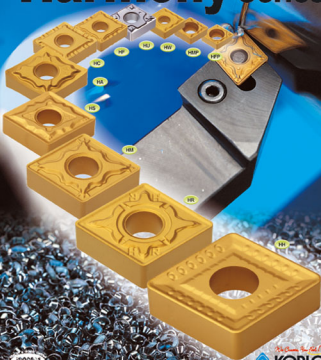




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New Concept on Turning Operations

# Harmony-Series



ISO 9001

## Necessary of Chip-breaker

1. Problems in Turning Operation: The long chips can be bound on tools and holders when we cut a work piece in continuous cutting operations. It means that we have to spend additional time to remove them and it is not efficient and decrease our productivity. Also when we use the negative insert, the relief angle will be minus value. It means the cutting resistance will be increased and it makes decrease of tool life.
2. Function of Chip-breaker in Turning Operations
  - ① It makes the shorter chip
  - ② It decrease cutting resistance by bigger relief angle
  - ③ It decrease the Non-cutting operation time such as removing of chips from your machine.

## Features of H - Series

1. The H - Series are designed with HARMONY concept. We carefully research chip flow directions as per variations of depth-of-cuts and designed the Chip-breakers having excellent properties such as better chip breaking, decreased cutting resistance and stronger cutting edge. And it ensures improving of tool life, cutting quality and productivity.
2. The cutting mechanism of H - series is the separation of chip breaker as finish, medium cutting and roughing to meet the variation of depth-of-cut. The following shows HM chip-breaker's action in variation of depth-of-cut.



$d < \text{Nose R}$

### • When the depth-of-cut is smaller than Nose-R

- Depth-of-cut 0.5~1.5mm(0.02~0.06inch), it is in finish or medium- finish cutting range.
- Main finish chip-breaker breaks the chip and sub finish chip-breaker controls the chip flow.



$d = \text{Nose R}$

### • When the depth-of-cut is same as Nose-R.

- Depth-of-cut 0.8~2.0mm(0.03~0.08inch), it is in medium-finish cutting range.
- Main and sub finish chip-breaker breaks the chip well.



$d = \text{Nose R} \times 4$

### • When the depth-of-cut is 2~4 times of Nose-R.

- Depth-of-cut 1.6~4.8mm(0.06~0.18inch), it is in medium cutting range.
- Roughing chip-breaker breaks the chip.



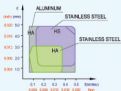
$d = \text{Nose R} \times 6.5$

### • When the depth-of-cut is 5~8 times of Nose-R.

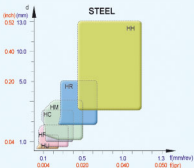
- Depth-of-cut 4.0~6.0mm(0.16~0.24inch), it is in medium-rough cutting range.
- Side of roughing chip-breaker breaks the chip.

# Harmony-Series

## STAINLESS & ALUMINUM



## STEEL

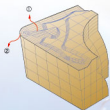
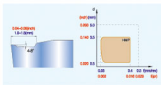
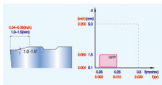
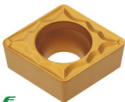
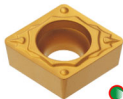


Work-piece		Recommended Grades					
ISO	Material	Grade	Wear Resistance		Toughness		
			01	10	20	30	40
P	Carbon Steel	Coated Carbide	NC310	NC311	NC313	NC315	
	Alloy Steel	Cement	GT10	GT20			
M	Stainless Steel	Coated Carbide	NC310 (NC313)		PC310 (PC213)		
	Cast Iron	Coated Carbide	NC313K	NC315K			

