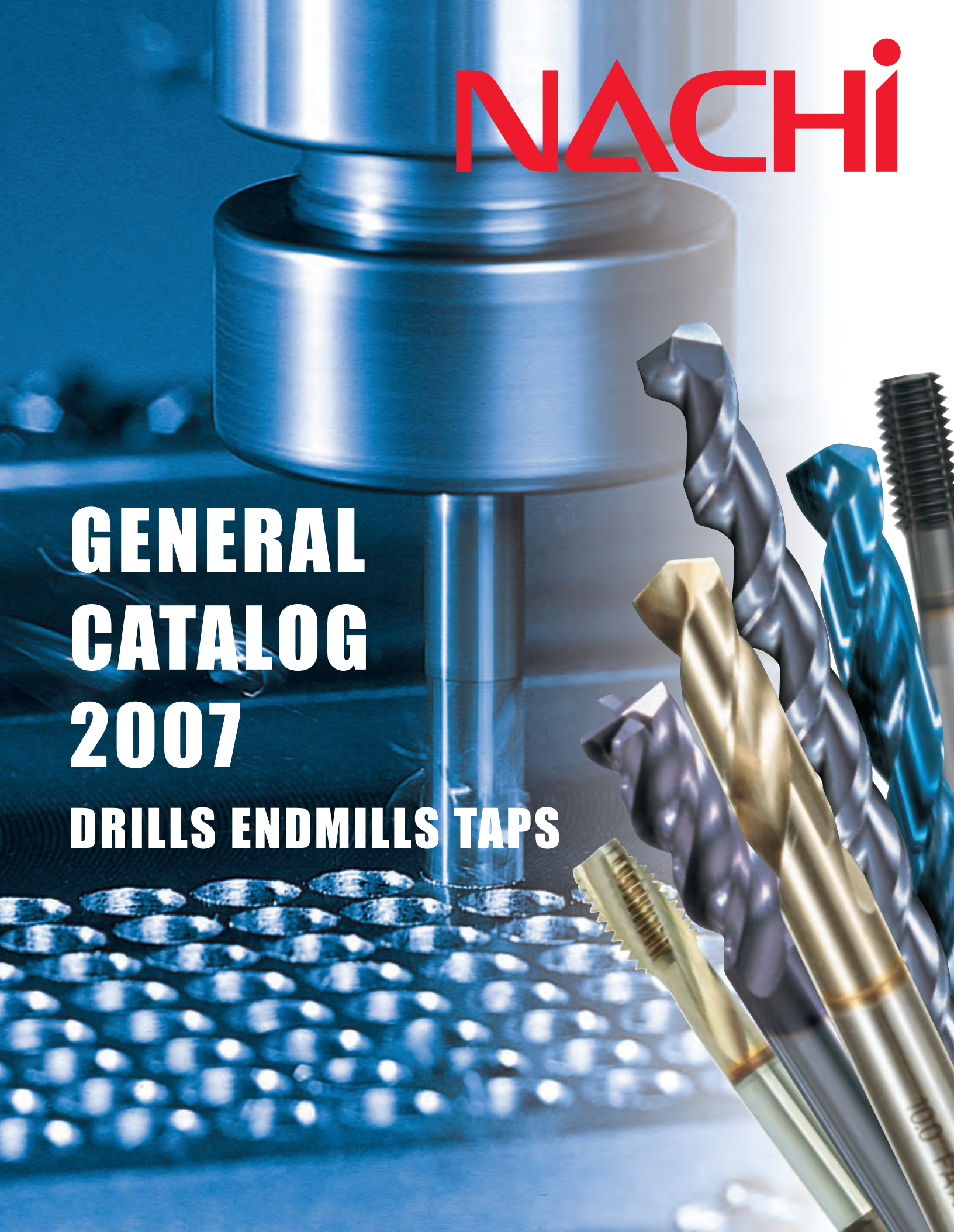
NACHI

GENERAL CATALOG 2007

DRILLS ENDMILLS TAPS



NACHI

Contributing to Progress in the World of Product Manufacture

The NACHI Difference:

NACHI-FUJIKOSHI CORP. is a pioneer of precision cutting tools in Japan and one of the leading manufacturers of tools worldwide. No manufacturer of cutting tools anywhere in the world exercises greater control over the quality of its products than NACHI. NACHI quality starts with the material itself because the High Speed Steel, premium Cobalt High Speed Steel, Powder High Speed, and Cermet we use comes from our own mills. The technology of the coating, such as Mixed Component multi-layer coating and Diamond coating (thin film diamond) has been developed specifically for our cutting tools.

Cutting tools are basic products for the machine industries. Successful performance of machine tools cannot be expected without precise cutting tools and high quality. NACHI pursues the highest quality 100% of the time. NACHI is the first Japanese cutting tool manufacturer to be awarded the prestigious honor of the Deming Award for Quality.

When You Buy From NACHI:

When you purchase cutting tools from NACHI you are using products produced by one of the largest, most innovative manufacturers of industrial equipment in the world. Established more than 75 years ago, The NACHI-FUJIKOSHI CORP. has grown into a world-class, worldwide leader in its industry. The company has approximately ten million square feet of plant area and facilities in Japan, Production plants in The U.S.A., Singapore, Brazil, Taiwan, Spain and Korea, and sales marketing subsidiaries in all major industrial nations.

NACHI-FUJIKOSHI CORP.

We have a history of Seventy five years as a world-famous integrated manufacturers with the renowned brand "NACHI". With the continuous production system, from high class special steels to finished products, our well-coordinated technics stand high in public estimation.

Head Office: Toyama Plant

Higashi - Toyama, Steel Plant

Namerikawa Plant

Singapore Plant

NACHI MACHINING TECHNOLOGY CO.

Brazil Plant

Spain Plant

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Argeutina C.P. 11230, Mexico D.F. MEXICO
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Phone: (02) 838-3620 Fax: (02) 838-3623

NACHI

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

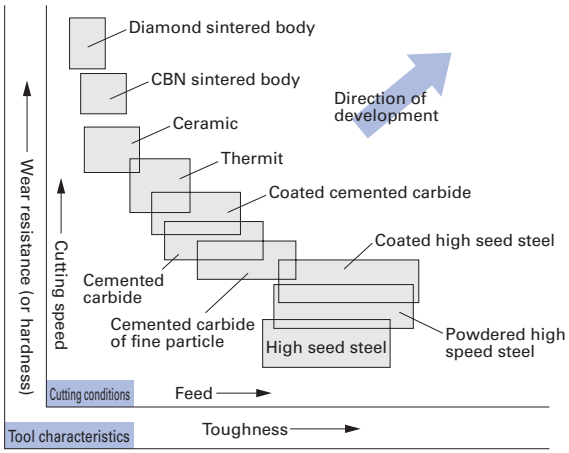
Classification	Steel type symbol			Chemical component						Application
	JIS	AISI	NACHI	C	Mo	W	Cr	V	Co	
High-speed steel	SKH10	T 15	HS55T	1.5		12	4	5	5	Basic steel type, cutting tool
	SKH51	M 2	SKH51	0.85	5	6	4	2		Drill, broach, others in general
	—	M33	HM33	0.9	9.5	1.5	4	1.2	8	Drill, gear cutting tool,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

Effects pf 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

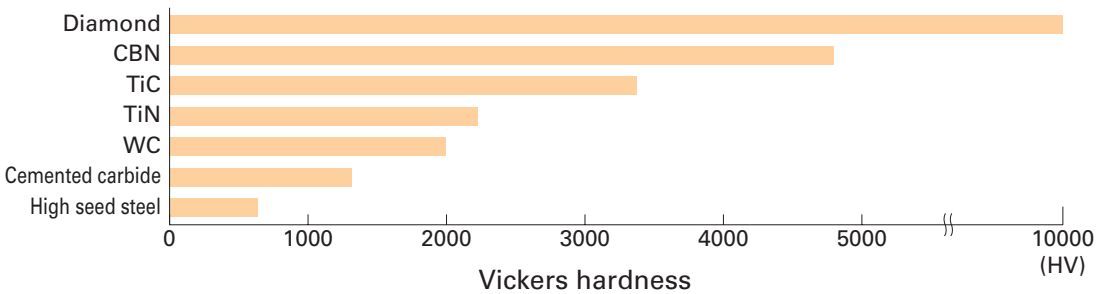
It is important that tool materials are characterized by excellent resistance to chipping or breakage. Selection is made from among various types of tool materials in conformity to the workpiece and machining method. NACHI's integrated production system covering the entire range from materials to tool 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 carbine	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-sped cutting.
Ceramic			A sintered body (porcelain). Available in two types; alumina type mainly consisting of Al2O3 and silicon type mainly consisting of Si2N4.	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.

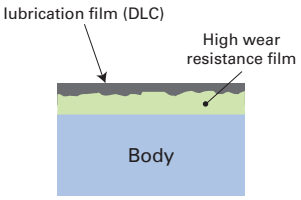
Hardness of high-hardness material



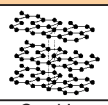
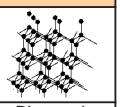
Coating Series with Excellent Characteristics

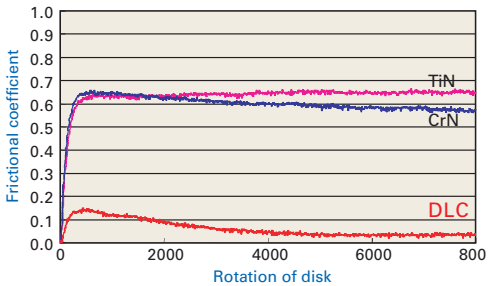
DLC Coating

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

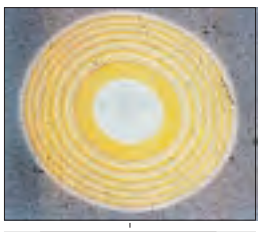
	Graphite	DLC	Diamond
Structure			
	Graphite	amorphous	Diamond
element	C	C+H	C
R/V	—	1000~8000HV	10000HV



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

Composite multi-layer coating

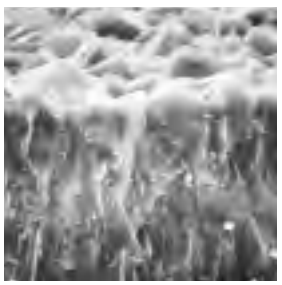
As a cutting tool coating technique, this coating technique provides improved wear resistance and ensures protection of the base materials (through the use of a composite multi-layer configuration), centering on the general-purpose TIN G-series. We have established the manufacturing conditions of various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



Composite multi-layer film (UG-Coating)

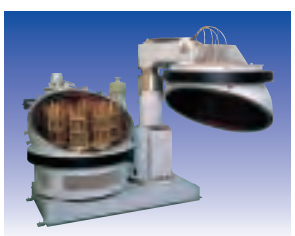
Diamond coating

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.

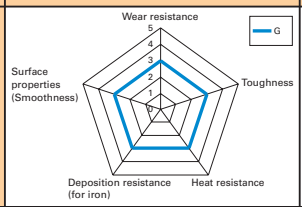
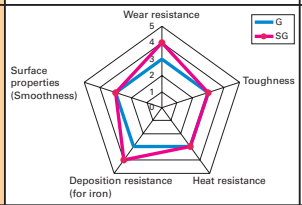
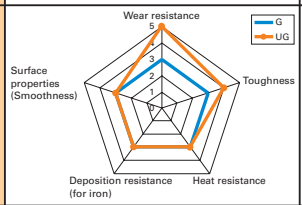
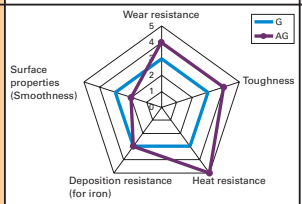
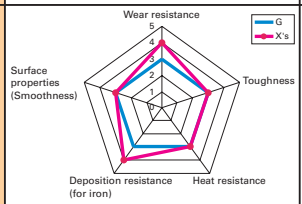
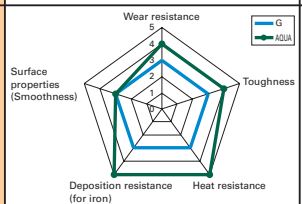
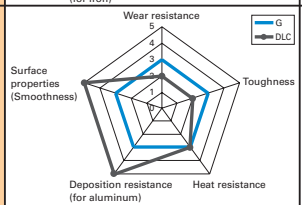
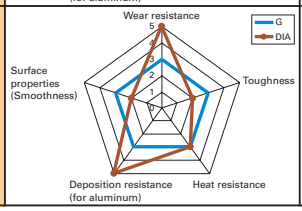

Diamond coated film

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)		- The basis for PVD coating. Coating method in common use.
SG		- Composite multi-layer film coating method characterized by improved wear resistance as compared to TiN.
UG		- Coating method characterized by adoption of a TiCN based composite multi-layer film to provide improved wear resistance.
AG		- Coating method based on the TiAlN film characterized by superb resistance to heat and wear. Commercialized for use in high-speed steel.
X's		- Coating method for cemented carbide end-milling cutters, based on the TiAlN film characterized by superb resistance to heat and wear.
AQUA		- Coating method characterized by excellent heat resistance and lubricity of the workpiece. Compatible with both dry machining and wet machining.
DLC		- 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.
DIA		- 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.

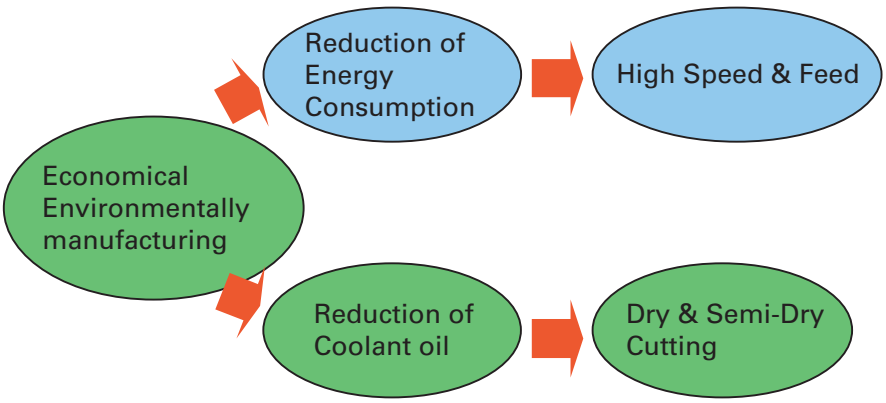
NACHI's Efficiency Theme "Eco & Eco"

Sets The New Standard for Cutting Tools

" ECO " = Economy of Cost Reduction

" ECO " = Ecologically Friendly

Achieving The Cost Efficient Environmentally Friendly Solution

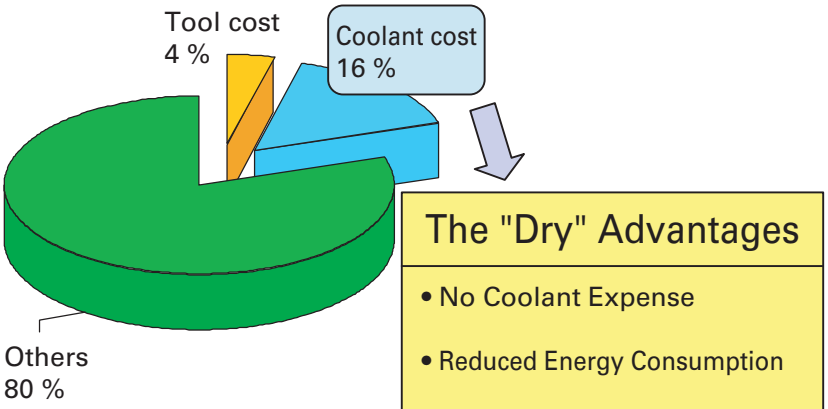


NACHI's Efficient Eco & Eco Lines
Dry & Semi-Dry Cutting

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

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

Reducing Machining Costs



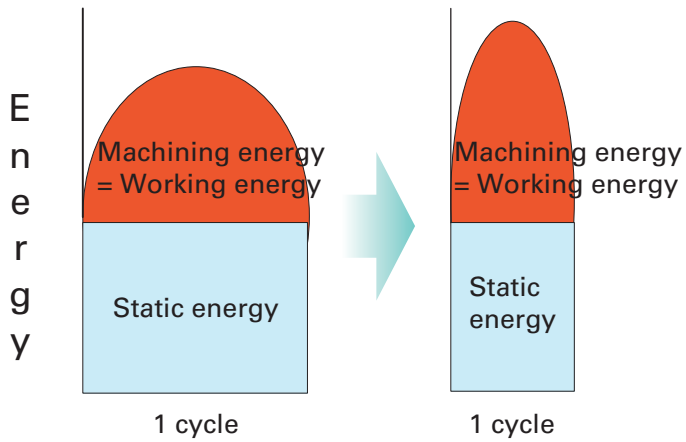
The "Dry" Advantages

- No Coolant Expense
- Reduced Energy Consumption
- Reduced Cleaning Effort

The NACHI Solution

High Speed and Feed Cutting

The Machining Energy Story



The NACHI Solution
High Speed
& Feed Cutting

Reduced Machining Time

Reduce Working and Static Energy

Less Energy = High Speed Efficient Cutting
(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	

GUIDE TO MARK (TOOL SPECIFICATION)

	Mark	Explanation
Coating	G	G (TiN) Coating
	UG	UG (TiCN multi layer) Coating
	SG	SG (TiCN multi layer) Coating
	AG	AG (TiAlN multi layer) Coating
	AQ	AQ (TiAlN multi layer) Coating
	X's	X's (TiAlN multi layer) Coating
	GS	GS (TiAlN multi layer) Coating
	DLC	DLC Coating
	DIA	Diamond Coating
Tool Materials	HSS	High Speed Steels
	HSS Co	Cobalt High Speed Steels
	FMX	Fine Melting HSS
	FAX	High Grade Powder HSS
	PREMIUM	Vanadium HSS
	HSSE-V	Vanadium HSS
	HSSE	Cobalt/Vanadium HSS
	Carbide	Tungsten Carbide

	Mark	Explanation
Flutes of Drills	HELIX N	Normal Helix Flutes
	HELIX H	High Helix Flutes
	HELIX L	Low Helix Flutes
Drill Dimension	118°	Point Angle of Drills
		Drill Length is from Center Point
		Drill Length is from Corner Point
	OIL HOLE	Oil-hole Drills
	3FLUTE	Three Flutes Drills
Lip Relief of Drills	Conical	Shape of Lip Relief is Conical
	2RAKE	Shape of Lip Relief is Two Rake
	3RAKE	Shape of Lip Relief is Three Rake
Thinning of Drills	S-type	S-type Thinning
	N-type	Notch Thinning
	X-type	X-type Thinning
	X-type	
	XH-type	XH-type Thinning
	2RAKE+X	2Rake Relief & X-type Thinning
	2RAKE+XR	2Rake Relief & XR-type Thinning
	2RAKE+3F	3 Flutes Drills & 3F-type Thinning

GUIDE TO MARK (TOOL SPECIFICATION)

