

Technical Data

DRILLS

DRILLS
Cutting Condition

END MILLS

END MILLS
Cutting Condition

TAPS

TAPS
Cutting Condition

Others

Clean Steel

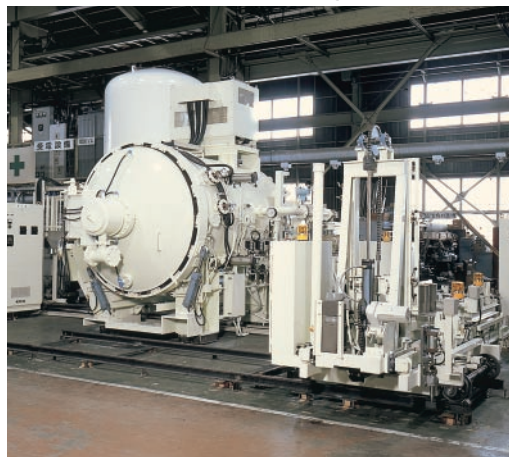
Material and heat treatment are major factors in determining the performances of the HSS tool. To provide high-quality HSS tools, NACHI-FUJIKOSHI has a steel mill to manufacture the HSS steels conforming to individual requirements for our in-house use as well as for outside sales.



Electric arc furnace

Clean Heat Treatment

In the field of heat treatment, we are producing and marketing vacuum heat treatment furnaces, which are highly evaluated among users both in Japan and abroad. Further, through technical tie-ups with Sumitomo Electric Industries Co., Ltd., we use cemented carbide materials best suited to individual requirements.



Horizontal type one chamber gas pressure quenching vacuum furnace

High-speed tool

Main high-speed tools and their applications

Classification	Steel type symbol			Chemical component						Application
	JIS	AISI	NACHI	C	Mo	W	Cr	V	Co	
High-speed steel	SKH10	T 15	HS55T	1.5		12	4	5	5	Basic steel type, cutting tool Drill, broach, others in general Drill, gear cutting tool, others in general Cutting tool, others in general Cutting tool, others in general Tool material End milling cutter and others End milling cutter, tap
	SKH51	M 2	SKH51	0.85	5	6	4	2		
	—	M33	HM33	0.9	9.5	1.5	4	1.2	8	
	—	M34	HM34	0.9	8	2	4	2	8	
	SKH55	M35	HS53M	1.05	5.5	6	4	2.5	5	
	SKH57	—	HS93R	1.25	3.5	10	4	3.5	10	
	SKH59	M42	HS96H	1.1	9.5	1.5	4	1.2	8	
Powdered High-speed steel			HS97R	1.1	5.5	7.5	4	1.8	9	Saws and others General Gear cutting tool, tap, others in general Gear cutting tool, broach, others in general General (high alloy material)
			FAX18	1.1	9.5	1.5	4	1.2	8	
			FAX31	1.3	5.5	6	4	3		
			FAX38	1.3	5	6	4	3	8	
			FAX55	1.6		12	4	5	5	
Alloy tool steel			FAX90	2.6	3.5	10	4	8.5	10	Hack saw, etc.]Molding tools including dies and molds
	SKS 7		SKS 7	1.15		2.2	0.3			
	SKD11		SKD11	1.5	1		12	0.4		
	SKD61		SKD61	0.4	1.3		5	1	Si1	

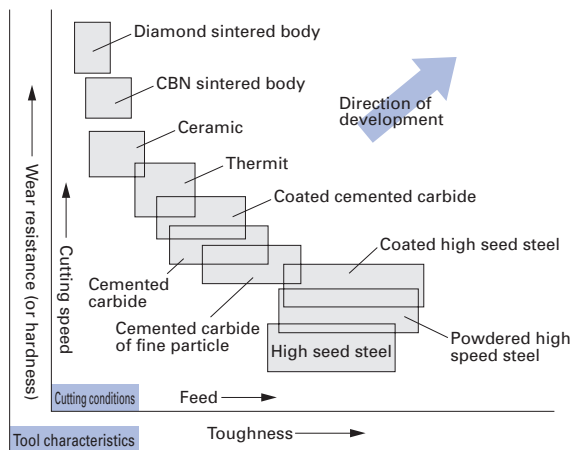
Effects of major alloy components

- W : Hard double carbide is formed to ensure improved wear resistance
- Mo : Fine carbide and improved toughness to ensure improved wear resistance
- Cr : Tissue stabilization factor (upgraded solubility)

- V : Extended and improved wear resistance of secondary carbon
- C : Enhanced carbon formation factor and hardening properties
- Co : Best suited to heavy-duty cutting due to improved heat resistance