Type	D/B	Application	Cutting Condition			Work-piece		
			Depth of cut (d)	Feed (f)	Feed (f)	Steel	Cast Iron	Al
Negra Type	HU	Ultra-Fine - finish	0.1-1.0	0.03-0.30	0.004-0.04	0.010-0.015	●	
	HV	WFDR	0.3-2.0	0.10-0.50	0.012-0.08	0.004-0.02		
	HF	Finish	0.3-2.5	0.05-0.35	0.012-0.10	0.002-0.04	●	
	HC	Medium finish	0.8-4.0	0.06-0.40	0.002-0.16	0.003-0.08	●	●
	HM	Medium	1.0-6.0	0.10-0.50	0.04-0.25	0.004-0.02	●	●
	HR	Roughing	2.5-1.0	0.25-0.85	0.10-0.28	0.01-0.05	●	●
	HH	Roughing	4.0-1.3	0.40-1.1	0.10-0.32	0.008-0.04	●	
	HA	Medium finish	0.5-2.5	0.05-0.33	0.02-0.16	0.002-0.02		●
Negra Type	HS	Bevel-Cutting	1.0-6.0	0.1-0.4	0.04-0.16	0.004-0.05	●	
	HFP	Finish	0.1-1.5	0.03-0.30	0.004-0.08	0.002-0.02	●	●
Posi Type	HVP	Medium	0.5-0.5	0.10-0.40	0.02-0.14	0.004-0.05	●	●

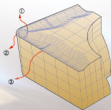
## Positive type, HFP (Fine finish, Finish area)

## Positive type, HMP (Medium-finish, Medium area)



- ① Excellent and stable chip control due to 2 step chip-breaker in fine finish area
- ② Excellent surface finish, cutting performance due to the sharp cutting edge in low cutting resistance applications (Grinding process applied on sides of insert)

\* Main work-piece materials: Steels, Stainless steels.



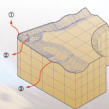
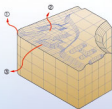
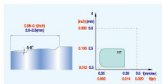
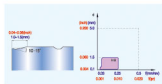
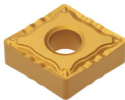
- ① Chip control sensor ensures stable chip removal in low depth-of-cut and efficient chip breaking.
- ② Ideal land relief angle design ensures better cutting performance, surface finish quality and chip breaking.
- ③ Reinforced non-cutting edge and land part ensures good and stable operation in the sudden change of depth-of-cut.

\* Main work-piece materials: Steels, Stainless steels, Cast Irons

## Negative type, HU (Ultra fine finish, Finish area)



## Negative type, HF (Finish, Medium-finish area)



- ① Excellent surface finish, cutting performance due to the sharp cutting edge in low cutting resistance applications (Grinding process applied on sides of insert)
- ② Special figure designed main chip breaker ensures stable chip control in the ultra fine finish operations.
- ③ Sub chip-breaker ensures good chip breaking in low depth-of-cut and stable operation in sudden change of depth-of-cut.

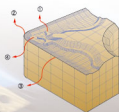
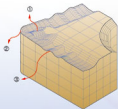
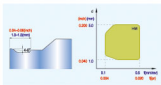
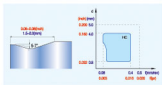
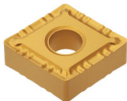
- ① Ideal land relief angle design ensures better surface finish quality and lower cutting resistance.
- ② Special figure design ensures stable chip control in finish operations.
- ③ Concave and convex design ensures excellent chip control in various change of depth-of-cut.

\* Main work-piece material: Steels

\* Main work-piece material: Steels; Stainless steels

## Negative type, HC (Medium-finish, Medium)

## Negative type, HM (Medium, Medium-roughing)



- ① Unique figure design ensures stable chip control in small depth-of-cut and good chip breaking in large depth-of-cut.
- ② Ideal land relief angle design ensures better surface finish quality and lower cutting resistance.
- ③ Concave and convex design ensures excellent chip control in various change of depth-of-cut such as copy machining.

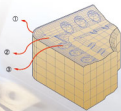
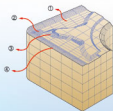
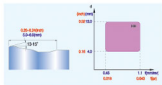
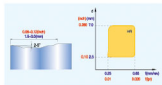
\* Main work-piece material: Steels, Stainless steels

- ① 3-Chip-control-sensors design, it can be applied at the wide application range from medium-finish to medium-roughing operations.
- ② Ideal land relief angle design ensures better cutting performance and lower cutting resistance.
- ③ Stronger cutting edge adopting of large land width on main cutting edge part, it is able to be applied at intermittent cutting or bad conditioned work piece.
- ④ Special design on chip pocket part ensures excellent tool life at high speed cutting, high feed cutting and CNC machining.

