

Milling with NTK Grades by Application

General Guidelines for Successful Milling

- Select the best grade for the application
- Select cutter diameter 1.5 times greater than the workpiece width
- Eliminate any overhang to increase stability
- Choose the strongest nose radius
- No Coolant. Use compressed air
- Check clamp and part rigidity



Guidelines for Successful Milling by Material

Heat resistant alloy / PH stainless steel

- Down or climb milling where the chip thins upon exit is the preferred method for HNBA materials
- Reduce feed rate 50% upon entrance and exit
- Do not recut side walls as this can cause work hardening
- Use balanced shell mill adapter or shrink fit for end-mills
- As DOC gets thinner the feed must be increased to compensate for heat loss
- Use RPG geometries if tool pressure is a problem
- E01, E02 edge preparation recommended

Hardened Steel / Die mold / Chilled iron / Overlay

- Larger edge preparations need to be used
- Speed is reduced as hardness goes up

Cast Iron / Ductile Cast Iron

- Parts that are cast are more difficult to machine than forged • decrease feed rates by 25%
- Maximize feed rates for gray cast irons

Trouble shooting

Material	Insert Grade	NTK Grade	Problem	Solution					
				Speed	Feed	DOC	Edge Prep.	Insert Grade	Others
Hardened Steel	Ceramic	HC7 WA1	Chipping	—	↘	—	Wider	—	—
			Break	↘	↘	—	—	—	—
Cast Iron	Silicon Nitride	SX6 SP9	Chipping	↘	↘	—	Wider	—	—
			Break	↘	↘	↘	—	Tougher	Larger radius
			Thermal Crack	↘	↘	—	—	—	—
			Crater Wear	—	—	—	Sharper	—	—
Heat Resistant Alloy	SiALON	SX9 SX7	Notching	↗	↗	Vary / ↘	Wider	—	Pre-chamfer parts
			Flank Wear	↘	↗	—	—	Harder	—
			Chipping	—	—	—	Wider	Tougher	—
			Break	↘	—	↘	—	Tougher	—
			Tool Pressure	—	—	—	—	—	Use RPG insert

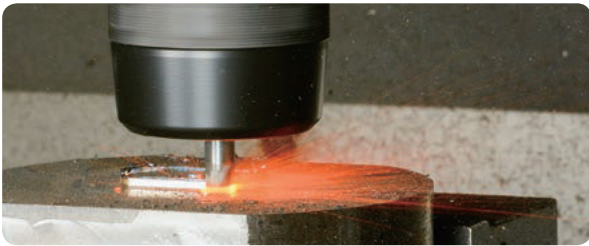
NEW Solid Ceramic End Mill



Features

- Extremely high speed machining for HRSA materials with our durable SiAlON grade "SX9"
- More than 15 times higher productivity than a Carbide end mill
- 4, 6 and 8 flutes are available
- Unique patent pending design provides toughness to the edge

RCE for HRSA materials



• Ceramic specialist's design

Helix angle

- Designed for the purpose of:
 - 4-flute: toughness
 - 6-flute: less tool pressure and better chip evacuation



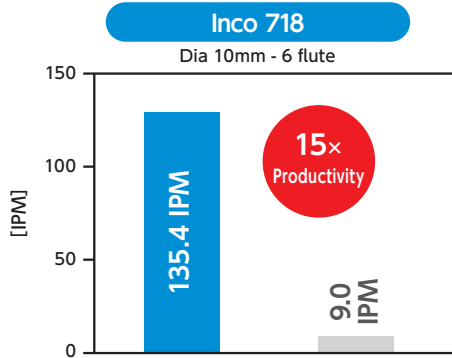
- SX9(SiAlON)**
 - Well balanced for toughness and wear resistance

Bottom edge

- Unique shape provides toughness

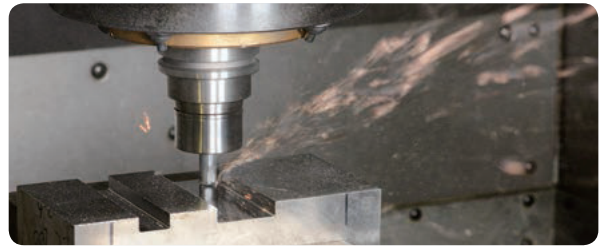
Flute

- Optimized for HRSA materials
- Excellent toughness



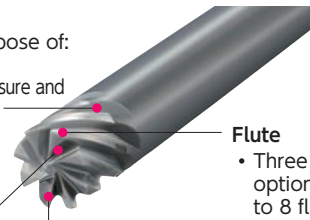
	SX9	Carbide
SFM	1970	130
IPT	.0012	←
DOC	.118	←

