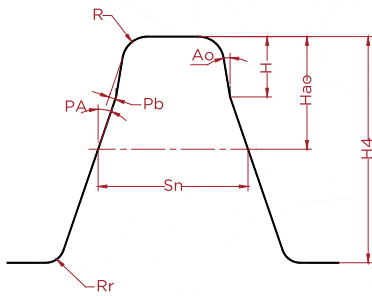




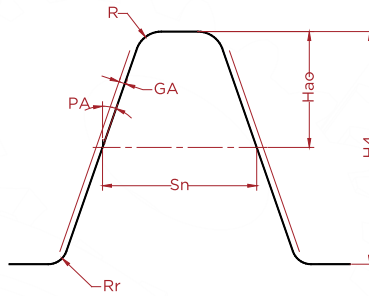
Hob Nomenclature



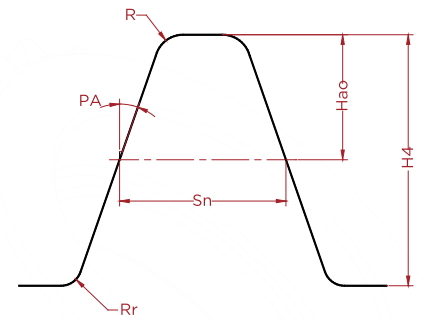
Standard Hob Tooth Profiles



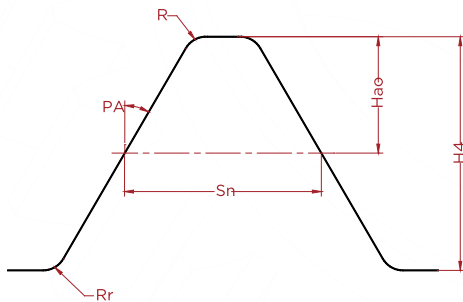
Pre-shaving/pre-grinding
With Pb - BP III DIN 3972



Pre-shaving/pre-grinding
Without Pb - BP III DIN 3972



Standard Finishing Hob
BP II DIN 3972



Involute Spline Hob
as per DIN 5480

- Hao = Addendum
- Sn = Tooth Thickness
- H4 = Full Depth
- H = Protuberance Height
- Pb = Protuberance Amount
- R = Hob Tip Radius
- Ao = Protuberance Angle
- Rr = Root Radius
- GA = Grinding Allowance

Standard Hob Sizes

Normal Module	Normal DP	Size (mm)		
		OD	OAL	Bore
1 - 1.25	24 - 20	50	50	22
1.5 - 1.75	18 - 14	55	55	22
2 - 2.25	12 - 11	60	60	22
2.5 - 2.75	10 - 9	70	65	22
3 - 3.25	-	70	70	27
3.5	8	80	75	27
3.75	7	80	75	27
4	6	90	80	27
4.5	5.5	90	85	27
5	5	100	90	27
5.5	-	100	95	32
6	4.5	110	100	32
6.5	4	110	110	32
7	3.5	110	115	32
8	3	120	130	32
9	2.65	125	145	32
10	2.5	140	160	32
11	-	160	175	40
12	2.25	160	190	40
13	2	170	200	40
14	-	180	210	40
15	1.75	180	220	40
16	-	200	230	40
18	1.5	220	250	50
20	-	240	270	50
22	1.25	250	270	50
24	-	250	300	50
25	1	270	300	50