	Mark	Explanation		Mark	Explanation
Tolerance of Drills Dia.	js6	Tolerance of Drills Diameter is js6	Flutes of End Mills		4 Flutes Radius End mills (Center Cut)
	h7	Tolerance of Drills Diameter is h7			2 Flutes Ball Nose End mills (Center Cut)
	h8	Tolerance of Drills Diameter is h8			4 Flutes Ball Nose End mills (Center Cut)
Flutes of End Mills	Sharp Corner	Sharp corner Type End mills			6 Flutes Ball Nose End mills (Center Cut)
		2 Flutes Square End mills (Center Cut)	Type of Taps		Cutting Taps
		3 Flutes Square End mills (Center Cut)			Forming Taps
		4 Flutes Square End mills (Center Cut)	Flutes of Taps	TAPS FLUTE ST	Straight Flutes Taps
		4 Flutes Square for X's-mill Hard (Center Cut)		TAPS FLUTE SP	Spiral Pointed Taps
		5 Flutes Square End mills (Center Cut)		TAPS FLUTE NH	Normal Helix Flutes Taps
		6 Flutes Square End mills (Center Cut)		TAPS FLUTE HH	High Helix Flutes Taps
		6 Flutes Square for X's-mill Hard & X's-mill Multi Flutes (Center Cut)		TAPS FLUTE L	Low Helix Flutes Taps
		8 Flutes Square for X's-mill Hard & X's-mill Multi Flutes (Center Cut)	Chamfer of Taps	MB CHAMFER	Chamfer Length is 2.5P to 3P
		4 Flutes Square End mills (with Center Hole)		P CHAMFER	Chamfer Length is 4P to 5P (for through hole)
		5 Flutes Square End mills (with Center Hole)		B CHAMFER	Chamfer Length is 1.5P (for blind hole)
		6 Flutes Square End mills (with Center Hole)		2.5P CHAMFER	Chamfer Length is 2.5P
		Multiple Flutes (over 8) Square End mills (with Center Hole)		3.5P CHAMFER	Chamfer Length is 3.5P
		2 Flutes Radius End mills (Center Cut)		TAPER PIPE	Cutting Taps for Taper Pipe

Drills / Visual Index

HIGH PERFORMANCE DRILLS

Drills / Visual Index

Drills / Visual Index

STRAIGHT SHANK DRILLS

List 500 STRAIGHT SHANK JOBBERS LENGTH DRILL / METRIC SIZES

Specs/Sizes Speeds/Feeds

h8 | HSS | HELIX N | 108° | 118° >0.55 | S-type >13.0 | Conical

P71
P97

List 6520 STRAIGHT SHANK COBALT DRILL TYPE Ⅰ / METRIC SIZES

h8 | HSS Co | HELIX H | 135° | X-type >1.5 | Conical

P72
P97

List 520P G STANDARD DRILLS / METRIC SIZES

h8 | G | HSS | HELIX N | 118° | X-type >3 | Conical

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STRAIGHT SHANK JOBBERS LENGTH DRILL / LETTER SIZES

List 501 General Purpose

h8 | HSS | HELIX N | 118° | Conical

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P97

List 501A General Purpose

h8 | HSS | HELIX N | 118° | Conical

P74
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List 6501 Aircraft NAS907-J

h8 | HSS Co | HELIX N | 135° | X-type

P74
P97

STRAIGHT SHANK JOBBERS LENGTH DRILLS / FRACTIONAL

List 501 General Purpose

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

P74
P97

List 501A General Purpose

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

P74
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List 6501 Aircraft NAS907-J

h8 | HSS Co | HELIX N | 135° | X-type >5/64 | Conical

P74
P97

List 501P General Purpose

h8 | G | HSS | HELIX N | 118° | S-type >1/2 | Conical

P74
P97

List 517P Parabolic

h8 | G | HSS | HELIX H | 135° | XH-type

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Drills / Visual Index

STRAIGHT SHANK JOBBERS LENGTH DRILLS / WIRE GAUGE SIZES

Specs/Sizes Speeds/Feeds

List 501 General Purpose

h8 | HSS | HELIX N | 118° | Conical

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List 501A General Purpose

h8 | HSS | HELIX N | 118° | Conical

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List 6501 Aircraft NAS907-J

h8 | HSS Co | HELIX N | 135° | X-type >#53 | Conical

P74 P97

List 501P General Purpose

h8 | G | HSS | HELIX N | 118° | Conical

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List 517P Parabolic

h8 | G | HSS | HELIX H | 135° | XH-type

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SCREW MACHINE LENGTH / FRACTIONAL SIZES

List 561 General Purpose

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

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List 561P General Purpose

h8 | G | HSS | HELIX N | 118° | Conical

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List 563 Aircraft NAS907-C

h8 | HSS | HELIX N | 135° | X-type >5/64 | Conical

P76 P97

List 6563 Aircraft NAS907-C

h8 | HSS Co | HELIX N | 135° | X-type >5/64 | Conical

P76 P97

SCREW MACHINE LENGTH / WIRE GAUGE SIZES

List 561 General Purpose

h8 | HSS | HELIX N | 118° | Conical

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List 561P General Purpose

h8 | G | HSS | HELIX N | 118° | Conical

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List 563 Aircraft NAS907-C

h8 | HSS | HELIX N | 135° | X-type >#53 | Conical

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Drills / Visual Index

Specs/Sizes
Speeds/Feeds

SCREW MACHINE LENGTH / WIRE GAUGE SIZES

List 6563 Aircraft NAS907-C

h8 | HSS Co | HELIX N | 135° | X-type >#53 | Conical

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P97

SCREW MACHINE LENGTH / LETTER SIZES

List 561 General Purpose

h8 | HSS | HELIX N | 118° | Conical

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P97

List 563 Aircraft NAS907-C

h8 | HSS | HELIX N | 135° | X-type

P76
P97

List 6563 Aircraft NAS907-C

h8 | HSS Co | HELIX N | 135° | X-type

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STRAIGHT SHANK TAPER LENGTH / FRACTIONAL SIZES

List 531 General Purpose

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

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List 6531 General Purpose

h8 | HSS Co | HELIX N | 135° | X-type

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List 545P Parabolic Style

h8 | G | HSS | HELIX H | 135° | XH-type

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STRAIGHT SHANK DRILL-EXTRA LENGTH

List 551

h8 | HSS | HELIX N | 118° | S-type

P80
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List 6551 Parabolic Tang Drive

h8 | HSS Co | HELIX H | 118° | XH-type

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List 581 OIL HOLE DRILLS / STRAIGHT SHANK

h8 | HSS Co | HELIX N | 118° | S-type | OIL HOLE

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TAPER SHANK DRILLS

List 601 TAPER SHANK DRILLS / REGULAR SHANKS / FRACTIONAL

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

Specs/Sizes Speeds/Feeds

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List 651 EXTRA LENGTH DRILLS / TAPER SHANK DRILLS

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

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P98

List 683 OIL HOLE DRILLS / TAPER SHANK

h8 | HSS Co | HELIX N | 118° | N-type | OIL HOLE

P84
P100

SPECIAL

List 575 SILVER AND DEMING DRILLS

h8 | HSS | HELIX N | 118° | S-type >23/32 | Conical

Specs/Sizes Speeds/Feeds

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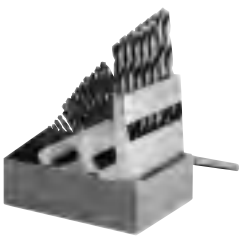
P100

List 599 DRILL SETS / JOBBERS LENGTH



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Endmills / Visual Index

HIGH PERFORMANCE END MILLS

Specs/Sizes Speeds/Feeds

List 9382 GS-MILL TWO FLUTE
GS Carbide HELIX N Sharp Corner

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List 9384 GS-MILL FOUR FLUTE
GS Carbide HELIX N Sharp Corner

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P160

List 9386 GS-MILL BALL
GS Carbide HELIX N

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List 9408 MOLD MEISTER BALL
X's Carbide HELIX N

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List 9398 GS-MILL HARD
GS Carbide HELIX H

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List 9422 GS-MILL HARD BALL
GS Carbide HELIX N

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List 9322 X'S-MILL GEO / METRIC SIZES
X's Carbide HELIX H

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List 9321 X'S-MILL GEO / INCH SIZES
X's Carbide HELIX H

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List 9324 X'S-MILL GEO RADIUS
X's Carbide HELIX H

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P164

List 9338 X'S-MILL GEO SLOT
X's Carbide HELIX H

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List 9366 X'S-MILL GEO KV TWO FLUTES
X's Carbide HELIX H Sharp Corner

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List 9368 X'S-MILL GEO KV FOUR FLUTES
X's Carbide HELIX N Sharp Corner

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Endmills / Visual Index

Endmills / Visual Index

END MILLS

GENAC END MILLS "SG" COATED CARBIDE

Specs/Sizes Speeds/Feeds

Endmills / Visual Index

GENAC END MILLS "SG" COATED CARBIDE LONG SERIES

Specs/Sizes Speeds/Feeds

ROUGHING AND FINISHING (HEAVY DUTY) END MILLS

ROUGHING (HOG) END MILLS

TWO FLUTE END MILLS / REGULAR-SINGLE END

Endmills / Visual Index

TWO FLUTE END MILLS / REGULAR-SINGLE END

Specs/Sizes Speeds/Feeds

List 6231X

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List 6233 TWO FLUTE END MILLS / LONG, SINGLE END

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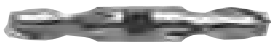
TWO FLUTE DOUBLE END MILLS

List 261



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METRIC SIZES, REGULAR, SINGLE END

List 6230

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List 6210

P155 P183

MULTI FLUTE END MILLS / REGULAR SINGLE END CENTER CUTTING

List 211

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List 6211M

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List 6211X

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MULTI FLUTE END MILLS / LONG SINGLE END, CENTER CUTTING

List 213

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List 6213

P157 P183

List 215 FOUR FLUTE END MILLS / EXTRA LONG SINGLE END, CENTER CUTTING

Specs/Sizes
Speeds/Feeds

HSS Co | HELIX N

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FOUR FLUTE, DOUBLE END END MILLS

List 271

HSS | HELIX N

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Taps / Visual Index

HIGH PERFORMANCE TAPS

VIPER T-SERIES

List 7977 VIPER T SERIES-SPIRAL POINTED / FOR STAINLESS STEEL

HSSE · TAPS FLUTE SP · P CHAMFER

Specs/Sizes Speeds/Feeds
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VIPER T SERIES METRIC TAPS / FOR STAINLESS STEEL

List 7982 Spiral Fluted

HSSE · TAPS FLUTE NH · MB CHAMFER

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List 7972 Spiral Pointed

HSSE · TAPS FLUTE SP · P CHAMFER

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VIPER TAFLET

VIPER TAFLET FOR STEELS

Specs/Sizes Speeds/Feeds

List 995 Machine Screw Sizes

HSSE-V · P CHAMFER · B CHAMFER

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List 995 Fractional Sizes

HSSE-V · P CHAMFER · B CHAMFER

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List 996 VIPER TAFLET METRIC TAPS FOR STEELS

HSSE-V · P CHAMFER · B CHAMFER

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VTP TAPS

VTP SPIRAL FLUTED

Specs/Sizes Speeds/Feeds

List 983 Machine Screw Sizes

HSSE-V · TAPS FLUTE NH · MB CHAMFER

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List 981 Fractional Sizes

HSSE-V · TAPS FLUTE NH · MB CHAMFER

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Taps / Visual Index

VTP SPIRAL POINTED

Specs/Sizes Speeds/Feeds

List 973 Machine Screw Sizes

HSSE-V · TAPS FLUTE SP · P CHAMFER

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List 971 Fractional Sizes

HSSE-V · TAPS FLUTE SP · P CHAMFER

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VTP ROLL FORM TAPS

List 993 Machine Screw Sizes

PREMIUM · P CHAMFER · B CHAMFER

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List 991 Fractional Sizes

PREMIUM · P CHAMFER · B CHAMFER

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List 980 VTP METRIC TAPS SPIRAL FLUTED

HSSE-V · TAPS FLUTE NH · MB CHAMFER

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List 982 VTP METRIC TAPS SPIRAL POINTED

HSSE-V · TAPS FLUTE SP · P CHAMFER

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STANDARD TAPS

STANDARD HAND TAPS

Specs/Sizes Speeds/Feeds

List 911 Fractional Sizes

HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

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List 911P Fractional Sizes

G · HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

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List 913 Machine Screw Size

HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

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List 913P Machine Screw Sizes

G · HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

P233 P242

Taps / Visual Index

STANDARD TAPS SPIRAL POINTED / FRACTIONAL SIZES

Specs/Sizes Speeds/Feeds

STANDARD TAPS SPIRAL POINTED / MACHINE SCREW SIZES

STANDARD TAPS / SPIRAL FLUTED

STANDARD TAPS / FAST SPIRAL FLUTED

Taps / Visual Index

STANDARD TAPS / .005 OVERSIZED

Specs/Sizes Speeds/Feeds

List 915 Fractional Sizes & Machine Screw Sizes

HSS · TAPS FLUTE ST · P CHAMFER

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List 925 Fractional & Machine Screw Sizes

HSS · TAPS FLUTE SP · P CHAMFER

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TAPER PIPE TAPS / STRAIGHT FLUTED

List 941 (NPT)

HSS · TAPS FLUTE ST · TAPER PIPE

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List 941P (NPT)

G · HSS · TAPS FLUTE ST · TAPER PIPE

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TAPER PIPE TAPS / STRAIGHT FLUTED

List 941D (NPTF)

HSS · TAPS FLUTE ST · TAPER PIPE

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List 943 TAPER PIPE TAPS / INTERRUPTED

HSS · TAPS FLUTE ST · TAPER PIPE

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TAPER PIPE TAPS / SPIRAL FLUTED

List 947 (NPT)

PREMIUM · TAPS FLUTE L · TAPER PIPE

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List 947D (NPTF)

PREMIUM · TAPS FLUTE L · TAPER PIPE

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STRAIGHT PIPE TAPS / STRAIGHT FLUTED

List 945 (NPS)

HSS · TAPS FLUTE ST · 2.5P CHAMFER

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List 945D (NPSF)

HSS · TAPS FLUTE ST · 2.5P CHAMFER

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Taps / Visual Index

List 910 STANDARD METRIC HAND TAPS

HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

List 920 STANDARD METRIC TAPS / SPIRAL POINTED

HSS · TAPS FLUTE SP · P CHAMFER

DRILLS

Features

- Utilizes a high accuracy shape of lip relief (3 rake, 2 rake + x-thinning)
- Made from premium powder metal with Composite Multi-Layer SG Coating (TiCN)
- End mill style shanks for highly precise and accurate drilling

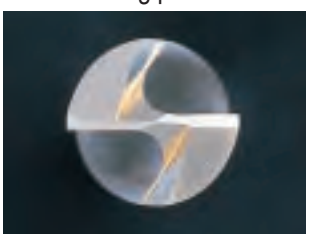
Work Materials

Structural Steels, Carbon Steels, Alloy Steels, Stainless Steels, Cast Irons, Aluminum Alloys

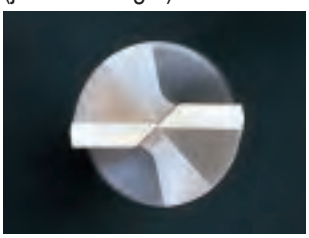
Performance

- Streamline the process and reduce machining time dramatically.
- Eliminate the center drill operation with our SG-ESS drills (Stub length)
- Stable positioning within 0.0006" (15µm)
- Faster feed & speed rates than regular HSS-Co drills
- Better cost performance than carbide drills

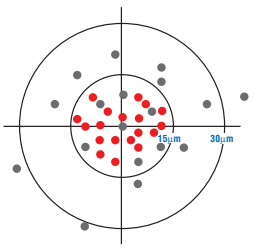
SG-ESS Drills (stub length)
Self centering point:



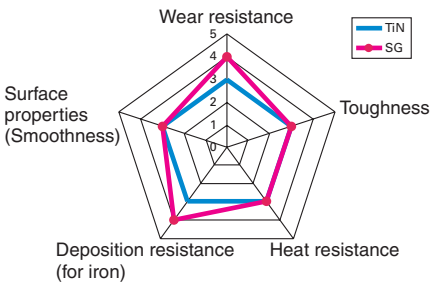
SG-ES Drill
(jobber's length):



Positioning

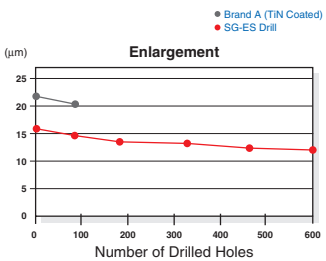


Characteristics of SG coating



Composite multi-layer film coating method characterized by improved wear resistance as compared to TiN.

Performance and cutting data of SG drill series



Cutting condition
Drill Dia : 9.0mm.
Hole Depth : 32mm
Cutting Speed : 20m/min. (65.6 SFM)
Feed : 142mm/min (5.6 IPM)
Work piece Material : Alloy steel (300HB)
Machine : Vertical machining center

Stocked Size

Drill Name	List No.	Page
SG-ESS Drill/Metric Sizes	7572P	46
SG-ESS Drill/Fractional Sizes	7573P	47
SG-ESS Drill/Wire & Letter Sizes	7573P	47
SG-ES Drill/Metric Sizes	7570P	48
SG-ES Drill/Fractional Sizes	7571P	49
SG-ES Drill/Wire & Letter Sizes	7571P	49
SG-OH Drill/Fractional Sizes	7591P	50
SG-OH Drill/Metric Sizes	7596P	50

Features

- Utilizes a high accuracy shape of lip relief (3 rake thinning)
- Made from New HSS (FM-HSS: Fine melting HSS) with Composite Multi-Layer AG Coating (TiAlN)

	Conventional HSS	Powder Metal HSS	FM-HSS
Micro Structure			
Toughness	○	○	●
Heat Resistance	○	●	●
Wear Resistance	○	●	●

○ GOOD ● EXCELLENT

- End mill style shanks for highly precise and accurate drilling

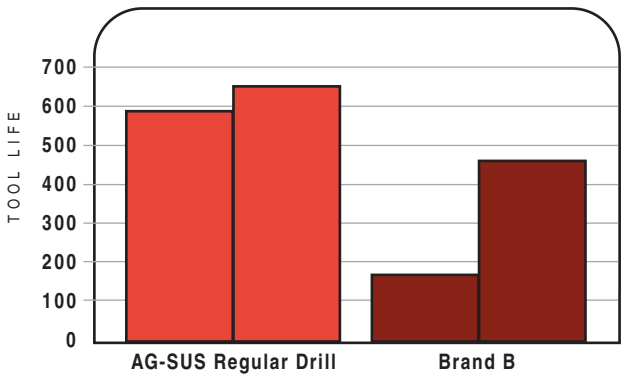
Work Materials

Austenitic Stainless Steels, Martensitic Stainless Steels, Feritic Stainless Steels, Structural Steels, Low Carbon Steels

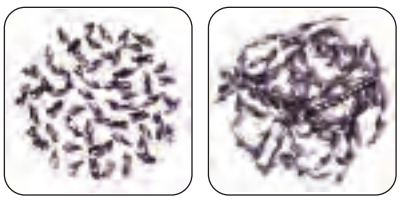
Performance

CUTTING CONDITION

Drill Dia.: 6mm
Material: S42020 (SUS420J2)
Hole Depth: 20mm through
Speed: 78 SFM (1.275 rpm)
Feed: 190mm/min (7.48 IPM)
Pecking: Non
Coolant: Emulsion

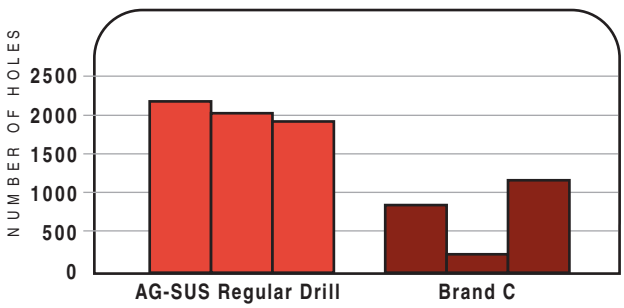


CHIP SHAPE-
NACHI AG-SUS DRILL VS. COMPETITOR FOR STAINLESS STEEL



CUTTING CONDITION

Drill Dia.: 1mm (0.039")
Material: S304 (175 HB)
Hole Depth: 5mm blind
Speed: 49 SFM (4.775 rpm)
Feed: 100mm/min (3.94 IPM)
Pecking: 1mm
Coolant: Emulsion



Stocked Size

Drill Name	List No.	Page
AG-SUS Drill Short/Metric Sizes	6596P	53
AG-SUS Drill Regular/Metric Sizes	6594P	54
AG-SUS Drill Regular/Fractional Sizes	6595P	55

TECHNICAL INFORMATION / UG POWER DRILLS

USA & JAPAN STOCK ITEM*

Features

New style Parabolic Drills

The Nachi UG-Power drill is designed for deep hole drilling. Flute geometry allows for easy chip removal and enable non pecking drilling up to 7X diameter.