\* Main work-piece: Steels, Stainless steels, Cast Iron

## Negative type, HR (Roughing)

## Negative type (Single sided), HH (Heavy-Duty)



- ① Superior chip-evacuation thanks to wide chip-groove design during high depth-of-cut and high feed machining
- ② Good edge strength during intermittent machining & superior chip-evacuation during ultra fine finishing operation thanks to enhanced edge strength
- ③ Good chip-curl induced by 2-step shape of chip breaker design and reduced chip-evacuation resistance during high-speed and high-feed machining
- ④ Low-resistance edge-line made by having an land-angle reduces cutting resistance

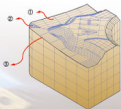
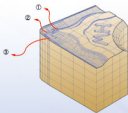
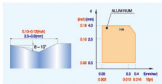
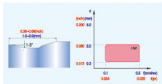
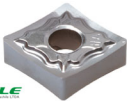
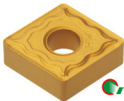
\* Main work-piece materials : Steel, Cast iron

- ① Having strong toughness doesn't cause chipping and damages on edge during high depth-of-cut, high-feed and severe intermittent machining thanks to nega-land design
- ② Reduced cutting-resistance as having good chip-evacuation resulted from small rake-angle
- ③ Minimization of frictional heat generation as reducing friction size between chip and inserts during cutting is making long tool-life

\* Main work-piece materials : Steel, Cast iron

## Negative type, HW (Wiper Inserts)

## Negative type, HA (Aluminum)



- ① Special shape design of chip-breaker ensures superior chip control in the low depth-of-cut
- ② Stable performance by special shape design at chip pocket in high-speed, high-feed
- ③ Having superior fine finish during machining because it is composed of recess type of edge and wiper type of edge

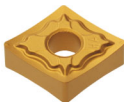
\* Main work-piece materials : Steels

- ① Good chip-removal by design of wide chip-groove and high rake angle prevents built-up-edge and generates small cutting-resistance
- ② Enhanced edge strength by enhanced edge shape prevents chipping, friction of edge and makes chip-removal superior during ultra fine finish machining
- ③ Enable to low-depth-of-cut by sharp edge and having superior fine finish

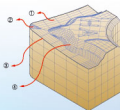
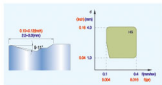
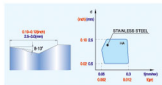
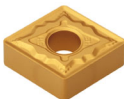
\* Main work-piece materials : Aluminum, Soft steels, Stainless steels



## Negative type, HA (Stainless steel)

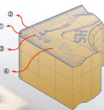


## Negative type, HS (Exclusive for Stainless steel)



- ① Good chip-removal by design of wide chip-groove and high rake-angle prevents build-up-edge and generates small cutting-resistance
- ② Enhanced edge strength by enhanced edge shape prevents chipping, friction of edge and makes chip-removal superior during ultra fine finish machining
- ③ Enable to low-depth-of-cut by sharp edge and having superior fine finish
- ④ 2-step shape of chip-breaker design induces good chip-out and reduces chip-removal resistance during high-speed and high-feed machining

\* Main work-piece materials: Aluminum, Soft steel, Stainless steel



- ① Superior fine finish and wear-resistance by low-resistance design of high-land rake angle as chip breaker exclusive for stainless steels
- ② Reduced chipping at boundary from low depth-of-cut up to high depth-of-cut by land width and change of angle at sides
- ③ Preventing chipping & damages as enhancing strength of edge on high-depth-of-cut and high-feed having increasing cutting load
- ④ Reducing chip removal resistance during high-depth-of-cut, high-feed as forming wide chip pocket


















































\* Main work-piece materials: Stainless steel, Difficult-to-cut steel

## Recommendation for General steels

■ Work-piece material : DIN/CK45, CK55, 42CrMo4 and etc.)  
 AISI/1045, 1055, 4130, 4140 and etc.)