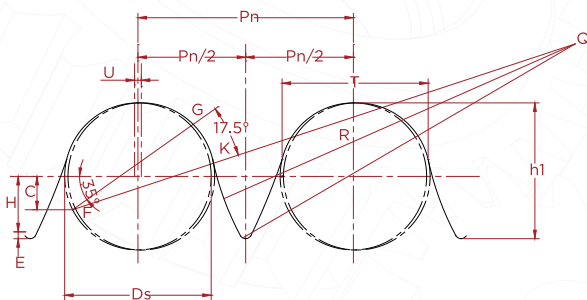


Chain Sprocket Hobs

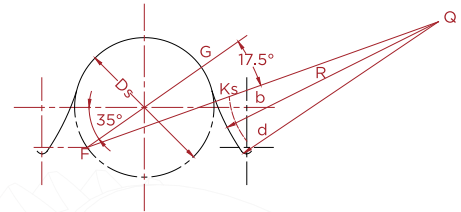
Roller Chain Sprocket Hob

Chain Pitch			Hob Specifications		
	Roller Diameter	ASA I, II Chain	Outer Diameter	Overall Length	Bore Length
6.35 (1/4")	3.3	RS25	60	60	22
9.525 (3/8")	3.3	RS35	65	65	
9.525 (3/8")	5.08	RS35	65	65	
12.7 (1/2")	6.35	RS41	80	75	27 / 32
12.7 (1/2")	7.77 (Agriculture)	RS40	80	75	
12.7 (1/2")	7.95 (Standard)	RS40	80	75	
15.875 (5/8")	8.5 (Motorcycle)	RS50	90	90	27
19.05 (3/4")	10.16	RS60	90	105	
25.4 (1")	11.907	RS80	110	125	32
31.75 (1.1/4")	15.875	RS100	120	140	
38.1 (1.1/2")	19.05	RS120	140	160	32 / 40
44.45 (1.3/4")	22.225	RS140	160	190	
50.8 (2")	25.4	RS160	170	210	40

ASA Profile



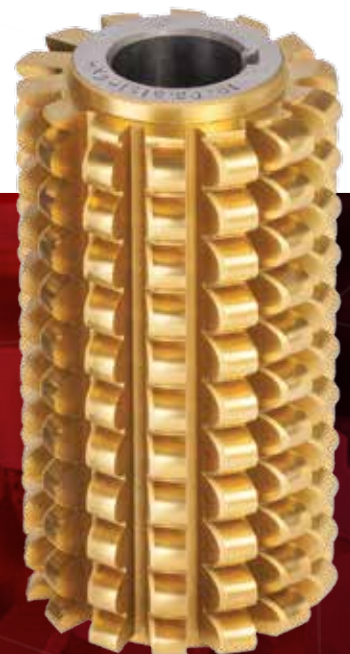
ASA Type 1 (U Type)



ASA Type 2 (S Type)

Ordering Instructions

- Standard of Chain
 - ASA-1
 - ASA-2
 - DIN
 - JIS-U
 - JIS-S
 - BS (ISO)
- Chain pitch
- Chain number
- Roller diameter
- Bore size of hob



Parallel or Straight Spline Hobs

Dimension Details

Hob Dimensions			Spline Dimensions										
Outside Ø	Overall Length	Bore Ø	TYPE 1					TYPE 2					
			N	Minor Ø	Major Ø	Width	Chamfer Amount	N	Minor Ø	Major Ø	Width	Chamfer Amount	
60	60	22	6				.3	6	11	14	3	0.3	
									13	16	3.5		
									16	20	4		
				18	22	5							
				21	25	5							
				23	28	6							
80	75	27 (26.988)		23	26	6	.4	6	23	28	6	0.4	
				26	30	6			26	32	6		
				28	32	7			28	34	7		
				32	36	8			32	38	8		
				36	40	8			36	42	8		
				42	46	10			42	48	10		
100	95	32 (31.75)	8	46	50	12	.5	8	46	54	12	0.5	
110	115	40 (38.1)		56	62	14			56	65	14		
				62	68	16			62	72	16		
				78	82	18			72	82	18		
140	170	82 88		82	88	20			82	92	20		
				80	75	27 (26.988)			8	.4	8		32
			36				40	7				36	42
42	46	8	42				48	8					
100	90	32 (31.75)	50	9	9	.5	8	46	54	9	0.5		
			52	58	10			52	60	10			
			56	62	10			56	65	10			
			62	68	12			62	72	12			
110	115		10	72	78	12	.5	10	10	72	82	0.5	
				82	88	12			82	92	12		
				92	98	14			92	102	14		

Ordering Instructions

1. Outside Diameter with tolerance
2. Root Diameter with Tolerance
3. Spline width with Tolerance
4. Number of Splines
5. Component Drawing



ES-Cut HOBES for High Speed Cutting

ESGI has introduced ES-Cut series hobs for high speed wet and dry cutting giving multiple benefits. ESGI has identified and shortlisted special high performance materials from all around the world after conducting extensive trials.