Work Materials

APPLICABLE MATERIAL
- Carbon Steel
- Alloy Steel
- Tool Steel
- Die Steel
- Cast Iron
- Stabilized Steel (under 35HRC)

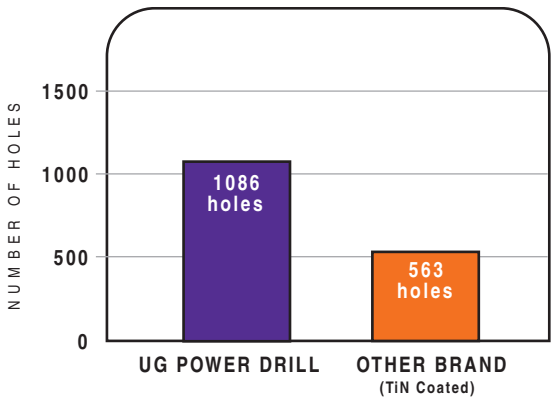
UNSUITABLE MATERIAL
- Soft Steel
- Aluminum
- Copper Alloy
- Hardened Steel (over 40HRC)

Performance

TOOL LIFE–
NACHI UG DRILL VS. OTHER PARABOLIC BRAND DRILLS

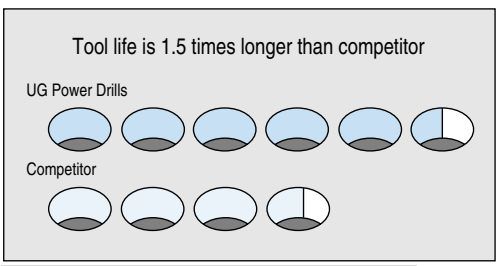
CONDITION

Drill Dia. : 1/4"
Material : AISI 1049
Hole Depth : 1-3/4" (7D)
Speed : 105'/min (1800 RPM)
Feed : 12.4"/min (.007"/rev)
Without pecking



UG Power Drills

Competitor



Cutting condition
Drill : 6mm (0.236in)
Speed : 33m/min (108 SFM)
Feed : 0.18mm/rev (12.4 IPM)
Depth : 48mm (1.9in) blind hole
Material : C45 (180HB) / S45C / 1045
Fluid : Emulsion

Stocked Size	Drill Name	List No.	Page
	UG-POWER Drill/Fractional Sizes	6517U	51
*	**UG-POWER Drill/Metric Sizes**	6528P	52

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

TECHNICAL INFORMATION / AG POWER LONG DRILLS

USA & JAPAN STOCK ITEM*

Features

New style Parabolic Drills

- Flute geometry and coating enables non pecking deep hole drilling up to 20XD.
- AG Coating (TiAlN) and HSS-Co material increases tool life.

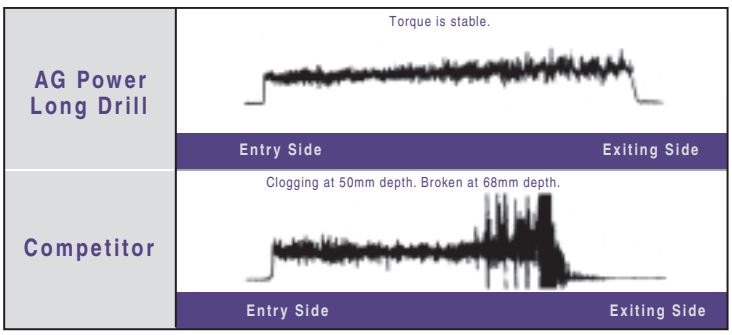
Work Materials

Carbon Steels, Alloy Steels, Mold Steels,
Hardened Steels (under 40HRC), Cast Irons

Performance

AG POWER LONG DRILL VS. STANDARD DRILL

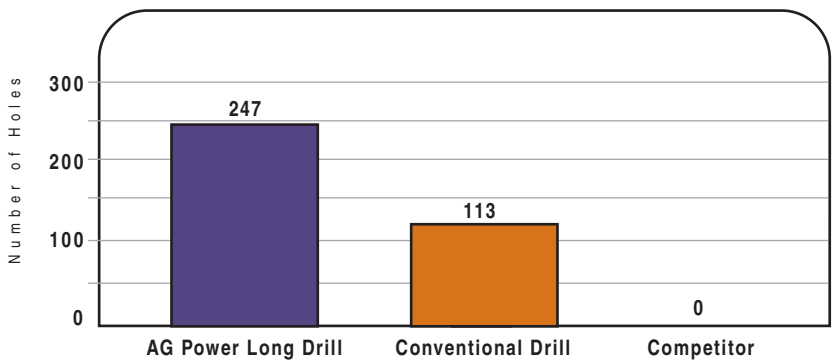
Stable torque



CUTTING CONDITION

Drill : 6mm (0.236in)
Material : 1050 (217HB) S50C
Hole Depth : 102mm (4.01in : 17D) through
Speed : 1590rpm (98 SFM)
Feed : 0.1mm/rev (6.26 IPM)
non-pecking drilling
Fluid : Emulsion

Long tool life

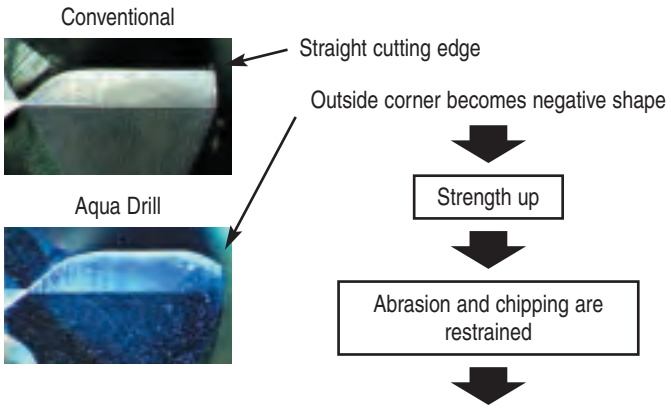


Stocked Size Drill Name	List No.	Page
AG Power Long Drill/Metric Sizes	6540P	56
AG Power Long Drill/Fractional Sizes	6541P	56

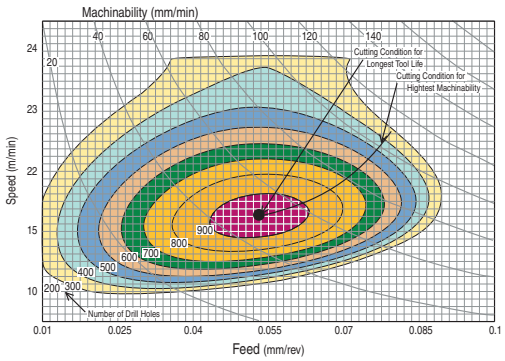
* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

Features

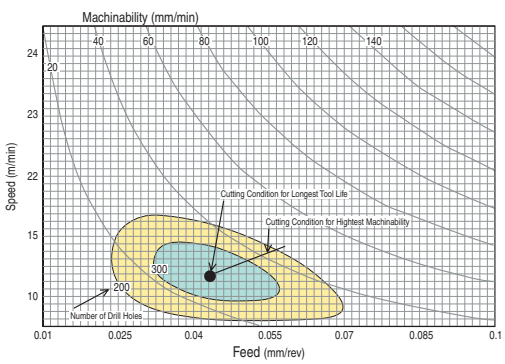
- Aqua coating has a self-lubricant and offers superior heat resistance. (Composite and multi-layered TiAlN + original lubricant film)
- Tough micro grain carbide enables a longer tool life.
- End mill type shank (List 9550, 9551, 9552, 9546, 9548, 9544)
- Cylindrical type shank (List 9556, 9569)
- Negative corner edge design prevents chipping.



- Wide range of Cutting condition



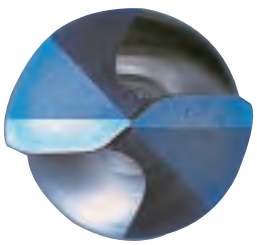
AQUA Drills Hard



Competitor

AQUA Drills 3flutes

AQUA Drills Stub



	Stocked Size / Drill Name	List No.	Page
*	**AQUA Drill Stub/Metric Sizes**	9550	58
	AQUA Drill Stub/Fractional Sizes	9551	59
	AQUA Drill Regular/Metric Sizes	9552	60
	AQUA Drill with Mist Hole 3D	9558	61
	AQUA Drill with Mist Hole 5D	9554	62
	AQUA Drill with Mist Hole 7D/Metric Sizes	9556	63
	AQUA Drill with Mist Hole 7D/Fractional Sizes	9569	63
*	**AQUA Drill 3 Flute/Metric Sizes**	9546	64
*	**AQUA Drill Hard/Metric Sizes**	9548	65
*	**AQUA Drill Micro/Metric Sizes**	9544	66

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

Work Materials

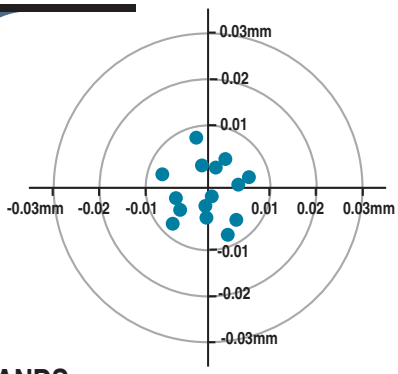
- Structural Steel
- Carbon Steel
- Alloy Steel
- Pre-Hardened Steel
- Cast Iron
- Stainless Steel (*AQUA Micro Drill)
- Die Steel
- Annealed Steel (30 - 40HRC)
- Hardened Steel (40 - 50HRC)

* AQUA Drill Hard.
- Hardened Steel (50 - 70HRC)

Performance

Excellent for accurate drilling

- Has accurate point geometry for high rigidity
- Superior positioning within 0.01mm (0.0004") without center drill

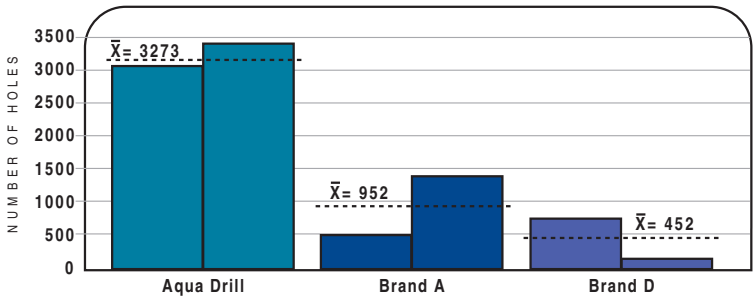


Drill Dia. : 1/4"
Material : S50C (1050),185 HB
Hole Depth : 18mm through
Speed : 108m/min (5000 RPM)
Feed : 0.16mm/rev (800mm/min)
Coolant : Water base coolant

HIGH SPEED DRY DRILLING– THE NACHI AQUA DRILL VS. OTHER BRANDS

CONDITION

Drill : 6mm (0.2362")
Material : Alloy steel
(Hardness : 310 HB)
Hole Depth : 18mm blind
Speed : 60m/min (196 SFM)
Revolution : 3183 RPM
Feed : 477mm/min (18.7 IPM)
Dry (Air blow)



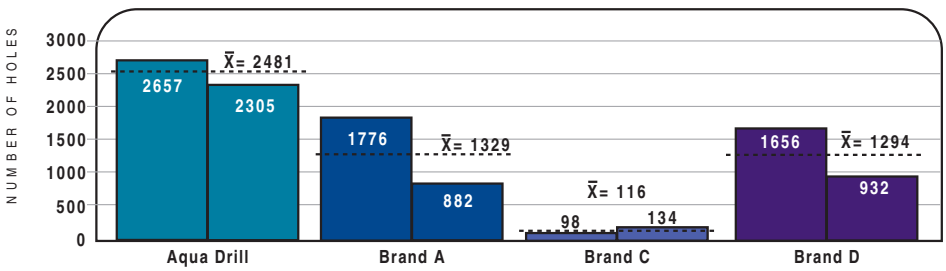
CHIP SHAPE

The Aqua Drill produces chips which will dissipate heat quickly.

HIGH SPEED WET DRILLING–THE NACHI AQUA DRILL VS. OTHER BRANDS

CONDITION

Drill : 6mm (0.2362")
Material : Alloy steel
(Hardness : 310 HB)
Hole Depth : 21mm through
Speed : 100m/min (328 SFM)
Revolution : 5305 RPM
Feed : 1061mm/min (41.7 IPM)
Water Soluble



Roundness is under 3μm in pre-hardened steels

Drilling condition

Drill : 10mm
Speed : 80m/min (2,550min^{-1})
Feed : 0.27mm/rev (680mm/min)
Hole Depth : 30mm (Blind)
Material : NAK80 (40HRC) / Die Steel
Coolant : Emulsion

AQUA Drills 3flutes

Roundness 2.8μm

Conventional

Roundness 17.2μm

TECHNICAL INFORMATION / MQL POWER LONG DRILL

Solid Carbide Long Drill with OH for MQL (Custom-made)

Features

- Rigid Flute design for deep hole drilling.
- Best oil hole design for MQL.
- Specially developed lubricant coating has a high heat resistance to prevent premature tool failure.
- Special carbide material.

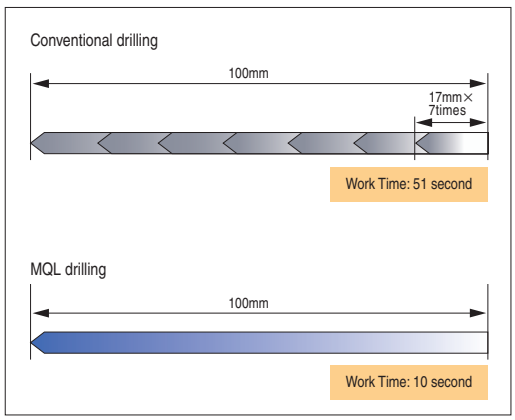
Up to 30×D

Work Materials

Crankshaft oil hole

Performance

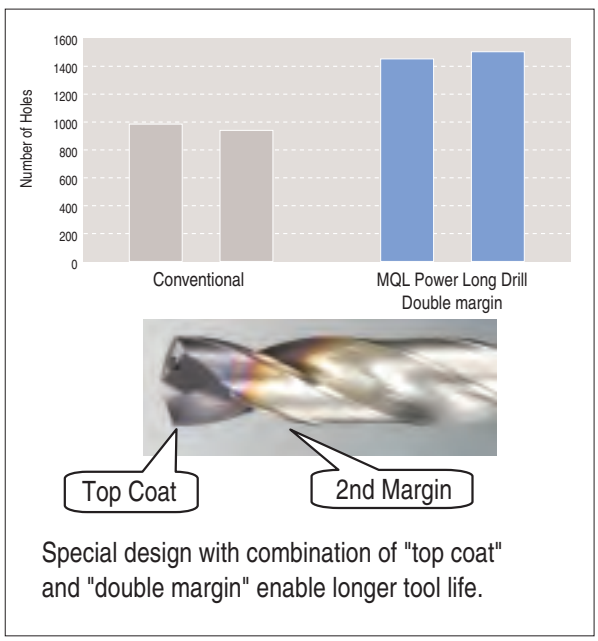
Non-step drilling, efficiency 5 times



Drilling condition
HSS Long drill : ø5mm (0.197in)
Cutting Speed : 20m/min (65.6 SFM)
Feed : 150mm/min (5.91 IPM)

Drilling condition
MQL Power Long Drill : ø5mm(0.197in)
Cutting Speed : 80m/min(262 SFM)
Feed : 750mm/min(29.5 IPM)

Comparison of tool life



Special design with combination of "top coat" and "double margin" enable longer tool life.

Drilling condition
Tool : ø5×130×180(0.197in×5.118in×7.087in)
Cutting Speed : 80m/min(262 SFM)(5093min^{-1})
Feed : 764mm/min(30.1 IPM)
Hole Depth : 100mm(3.94in)(blind)
Work Material : 1050(S50C),180HB
Cutting Fluid : MQL

What's MQL

MQL = Minimum Quantity Lubrication
= Mist Machining = Semi Dry Machining

Use a very small quantity of oil of 1~3cc per one hour, make oil mist of 1~2μm and machining while jetting in cutting edge.