■ Hardness : 180 ~ 260HB

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Operation	Select Chip-breaker and Grade					Select Shape of Insert as per Work-piece						
	Depth-of-cut	Chip-breaker	Feed	Grade	Speed	80°	80°	90°	60°	30°	90°	
	mm(inch)	First Choice	mm(rev)(pr)	Grade	m/min(wh)	(NEGA) DMC□	(NEGA) WMC□	(NEGA) DAC□	(NEGA) TNC□	(NEGA) WNC□	(NEGA) SMC□	
Finish Cuttings	1.3 ~ 1.5 ~ 1.2 0.012 ~ 0.040 -0.080 WAFER		0.10 ~ 0.30 -0.50 0.004 ~ 0.010 -0.020	NC310 NC3020	300 980 250 820							
	0.2 ~ 0.5 ~ 1.5 0.008 ~ 0.020 -0.040 Ultra-Fine - Finish		0.05 ~ 0.10 -0.20 0.002 ~ 0.004 -0.008	CC106 CND	190 623 180 525							
	0.5 ~ 1.0 ~ 2.0 0.020 ~ 0.050 -0.030 Finish		0.08 ~ 0.15 -0.30 0.002 ~ 0.004 -0.008	CN020 NC310 NC3015 NC3020	180 590 200 722 200 690 190 623							
Medium Cuttings	0.8 ~ 1.5 ~ 3.5 0.020 ~ 0.050 -0.130 Medium-Finish		0.10 ~ 0.20 -0.30 0.004 ~ 0.008 -0.014	NC310 NC3020 NC3015 NC330	210 699 180 590 190 630 180 525							
	1.0 ~ 2.0 ~ 5.0 0.020 ~ 0.050 -0.180 Medium		0.15 ~ 0.25 -0.50 0.008 ~ 0.010 -0.020	NC310 NC3015 NC3020 NC330	200 696 180 558 170 560 150 492							
	2.0 ~ 4.5 ~ 7.0 0.100 ~ 0.150 -0.280 Roughing		0.25 ~ 0.45 -0.85 0.010 ~ 0.016 -0.026	NC3015 NC3020 NC330	170 590 180 525 140 492							
HEAVY	4.0 ~ 8.0 ~ 15 0.180 ~ 0.320 -0.520 Roughing		0.45 ~ 0.70 -1.1 0.018 ~ 0.028 -0.040	NC3015 NC3020 NC330	120 390 100 330							
	Finish Cuttings	0.1 ~ 0.5 ~ 1.5 0.004 ~ 0.002 ~ 0.005 Finish		0.05 ~ 0.15 -0.25 0.002 ~ 0.005 -0.010	CC105 NC310 NC3020 NC3015	200 656 220 722 180 590 190 627						
Finish Cuttings		0.5 ~ 1.5 ~ 3.5 0.005 ~ 0.008 ~ 0.130 Medium		0.08 ~ 0.20 -0.40 0.003 ~ 0.008 -0.016	NC310 NC3020 NC3015 NC330	210 699 180 590 190 627 150 492						

### \* Advices

- According to the work-piece material and depth-of-cut.
  - Choose chip-breaker type
  - Choose the shape of insert as per work-piece
  - Choose the grade and decide feed and speed. Adjust factors by conditions from the first operation for the better productivity.
- If the work-piece material is a soft steel or the Brinell hardness is less than 180,
  - Increase speed as 20% as the above,
  - Increase feed as 20% as the above.
- If the work-piece material is a mold steel or a hard steel or the Brinell hardness is 260-350,
  - Decrease speed as 20% as the above,
  - Decrease feed as 10% as the above.

































## Recommendation for General steels

■ Work-piece material : DIN(X50CrNi1810, X50CrNiMo17122, X5CrNiNb1810 and etc.)

AISI(303, 316, 347, 202 and etc.)

■ Hardness : 135~ 185HB

■ Difficult-to-cut stainless steels, Austenite stainless steels and etc.