Up To

191%

Life Increase



Up To

76%

Time Saving

ES-40

Cutting Speed 150-175 m/mt
For 1.75 Module

ES-65

Cutting Speed 170-210 m/mt
For 1.75 Module

ES-80

Cutting Speed 275-300 m/mt
For 1.75 Module

Benefits

- Reduces cycle time.
- Increase in parts per sharpening.
- Lesser Inventories.
- Fewer Variables for smooth production.
- Increase in plant capacity at no additional investment on land, machinery and manpower.
- Reduced cost per component.

Characteristics

- Suitable for high volume components.
- Range up to 7 Module.
- Suitable for dry and wet cutting.
- Made in bore and shank type.

Case Studies

Particulars		Other	ES-Cut	Other	ES-Cut	Other	ES-Cut	Other	ES-Cut
Component Data	Normal Module	1.75 Mod		2.25 Mod		3.0 Mod		4.0 Mod	
	Normal PA	20		22.5		20		20	
	Number of Teeth	35		40		28		50	
	Face Width	10.4		14		10		38.5	
	Spur/Helical	SPUR		SPUR		SPUR		HEL 10°	
	Pre-Finish/Finish	Finish		Pre-Shaving		Pre-Shaving		Pre-Shaving	
	Component Hardness	170-210 BHN		170-210 BHN		160-200 BHN		190-210 BHN	
Hob Data	Hob Material	MACH-7	ES-65	ASP2052	ES-80	ASP2030	ES-65	ASP2052	ES-65
	Coating Type	AlCRONA	AlCRONA Pro	Futura	AlCRONA Pro	Futura	AlCRONA Pro	AlCRONA	AlCRONA Pro
	Hob Size	70*180*32	70*180*32	70*140*32	70*140*32	80*110*32	90*150*32	100*180*40	90*180*32
	Number of Threads	3	4	3	3	1	2	2	1
	Flutes	17	17	16	16	12	19	17	15
	Straight/Helical	Straight	Helical	Helical	Helical	Straight	Straight	Straight	Helical
Machine and Cutting data	Machine Make	Mitsubishi		Liebherr		Mitsubishi		Liebherr	
	Dry/Wet	Dry		Wet		Wet		Dry	
	Pieces per Stack	5		1		2		1	1
	No. of Passes	1	1	1	1	1	1	2	1
	Cutting Speed (m/mt)	157	210	160	300	80-85	130	85/100	130
	Axial Feed (mm)	1.6	1.4	1.4	1.4	2	2	2.5/1	3
	Chip thickness (mm)	0.174	0.209	0.188	0.188	0.23	0.199	0.202	0.138
	Feed Marks (mm)	0.0033	0.0026	0.0032	0.0032	0.0039	0.0022	0.00648	0.0105
	Cutting Time seconds)	43	27	27	14	180	44	253	150
	Parts per Sharpening	7000	15000	4500	7000	1100	3200	727	1030
Time Saving	-37%		-48%		-76%		-41%		
Life Increase	114%		56%		191%		42%		

We provide various grades of material are available depending on the type of machines, components and volumes.



Gear Shaving Cutters

Our designs and technology ensure the compatibility of the shaving cutters with the per-shaved tool for superior contact and to achieve the required true involute form diameters of the gears.



Specifications

- Thickness up to 60mm
- PCD from 150 to 260mm
- Range from 1.25 to 8 Module
- Available in material M2/M3/ASP2023
- Facilities to make all types of profiles like Tip Relief or Root Relief or both, 'K' profile, lead crowning or any customized profile.

Types


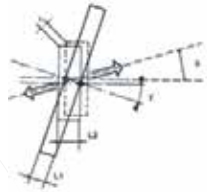


- Plunge
- Underpass
- Diagonal
- Conventional

Gear Shaving Cutters

Shaving Methods & Characteristics

Shaving Methods - Every shaving method differs according to the direction of the movement given to the cutter. The choice of method depends on the work piece shape, machine characteristics and volume of production.

Cross Axis Angle - The difference in the helix angle of the gear and the cutter is calculated along the PCD. Cross axis angle is an essential condition for shaving process.