Features

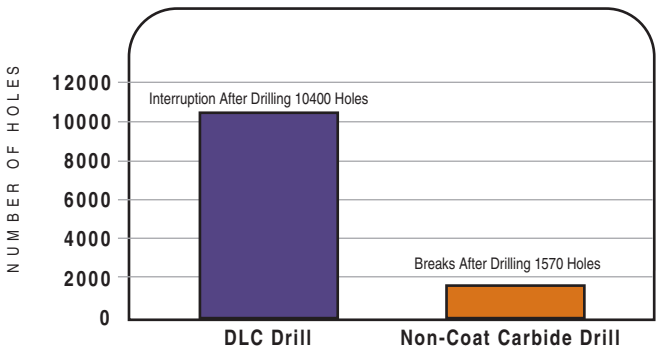
- Utilizes high accuracy shape of lip relief (2 rake thinning)
- Utilizes flute geometry resulting in excellent chip control and dry milling with no edge build-up
- End mill style shanks for highly precise and accurate drilling

Work Materials

Aluminums, Aluminum alloys, Aluminum Alloy Casting, Aluminum Alloy Die-casting, Copper alloys

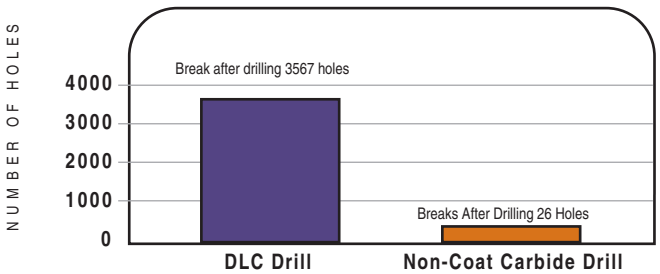
Performance

WET DRILLING BY DLC DRILL



Small wear after drilling 10400 holes

DRY DRILLING BY DLC DRILL



CONDITION

Drill: 5.5mm (0.2165")
Material: AlMg2.5 (A5052)
Hole Depth: 27.5mm (1.06") blind
Speed: 100m/min (328 SFM)
Feed: 0.08mm/rev (18.26 IPM)
Coolant: Emulsion

CONDITION

Drill: 5.5mm (0.2165")
Material: ADC12
Hole Depth: 16.5mm (0.65") blind
Speed: 100m/min (328 SFM)
Feed: 0.08mm/rev (18.26 IPM)
Coolant: Dry

Stocked Size

Drill Name	List No.	Page
DLC HSS Drill/Metric Sizes	544	68
DLC Micro Drill/Metric Sizes	9524	69
DLC Drill Regular/Metric Sizes	9520	70

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

Drills / Selection Chart

HIGH PERFORMANCE DRILLS

Drill Name	Material	Coating		Stock Size	Stock USA ● Japan○	LIST No / Page Size	LIST No / Page Cutting Condition	
SG-ESS Drills	PM-HSS	**SG**	Metric	1.0 to 20.0	●	***7572P*** p.46	p.88	
			Fractional	3/32 to 3/4	●	***7573P*** p.47	p.88	
			Letter Wire	B to Z #1 to #45	●	***7573P*** p.47	p.88	
SG-ES Drills			Metric	2.0 to 20.0	●	***7570P*** p.48	p.88	
			Fractional	3/32 to 3/4	●	***7571P*** p.49	p.88	
			Letter Wire	B to Z #1 to #45	●	***7571P*** p.49	p.88	
SG-OH Drills			Metric	5.0 to 20.0	●	***7596P*** p.50	p.89	
			Fractional	15/64 to 3/4	●	***7591P*** p.50	p.89	
UG-POWER Drills	HSS-Co	**UG**	Fractional	3/64 to 1/2	●	***6517U*** p.51	p.89	
			Metric	1.0 to 3.0	●	***6528P*** p.52	p.89	
				3.1 to 13.0	○			
AG-SUS Drills Short	FMX	**AG**	Metric	1.0 to 20.0	●	***6596P*** p.53	p.90	
AG-SUS Drills Regular			Fractional	3/32 to 3/4	●	***6595P*** p.55	p.90	
			Metric	1.0 to 20.0	●	***6594P*** p.54	p.90	
AG-Power Long Drills	HSS-Co		Fractional	1/8 to 23/64	●	***6541P*** p.56	p.90	
			Metric	1.0 to 13.0	●○ Mixed	***6540P*** p.56	p.90	
AQUA Drills Stub	Carbide	**AQUA**	Metric	3.0 to 20.0	○	***9550*** p.58	p.91	
			Fractional	1/8 to 3/4	●	***9551*** p.59	p.91	
AQUA Drills Regular			Metric	2.0 to 2.95	○	***9552*** p.60	p.92	
				3.0 to 20.0	●			
AQUA Drills with Mist Hole 3D			Metric	4.5 to 16.0	○	***9558*** p.61	p.94	
AQUA Drills with Mist Hole 5D			Metric	4.5 to 16.0	●○ Mixed	***9554*** p.62	p.94	
AQUA Drills with Mist Hole 7D			Metric	5.0 to 16.0	●	***9556*** p.63	p.95	
			Fractional	3/16 to 5/8	●	***9569*** p.63	p.95	
AQUA Drills 3Flute			Metric	3.0 to 12.0	○	***9546*** p.64	p.92	
AQUA Drills Hard			Metric	2.0 to 12.0	○	***9548*** p.65	p.93	
AQUA Micro Drills			Metric	0.20 to 1.99	○	***9544*** p.66	p.93	
DIAMOND COATED Drills		**DIAMOND**	Fractional	1/16 to 1/2	●	***9501D*** p.67	p.95	

Continue to next page.

●:Great ○:Good △:OK

Drilling Depth *1				Workpiece Material																
				Carbon Steel		Alloy Steel	Die Steel	Hardened Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron		Aluminum			Copper Alloys
								HRc												
≦3D	≦5D	≦7D	>7D	Low Carbon 1010,1018	High Carbon 1045,1065	4140,4330	D2	up to 35	35 to 45	45 to 65	Austenitic 300 Series	Martensitic 400 Series			Soft < 200HB	Hard > 200HB	6061 7075	Casting Si ≦ 12%	High Si Si > 13%	
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*Some sizes does not meet this preference. Please make sure of flute length of each sizes before use.

Drills / Selection Chart

High performance drills (Continued)

Drill Name	Material	Coating		Stock Size	Stock USA ● Japan ○	LIST No Page Size	LIST No Page Cutting Condition	
DLC HSS Drills	HSS	**DLC**	Metric	1.0 to 13.0	○	***544***	p.68	p.96
DLC Micro Drills	Carbide		Metric	0.5 to 1.9	○	***9524***	p.69	p.96
DLC Drills Regular			Metric	2.0 to 12.0	○	***9520***	p.70	p.96

STRAIGHT SHANK DRILLS

Drill Name		Material	Coating		Stock Size	Stock USA ● Japan ○	LIST No Page Size	LIST No Page Cutting Condition	
Jobbers Length	**Standard**	HSS	Black Oxide	Metric	0.2 to 17.5	●	***500***	p.71	p.97
				Fractional	3/64 to 11/16	●	***501***	p.74	p.97
				Wire	#1 to #60	●	***501***	p.74	p.97
				Letter	A to Z	●	***501***	p.74	p.97
			Bright	Fractional	1/64 to 11/16	●	***501A***	p.74	p.97
				Wire	#1 to #80	●	***501A***	p.74	p.97
				Letter	A to Z	●	***501A***	p.74	p.97
			TiN	Fractional	1/16 to 1/2	●	***501P***	p.74	p.97
				Wire	#1 to #52	●	***501P***	p.74	p.97
				Metric	0.5 to 13.0	○	***520P***	p.73	p.97
	High Helix	HSS-Co	Black Oxide	Metric	0.5 to 13.0	○	***6520***	p.72	p.97
	Aircraft NAS 907-B	HSS-Co	Black Oxide	Fractional	1/64 to 1/2	●	***6501***	p.74	p.97
				Wire	#1 to #80	●	***6501***	p.74	p.97
				Letter	A to Z	●	***6501***	p.74	p.97
	Parabolic	HSS	TiN	Fractional	1/16 to 1/2	●	***517P***	p.74	p.98
				Wire	#1 to #52	●	***517P***	p.74	p.98

●:Great ○:Good △:OK

Drilling Depth *1				Workpiece Material															
≦3D	≦5D	≦7D	>7D	Carbon Steel		Alloy Steel	Die Steel	Hardened Steel HRc			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron		Aluminum			Copper Alloys
				Low Carbon 1010,1018	High Carbon 1045,1065	4140,4330	D2	up to 35	35 to 45	45 to 65	Austenitic 300 Series	Martensitic 400 Series			Soft < 200HB	Hard > 200HB	6061 7075	Casting Si ≦ 12%	High Si Si > 13%	
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●:Great ○:Good △:OK

Drilling Depth *1				Workpiece Material															
≦3D	≦5D	≦7D	>7D	Carbon Steel		Alloy Steel	Die Steel	Hardened Steel HRc			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron		Aluminum			Copper Alloys
				Low Carbon 1010,1018	High Carbon 1045,1065	4140,4330	D2	up to 35	35 to 45	45 to 65	Austenitic 300 Series	Martensitic 400 Series			Soft < 200HB	Hard > 200HB	6061 7075	Casting Si ≦ 12%	High Si Si > 13%	
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*Some sizes does not meet this preference. Please make sure of flute length of each sizes before use.

Drills / Selection Chart

STRAIGHT SHANK DRILLS

Drill Name		Material	Coating		Stock Size	Stock USA ● Japan ○	LIST No / Page Size	LIST No / Page Cutting Condition	
Screw Machine Length	**Standard**	HSS	Black Oxide	Fractional	3/64 to 2	●	***561*** p.76	p.97	
				Wire	#1 to #60	●	***561*** p.76	p.97	
				Letter	A to Z	●	***561*** p.76	p.97	
			TiN	Fractional	1/16 to 1/2	●	***561P*** p.76	p.97	
				Wire	#1 to #52	●	***561P*** p.76	p.97	
	Aircraft NAS 907-B		Black Oxide	Fractional	3/64 to 1/2	●	***563*** p.76	p.97	
				Wire	#1 to #52	●	***563*** p.76	p.97	
				Letter	A to Z	●	***563*** p.76	p.97	
		HSS-Co		Fractional	3/64 to 1/2	●	***6563*** p.76	p.97	
				Wire	#1 to #52	●	***6563*** p.76	p.97	
				Letter	A to Z	●	***6563*** p.76	p.97	
Taper Length	**Standard**	HSS	Black Oxide	Fractional	1/64 to 1/2	●	***531*** p.78	p.97	
		HSS-Co	Black Oxide	Fractional	1/16 to 3/4	●	***6531*** p.78	p.97	
	Parabolic	HSS	TiN	Fractional	1/16 to 1/2	●	***545P*** p.78	p.98	
Extra Length	**12"**	HSS	Bright	Fractional	1/8 to 1	●	***551*** p.80	p.98	
	18"			Fractional	1/8 to 1	●	***551*** p.80	p.98	
	10"	HSS-Co	Black Oxide	Fractional	3/16 to 1/2	●	***6551*** p.80	p.98	
Oil Hole Drills		HSS-Co	Bright	Fractional	3/8 to 1 1/2	●	***581*** p.81	p.99	

● :Great ○ :Good △:OK

	Drilling Depth *1				Workpiece Material																
					Carbon Steel		Alloy Steel	Die Steel	Hardened Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron		Aluminum			Copper Alloys
									HRc												
	≦3D	≦5D	≦7D	>7D	Low Carbon 1010,1018	High Carbon 1045,1065	4140,4330	D2	up to 35	35 to 45	45 to 65	Austenitic 300 Series	Martensitic 400 Series			Soft < 200HB	Hard > 200HB	6061 7075	Casting Si ≦ 12%	High Si Si > 13%	
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*Some sizes does not meet this preference. Please make sure of flute length of each sizes before use.

Drills / Selection Chart

TAPER SHANK DRILLS

Drill Name		Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
Regular Shank		HSS	Black Oxide	Fractional	1/8 to 3 1/2	●	***601***	p.82 / p.100	
Extra Length	**18" Overall**	HSS	Bright	Fractional	1/4 to 2 1/2	●	***651***	p.83 / p.98	
	24" Overall			Fractional	1/4 to 2 1/2	●	***651***	p.83 / p.98	
Oil Hole Drills		HSS-Co	Bright	Fractional	3/8 to 1 1/2	●	***683***	p.84 / p.100	

SPECIAL

Drill Name	Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
SILVER AND DEMING DRILLS	HSS	Bright	Fractional	1/2 to 1 1/2	●	***575***	p.85 / p.100	
JOBBERS LENGTH/Set Drills	HSS, HSS-Co	Black Oxide, Bright	Several	Several	●	***599***	p.86 / p.97	

●:Great ○:Good △:OK

Drilling Depth *1				Workpiece Material																
				Carbon Steel		Alloy Steel	Die Steel	Hardened Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron		Aluminum			Copper Alloys
≦3D	≦5D	≦7D	>7D	Low Carbon 1010,1018	High Carbon 1045,1065	4140,4330	D2	HRc up to 35	HRc 35 to 45	HRc 45 to 65	Austenitic 300 Series	Martensitic 400 Series			Soft < 200HB	Hard > 200HB	6061 7075	Casting Si ≦ 12%	High Si Si > 13%	
●	○			○	○	○									△		△	△		△
			●	○	○	○											○	△		△
			●	○	○	○											○	△		△
●	●	○			●	●	●				△	○	○	△	○	△	△	△		△

●:Great ○:Good △:OK

Drilling Depth *1				Workpiece Material																
				Carbon Steel		Alloy Steel	Die Steel	Hardened Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron		Aluminum			Copper Alloys
≦3D	≦5D	≦7D	>7D	Low Carbon 1010,1018	High Carbon 1045,1065	4140,4330	D2	HRc up to 35	HRc 35 to 45	HRc 45 to 65	Austenitic 300 Series	Martensitic 400 Series			Soft < 200HB	Hard > 200HB	6061 7075	Casting Si ≦ 12%	High Si Si > 13%	
●				○	○	○												△		△
●	●	●		○	○	○	△								△		△	△		△

*Some sizes does not meet this preference. Please make sure of flute length of each sizes before use.

STUB LENGTH SG-ESS / METRIC SIZES

List No.7572P High Performance

h7 SG FAX HELIX N 118° 135° >1.9 3RAKE

Range 1.0 to 20.0

PM-HSS SG COATED

This drill having stub length is suited for high-speed drilling and precise positioning and diameter. This is useful in material from Carbon Steels and Stainless Steels to Aluminum.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
1.0	0.0394	6	38	3
1.05	0.0413	6	38	3
1.1	0.0433	7	39	3
1.15	0.0453	7	39	3
1.2	0.0472	8	40	3
1.25	0.0492	8	40	3
1.3	0.0512	8	40	3
1.35	0.0531	9	41	3
1.4	0.0551	9	41	3
1.45	0.0571	9	41	3
1.5	0.0591	9	41	3
1.55	0.0610	10	42	3
1.6	0.0630	10	42	3
1.65	0.0650	10	42	3
1.7	0.0669	10	42	3
1.75	0.0689	11	43	3
1.8	0.0709	11	43	3
1.85	0.0728	11	43	3
1.9	0.0748	11	43	3
1.95	0.0768	12	44	3
2.0	0.0787	12	44	3
2.1	0.0827	12	44	3
2.2	0.0866	13	45	3
2.3	0.0906	13	45	3
2.4	0.0945	14	46	3
2.5	0.0984	14	46	3
2.6	0.1024	14	46	3
2.7	0.1063	16	48	3
2.8	0.1102	16	48	3
2.9	0.1142	16	48	3
3.0	0.1181	16	48	3
3.1	0.1220	18	50	4
3.2	0.1260	18	50	4
3.3	0.1299	18	50	4
3.4	0.1339	20	52	4
3.5	0.1378	20	52	4
3.6	0.1417	20	52	4
3.7	0.1457	20	52	4
3.8	0.1496	22	54	4
3.9	0.1535	22	54	4
4.0	0.1575	22	54	4
4.1	0.1614	22	66	6
4.2	0.1654	22	66	6
4.3	0.1693	24	68	6
4.4	0.1732	24	68	6
4.5	0.1772	24	68	6
4.6	0.1811	24	68	6
4.7	0.1850	24	68	6
4.8	0.1890	26	70	6

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
4.9	0.1929	26	70	6
5.0	0.1969	26	70	6
5.1	0.2008	26	70	6
5.2	0.2047	26	70	6
5.3	0.2087	26	70	6
5.4	0.2126	28	72	6
5.5	0.2165	28	72	6
5.6	0.2205	28	72	6
5.7	0.2244	28	72	6
5.8	0.2283	28	72	6
5.9	0.2323	28	72	6
6.0	0.2362	28	72	6
6.1	0.2402	31	75	8
6.2	0.2441	31	75	8
6.3	0.2480	31	75	8
6.4	0.2520	31	75	8
6.5	0.2559	31	75	8
6.6	0.2598	31	75	8
6.7	0.2638	31	75	8
6.8	0.2677	34	78	8
6.9	0.2717	34	78	8
7.0	0.2756	34	78	8
7.1	0.2795	34	78	8
7.2	0.2835	34	78	8
7.3	0.2874	34	78	8
7.4	0.2913	34	78	8
7.5	0.2953	34	78	8
7.6	0.2992	37	81	8
7.7	0.3031	37	81	8
7.8	0.3071	37	81	8
7.9	0.3110	37	81	8
8.0	0.3150	37	81	8
8.1	0.3189	37	87	10
8.2	0.3228	37	87	10
8.3	0.3268	37	87	10
8.4	0.3307	37	87	10
8.5	0.3346	37	87	10
8.6	0.3386	40	90	10
8.7	0.3425	40	90	10
8.8	0.3465	40	90	10
8.9	0.3504	40	90	10
9.0	0.3543	40	90	10
9.1	0.3583	40	90	10
9.2	0.3622	40	90	10
9.3	0.3661	40	90	10
9.4	0.3701	40	90	10
9.5	0.3740	40	90	10
9.6	0.3780	43	93	10
9.7	0.3819	43	93	10

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
9.8	0.3858	43	93	10
9.9	0.3898	43	93	10
10.0	0.3937	43	93	10
10.1	0.3976	43	100	12
10.1	0.3976	43	100	12
10.2	0.4016	43	100	12
10.3	0.4055	43	100	12
10.4	0.4094	43	100	12
10.5	0.4134	43	100	12
10.6	0.4173	43	100	12
10.7	0.4213	47	104	12
10.8	0.4252	47	104	12
10.9	0.4291	47	104	12
11.0	0.4331	47	104	12
11.1	0.4370	47	104	12
11.2	0.4409	47	104	12
11.3	0.4449	47	104	12
11.4	0.4488	47	104	12
11.5	0.4528	47	104	12
11.6	0.4567	47	104	12
11.7	0.4606	47	104	12
11.8	0.4646	47	104	12
11.9	0.4685	51	108	12
12.0	0.4724	51	108	12
12.1	0.4764	51	108	12
12.2	0.4803	51	108	12
12.3	0.4843	51	108	12
12.4	0.4882	51	108	12
12.5	0.4921	51	108	12
12.6	0.4961	51	108	12
12.7	0.5000	51	108	12
12.8	0.5039	51	108	12
12.9	0.5079	51	108	12
13.0	0.5118	51	108	12
13.5	0.5315	72	132	16
14.0	0.5512	72	132	16
14.5	0.5709	76	136	16
15.0	0.5906	76	142	20
15.5	0.6102	80	146	20
16.0	0.6299	80	146	20
16.5	0.6496	84	150	20
17.0	0.6693	84	150	20
17.5	0.6890	87	153	20
18.0	0.7087	87	153	20
18.5	0.7283	90	156	20
19.0	0.7480	90	164	25
19.5	0.7677	94	168	25
20.0	0.7874	94	168	25

1 per tube

STUB LENGTH SG-ESS / FRACTIONAL SIZES

List No.7573P High Performance

h7 SG FAX HELIX N 135° 3RAKE

Range 3/32 to 3/4

PM-HSS SG COATED

This drill having stub length is suited for high-speed drilling and precise positioning and diameter. This is useful in material from Carbon Steels and Stainless Steels to Aluminum.