RCS for Cast iron / HRSA materials



Helix angle

- Designed for the purpose of:
 - 4-flute: toughness
 - 6/8-flute: less tool pressure and better chip evacuation



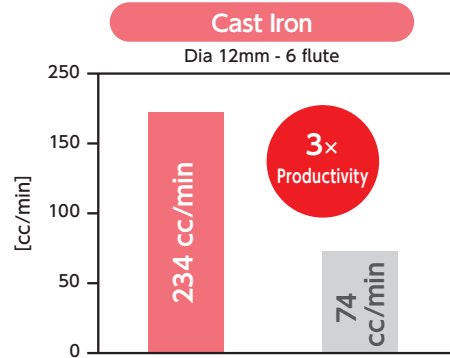
- Flute**
 - Three flute options up to 8 flute

End Gash

- Bigger end gash brings toughness

Edge

- Added chamfer provides toughness for cast iron machining



	SX9	Carbide
SFM	2300	360
IPT	.002	←
DOC	.138	.275

4-flute



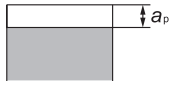

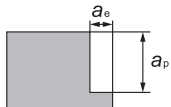

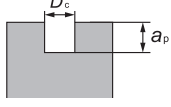



6-flute



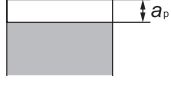

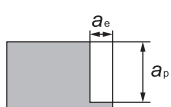

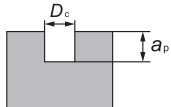

8-flute



● Recommend Cutting Conditions for HRSA material

Application	Grade	ϕD_c	Flute	Cutting Speed (SFM)			Feed (IPT)	Depth of cut (a_p —inch)	Width of cut (a_e —inch)	Coolant
				500	2000	3500				
Face Milling 	SX9	3/8"	4/6/8	[Red bar with 2 flutes]	[Red bar with 2 flutes]	.0012	.056	—	DRY 	
		1/2"								
		5/8"								
		3/4"								
		8mm								
		10mm								
		12mm								
		16mm								
		20mm								
Side Milling 	SX9	3/8"	4/6/8	[Red bar with 2 flutes]	[Red bar with 2 flutes]	.0012	.187	.037	DRY 	
		1/2"								
		5/8"								
		3/4"								
		8mm								
		10mm								
		12mm								
		16mm								
		20mm								
Slotting 	SX9	3/8"	4	[Red bar with 2 flutes]	[Red bar with 2 flutes]	.0012	.094	—	DRY 	
		1/2"								
		5/8"								
		8mm								
		10mm								
		12mm								
		16mm								
	SX9	6	[Red bar with 2 flutes]	[Red bar with 2 flutes]	.0012	.056	—	DRY 		
						1/2"				
						5/8"				
						8mm				
						10mm				
						12mm				
						16mm				
						.094				
SX9	8	[Red bar with 2 flutes]	[Red bar with 2 flutes]	.0012	.113	—	DRY 			
					3/4"					
					16mm					

● Recommended cutting conditions for Cast Iron

Application	Grade	ϕD_c	Flute	Cutting Speed (SFM)			Feed (IPT)	Depth of cut (a_p —inch)	Width of cut (a_e —inch)	Coolant
				500	2000	3500				
Face Milling 	SX9	1/2"	4/6/8	[Red bar with 2 flutes]	[Red bar with 2 flutes]	.004	.094	—	DRY 	
		5/8"								
		3/4"								
		12mm								
		16mm								
		20mm								
Side Milling 	SX9	1/2"	4/6/8	[Red bar with 2 flutes]	[Red bar with 2 flutes]	.004	.375	.083	DRY 	
		5/8"								
		3/4"								
		12mm								
		16mm								
		20mm								
Slotting 	SX9	1/2"	4/6/8	[Red bar with 2 flutes]	[Red bar with 2 flutes]	.004	.094	—	DRY 	
		5/8"								
		3/4"								
		12mm								
		16mm								
		20mm								

For Maximum Productivity

- A continuous cut is recommended. An interrupted cut may cause chipping or breakage.
- When using a Hydraulic or Shrink chuck, blow air to the arbor body, DON'T blow air to the endmill itself.
- A Minimum speed of 980 SFM is required. (Don't run at lower speed.)
- A 1.5 degree ramping angle is recommended. Run at 50% lower feed rate when ramping cut.

When cutting HRSA materials

- Continue to machine even if you see BUE, removing BUE may cause chipping or breakage to the edge.
- High speed machining work hardens the material. For this reason, leave at least 0.3mm of material for a finishing process.