Operation	Depth-of-cut	Select Chip-breaker and Grade				Select Shape of Insert as per Work-piece					
		Chip-breaker	Feed	Grade	Speed	80° 80°	80° 90°	55° 90°	90° TMMG	35° VMMG	90° SMMG
Free-Cutting	0.5 ~ 1.5 ~ 2.5 0.025 ~ 0.080 - 0.10 Medium-Finish	<b>HA</b> 	0.05 ~ 0.15 -0.30 0.001 ~ 0.005 - 0.012	<b>PC9038</b> <b>NC9025</b>	170 560 100 620						
Medium-Cutting	1.0 ~ 2.5 ~ 4.0 0.04 ~ 0.10 - 0.15 Medium-Cutting	<b>HS</b> 	0.10 ~ 0.25 -0.40 0.004 ~ 0.010 - 0.018	<b>PC9038</b> <b>NC9025</b>	160 520 160 590						
Roughing	2.0 ~ 4.0 ~ 6.5 0.08 ~ 0.18 - 0.25 Intermittent Medium-Roughing	<b>HW</b> 	0.20 ~ 0.40 -0.80 0.006 ~ 0.018 - 0.024	<b>PC9038</b> <b>NC9020</b>	120 360 160 520						
	mm(inch)	First Choice	mm/rev(ipf)	Grade	m/min(ft/min)	(P05) GCCT	(P05) WCCT	(P05) DCCT	(P05) TCCT	(P05) VCCCT	(P05) SCCT
Free-Cutting	0.1 ~ 0.5 ~ 1.5 0.004 ~ 0.025 - 0.030 Finishing	<b>HFP</b> 	0.05 ~ 0.10 -0.30 0.002 ~ 0.004 - 0.008	<b>PC9038</b> <b>HC9020</b>	170 560 180 620						
Medium-Cutting	0.6 ~ 1.0 ~ 3.0 0.02 ~ 0.024 - 0.12 Medium Finishing	<b>HMP</b> 	0.05 ~ 0.15 -0.3 0.003 ~ 0.006 - 0.012	<b>PC9038</b> <b>NC9028</b>	180 520 180 590						


















### \* Advices

- According to the work-piece material and depth-of-cut
  - Choose chip-breaker type
  - Choose the shape of insert as per work-piece
  - Choose the grade and decide feed and speed. Adjust factors by conditions of 1st operation for the better productivity.
- If the work-piece material is a Martensite or Ferrite stainless steel,
  - Increase speed as 20% as the above,
  - Increase feed as 20% as the above
- If the application requires the medium and general purpose area, we recommend our -GS chip-breaker with NC3255 grade.  
(Please see the "Difficult-to-cut material machining guide - No.97 of KORLOY TECH-NEWS".

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## Recommendation for Cast iron

- Work-piece material : DIN/GG10, GG15-GG35, GGG45-70 and etc.)  
AlSi(No 209- No 508, 060-40-18, 80-55-06, 100-70-03)
- Hardness : 150 ~ 300HB

Work-piece		Select Chip-breaker and Grade				Select Shape of Insert as per Work-piece					
Operation	Depth-of-cut	Chip-breaker	Feed	Grade	Speed	80°	80°	90°	60°	35°	90°
	mm(inch)	First Choice	mm/rev(ft)	Grade	m/min(ft/s)	(NEGA) CMBG	(NEGA) WMBG	(NEGA) DMBG	(NEGA) TMBG	(NEGA) VMBG	(NEGA) SMBG
Medium-Cutting	1.0 ~ 2.5 ~ 4.0 0.040 ~ 0.10 ~ 0.16		0.15 ~ 0.30 ~ 0.50	<b>NC306K</b> NC315K	300 1000 250 820						
	0.008 ~ 0.012 ~ 0.020										
Roughing	2.5 ~ 4.5 ~ 7.0 0.10 ~ 0.16 ~ 0.28		0.25 ~ 0.45 ~ 0.65	<b>NC309K</b> <b>NC316K</b>	270 890 230 750						
	0.010 ~ 0.016 ~ 0.028										
Medium-Cutting	0.5 ~ 1.5 ~ 3.0 0.020 ~ 0.06 ~ 0.12		0.08 ~ 0.20 ~ 0.40	<b>NC386K</b> NC315K	250 750 220 720						
	0.003 ~ 0.008 ~ 0.016										

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### \* Advices

1. According to the work-piece material and depth-of-cut
  - 1> Choose chip-breaker type
  - 2> Choose the shape of insert as per work-piece
  - 3> Choose the grade and decide feed and speed. Adjust factors by conditions from the first operation for the better productivity.
2. If the work-piece material is a soft steel or the Brinell hardness is less than 180,
  - 1> Increase speed as 20% as the above.
  - 2> Increase feed as 20% as the above.
3. If the work-piece material is a mold steel or a hard steel or the Brinell hardness is 260-350,
  - 1> Decrease speed as 20% as the above.
  - 2> Decrease feed as 10% as the above.