Size		Decimal	Metric	Flute	Overall	Shank
Fractional	Wire	Equivalent	Equivalent	Length	Length	Dia.
	#45	0.0820	2.08	3/4	2	1/8
	#44	0.0860	2.18	3/4	2	1/8
	#43	0.0890	2.26	3/4	2	1/8
	#42	0.0935	2.37	3/4	2	1/8
3/32		0.0938	2.38	1/2	1 3/4	1/8
	#41	0.0960	2.44	13/16	2 1/16	1/8
	#40	0.0980	2.49	13/16	2 1/16	1/8
	#39	0.0995	2.53	13/16	2 1/4	1/8
	#38	0.1015	2.58	13/16	2 1/4	1/8
	#37	0.1040	2.64	13/16	2 1/4	1/8
	#36	0.1065	2.71	13/16	2 1/4	1/8
7/64		0.1094	2.78	5/8	1 7/8	1/8
	#34	0.1110	2.82	7/8	2 5/16	1/8
	#33	0.1130	2.87	7/8	2 5/16	1/8
1/8		0.1250	3.18	3/4	2	1/8
	#30	0.1285	3.26	15/16	2 3/8	3/16
	#29	0.1365	3.47	15/16	2 3/8	3/16
	#28	0.1405	3.57	15/16	2 3/8	3/16
9/64		0.1406	3.57	13/16	2 1/8	3/16
	#27	0.1440	3.66	1	2 7/16	3/16
	#26	0.1470	3.73	1	2 7/16	3/16
	#25	0.1495	3.80	1	2 7/16	3/16
	#24	0.1520	3.86	1	2 7/16	3/16
	#23	0.1540	3.91	1	2 7/16	3/16
5/32		0.1563	3.97	13/16	2 1/8	3/16
	#22	0.1570	3.99	1 1/16	2 1/2	3/16
	#21	0.1590	4.04	1 1/16	2 1/2	3/16
	#20	0.1610	4.09	1 1/16	2 1/2	3/16
	#19	0.1660	4.22	1 1/16	2 1/2	3/16
11/64		0.1719	4.37	1	2 3/8	3/16
	#15	0.1800	4.57	1 1/18	2 9/16	3/16
	#14	0.1820	4.62	1 1/18	2 9/16	3/16
3/16		0.1875	4.76	1	2 3/8	3/16
	#10	0.1935	4.91	1 3/16	3	1/4
	#9	0.1960	4.98	1 3/16	3	1/4
	#8	0.1990	5.05	1 3/16	3	1/4
	#7	0.2010	5.11	1 3/16	3	1/4
13/64		0.2031	5.16	1 1/8	2 7/8	1/4
	#6	0.2040	5.18	1 1/4	3 1/16	1/4
	#5	0.2055	5.22	1 1/4	3 1/16	1/4
	#4	0.2090	5.31	1 1/4	3 1/16	1/4
	#3	0.2130	5.41	1 1/4	3 1/16	1/4
7/32		0.2188	5.56	1 1/8	2 7/8	1/4
	#2	0.2210	5.61	1 5/16	3 1/8	1/4
	#1	0.2280	5.79	1 5/16	3 1/8	1/4

Size		Decimal	Metric	Flute	Overall	Shank
Fractional	Letter	Equivalent	Equivalent	Length	Length	Dia.
15/64		0.2344	5.95	1 1/4	3	1/4
	B	0.2380	6.05	1 3/8	3 3/16	1/4
	C	0.2420	6.15	1 3/8	3 3/16	1/4
	D	0.2460	6.25	1 3/8	3 3/16	1/4
1/4		0.2500	6.35	1 1/4	3	1/4
	F	0.2570	6.53	1 7/16	3 1/4	3/8
	G	0.2610	6.63	1 7/16	3 1/4	3/8
17/64		0.2656	6.75	1 3/8	3 3/16	3/8
	I	0.2720	6.91	1 1/2	3 5/16	3/8
	J	0.2770	7.04	1 1/2	3 5/16	3/8
9/32		0.2813	7.14	1 3/8	3 3/16	3/8
	L	0.2900	7.37	1 9/16	3 3/8	3/8
	M	0.2950	7.49	1 9/16	3 3/8	3/8
19/64		0.2969	7.54	1 3/8	3 3/16	3/8
	N	0.3020	7.67	1 5/8	3 7/16	3/8
5/16		0.3125	7.94	1 1/2	3 3/8	3/8
	O	0.3160	8.03	1 11/16	3 1/2	3/8
21/64		0.3281	8.33	1 1/2	3 3/8	3/8
	Q	0.3320	8.43	1 11/16	3 1/2	3/8
	R	0.3390	8.61	1 11/16	3 1/2	3/8
11/32		0.3438	8.73	1 5/8	3 1/2	3/8
23/64		0.3594	9.13	1 5/8	3 1/2	3/8
	U	0.3680	9.35	1 13/16	3 5/8	3/8
3/8		0.3750	9.53	1 5/8	3 1/2	3/8
	V	0.3770	9.58	1 7/8	3 31/32	1/2
25/64		0.3906	9.92	1 11/16	3 7/8	1/2
	X	0.3970	10.08	1 15/16	4 1/32	1/2
	Y	0.4040	10.26	1 15/16	4 1/32	1/2
13/32		0.4063	10.32	1 11/16	3 7/8	1/2
	Z	0.4130	10.49	2	4 3/32	1/2
27/64		0.4219	10.72	1 7/8	4 1/8	1/2
7/16		0.4375	11.11	1 7/8	4 1/8	1/2
29/64		0.4531	11.51	1 7/8	4 1/8	1/2
15/32		0.4688	11.91	2	4 1/4	1/2
31/64		0.4844	12.30	2	4 1/4	1/2
1/2		0.5000	12.70	2	4 1/4	1/2
17/32		0.5313	13.49	2 7/8	5 3/16	5/8
9/16		0.5625	14.29	3	5 3/8	5/8
19/32		0.5938	15.08	3	5 5/8	3/4
5/8		0.6250	15.88	3 3/16	5 3/4	3/4
21/32		0.6563	16.67	3 3/8	5 15/16	3/4
11/16		0.6875	17.46	3 7/16	6	3/4
23/32		0.7188	18.26	3 7/16	6	7/8
3/4		0.7500	19.05	3 9/16	6 1/2	7/8

1 per tube

JOBBERS LENGTH SG-ES / METRIC SIZES

List No.7570P High Performance

h7 SG FAX HELIX N 135° 2RAKE+X

Range 2.0 to 20.0 mm

PM-HSS SG COATED

Jobber length drill provides stable high-speed drilling and long tool life in a variety of materials; not suitable for Austenintic Stainless Steel.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
2.0	0.0787	24	56	3
2.1	0.0827	24	56	3
2.2	0.0866	25	56	3
2.3	0.0906	25	56	3
2.4	0.0945	30	61	3
2.5	0.0984	30	61	3
2.6	0.1024	30	61	3
2.7	0.1063	33	64	3
2.8	0.1102	33	64	3
2.9	0.1142	33	64	3
3.0	0.1181	33	64	3
3.1	0.1220	36	68	4
3.2	0.1260	36	68	4
3.3	0.1299	36	68	4
3.4	0.1339	39	71	4
3.5	0.1378	39	71	4
3.6	0.1417	39	71	4
3.7	0.1457	39	71	4
3.8	0.1496	43	75	4
3.9	0.1535	43	75	4
4.0	0.1575	43	75	4
4.1	0.1614	43	85	6
4.2	0.1654	43	85	6
4.3	0.1693	47	89	6
4.4	0.1732	47	89	6
4.5	0.1772	47	89	6
4.6	0.1811	47	89	6
4.7	0.1850	47	89	6
4.8	0.1890	52	94	6
4.9	0.1929	52	94	6
5.0	0.1969	52	94	6
5.1	0.2008	52	94	6
5.2	0.2047	52	94	6
5.3	0.2087	52	94	6
5.4	0.2126	57	99	6
5.5	0.2165	57	99	6
5.6	0.2205	57	99	6
5.7	0.2244	57	99	6
5.8	0.2283	57	99	6
5.9	0.2323	57	99	6
6.0	0.2362	57	99	6
6.1	0.2402	63	107	8
6.2	0.2441	63	107	8
6.3	0.2480	63	107	8
6.4	0.2520	63	107	8
6.5	0.2559	63	107	8
6.6	0.2598	63	107	8
6.7	0.2638	63	107	8
6.8	0.2677	69	113	8
6.9	0.2717	69	113	8
7.0	0.2756	69	113	8
7.1	0.2795	69	113	8
7.2	0.2835	69	113	8
7.3	0.2874	69	113	8
7.4	0.2913	69	113	8
7.5	0.2953	69	113	8
7.6	0.2992	75	119	8
7.7	0.3031	75	119	8
7.8	0.3071	75	119	8
7.9	0.3110	75	119	8
8.0	0.3150	75	119	8
8.1	0.3189	75	125	10
8.2	0.3228	75	125	10
8.3	0.3268	75	125	10
8.4	0.3307	75	125	10
8.5	0.3346	75	125	10
8.6	0.3386	81	131	10
8.7	0.3425	81	131	10
8.8	0.3465	81	131	10
8.9	0.3504	81	131	10
9.0	0.3543	81	131	10
9.1	0.3583	81	131	10
9.2	0.3622	81	131	10
9.3	0.3661	81	131	10
9.4	0.3701	81	131	10
9.5	0.3740	81	131	10
9.6	0.3780	87	137	10
9.7	0.3819	87	137	10
9.8	0.3858	87	137	10
9.9	0.3898	87	137	10
10.0	0.3937	87	137	10
10.1	0.3976	87	144	12
10.1	0.3976	87	144	12
10.2	0.4016	87	144	12
10.3	0.4055	87	144	12
10.4	0.4094	87	144	12
10.5	0.4134	87	144	12
10.6	0.4173	87	144	12
10.7	0.4213	94	151	12
10.8	0.4252	94	151	12
10.9	0.4291	94	151	12
11.0	0.4331	94	151	12
11.1	0.4370	94	151	12
11.2	0.4409	94	151	12
11.3	0.4449	94	151	12
11.4	0.4488	94	151	12
11.5	0.4528	94	151	12
11.6	0.4567	94	151	12
11.7	0.4606	94	151	12
11.8	0.4646	94	151	12
11.9	0.4685	101	158	12
12.0	0.4724	101	158	12
12.1	0.4764	101	158	12
12.2	0.4803	101	158	12
12.3	0.4843	101	158	12
12.4	0.4882	101	158	12
12.5	0.4921	101	158	12
12.6	0.4961	101	158	12
12.7	0.5000	101	158	12
12.8	0.5039	101	158	12
12.9	0.5079	101	158	12
13.0	0.5118	101	158	12
13.5	0.5315	108	168	16
14.0	0.5512	108	168	16
14.5	0.5709	114	173	16
15.0	0.5906	114	180	20
15.5	0.6102	120	185	20
16.0	0.6299	120	185	20
16.5	0.6496	125	189	20
17.0	0.6693	125	189	20
17.5	0.6890	130	194	20
18.0	0.7087	130	194	20
18.5	0.7283	135	198	20
19.0	0.7480	135	206	25
19.5	0.7677	140	210	25
20.0	0.7874	140	210	25

Not recommended for Austenite type of stainless steel

1 per tube

JOBBERS LENGTH SG-ES / FRACTIONAL SIZES

List No.7571P High Performance

h7 SG FAX HELIX N 135° 2RAKE+X

Range 3/32 to 3/4

PM-HSS SG COATED

Jobber length drill provides stable high-speed drilling and long tool life in a variety of materials; not suitable for Austenintic Stainless Steel.

Size		Decimal	Metric	Flute	Overall	Shank
Fractional	Wire	Equivalent	Equivalent	Length	Length	Dia.
	#45	0.0820	2.08	1 1/8	2 3/8	1/8
	#44	0.0860	2.18	1 1/8	2 3/8	1/8
	#43	0.0890	2.26	1 1/4	2 1/2	1/8
	#42	0.0935	2.37	1 1/4	2 1/2	1/8
3/32		0.0938	2.38	1 1/8	2 3/8	1/8
	#41	0.0960	2.44	1 3/8	2 5/8	1/8
	#40	0.0980	2.49	1 3/8	2 5/8	1/8
	#39	0.0995	2.53	1 3/8	2 13/16	1/8
	#38	0.1015	2.58	1 7/16	2 7/8	1/8
	#37	0.1040	2.64	1 7/16	2 7/8	1/8
	#36	0.1065	2.71	1 7/16	2 7/8	1/8
7/64		0.1094	2.78	1 1/4	2 1/2	1/8
	#34	0.1110	2.82	1 1/2	2 15/16	1/8
	#33	0.1130	2.87	1 1/2	2 15/16	1/8
1/8		0.1250	3.18	1 3/8	2 5/8	1/8
	#30	0.1285	3.26	1 5/8	3 1/16	3/16
	#29	0.1365	3.47	1 3/4	3 3/16	3/16
	#28	0.1405	3.57	1 3/4	3 3/16	3/16
9/64		0.1406	3.57	1 1/2	2 7/8	3/16
	#27	0.1440	3.66	1 7/8	3 5/16	3/16
	#26	0.1470	3.73	1 7/8	3 5/16	3/16
	#25	0.1495	3.80	1 7/8	3 5/16	3/16
	#24	0.1520	3.86	2	3 7/16	3/16
	#23	0.1540	3.91	2	3 7/16	3/16
5/32		0.1563	3.97	1 3/4	3 1/8	3/16
	#22	0.1570	3.99	2	3 7/16	3/16
	#21	0.1590	4.04	2 1/8	3 9/16	3/16
	#20	0.1610	4.09	2 1/8	3 9/16	3/16
	#19	0.1660	4.22	2 1/8	3 9/16	3/16
11/64		0.1719	4.37	1 7/8	3 1/4	3/16
	#15	0.1800	4.57	2 3/16	3 5/8	3/16
	#14	0.1820	4.62	2 3/16	3 5/8	3/16
3/16		0.1875	4.76	2	3 3/8	3/16
	#10	0.1935	4.91	2 7/16	4 1/4	1/4
	#9	0.1960	4.98	2 7/16	4 1/4	1/4
	#8	0.1990	5.05	2 7/16	4 1/4	1/4
	#7	0.2010	5.11	2 7/16	4 1/4	1/4
13/64		0.2031	5.16	2 1/16	3 7/8	1/4
	#6	0.2040	5.18	2 7/16	4 1/4	1/4
	#5	0.2055	5.22	2 1/2	4 5/16	1/4
	#4	0.2090	5.31	2 1/2	4 5/16	1/4
	#3	0.2130	5.41	2 1/2	4 5/16	1/4
7/32		0.2188	5.56	2 1/16	3 7/8	1/4
	#2	0.2210	5.61	2 5/8	4 7/16	1/4
	#1	0.2280	5.79	2 5/8	4 7/16	1/4

Size		Decimal	Metric	Flute	Overall	Shank
Fractional	Letter	Equivalent	Equivalent	Length	Length	Dia.
15/64		0.2344	5.95	2 3/8	4 1/4	1/4
	B	0.2380	6.05	2 3/4	4 9/16	1/4
	C	0.2420	6.15	2 3/4	4 9/16	1/4
	D	0.2460	6.25	2 3/4	4 9/16	1/4
1/4		0.2500	6.35	2 3/8	4 1/4	1/4
	F	0.2570	6.53	2 7/8	4 11/16	3/8
	G	0.2610	6.63	2 7/8	4 11/16	3/8
17/64		0.2656	6.75	2 3/4	4 5/8	3/8
	I	0.2720	6.91	2 7/8	4 11/16	3/8
	J	0.2770	7.04	2 7/8	4 11/16	3/8
9/32		0.2813	7.14	2 3/4	4 5/8	3/8
	L	0.2900	7.37	2 15/16	4 3/4	3/8
	M	0.2950	7.49	3 1/16	4 7/8	3/8
19/64		0.2969	7.54	2 7/8	4 3/4	3/8
	N	0.3020	7.67	3 1/16	4 7/8	3/8
5/16		0.3125	7.94	2 7/8	4 3/4	3/8
	O	0.3160	8.03	3 3/16	5	3/8
21/64		0.3281	8.33	2 7/8	4 3/4	3/8
	Q	0.3320	8.43	3 7/16	5 1/4	3/8
	R	0.3390	8.61	3 7/16	5 1/4	3/8
11/32		0.3438	8.73	3 1/4	5 1/8	3/8
23/64		0.3594	9.13	3 1/4	5 1/8	3/8
	U	0.3680	9.35	3 5/8	5 7/16	3/8
3/8		0.3750	9.53	3 1/4	5 1/8	3/8
	V	0.3770	9.58	3 5/8	5 23/32	1/2
25/64		0.3906	9.92	3 3/8	5 1/2	1/2
	X	0.3970	10.08	3 3/4	5 27/32	1/2
	Y	0.4040	10.26	3 7/8	5 31/32	1/2
13/32		0.4063	10.32	3 3/8	5 1/2	1/2
	Z	0.4130	10.49	3 7/8	5 31/32	1/2
27/64		0.4219	10.72	3 3/4	5 7/8	1/2
7/16		0.4375	11.11	3 3/4	5 7/8	1/2
29/64		0.4531	11.51	3 3/4	5 7/8	1/2
15/32		0.4688	11.91	4	6 1/4	1/2
31/64		0.4844	12.30	4	6 1/4	1/2
1/2		0.5000	12.70	4	6 1/4	1/2
17/32		0.5313	13.49	4 1/4	6 3/4	5/8
9/16		0.5625	14.29	4 1/2	7	5/8
37/64		0.5781	14.68	4 1/2	7	5/8
19/32		0.5938	15.08	4 3/4	7 1/4	3/4
5/8		0.6250	15.88	4 3/4	7 1/4	3/4
21/32		0.6563	16.67	5	7 1/2	3/4
11/16		0.6875	17.46	5 1/8	7 5/8	3/4
23/32		0.7188	18.26	5 3/8	7 3/4	7/8
3/4		0.7500	19.05	5 1/2	7 7/8	7/8

Not recommended for Austenite type of stainless steel

1 per tube

SG DRILLS WITH OIL-HOLES / METRIC SIZES FRACTIONAL SIZES

List No.7596P Metric Sizes
List No.7591P Fractional

L7596P Range 5.0 to 20.0
L7591P Range 15/64 to 3/4

PM-HSS SG COATED

This oil hole drill is suitable for high-speed and long life drilling, and adapted in workpiece material from Carbon Steels and Stainless Steels to Aluminum.