Particulars	Conventional	Diagonal	Underpass	Plunge
Pictorial View & movement of Shaving method				
	Gear and the cutter, move parallel to the work piece axes.	The relative motion between cutter and gear takes place with an angle included in the range 5° to 45° w.r.t the gear axis.	Cutter feed in movement towards the gear is perpendicular to gear axis.	Cutter feed in movement towards the gear is radial to gear axis.
Where to be used	Suitable for low and medium production operations.	Suitable for medium & high production operations.	Suitable for high production operations.	Suitable for high production operations.
	Suitable for open gears	Suitable for open gears	Suitable for shoulder type gears with cross axis angle limitation.	Used for open and shoulder type gears
	Large width gears can be shaved.	Gear Face width is limited to 100mm as component face width should be necessarily more than cutter face width.	Max. Gear face width is limited to 55mm as cutter face width is more than component face width.	Max. Gear face width is limited to 55mm as cutter face width is more than component face width.
Shaving time	Stroke length is long	Stroke length is relatively short.	Shaving stroke is extremely short.	No longitudinal movement of cutter.
	Very long Shaving time	Shaving time is relatively short	Shaving time is very short.	Shaving time is least.
Cutter Utilization	The cutter works only with a limited contact area at the center of teeth.	Better use of the cutter that can exploit all its length.	Cutter works progressively and partially along the whole face width.	Cutter works progressively and partially along the whole face width.
Guidelines for better results	Length of traverse should be 1/16" greater than face width of the component.	Sum of Traverse Angle & Cross Axis Angle should not be more than 55°.	It can be used with shoulder gears with minimum cross axis angle of 3°.	Radial in-feed should be carefully selected.

γ = Cross of Axes Angle, ϵ = Diagonal Angle, L_1 = Shaving Cutter Tooth Length, L_2 = Gear Tooth Length, L = Stroke Length

Worm Gear Hobs

We manufacture worm wheel gear hobs which are bore and shank type in single or multi start. ESGI worm gear hobs are available in topping or non-topping as per customer requirements.

Ordering Instructions

- Worm & Worm Wheel data
- Types of profiles: ZI, ZE, ZK, ZN, ZA
- In case of shank type, shank details
- Contact Ratio
- Please specify the contact patten whether required at entry or leaving side.



Rack Milling Cutters



We produce special form cutters for cutting Racks & Serrations. These cutters are produced in single or multiple rows with straight or spiral flutes with very close tolerances.

- Range from 1.5 to 6 module
- Diameter from 50mm to 200mm
- Length from 20mm to 220mm
- Accuracy class up to AAA
- Manufactured in M35, ASP2030, ASP2052 & S390 materials.
- Supplied with all types of coatings.

Spline Rollers

Spline rollers are used for cutting involute shafts and splines.

Made from special materials, these rollers are used on highly specialized rolling machines.



Rotary Cutters

Rotary cutters are used for cutting Straight Bevel Gears.

- Made for G 104 & G 102
- Made in 'T' and 'U' Types
- Material M2 and ASP2023
- Also Supplied with PVD Coating



Master Gears

Specifications

- Range from 1.0 to 8 Module
- PCD from 95 to 200mm
- Thickness up to 70mm
- Accuracy class IV as per DIN 3962
- Material M2



Shaper Cutters

Specifications

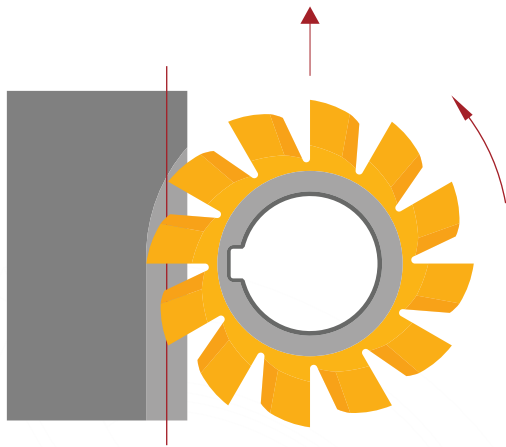
- Range from 1.5 to 10 Module
- PCD from 75 to 200mm for Disc & Hub Type
- PCD starts from 15mm for Shank Type
- For Internal & External gears
- Spur Type
- Profiles like Semi-topping & pre-shaving
- Accuracy class 'AA' & 'A' as per DIN1829
- Material M35/ASP2030/ASP2052/390