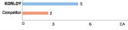

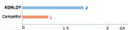



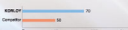
Specification	Stack-Management Items by applied grade and work-Piece(Piece-Type)											Corrosion Steel	Tensile Strength Aluminum
	Coating												
	Steel				Cast Iron(Gray Type)				Stainless Steel				
	NC210	NC215	NC220	NC230	NC25K	NC25K	NC25S	NC300	PC300	CR2	CR30		
CO2F9030	CO2F71 80.5		HFP										
CO2F9034	CO2F71 81	HFP	HFP										
CO2F9032	CO2F72 80.8		HFP										
CO2F9034	CO2F72 81	HFP	HFP	HFP									
CO2F9036	CO2F72 82	HFP	HFP		HFP								
CO2F9032	CO2F71 80.5		HFP										
CO2F9034	CO2F71 81	HFP	HFP	HFP		HFP	HFP	HFP	HFP			HFP	
CO2F9036	CO2F71 82		HFP	HFP				HFP	HFP				
CO2F9034	CO2F72 81	HFP	HFP	HFP		HFP	HFP	HFP	HFP			HFP	
CO2F9036	CO2F72 82	HFP	HFP	HFP		HFP	HFP	HFP	HFP			HFP	
CO2F7040	CO2F401		HFP	HFP		HFP		HFP					
CO2F7040	CO2F42	HFP	HFP	HFP	HFP	HFP		HFP	HFP				
DO2F7020	DO2F21 81		HFP										
DO2F7108	DO2F12 81	HFP	HFP										
DO2F7032	DO2F71 80.5		HFP	HFP									
DO2F7034	DO2F71 81		HFP	HFP			HFP	HFP					
DO2F7036	DO2F71 82		HFP										
DO2F7034	DO2F72 81	HFP	HFP	HFP	HFP	HFP	HFP	HFP	HFP			HFP	
DO2F7036	DO2F72 82	HFP	HFP					HFP	HFP			HFP	
SO2F7034	SO2F72 81		HFP				HFP						
SO2F9036	SO2F72 82	HFP	HFP				HFP						
SO2F7040	SO2F72 2		HFP	HFP			HFP						
TC2F7034	TC2F72 81		HFP										
TC2F7120	TC2F71 81	HFP	HFP	HFP				HFP	HFP			HFP	
TC2F7122	TC2F71 82		HFP	HFP									
TC2F7034	TC2F72 81	HFP	HFP	HFP			HFP		HFP	HFP			
TC2F7036	TC2F72 82	HFP	HFP				HFP		HFP	HFP			
VC2F7104	VC2F721		HFP										
VC2F7040	VC2F731		HFP										
VC2F7040	VC2F732		HFP										
VM7F7034	VM7T21		HFP										
VM7F7034	VM7T31		HFP										
VM7F7036	VM7T32		HFP										
VM7F804	VM7T31		HFP										

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## "H" Application Examples

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Shape of work-piece	Work-piece (Material)	Insert	Cutting Condition		Result
			V: Speed(m/min)	f: feed(mm/rev) d: Depth(mm)	
	Front piston (CK12 - DIN, 1010 - AISI)	CNMG 120408-HF CNMG 412-HF	V=180 f=0.35 d=0.125-0.4 V=550 f=0.0138 d=0.0053-0.0157		
	T Shaft (CK45 - DIN, 1045 - AISI, Forged steel)	DNMG 150606-HC DNMG 442-HC	V=135 f=0.2 d=0.15 V=443 f=0.008 d=0.0059		
	MX-BJ Out-side wheel (1050 - AISI)	CNMG 120412-HM CNMG 433-HM	V=300 f=0.3 d=3-4 V=564 f=0.0118 d=0.118-0.157		
	Check Valve Body (Cast Steel)	SNMG 120408-HR SNMG 432-HR	V=170 f=0.15 d=1.5-3.0 V=550 f=0.006 d=0.05-0.12		
	Connecting Rod (In CK05) (AISI 1025)	CNMG 250824-HH CNMG 666-HH	V=60 f=1.3 d=10-20 V=300 f=0.05 d=0.4-0.8		
	Gear (SCR420H - K3)	TCGT 16T304-HFP TCGT 32.51-HFP	V=240 f=0.1-0.2 d=0.15 V=787 f=0.004-0.008 d=0.0059		
	Bushing (S520C - K3)	CCMT 090204-HMP CCMT 21.51-HMP	V=110 f=0.2 d=0.5 V=361 f=0.0079 d=0.031		



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