(Unit) : mm

L7596P

Size	Decimal Equivalent	Flute Length	Overall Length
5.0	0.1969	52	94
5.5	0.2165	57	99
6.0	0.2362	57	99
6.5	0.2559	63	107
7.0	0.2756	69	113
7.5	0.2953	69	113
8.0	0.3150	75	119
8.5	0.3346	75	125
9.0	0.3543	81	131
9.5	0.3740	81	131
10.0	0.3937	87	137
10.5	0.4134	87	144
11.0	0.4331	94	151
11.5	0.4528	94	151
12.0	0.4724	101	158
12.5	0.4921	101	158
13.0	0.5118	101	158
13.5	0.5315	108	168
14.0	0.5512	108	168
14.5	0.5709	114	173
15.0	0.5906	114	180
15.5	0.6102	120	185
16.0	0.6299	120	185
16.5	0.6496	125	189
17.0	0.6693	125	189
17.5	0.6890	130	194
18.0	0.7087	130	194
18.5	0.7283	135	198
19.0	0.7480	135	206
19.5	0.7677	140	210
20.0	0.7874	140	210

L7591P

Size	Decimal Equivalent	Flute Length	Overall Length
15/64	0.2344	2-3/8	4-1/4
1/4	0.2500	2-3/8	4-1/4
17/64	0.2656	2-3/4	4-5/8
9/32	0.2813	2-3/4	4-5/8
19/64	0.2969	2-7/8	4-3/4
5/16	0.3125	2-7/8	4-3/4
21/64	0.3281	2-7/8	4-3/4
11/32	0.3438	3-1/4	5-1/8
23/64	0.3594	3-1/4	5-1/8
3/8	0.3750	3-1/4	5-1/8
25/64	0.3906	3-3/8	5-1/2
13/32	0.4063	3-3/8	5-1/2
27/64	0.4219	3-3/4	5-7/8
7/16	0.4375	3-3/4	5-7/8
29/64	0.4531	3-3/4	5-7/8
15/32	0.4688	4	6-1/4
31/64	0.4844	4	6-1/4
1/2	0.5000	4	6-1/4
17/32	0.5313	4-1/4	6-3/4
9/16	0.5625	4-1/2	7
37/64	0.5781	4-1/2	7
19/32	0.5938	4-3/4	7-1/4
5/8	0.6250	4-3/4	7-1/4
21/32	0.6563	5	7-1/2
11/16	0.6875	5-1/8	7-5/8
23/32	0.7188	5-3/8	7-3/4
3/4	0.7500	5-1/2	7-7/8

1 per tube

UG POWER DRILLS / FRACTIONAL SIZES

List No.6517U High Performance

h8 UG HSS Co HELIX H 118° X-type

Range 3/64 to 1/2

HSS-Co UG COATED

This drill is designed for deep hole drilling Flute geometry allows for easy chip removal and can be drilled up to 7 times of drill diameter without pecking.

Size	Decimal Equivalent	Flute Length	Overall Length
3/64	0.0469	3/4	1 3/4
1/16	0.0625	7/8	1 7/8
5/64	0.0781	1	2
3/32	0.0938	1 1/4	2 1/4
7/64	0.1094	1 1/2	2 5/8
1/8	0.1250	1 5/8	2 3/4
9/64	0.1406	1 3/4	2 7/8
5/32	0.1563	2	3 1/8
11/64	0.1719	2 1/8	3 1/4
3/16	0.1875	2 5/16	3 1/2
13/64	0.2031	2 7/16	3 5/8
7/32	0.2188	2 1/2	3 3/4
15/64	0.2344	2 5/8	3 7/8
1/4	0.2500	2 3/4	4
17/64	0.2656	2 7/8	4 1/8
9/32	0.2813	2 15/16	4 1/4
19/64	0.2969	3 1/16	4 3/8
5/16	0.3125	3 3/16	4 1/2
21/64	0.3281	3 5/16	4 5/8
11/32	0.3438	3 7/16	4 3/4
23/64	0.3594	3 1/2	4 7/8
3/8	0.3750	3 5/8	5
25/64	0.3906	3 3/4	5 1/8
13/32	0.4063	3 7/8	5 1/4
27/64	0.4219	3 15/16	5 3/8
7/16	0.4375	4 1/16	5 1/2
29/64	0.4531	4 3/16	5 5/8
15/32	0.4688	4 5/16	5 3/4
31/64	0.4844	4 3/8	5 7/8
1/2	0.5000	4 1/2	6

"UG" Coating is NACHI's Special Multi-Layered TiCN Coating

"UG" Power Drills is suitable for 7D Non-Step Drilling

3/64 to 5/64 in package of 10, 3/32 to 1/2 1 per tube

HIGH PERFORMANCE DRILLS

UG POWER DRILLS / METRIC SIZES

USA & JAPAN STOCK ITEM*

List No.6528P High Performance

h8 UG HSS Co HELIX H 118 X-type

Range 1.0 to 13.0

HSS-Co UG COATED

This drill can proceed non-step drilling deeply up to 7 times of drill diameter.

(Unit) : mm

	Size	Decimal Equivalent	Flute Length	Overall Length
	1.0	0.0394	12	34
	1.1	0.0433	14	36
	1.2	0.0472	16	38
	1.3	0.0512	16	38
	1.4	0.0551	18	40
	1.5	0.0591	18	40
	1.6	0.0630	20	43
	1.7	0.0669	20	43
	1.8	0.0709	22	46
	1.9	0.0748	22	46
	2.0	0.0787	24	49
	2.1	0.0827	24	49
	2.2	0.0866	27	53
	2.3	0.0906	27	53
	2.4	0.0945	30	57
	2.5	0.0984	30	57
	2.6	0.1024	30	57
	2.7	0.1063	33	61
	2.8	0.1102	33	61
	2.9	0.1142	33	61
	3.0	0.1181	33	61
*	3.1	0.1220	36	65
*	3.2	0.1260	36	65
*	3.3	0.1299	36	65
*	3.4	0.1339	39	70
*	3.5	0.1378	39	70
*	3.6	0.1417	39	70
*	3.7	0.1457	39	70
*	3.8	0.1496	43	75
*	3.9	0.1535	43	75
*	4.0	0.1575	43	75
*	4.1	0.1614	43	75
*	4.2	0.1654	43	75
*	4.3	0.1693	47	80
*	4.4	0.1732	47	80
*	4.5	0.1772	47	80
*	4.6	0.1811	47	80
*	4.7	0.1850	47	80
*	4.8	0.1890	52	86
*	4.9	0.1929	52	86
*	5.0	0.1969	52	86
*	5.1	0.2008	52	86
*	5.2	0.2047	52	86
*	5.3	0.2087	52	86
*	5.4	0.2126	57	93
*	5.5	0.2165	57	93
*	5.6	0.2205	57	93
*	5.7	0.2244	57	93
*	5.8	0.2283	57	93
*	5.9	0.2323	57	93
*	6.0	0.2362	57	93
*	6.1	0.2402	63	101
*	6.2	0.2441	63	101
*	6.3	0.2480	63	101
*	6.4	0.2520	63	101
*	6.5	0.2559	63	101
*	6.6	0.2598	63	101
*	6.7	0.2638	63	101
*	6.8	0.2677	69	109
*	6.9	0.2717	69	109
*	7.0	0.2756	69	109

	Size	Decimal Equivalent	Flute Length	Overall Length
*	7.1	0.2795	69	109
*	7.2	0.2835	69	109
*	7.3	0.2874	69	109
*	7.4	0.2913	69	109
*	7.5	0.2953	69	109
*	7.6	0.2992	75	117
*	7.7	0.3031	75	117
*	7.8	0.3071	75	117
*	7.9	0.3110	75	117
*	8.0	0.3150	75	117
*	8.1	0.3189	75	117
*	8.2	0.3228	75	117
*	8.3	0.3268	75	117
*	8.4	0.3307	75	117
*	8.5	0.3346	75	117
*	8.6	0.3386	81	125
*	8.7	0.3425	81	125
*	8.8	0.3465	81	125
*	8.9	0.3504	81	125
*	9.0	0.3543	81	125
*	9.1	0.3583	81	125
*	9.2	0.3622	81	125
*	9.3	0.3661	81	125
*	9.4	0.3701	81	125
*	9.5	0.3740	81	125
*	9.6	0.3780	87	133
*	9.7	0.3819	87	133
*	9.8	0.3858	87	133
*	9.9	0.3898	87	133
*	10.0	0.3937	87	133
*	10.1	0.3976	87	133
*	10.2	0.4016	87	133
*	10.3	0.4055	87	133
*	10.4	0.4094	87	133
*	10.5	0.4134	87	133
*	10.6	0.4173	87	133
*	10.7	0.4213	94	142
*	10.8	0.4252	94	142
*	10.9	0.4291	94	142
*	11.0	0.4331	94	142
*	11.1	0.4370	94	142
*	11.2	0.4409	94	142
*	11.3	0.4449	94	142
*	11.4	0.4488	94	142
*	11.5	0.4528	94	142
*	11.6	0.4567	94	142
*	11.7	0.4606	94	142
*	11.8	0.4646	94	142
*	11.9	0.4685	101	151
*	12.0	0.4724	101	151
*	12.1	0.4764	101	151
*	12.2	0.4803	101	151
*	12.3	0.4843	101	151
*	12.4	0.4882	101	151
*	12.5	0.4921	101	151
*	12.6	0.4961	101	151
*	12.7	0.5000	101	151
*	12.8	0.5039	101	151
*	12.9	0.5079	101	151
*	13.0	0.5118	101	151

1.0 to 1.9 in package of 10, 20 to 13.0 1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AG-SUS DRILLS SHORT / METRIC SIZES

List No.6596P High Performance

h7 AG FMX HELIX H 135° 2RAKE 3RAKE >1.9

Range 1.0 to 20.0

FM HSS AG COATED

This drill meets stable drilling by AG coat, and is very suitable for drilling of Stainless Steel.

(Unit) : mm

Size	Flute Length	Overall Length	Shank Dia.
1.0	6	40	3
1.1	7	40	3
1.2	8	40	3
1.3	8	40	3
1.4	9	40	3
1.5	9	40	3
1.6	10	44	3
1.7	10	44	3
1.8	11	44	3
1.9	11	44	3
2.0	12	44	3
2.1	12	44	3
2.2	13	44	3
2.3	13	44	3
2.4	14	48	3
2.5	14	48	3
2.6	14	48	3
2.7	16	48	3
2.8	16	48	3
2.9	16	48	3
3.0	16	48	3
3.1	18	54	4
3.2	18	54	4
3.3	18	54	4
3.4	20	54	4
3.5	20	54	4
3.6	20	54	4
3.7	20	54	4
3.8	22	54	4
3.9	22	54	4
4.0	22	54	4
4.1	22	66	6
4.2	22	66	6
4.3	24	68	6
4.4	24	68	6
4.5	24	68	6
4.6	24	68	6
4.7	24	68	6
4.8	26	70	6
4.9	26	70	6
5.0	26	70	6
5.1	26	70	6
5.2	26	70	6
5.3	26	70	6
5.4	28	72	6
5.5	28	72	6
5.6	28	72	6
5.7	28	72	6
5.8	28	72	6
5.9	28	72	6
6.0	28	72	6
6.1	31	75	8
6.2	31	75	8
6.3	31	75	8
6.4	31	75	8
6.5	31	75	8
6.6	31	75	8
6.7	31	75	8
6.8	34	78	8
6.9	34	78	8
7.0	34	78	8
7.1	34	78	8
7.2	34	78	8
7.3	34	78	8
7.4	34	78	8
7.5	34	78	8
7.6	37	81	8
7.7	37	81	8
7.8	37	81	8
7.9	37	81	8
8.0	37	81	8
8.1	37	87	10
8.2	37	87	10
8.3	37	87	10
8.4	37	87	10
8.5	37	87	10
8.6	40	90	10
8.7	40	90	10
8.8	40	90	10
8.9	40	90	10
9.0	40	90	10
9.1	40	90	10
9.2	40	90	10
9.3	40	90	10
9.4	40	90	10
9.5	40	90	10
9.6	43	93	10
9.7	43	93	10
9.8	43	93	10
9.9	43	93	10
10.0	43	93	10
10.1	43	100	12
10.2	43	100	12
10.3	43	100	12
10.4	43	100	12
10.5	43	100	12
10.6	43	100	12
10.7	47	104	12
10.8	47	104	12
10.9	47	104	12
11.0	47	104	12
11.1	47	104	12
11.2	47	104	12
11.3	47	104	12
11.4	47	104	12
11.5	47	104	12
11.6	47	104	12
11.7	47	104	12
11.8	47	104	12
11.9	51	108	12
12.0	51	108	12
12.1	51	108	12
12.2	51	108	12
12.3	51	108	12
12.4	51	108	12
12.5	51	108	12
12.6	51	108	12
12.7	51	108	12
12.8	51	108	12
12.9	51	108	12
13.0	51	108	12
13.5	72	132	16
14.0	72	132	16
14.5	76	136	16
15.0	76	142	20
15.5	80	146	20
16.0	80	146	20
16.5	84	150	20
17.0	84	150	20
17.5	87	153	20
18.0	87	153	20
18.5	90	156	20
19.0	90	164	25
19.5	94	168	25
20.0	94	168	25

1 per tube

AG-SUS DRILLS REGULAR / METRIC SIZES

List No.6594P High Performance

h7 AG FMX HELIX H 135° 2RAKE 3RAKE >1.4

Range 2.0 to 20.0

FM HSS AG COATED

This drill meets stable drilling by AG coat, and is very suitable for drilling of Stainless Steel.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Diameter
1.0	0.0394	12	50	3
1.1	0.0433	14	50	3
1.2	0.0472	16	50	3
1.3	0.0512	16	50	3
1.4	0.0551	18	50	3
1.5	0.0591	18	50	3
1.6	0.0630	20	56	3
1.7	0.0669	20	56	3
1.8	0.0709	22	56	3
1.9	0.0748	22	56	3
2.0	0.0787	24	56	3
2.1	0.0827	24	56	3
2.2	0.0866	25	56	3
2.3	0.0906	25	56	3
2.4	0.0945	30	61	3
2.5	0.0984	30	61	3
2.6	0.1024	30	61	3
2.7	0.1063	33	64	3
2.8	0.1102	33	64	3
2.9	0.1142	33	64	3
3.0	0.1181	33	64	3
3.1	0.1220	36	71	4
3.2	0.1260	36	71	4
3.3	0.1299	36	71	4
3.4	0.1339	39	71	4
3.5	0.1378	39	71	4
3.6	0.1417	39	71	4
3.7	0.1457	39	71	4
3.8	0.1496	43	75	4
3.9	0.1535	43	75	4
4.0	0.1575	43	75	4
4.1	0.1614	43	85	6
4.2	0.1654	43	85	6
4.3	0.1693	47	89	6
4.4	0.1732	47	89	6
4.5	0.1772	47	89	6
4.6	0.1811	47	89	6
4.7	0.1850	47	89	6
4.8	0.1890	52	94	6
4.9	0.1929	52	94	6
5.0	0.1969	52	94	6
5.1	0.2008	52	94	6
5.2	0.2047	52	94	6
5.3	0.2087	52	94	6
5.4	0.2126	57	99	6
5.5	0.2165	57	99	6
5.6	0.2205	57	99	6
5.7	0.2244	57	99	6
5.8	0.2283	57	99	6
5.9	0.2323	57	99	6
6.0	0.2362	57	99	6
6.1	0.2402	63	107	8
6.2	0.2441	63	107	8
6.3	0.2480	63	107	8
6.4	0.2520	63	107	8
6.5	0.2559	63	107	8
6.6	0.2598	63	107	8
6.7	0.2638	63	107	8
6.8	0.2677	69	113	8
6.9	0.2717	69	113	8
7.0	0.2756	69	113	8
7.1	0.2795	69	113	8
7.2	0.2835	69	113	8
7.3	0.2874	69	113	8
7.4	0.2913	69	113	8
7.5	0.2953	69	113	8
7.6	0.2992	75	119	8
7.7	0.3031	75	119	8
7.8	0.3071	75	119	8
7.9	0.3110	75	119	8
8.0	0.3150	75	119	8
8.1	0.3189	75	125	10
8.2	0.3228	75	125	10
8.3	0.3268	75	125	10
8.4	0.3307	75	125	10
8.5	0.3346	75	125	10
8.6	0.3386	81	131	10
8.7	0.3425	81	131	10
8.8	0.3465	81	131	10
8.9	0.3504	81	131	10
9.0	0.3543	81	131	10
9.1	0.3583	81	131	10
9.2	0.3622	81	131	10
9.3	0.3661	81	131	10
9.4	0.3701	81	131	10
9.5	0.3740	81	131	10
9.6	0.3780	87	137	10
9.7	0.3819	87	137	10
9.8	0.3858	87	137	10
9.9	0.3898	87	137	10
10.0	0.3937	87	137	10
10.1	0.3976	87	144	12
10.2	0.4016	87	144	12
10.3	0.4055	87	144	12
10.4	0.4094	87	144	12
10.5	0.4134	87	144	12
10.6	0.4173	87	144	12
10.7	0.4213	94	151	12
10.8	0.4252	94	151	12
10.9	0.4291	94	151	12
11.0	0.4331	94	151	12
11.1	0.4370	94	151	12
11.2	0.4409	94	151	12
11.3	0.4449	94	151	12
11.4	0.4488	94	151	12
11.5	0.4528	94	151	12
11.6	0.4567	94	151	12
11.7	0.4606	94	151	12
11.8	0.4646	94	151	12
11.9	0.4685	101	158	12
12.0	0.4724	101	158	12
12.1	0.4764	101	158	12
12.2	0.4803	101	158	12
12.3	0.4843	101	158	12
12.4	0.4882	101	158	12
12.5	0.4921	101	158	12
12.6	0.4961	101	158	12
12.7	0.5000	101	158	12
12.8	0.5039	101	158	12
12.9	0.5079	101	158	12
13.0	0.5118	101	158	12
13.5	0.5315	108	168	16
14.0	0.5512	108	168	16
14.5	0.5709	114	173	16
15.0	0.5906	114	180	20
15.5	0.6102	120	185	20
16.0	0.6299	120	185	20
16.5	0.6496	125	189	20
17.0	0.6693	125	189	20
17.5	0.6890	130	194	20
18.0	0.7087	130	194	20
18.5	0.7283	135	198	20
19.0	0.7480	135	206	25
19.5	0.7677	140	210	25
20.0	0.7874	140	210	25

1 per tube

AG-SUS DRILLS REGULAR / FRACTIONAL SIZES

List No.6595P High Performance

h7 AG FMX HELIX H 135° 3RAKE

Range 3/32 to 3/4

FM HSS AG COATED

This drill meets stable drilling by AG coat, and is very suitable for drilling of Stainless Steel.