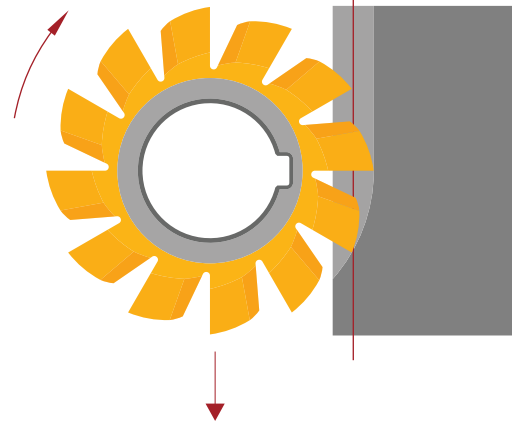


Types Of Hobbing

Climb Cutting



Conventional Cutting



Quick hob wear	Hob wear	Less hob wear
Prolonged comma	Basic shape of chip	Shorter comma
Lower	Cutting speed	Higher
Good	Hob performance	Poor
No	Backlash	Yes
Regular	Table feed	Jumpy
Poor	Component profile	Good
Lower	Productivity	Higher
Preferred	Helical Gear	-
Large Gears	Gear Type	Small Gear
Poor	Gear Finish	Good
Avoided	CNC Hobbing M/C	Recommended

Hob RPM

Depending upon the cutting speed requirement, RPM can be calculated by following formula

$$RPM = \frac{V \times 1000}{\pi \times D}$$

V : Cutting speed in meter/minute **D**: Diameter of Hob in mm.

Cycle Time

Cycle Time (t) can be calculated by using following calculations

$$\text{Cutting Time} = \frac{Z \times L}{\text{RPM} \times f \times i}$$

Z: Gear Teeth **L:** Hob Travel Length **RPM:** Hob Revolution **f:** Feed (mm/ work piece revolution) **i:** No. of Starts

Hob Shift

Most important part of Hobbing operation is to use the optimal life of Hob by uniformly distributing the wear amount. This is achieved by shifting the Hob in axial direction by using following calculations, where micro shifting is not available on hobbing machine.

$$\text{Shifting Amount} = \frac{M \times \pi}{N}$$

M: Module **N:** Number of Flutes

Effect of Sharpening Errors on Gear Profile

- Positive rake angle produces Gear Tip plus (minus pressure angle)
- Negative rake angle produces Gear Tip minus (plus pressure angle)
- Convex rake angle produces thinner gear teeth on middle of the profile
- Indexing error produces irregular profiles.

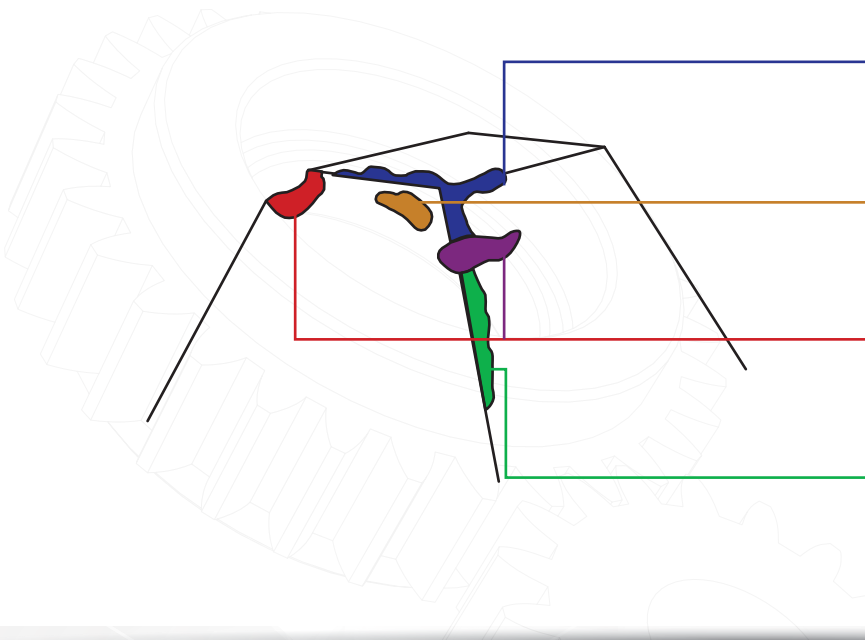
Hob Setting Angle

- When hand of Hob & Work piece are same, then setting angle shall be $\beta - \gamma$
 - When hand of Hob & Work piece are opposite, then setting angle shall be $\beta + \gamma$
- B :** Gear Helix Angle **γ :** Hob Lead Angle