Characteristic of various tool materials

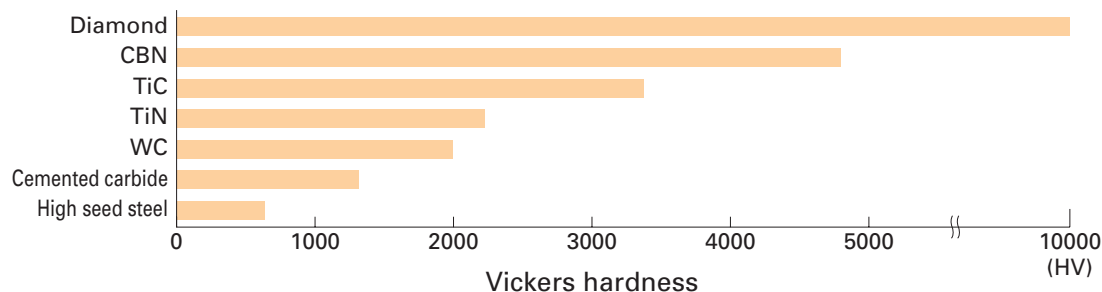
It is important that tool materials are characterized by excellent resistance to chipping or breakage. Selection is made from among various types of tool materials in conformity to the workpiece and machining method. NACHI's integrated production system covering the entire range from materials to tool produces provides tool materials meeting each of your requirements.



Characteristics of various tool materials

Type	Symbol	(Example)	Production method	Features
Carbon tool steel	SK □	SK 3	Tool steel where carbon is put into iron to enable hardening.	Less expensive, but low hardness at a high temperature.
Alloy tool steel	SKS □ SKD □	SKS 7 SKD 11	Tool steel with its wear resistance improved by alloy steel such as iron, Cr and W.	
High speed steel	SKH □	SKH 51 SKH 55	Tool steel with wear resistance and toughness improved by hard carbide created by mixing W, Mo, Cr and V with iron.	The steel type with much Co content is called cobalt high speed tool characterized by excellent heat resistance.
Powdered high speed steel	NACHI symbol FAX □	FAX 38 FAX 55	Fine powder of the high speed steel sintered by the powder metallurgy. This method can also be used to manufacture the type of steep containing such components as V and Co.	The tissue is minute, uniform and tough. Further, excellent wear resistance is provided by such components.
Cemented carbide	K □ P □	K 10 P 20	The major component is W. It is manufactured by sintering the TiC, TaC and Co (bonding agent) according to powder metallurgy method.	Very hard at a high temperature and excellent in wear resistance, but chips easily.
Ultrafine grain cemented carbide	Z □	Z 20	Cemented carbide characterized in that the particle diameter of carbide such as W, Ti and Ta does not exceed 1 micron.	The toughness is higher than that of cemented carbide, but wear resistance is lower.
Thermit	NACHI symbol NAX □	NAX T NAX LL	The main components are carbide such as Ti and Ta, nitride and carbonitride. They are sintered with Ni and Co (binder) by powder metallurgy to produce Thermit.	Excellent in resistance to wear, heat and deposition, but susceptible to chipping. Used for high-speed cutting.
Ceramic			A sintered body (porcelain). Available in two types; alumina type mainly consisting of Al ₂ O ₃ and silicon type mainly consisting of Si ₂ N ₄ .	Excellent wear resistance but poor toughness.
CBN sintered body	NACHI symbol BM □ BC □	BM 10 BC 30B	Manufactured by sintering the powder of CBN, the hardest second only to diamond, at a high temperature under super high pressure. Excellent hardness even at a high temperature.	Reaction with metal occurs very rarely. Characterized by excellent stability at a high temperature.
Diamond sintered body	NACHI symbol DM □	DM 10 DM 10F	A polycrystalline body formed by sintering powdered diamond at a high temperature under super high pressure. Characterized by excellent hardness.	Chemically stable to the workpiece made of other than iron.

Hardness of high-hardness material



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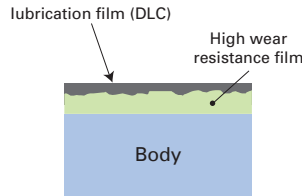
Others

Coating Series with Excellent Characteristics

DLC Coating

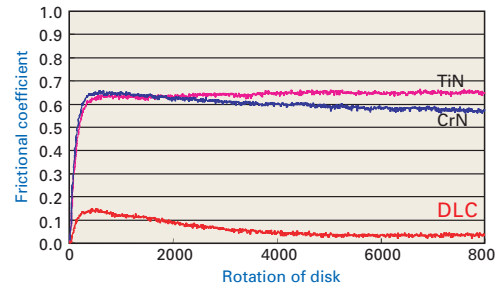
High-speed dry machining of aluminum alloy has been realized by adoption of cemented carbide alloy and coating of DLC (Diamond-Like Carbon) -- an amorphous substance having diamond-like properties characterized by a high degree of hardness, a low friction coefficient and wear resistance.