DIAMETER	DECIMAL EQUIVALENT	FLUTE LENGTH	OVERALL LENGTH	SHANK DIAMETER
3/32	0.0938	1-1/8	2-3/8	1/8
7/64	0.1094	1-1/4	2-1/2	1/8
1/8	0.1250	1-3/8	2-5/8	1/8
9/64	0.1406	1-1/2	2-7/8	3/16
5/32	0.1563	1-3/4	3-1/8	3/16
11/64	0.1719	1-7/8	3-1/4	3/16
3/16	0.1875	2	3-3/8	3/16
13/64	0.2031	2-1/16	3-7/8	1/4
7/32	0.2188	2-1/16	3-7/8	1/4
15/64	0.2344	2-3/8	4-1/4	1/4
1/4	0.2500	2-3/8	4-1/4	1/4
17/64	0.2656	2-3/4	4-5/8	3/8
9/32	0.2813	2-3/4	4-5/8	3/8
19/64	0.2969	2-7/8	4-3/4	3/8
5/16	0.3125	2-7/8	4-3/4	3/8
21/64	0.3281	2-7/8	4-3/4	3/8
11/32	0.3438	3-1/4	5-1/8	3/8
23/64	0.3594	3-1/4	5-1/8	3/8
3/8	0.3750	3-1/4	5-1/8	3/8
25/64	0.3906	3-3/8	5-1/2	1/2
13/32	0.4063	3-3/8	5-1/2	1/2
27/64	0.4219	3-3/4	5-7/8	1/2
7/16	0.4375	3-3/4	5-7/8	1/2
29/64	0.4531	3-3/4	5-7/8	1/2
15/32	0.4688	4	6-1/4	1/2
31/64	0.4844	4	6-1/4	1/2
1/2	0.5000	4	6-1/4	1/2
17/32	0.5313	4-1/4	6-3/4	5/8
9/16	0.5625	4-1/2	7	5/8
37/64	0.5781	4-1/2	7	5/8
19/32	0.5938	4-3/4	7-1/4	3/4
5/8	0.6250	4-3/4	7-1/4	3/4
21/32	0.6563	5	7-1/2	3/4
11/16	0.6875	5-1/8	7-5/8	3/4
23/32	0.7188	5-3/8	7-3/4	7/8
3/4	0.7500	5-1/2	7-7/8	7/8

1 per tube

AG-POWER LONG DRILLS / METRIC SIZES FRACTIONAL SIZES

USA & JAPAN STOCK ITEM*

List No.6540P Metric Sizes
List No.6541P Fractional

h8 AG HSS Co H 118 XH-type

Series 1 Range 1.0 to 13.0
Series 2 Range 1.0 to 10.0
Series 3 Range 3.0 to 10.0

HSS-Co AG COATED

This drill meets non-step drilling of deep holes up to 20 times of a diameter, and is used for workpiece materials from raw materials to Mold Die Steels.
Note : Pre-hole should be drilled.

Series 1

(Unit) : mm

	Size		Decimal Equivalent	Flute Length	Overall Length
	Fractional L6541P	Metric L6540P			
		1.0	0.0394	33	56
		1.1	0.0433	37	60
		1.2	0.0472	41	65
*		1.3	0.0512	41	65
		1.4	0.0551	45	70
		1.5	0.0591	45	70
		1.6	0.0630	50	76
*		1.7	0.0669	50	76
		1.8	0.0709	53	80
*		1.9	0.0748	53	80
		2.0	0.0787	56	85
*		2.1	0.0827	56	85
		2.2	0.0866	59	90
*		2.3	0.0906	59	90
		2.4	0.0945	62	95
		2.5	0.0984	62	95
		2.6	0.1024	62	95
*		2.7	0.1063	66	100
		2.8	0.1102	66	100
*		2.9	0.1142	66	100
		3.0	0.1181	66	100
*		3.1	0.1220	69	106
	1/8	3.175	0.1250	69	106
		3.2	0.1260	69	106
*		3.3	0.1299	69	106
*		3.4	0.1339	73	112
		3.5	0.1378	73	112
△	9/64	3.572	0.1406	73	112
		3.6	0.1417	73	112
*		3.7	0.1457	73	112
*		3.8	0.1496	78	119
*		3.9	0.1535	78	119
△	5/32	3.969	0.1563	78	119
		4.0	0.1575	78	119
*		4.1	0.1614	78	119
*		4.2	0.1654	78	119
*		4.3	0.1693	82	126
△	11/64	4.366	0.1719	82	126
		4.4	0.1732	82	126
		4.5	0.1772	82	126
*		4.6	0.1811	82	126
*		4.7	0.1850	82	126
	3/16	4.762	0.1875	87	132
		4.8	0.1890	87	132
*		4.9	0.1929	87	132
		5.0	0.1969	87	132
*		5.1	0.2008	87	132
△	13/64	5.159	0.2031	87	132
		5.2	0.2047	87	132
*		5.3	0.2087	87	132
*		5.4	0.2126	91	139
		5.5	0.2165	91	139
△	7/32	5.556	0.2187	91	139
		5.6	0.2205	91	139
*		5.7	0.2244	91	139
*		5.8	0.2283	91	139
*		5.9	0.2323	91	139
		6.0	0.2362	91	139
	1/4	6.35	0.2500	97	148
		6.5	0.2559	97	148
△	17/64	6.747	0.2656	102	156
		6.8	0.2677	102	156
*		7.0	0.2756	102	156
	9/32	7.144	0.2813	102	156
		7.5	0.2953	102	156
△	19/64	7.541	0.2969	109	165
	5/16	7.933	0.3123	109	165
		8.0	0.3150	109	165
	21/64	8.334	0.3281	109	165
		8.5	0.3346	109	165
	11/32	8.731	0.3437	115	175
		9.0	0.3543	115	175
	23/64	9.128	0.3594	115	175
		9.5	0.3740	115	175
△	3/8	9.525	0.3750	121	184
		10.0	0.3937	121	184
*		10.5	0.4134	121	184
*		11.0	0.4331	128	195
*		11.5	0.4528	128	195
*		12.0	0.4724	134	205
*		12.5	0.4921	134	205
*		13.0	0.5118	134	205

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery
△CUSTOM-MADE ITEM : Please choose nearest metric size. If it is not acceptable, please contact our office 1-888-340-8665.

AG-POWER LONG DRILLS / METRIC SIZES FRACTIONAL SIZES

USA & JAPAN STOCK ITEM*

Series 2

(Unit) : mm

	Size		Decimal Equivalent	Flute Length	Overall Length
	Fractional L6541P	Metric L6540P			
*		1.0	0.0394	60	100
*		1.1	0.0433	60	100
*		1.2	0.0472	65	105
*		1.3	0.0512	65	105
*		1.4	0.0551	70	110
*		1.5	0.0591	70	110
*		1.6	0.0630	75	115
*		1.7	0.0669	75	115
*		1.8	0.0709	80	120
*		1.9	0.0748	80	120
*		2.0	0.0787	85	125
*		2.1	0.0827	85	125
*		2.2	0.0866	90	135
*		2.3	0.0906	90	135
		2.4	0.0945	95	140
		2.5	0.0984	95	140
		2.6	0.1024	95	140
*		2.7	0.1063	100	150
		2.8	0.1102	100	150
*		2.9	0.1142	100	150
		3.0	0.1181	100	150
*		3.1	0.1220	105	155
	1/8	3.175	0.1250	105	155
		3.2	0.1260	105	155
*		3.3	0.1299	105	155
*		3.4	0.1339	115	165
		3.5	0.1378	115	165
△	9/64	3.572	0.1406	115	165
		3.6	0.1417	115	165
*		3.7	0.1457	115	165
*		3.8	0.1496	120	175
*		3.9	0.1535	120	175
△	5/32	3.969	0.1563	120	175
		4.0	0.1575	120	175
*		4.1	0.1614	120	175
*		4.2	0.1654	120	175
*		4.3	0.1693	125	185
△	11/64	4.366	0.1719	125	185
		4.4	0.1732	125	185
		4.5	0.1772	125	185
*		4.6	0.1811	125	185
*		4.7	0.1850	125	185
	3/16	4.762	0.1875	135	195
		4.8	0.1890	135	195
*		4.9	0.1929	135	195
		5.0	0.1969	135	195
*		5.1	0.2008	135	195
△	13/64	5.159	0.2031	135	195
		5.2	0.2047	135	195
*		5.3	0.2087	135	195
*		5.4	0.2126	140	205
		5.5	0.2165	140	205
△	7/32	5.556	0.2187	140	205
		5.6	0.2205	140	205
*		5.7	0.2244	140	205
*		5.8	0.2283	140	205
*		5.9	0.2323	140	205
		6.0	0.2362	140	205
	1/4	6.35	0.2500	150	215
		6.5	0.2559	150	215
△	17/64	6.747	0.2656	155	225
		6.8	0.2677	155	225
		7.0	0.2756	155	225
	9/32	7.144	0.2813	155	225
		7.5	0.2953	155	225
△	19/64	7.541	0.2969	165	240
	5/16	7.933	0.3123	165	240
		8.0	0.3150	165	240
	21/64	8.334	0.3281	165	240
		8.5	0.3346	165	240
	11/32	8.731	0.3437	175	250
		9.0	0.3543	175	250
	23/64	9.128	0.3594	175	250
		9.5	0.3740	175	250
△	3/8	9.525	0.3750	185	265
		10.0	0.3937	185	265

Series 3

(Unit) : mm

	Size		Decimal Equivalent	Flute Length	Overall Length
	Fractional L6541P	Metric L6540P			
*		3.0	0.1181	130	190
	1/8	3.175	0.1250	135	200
*		3.5	0.1378	145	210
△	9/64	3.572	0.1406	145	210
△	5/32	3.969	0.1563	150	220
*		4.0	0.1575	150	220
△	11/64	4.366	0.1719	160	235
*		4.5	0.1772	160	235
	3/16	4.762	0.1875	170	245
		5.0	0.1969	170	245
		5.5	0.2165	180	260
△	7/32	5.556	0.2187	180	260
		6.0	0.2362	180	260
	1/4	6.35	0.2500	190	275
		6.5	0.2559	190	275
*		7.0	0.2756	200	290
*		7.5	0.2953	200	290
	5/16	7.933	0.3123	210	305
*		8.0	0.3150	210	305
*		8.5	0.3346	210	305
*		9.0	0.3543	220	320
*		9.5	0.3740	220	320
*		10.0	0.3937	235	340

• Other size manufactured upon request.

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

△CUSTOM-MADE ITEM : Please choose nearest metric size. If it is not acceptable, please contact our office 1-888-340-8665.

AQUA DRILLS STUB / METRIC SIZES

JAPAN STOCK ITEM*

List No.9550 High Performance

h7 AQ Carbide HELIX N 140 2RAKE+XR

Range 3.0 to 20.0

SOLID CARBIDE AQUA COATED

This drill having stub length is suited for high-speed and long life drilling, and is useful in dry-process. This is suitable for most workpiece materials from raw material to hardened material.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
3.0	0.1181	16	48	3
3.1	0.1220	18	50	4
3.2	0.1260	18	50	4
3.3	0.1299	18	50	4
3.4	0.1339	20	52	4
3.5	0.1378	20	52	4
3.6	0.1417	20	52	4
3.7	0.1457	20	52	4
3.8	0.1496	22	54	4
3.9	0.1535	22	54	4
4.0	0.1575	22	54	4
4.1	0.1614	22	66	6
4.2	0.1654	22	66	6
4.3	0.1693	24	68	6
4.4	0.1732	24	68	6
4.5	0.1772	24	68	6
4.6	0.1811	24	68	6
4.7	0.1850	24	68	6
4.8	0.1890	26	70	6
4.9	0.1929	26	70	6
5.0	0.1969	26	70	6
5.1	0.2008	26	70	6
5.2	0.2047	26	70	6
5.3	0.2087	26	70	6
5.4	0.2126	28	72	6
5.5	0.2165	28	72	6
5.6	0.2205	28	72	6
5.7	0.2244	28	72	6
5.8	0.2283	28	72	6
5.9	0.2323	28	72	6
6.0	0.2362	28	72	6
6.1	0.2402	31	75	8
6.2	0.2441	31	75	8
6.3	0.2480	31	75	8
6.4	0.2520	31	75	8
6.5	0.2559	31	75	8
6.6	0.2598	31	75	8
6.7	0.2638	31	75	8
6.8	0.2677	34	78	8
6.9	0.2717	34	78	8
7.0	0.2756	34	78	8
7.1	0.2795	34	78	8
7.2	0.2835	34	78	8
7.3	0.2874	34	78	8
7.4	0.2913	34	78	8
7.5	0.2953	34	78	8
7.6	0.2992	37	81	8
7.7	0.3031	37	81	8
7.8	0.3071	37	81	8
7.9	0.3110	37	81	8
8.0	0.3150	37	81	8
8.1	0.3189	37	87	10
8.2	0.3228	37	87	10
8.3	0.3268	37	87	10
8.4	0.3307	37	87	10
8.5	0.3346	37	87	10
8.6	0.3386	40	90	10
8.7	0.3425	40	90	10
8.8	0.3465	40	90	10

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
8.9	0.3504	40	90	10
9.0	0.3543	40	90	10
9.1	0.3583	40	90	10
9.2	0.3622	40	90	10
9.3	0.3661	40	90	10
9.4	0.3701	40	90	10
9.5	0.3740	40	90	10
9.6	0.3780	43	93	10
9.7	0.3819	43	93	10
9.8	0.3858	43	93	10
9.9	0.3898	43	93	10
10.0	0.3937	43	93	10
10.1	0.3976	43	100	12
10.2	0.4016	43	100	12
10.3	0.4055	43	100	12
10.4	0.4094	43	100	12
10.5	0.4134	43	100	12
10.6	0.4173	43	100	12
10.7	0.4213	47	104	12
10.8	0.4252	47	104	12
10.9	0.4291	47	104	12
11.0	0.4331	47	104	12
11.1	0.4370	47	104	12
11.2	0.4409	47	104	12
11.3	0.4449	47	104	12
11.4	0.4488	47	104	12
11.5	0.4528	47	104	12
11.6	0.4567	47	104	12
11.7	0.4606	47	104	12
11.8	0.4646	47	104	12
11.9	0.4685	51	108	12
12.0	0.4724	51	108	12
12.1	0.4764	51	110	14
12.2	0.4803	51	110	14
12.3	0.4843	51	110	14
12.4	0.4882	51	110	14
12.5	0.4921	51	110	14
12.6	0.4961	51	110	14
12.7	0.5000	51	110	14
12.8	0.5039	51	110	14
12.9	0.5079	51	110	14
13.0	0.5118	51	110	14
13.5	0.5315	72	130	14
14.0	0.5512	72	130	14
14.1	0.5551	76	136	16
14.5	0.5709	76	136	16
14.6	0.5748	76	136	16
15.0	0.5906	76	136	16
15.5	0.6102	80	144	16
16.0	0.6299	80	144	16
16.5	0.6496	84	150	18
17.0	0.6693	84	150	18
17.5	0.6890	87	153	18
18.0	0.7087	87	153	18
18.5	0.7283	90	156	20
19.0	0.7480	90	156	20
19.5	0.7677	94	160	20
20.0	0.7874	94	160	20

1 per tube

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AQUA DRILLS STUB / FRACTIONAL SIZES

List No.9551 High Performance

h7 AQ Carbide HELIX N 140° 2RAKE+XR

Range 1/8 to 3/4

SOLID CARBIDE AQUA COATED

This drill having stub length is suited for high-speed and long life drilling, and is useful in dry-process. This is suitable for most workpiece materials from raw material to hardened material.

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
1/8	0.1250	3/4	2	1/8
9/64	0.1406	13/16	2-1/8	3/16
5/32	0.1563	13/16	2-1/8	3/16
11/64	0.1719	1	2-3/8	3/16
3/16	0.1875	1	2-3/8	3/16
13/64	0.2031	1-1/8	2-7/8	1/4
7/32	0.2188	1-1/8	2-7/8	1/4
15/64	0.2344	1-1/4	3	1/4
1/4	0.2500	1-1/4	3	1/4
17/64	0.2656	1-3/8	3-3/16	3/8
9/32	0.2813	1-3/8	3-3/16	3/8
19/64	0.2969	1-3/8	3-3/16	3/8
5/16	0.3125	1-1/2	3-3/8	3/8
21/64	0.3281	1-1/2	3-3/8	3/8
11/32	0.3438	1-5/8	3-1/2	3/8
23/64	0.3594	1-5/8	3-1/2	3/8
3/8	0.3750	1-5/8	3-1/2	3/8
25/64	0.3906	1-11/16	3-7/8	1/2
13/32	0.4063	1-11/16	3-7/8	1/2
27/64	0.4219	1-7/8	4-1/8	1/2
7/16	0.4375	1-7/8	4-1/8	1/2
29/64	0.4531	1-7/8	4-1/8	1/2
15/32	0.4688	2	4-1/4	1/2
31/64	0.4844	2	4-1/4	1/2
1/2	0.5000	2	4-1/4	1/2
17/32	0.5313	2-7/8	5-3/16	5/8
9/16	0.5625	3	5-3/8	5/8
19/32	0.5938	3	5-5/8	3/4
5/8	0.6250	3-3/16	5-3/4	3/4
21/32	0.6563	3-3/8	5-15/16	3/4
11/16	0.6875	3-7/16	6	3/4
23/32	0.7188	3-7/16	6	7/8
3/4	0.7500	3-9/16	6-1/2	7/8

1 per tube

AQUA DRILLS REGULAR / METRIC SIZES

USA & JAPAN STOCK ITEM*

List No.9552 High Performance

h7 AQ Carbide HELIX N 140° 2RAKE+X

Range 2.0 to 20.0

SOLID CARBIDE AQUA COATED

This drill having 5 times flute of drill diameter is suited for high-speed and long life drilling, and is useful in dry-process. This is suitable for most workpiece materials from raw material to hardened material.