Hob Wear Amount

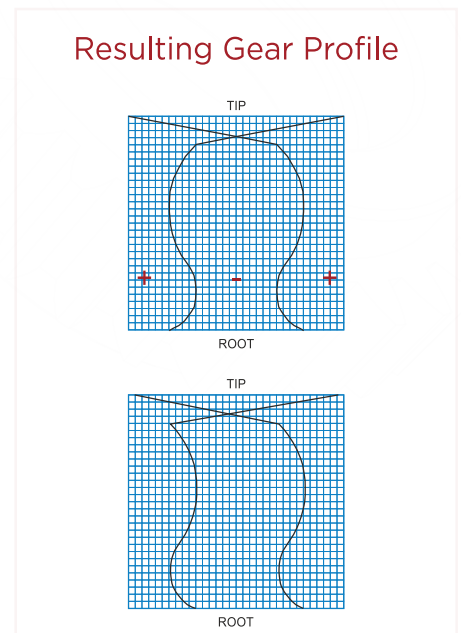
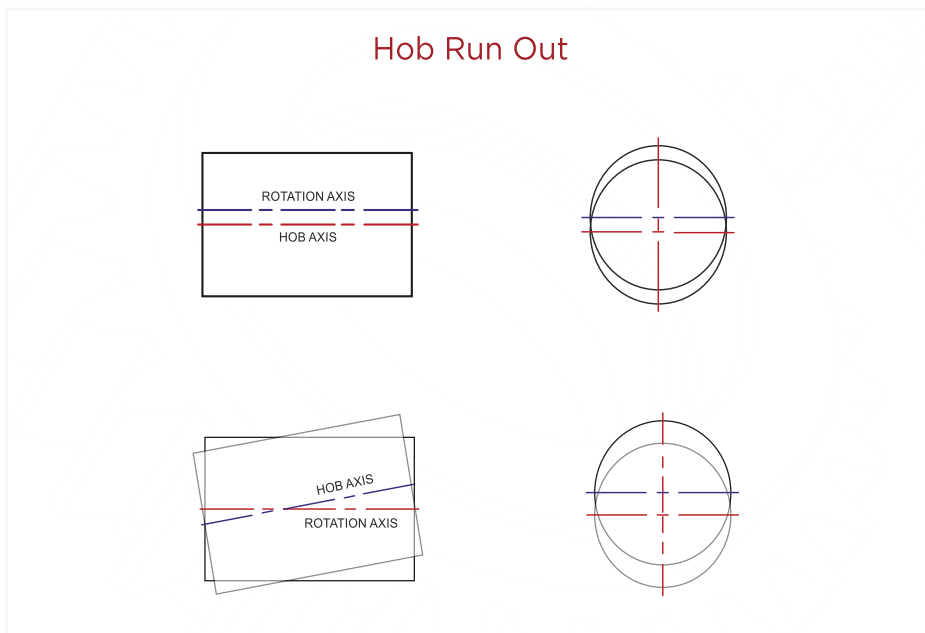
For better cutting efficiency, Hob wear should not be increased beyond following limits and should be sharpened quickly for better results.

Module	Max Wear Amount
1 to 2 Module	0.20 mm
3 to 4 Module	0.25 mm
5 to 6 Module	0.30 mm
6 to 8 Module	0.40mm



- **Periphery Wear**
Due to prolonged use of chipped edge and flank wear.
- **Crater Wear**
Wear on the cutting face due to excessive feed rate.
- **Chipping / Gauging**
When Crater extends to Cutting edge, it gets chipped off
- **Normal Wear**
Desirable mode of hob wear after cutting substantial parts.

Effect of Sharpening Errors on Gear Profile





Your Complete Gear Cutting Tool Source

We are a leading tool manufacturing company set up in 1991, renowned for its products in the precision Gear Cutting Tools industry. We provide a comprehensive range of high precision gear cutting tools to our customers with additional facilities of coating and re-sharpening.



Delivering Precision Worldwide



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