It has a low friction coefficient and resistance to deposition of aluminum alloy. Deposition is reduced even in high-speed dry machining, and excellent properties of machining surfaces are provided.



Construction of DLC

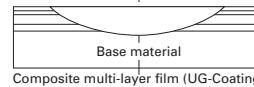
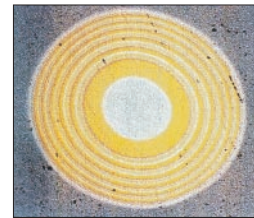
	Graphite	DLC	Diamond
Structure			
element	C	C+H	C
R/V	—	1000~8000HV	10000HV



BALL : SUJ2 Disk : Film/HSS (Ry0.2μm)
 Revolution : 500RPM Over weight : 100N Dry
 Machine : CSEM Tribometer

Composite multi-layer coating

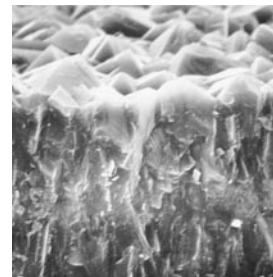
As a cutting tool coating technique, this coating technique provides improved wear resistance and ensures protection of the base materials (through the use of a composite multi-layer configuration), centering on the general-purpose TiN G-series. We have established the manufacturing conditions of various series of our company, including the SG series of high-speed steel.



Diamond coating

We are the first in the world to succeed in commercial use of a diamond film (so-called a tool of dream), using our coating technique.

Diamond coating by vapor phase synthetic method provides the close adhesion that has been inconceivable so far. The technique ensures drastic improvement of cutting performance in the field of machining the nonferrous metal, graphite, composite material or aluminum alloy.



Diamond coated film

Coating equipment

Our R & D efforts cover the development of coating equipment indispensable to the developing of new coating technology.



Coating equipment

Comparison of characteristics of NACHI coating film

Name	Evaluation of relative characteristics	Features
G (TiN)		<p>- The basis for PVD coating. Coating method in common use.</p>
SG		<p>- Composite multi-layer film coating method characterized by improved wear resistance as compared to TiN.</p>
UG		<p>- Coating method characterized by adoption of a TiCN based composite multi-layer film to provide improved wear resistance.</p>
AG		<p>- Coating method based on the TiAlN film characterized by superb resistance to heat and wear. Commercialized for use in high-speed steel.</p>
X's		<p>- Coating method for cemented carbide end-milling cutters, based on the TiAlN film characterized by superb resistance to heat and wear.</p>
AQUA		<p>- Coating method characterized by excellent heat resistance and lubricity of the workpiece. Compatible with both dry machining and wet machining.</p>
DLC		<p>- Coating method characterized by a film having a structural characteristic intermediate between graphite and diamond, where the surface is provided with a smooth film, thereby enhancing resistance of aluminum alloy and others to deposition.</p>
DIA		<p>- Coating method best suited to processing of non-ferrous metal, graphite and aluminum alloy, where NACHI is the first to realize commercialization of a diamond film.</p>

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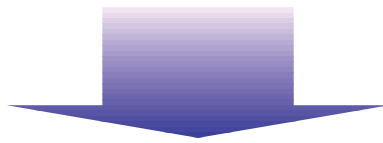
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NACHI's Efficiency Theme "Eco & Eco"

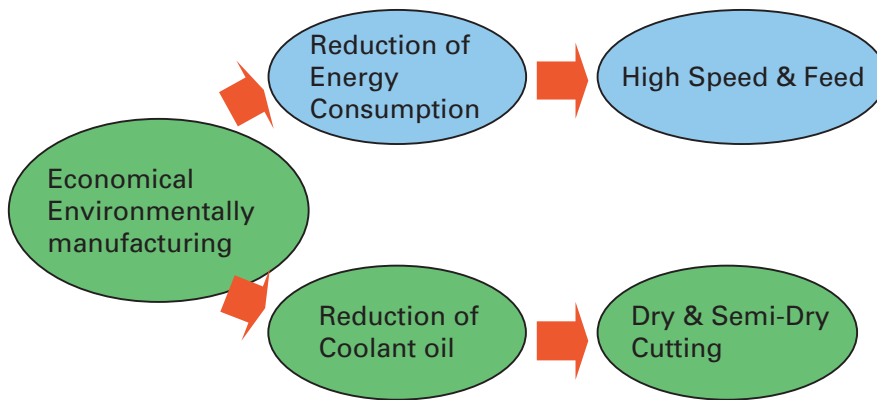
Sets The New Standard for Cutting Tools

" ECO " = Economy of Cost Reduction

" ECO " = Ecologically Friendly



Achieving The Cost Efficient Environmentally Friendly Solution



NACHI's Efficient Eco & Eco Lines Dry & Semi-Dry Cutting

Drilling	AQUA Drill Series	for Steel
	DLC Drill Series	for Aluminum
Milling	DLC Endmill Series	for Aluminum
	X's mill GEO Series	for Steel
	X's mill Series	for Steel
Tapping	DLC TAFLET Series	for Aluminum

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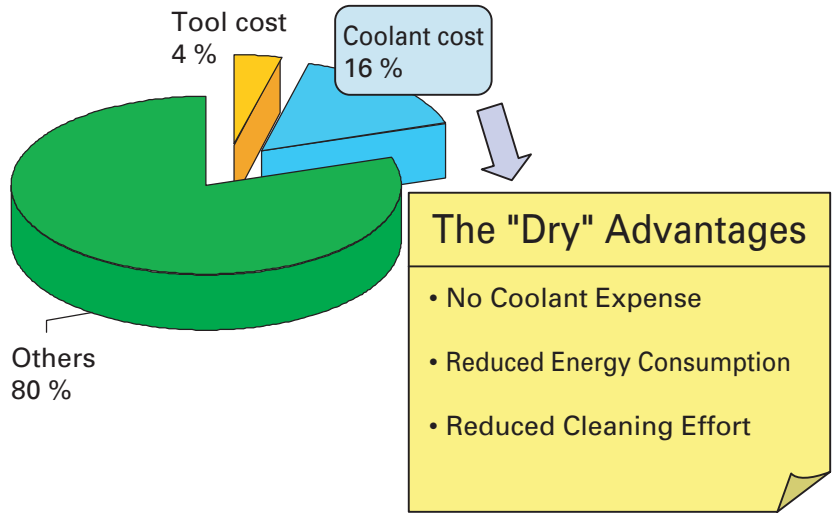
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**If you can reduce coolant use,
you can reduce cost by more than 16%**

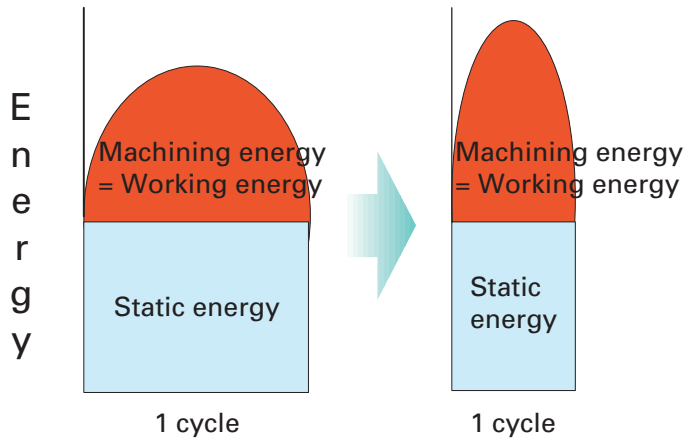
Reducing Machining Costs



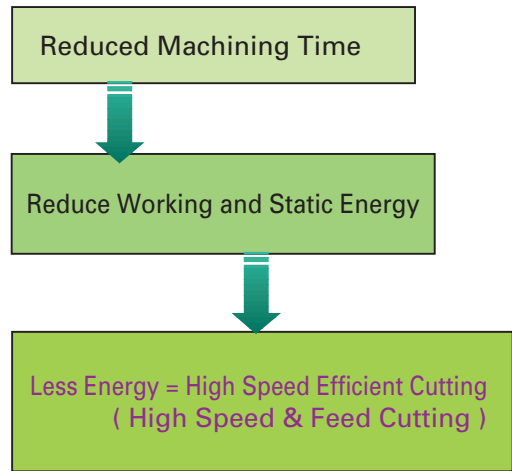
The NACHI Solution

High Speed and Feed Cutting

The Machining Energy Story



The NACHI Solution
High Speed
& Feed Cutting



NACHI High Speed & Feed Lines

- Drilling** AQUA Drill Series for Steel
 AG /UG Power Series for Steel
- Milling** X's mill GEO Series
 X's mill Series

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