(Unit) : mm

	Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
*	2.0	0.0787	15	47	3
*	2.05	0.0807	15	47	3
*	2.1	0.0827	15	47	3
*	2.15	0.0846	16	48	3
*	2.2	0.0866	16	48	3
*	2.25	0.0886	16	48	3
*	2.3	0.0906	16	48	3
*	2.35	0.0925	16	48	3
*	2.4	0.0945	17	49	3
*	2.45	0.0965	17	49	3
*	2.5	0.0984	17	49	3
*	2.55	0.1004	17	49	3
*	2.6	0.1024	17	49	3
*	2.65	0.1043	17	49	3
*	2.7	0.1063	19	51	3
*	2.75	0.1083	19	51	3
*	2.8	0.1102	19	51	3
*	2.85	0.1122	19	51	3
*	2.9	0.1142	19	51	3
*	2.95	0.1161	19	51	3
	3.0	0.1181	19	51	3
	3.1	0.1220	21	53	4
	3.2	0.1260	21	53	4
	3.3	0.1299	21	53	4
	3.4	0.1339	24	56	4
	3.5	0.1378	24	56	4
	3.6	0.1417	24	56	4
	3.7	0.1457	24	56	4
	3.8	0.1496	27	59	4
	3.9	0.1535	27	59	4
	4.0	0.1575	27	59	4
	4.1	0.1614	27	71	6
	4.2	0.1654	27	71	6
	4.3	0.1693	31	75	6
	4.4	0.1732	31	75	6
	4.5	0.1772	31	75	6
	4.6	0.1811	31	75	6
	4.7	0.1850	31	75	6
	4.8	0.1890	33	77	6
	4.9	0.1929	33	77	6
	5.0	0.1969	38	82	6
	5.1	0.2008	38	82	6
	5.2	0.2047	38	82	6
	5.3	0.2087	38	82	6
	5.4	0.2126	38	82	6
	5.5	0.2165	38	82	6
	5.6	0.2205	41	85	6
	5.7	0.2244	41	85	6
	5.8	0.2283	41	85	6
	5.9	0.2323	41	85	6
	6.0	0.2362	41	85	6
	6.1	0.2402	41	85	8
	6.2	0.2441	41	85	8
	6.3	0.2480	41	85	8
	6.4	0.2520	41	85	8
	6.5	0.2559	41	85	8
	6.6	0.2598	43	87	8
	6.7	0.2638	43	87	8
	6.8	0.2677	43	87	8
	6.9	0.2717	43	87	8
	7.0	0.2756	43	87	8
	7.1	0.2795	45	89	8
	7.2	0.2835	45	89	8
	7.3	0.2874	45	89	8
	7.4	0.2913	45	89	8
	7.5	0.2953	45	89	8
	7.6	0.2992	48	92	8
	7.7	0.3031	48	92	8
	7.8	0.3071	48	92	8
	7.9	0.3110	48	92	8
	8.0	0.3150	48	92	8
	8.1	0.3189	53	103	10
	8.2	0.3228	53	103	10
	8.3	0.3268	53	103	10
	8.4	0.3307	53	103	10
	8.5	0.3346	53	103	10
	8.6	0.3386	55	105	10
	8.7	0.3425	55	105	10
	8.8	0.3465	55	105	10
	8.9	0.3504	55	105	10
	9.0	0.3543	55	105	10
	9.1	0.3583	58	108	10
	9.2	0.3622	58	108	10
	9.3	0.3661	58	108	10
	9.4	0.3701	58	108	10
	9.5	0.3740	58	108	10
	9.6	0.3780	60	110	10
	9.7	0.3819	60	110	10
	9.8	0.3858	60	110	10
	9.9	0.3898	60	110	10
	10.0	0.3937	60	110	10
	10.1	0.3976	66	123	12
	10.2	0.4016	66	123	12
	10.3	0.4055	66	123	12
	10.4	0.4094	66	123	12
	10.5	0.4134	66	123	12
	10.6	0.4173	68	125	12
	10.7	0.4213	68	125	12
	10.8	0.4252	68	125	12
	10.9	0.4291	68	125	12
	11.0	0.4331	68	125	12
	11.1	0.4370	71	128	12
	11.2	0.4409	71	128	12
	11.3	0.4449	71	128	12
	11.4	0.4488	71	128	12
	11.5	0.4528	71	128	12
	11.6	0.4567	73	130	12
	11.7	0.4606	73	130	12
	11.8	0.4646	73	130	12
	11.9	0.4685	73	130	12
	12.0	0.4724	73	130	12
	12.1	0.4764	76	135	14
	12.2	0.4803	76	135	14
	12.3	0.4843	76	135	14
	12.4	0.4882	76	135	14
	12.5	0.4921	76	135	14
	12.6	0.4961	78	137	14
	12.7	0.5000	78	137	14
	12.8	0.5039	78	137	14
	12.9	0.5079	78	137	14
	13.0	0.5118	78	137	14
	13.5	0.5315	84	144	14
	14.0	0.5512	86	144	14
	14.5	0.5709	89	149	16
	15.0	0.5906	91	151	16
	15.5	0.6102	94	158	16
	16.0	0.6299	96	160	16
	16.5	0.6496	102	168	18
	17.0	0.6693	102	168	18
	17.5	0.6890	102	168	18
	18.0	0.7087	102	168	18
	18.5	0.7283	114	184	20
	19.0	0.7480	114	184	20
	19.5	0.7677	114	184	20
	20.0	0.7874	114	184	20

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AQUA DRILLS WITH MIST-HOLE 3D / METRIC SIZES

JAPAN STOCK ITEM*

List No.9558 Metric Sizes

h7 AQ Carbide HELIX N 140° 2RAKE+X OIL HOLE

Range 4.5 to 16.0

SOLID CARBIDE AQUA COATED

This mist-hole drill having 3 times flute of drill diameter is most suitable for "Semi-dry(MQL)" drilling, and applied in high-speed and long life drilling of most workpiece materials from raw materials to hardened materials.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
4.5	0.1772	25	78	5
5.0	0.1969	28	78	5
5.1	0.2008	31	82	6
5.5	0.2165	31	82	6
5.6	0.2205	33	82	6
6.0	0.2362	33	82	6
6.1	0.2402	36	88	7
6.5	0.2559	36	88	7
6.7	0.2638	39	88	7
6.8	0.2677	39	88	7
6.9	0.2717	39	88	7
7.0	0.2756	39	88	7
7.1	0.2795	42	94	8
7.5	0.2953	42	94	8
7.9	0.3110	44	94	8
8.0	0.3150	44	94	8
8.5	0.3346	47	100	9
8.6	0.3386	50	100	9
8.8	0.3465	50	100	9
9.0	0.3543	50	100	9
9.1	0.3583	53	106	10
9.3	0.3661	53	106	10
9.5	0.3740	53	106	10
9.7	0.3819	55	106	10
9.8	0.3858	55	106	10
9.9	0.3898	55	106	10
10.0	0.3937	55	106	10
10.1	0.3976	58	116	11
10.2	0.4016	58	116	11
10.3	0.4055	58	116	11
10.4	0.4094	58	116	11
10.5	0.4134	58	116	11
10.6	0.4173	61	116	11
10.7	0.4213	61	116	11
10.8	0.4252	61	116	11
10.9	0.4291	61	116	11
11.0	0.4331	61	116	11
11.1	0.4370	64	122	12
11.2	0.4409	64	122	12
11.3	0.4449	64	122	12
11.4	0.4488	64	122	12
11.5	0.4528	64	122	12
11.6	0.4567	66	122	12
11.7	0.4606	66	122	12
11.8	0.4646	66	122	12
11.9	0.4685	66	122	12
12.0	0.4724	66	122	12
12.1	0.4764	69	128	13
12.2	0.4803	69	128	13
12.3	0.4843	69	128	13
12.4	0.4882	69	128	13
12.5	0.4921	69	128	13
12.6	0.4961	72	128	13
12.8	0.5039	72	128	13
13.0	0.5118	72	128	13
13.3	0.5236	75	134	14
13.4	0.5276	75	134	14
13.5	0.5315	75	134	14
13.6	0.5354	77	134	14
13.7	0.5394	77	134	14
13.8	0.5433	77	134	14
13.9	0.5472	77	134	14
14.0	0.5512	77	134	14
14.1	0.5551	80	140	15
14.3	0.5630	80	140	15
14.4	0.5669	80	140	15
14.5	0.5709	80	140	15
14.6	0.5748	83	140	15
14.7	0.5787	83	140	15
14.8	0.5827	83	140	15
14.9	0.5866	83	140	15
15.0	0.5906	83	140	15
15.1	0.5945	86	146	16
15.2	0.5984	86	146	16
15.3	0.6024	86	146	16
15.4	0.6063	86	146	16
15.5	0.6102	86	146	16
15.6	0.6142	88	146	16
15.7	0.6181	88	146	16
15.8	0.6220	88	146	16
15.9	0.6260	88	146	16
16.0	0.6299	88	146	16

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AQUA DRILLS WITH MIST-HOLE 5D / METRIC SIZES

USA & JAPAN STOCK ITEM*

List No.9554 Metric Sizes

h7 AQ Carbide HELIX N 140° 2RAKE+X OIL HOLE

Range 4.2 to 16.0

SOLID CARBIDE AQUA COATED

This mist-hole drill having 5 times flute of drill diameter is most suitable for "Semi-dry(MQL)" drilling, and applied in high-speed and long life drilling of most workpiece materials from raw materials to hardened materials.

(Unit) : mm

	Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
*	4.2	0.1654	34	88	5
*	4.3	0.1693	34	88	5
	4.5	0.1772	34	88	5
*	4.6	0.1811	38	88	5
	4.8	0.1890	38	88	5
	4.9	0.1929	38	88	5
	5.0	0.1969	38	88	5
*	5.1	0.2008	42	95	6
*	5.2	0.2047	42	95	6
*	5.4	0.2126	42	95	6
	5.5	0.2165	42	95	6
	5.6	0.2205	45	95	6
*	5.7	0.2244	45	95	6
	5.8	0.2283	45	95	6
	6.0	0.2362	45	95	6
*	6.1	0.2402	49	103	7
*	6.2	0.2441	49	103	7
	6.3	0.2480	49	103	7
	6.4	0.2520	49	103	7
	6.5	0.2559	49	103	7
*	6.6	0.2598	53	103	7
*	6.7	0.2638	53	103	7
*	6.8	0.2677	53	103	7
*	6.9	0.2717	53	103	7
	7.0	0.2756	53	103	7
*	7.2	0.2835	57	111	8
*	7.3	0.2874	57	111	8
*	7.4	0.2913	57	111	8
	7.5	0.2953	57	111	8
*	7.6	0.2992	60	111	8
*	7.7	0.3031	60	111	8
*	7.8	0.3071	60	111	8
	8.0	0.3150	60	111	8
*	8.2	0.3228	64	119	9
*	8.4	0.3307	64	119	9

	Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
	8.5	0.3346	64	119	9
*	8.6	0.3386	68	119	9
	8.7	0.3425	68	119	9
*	8.8	0.3465	68	119	9
*	8.9	0.3504	68	119	9
	9.0	0.3543	68	119	9
*	9.2	0.3622	72	127	10
*	9.4	0.3701	72	127	10
	9.5	0.3740	72	127	10
*	9.6	0.3780	75	127	10
*	9.7	0.3819	75	127	10
*	9.8	0.3858	75	127	10
*	9.9	0.3898	75	127	10
	10.0	0.3937	75	127	10
*	10.1	0.3976	79	140	11
	10.3	0.4055	79	140	11
*	10.4	0.4094	79	140	11
	10.5	0.4134	79	140	11
*	10.6	0.4173	83	140	11
*	10.8	0.4252	83	140	11
	11.0	0.4331	83	140	11
	11.1	0.4370	87	148	12
*	11.2	0.4409	87	148	12
*	11.3	0.4449	87	148	12
*	11.4	0.4488	87	148	12
	11.5	0.4528	87	148	12
*	11.6	0.4567	90	148	12
*	11.8	0.4646	90	148	12
	11.9	0.4685	90	148	12
	12.0	0.4724	90	148	12
*	12.1	0.4764	94	156	13
*	12.2	0.4803	94	156	13
*	12.3	0.4843	94	156	13
*	12.4	0.4882	94	156	13

	Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
	12.5	0.4921	94	156	13
*	12.6	0.4961	98	156	13
	12.7	0.5000	98	156	13
*	12.8	0.5039	98	156	13
*	12.9	0.5079	98	156	13
	13.0	0.5118	98	156	13
*	13.1	0.5157	102	164	14
*	13.2	0.5197	102	164	14
*	13.4	0.5276	102	164	14
	13.5	0.5315	102	164	14
*	13.6	0.5354	105	164	14
*	13.7	0.5394	105	164	14
*	13.8	0.5433	105	164	14
*	13.9	0.5472	105	164	14
	14.0	0.5512	105	164	14
*	14.2	0.5591	109	172	15
	14.3	0.5630	109	172	15
*	14.4	0.5669	109	172	15
	14.5	0.5709	109	172	15
*	14.6	0.5748	113	172	15
*	14.7	0.5787	113	172	15
*	14.8	0.5827	113	172	15
*	14.9	0.5866	113	172	15
	15.0	0.5906	113	172	15
	15.1	0.5945	117	180	16
*	15.2	0.5984	117	180	16
*	15.3	0.6024	117	180	16
*	15.4	0.6063	117	180	16
	15.5	0.6102	117	180	16
*	15.6	0.6142	120	180	16
*	15.7	0.6181	120	180	16
*	15.8	0.6220	120	180	16
	15.9	0.6260	120	180	16
	16.0	0.6299	120	180	16

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AQUA DRILLS WITH MIST-HOLE 7D / METRIC SIZES FRACTIONAL SIZES

List No.9556 Metric Sizes
List No.9569 Fractional

h7 AQ Carbide HELIX N 140 2RAKE+X OIL HOLE

Range L9556 5.0 to 16.0
Range L9569 3/16 to 5/8

SOLID CARBIDE AQUA COATED

This mist-hole drill having 7 times flute of drill diameter is most suitable for "Semi-dry(MQL)" drilling, and applied in high-speed and long life drilling of most workpiece materials from raw materials to hardened materials.

(Unit) : mm

L9556

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
5.0	0.1969	48	97	5
5.1	0.2008	53	110	6
5.5	0.2165	53	110	6
6.0	0.2362	57	110	6
6.1	0.2402	62	120	7
6.5	0.2559	62	120	7
6.8	0.2677	67	120	7
6.9	0.2717	67	120	7
7.0	0.2756	67	120	7
7.5	0.2953	72	130	8
8.0	0.3150	76	130	8
8.5	0.3346	81	140	9
8.6	0.3386	86	140	9
8.8	0.3465	86	140	9
9.0	0.3543	86	140	9
9.5	0.3740	91	150	10
9.8	0.3858	95	150	10
9.9	0.3898	95	150	10
10.0	0.3937	95	150	10
10.3	0.4055	100	170	11
10.5	0.4134	100	170	11
10.8	0.4252	105	170	11
11.0	0.4331	105	170	11
11.5	0.4528	110	180	12
12.0	0.4724	114	180	12
12.5	0.4921	119	190	13
13.0	0.5118	124	190	13
13.5	0.5315	129	200	14
14.0	0.5512	133	200	14
14.5	0.5709	138	210	15
15.0	0.5906	143	210	15
15.5	0.6102	148	220	16
16.0	0.6299	152	220	16

1 per tube

L9569

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
3/16	0.1875	1-7/8	3-13/16	3/16
13/64	0.2031	2-1/16	4-21/64	13/64
7/32	0.2188	2-15/64	4-21/64	7/32
15/64	0.2344	2-15/64	4-21/64	15/64
1/4	0.2500	2-7/16	4-23/32	1/4
17/64	0.2656	2-5/8	4-23/32	17/64
9/32	0.2813	2-53/64	5-7/64	9/32
19/64	0.2969	2-63/64	5-7/64	19/64
5/16	0.3125	2-63/64	5-7/64	5/16
21/64	0.3281	3-3/16	5-1/2	21/64
11/32	0.3438	3-3/8	5-1/2	11/32
23/64	0.3594	3-37/64	5-57/64	23/64
3/8	0.3750	3-37/64	5-57/64	3/8
25/64	0.3906	3-47/64	5-57/64	25/64
13/32	0.4063	3-59/64	6-11/16	13/32
27/64	0.4219	4-3/16	6-11/16	27/64
7/16	0.4375	4-21/64	7-5/64	7/16
29/64	0.4531	4-31/64	7-5/64	29/64
15/32	0.4688	4-31/64	7-5/64	15/32
31/64	0.4844	4-43/64	7-15/32	31/64
1/2	0.5000	4-7/8	7-15/32	1/2
17/32	0.5313	5-5/64	7-7/8	17/32
9/16	0.5625	5-27/64	8-17/64	9/16
19/32	0.5938	5-13/16	8-21/32	19/32
5/8	0.6250	5-63/64	8-21/32	5/8

1 per tube

AQUA DRILLS THREE FLUTES / METRIC SIZES

JAPAN STOCK ITEM*

List No.9546 High Performance

3FLUTE js6 AQ Carbide HELIX N 150 2RAKE+3F

Range 3.0 to 12.0

SOLID CARBIDE AQUA COATED

This drill having balanced 3 flutes is suitable for precision drilling without reaming.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
3.0	0.1181	16	48	3
3.1	0.1220	18	50	4
3.2	0.1260	18	50	4
3.3	0.1299	18	50	4
3.4	0.1339	20	52	4
3.5	0.1378	20	52	4
3.6	0.1417	20	52	4
3.7	0.1457	20	52	4
3.8	0.1496	22	54	4
3.9	0.1535	22	54	4
4.0	0.1575	22	54	4
4.1	0.1614	22	66	6
4.2	0.1654	22	66	6
4.3	0.1693	24	68	6
4.4	0.1732	24	68	6
4.5	0.1772	24	68	6
4.6	0.1811	24	68	6
4.7	0.1850	24	68	6
4.8	0.1890	26	70	6
4.9	0.1929	26	70	6
5.0	0.1969	26	70	6
5.1	0.2008	26	70	6
5.2	0.2047	26	70	6
5.3	0.2087	26	70	6
5.4	0.2126	28	72	6
5.5	0.2165	28	72	6
5.6	0.2205	28	72	6
5.7	0.2244	28	72	6
5.8	0.2283	28	72	6
5.9	0.2323	28	72	6
6.0	0.2362	28	72	6
6.1	0.2402	31	75	8
6.2	0.2441	31	75	8
6.3	0.2480	31	75	8
6.4	0.2520	31	75	8
6.5	0.2559	31	75	8
6.6	0.2598	31	75	8
6.7	0.2638	31	75	8
6.8	0.2677	34	78	8
6.9	0.2717	34	78	8
7.0	0.2756	34	78	8
7.1	0.2795	34	78	8
7.2	0.2835	34	78	8
7.3	0.2874	34	78	8
7.4	0.2913	34	78	8
7.5	0.2953	34	78	8

Size		Tolerance (μm)
Above	Up to	
	3.0	±3
3.0	10.0	±4
10.0		±5

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
7.6	0.2992	37	81	8
7.7	0.3031	37	81	8
7.8	0.3071	37	81	8
7.9	0.3110	37	81	8
8.0	0.3150	37	81	8
8.1	0.3189	37	87	10
8.2	0.3228	37	87	10
8.3	0.3268	37	87	10
8.4	0.3307	37	87	10
8.5	0.3346	37	87	10
8.6	0.3386	40	90	10
8.7	0.3425	40	90	10
8.8	0.3465	40	90	10
8.9	0.3504	40	90	10
9.0	0.3543	40	90	10
9.1	0.3583	40	90	10
9.2	0.3622	40	90	10
9.3	0.3661	40	90	10
9.4	0.3701	40	90	10
9.5	0.3740	40	90	10
9.6	0.3780	43	93	10
9.7	0.3819	43	93	10
9.8	0.3858	43	93	10
9.9	0.3898	43	93	10
10.0	0.3937	43	93	10
10.1	0.3976	43	100	12
10.2	0.4016	43	100	12
10.3	0.4055	43	100	12
10.4	0.4094	43	100	12
10.5	0.4134	43	100	12
10.6	0.4173	43	100	12
10.7	0.4213	47	104	12
10.8	0.4252	47	104	12
10.9	0.4291	47	104	12
11.0	0.4331	47	104	12
11.1	0.4370	47	104	12
11.2	0.4409	47	104	12
11.3	0.4449	47	104	12
11.4	0.4488	47	104	12
11.5	0.4528	47	104	12
11.6	0.4567	47	104	12
11.7	0.4606	47	104	12
11.8	0.4646	47	104	12
11.9	0.4685	51	108	12
12.0	0.4724	51	108	12

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AQUA DRILLS HARD / METRIC SIZES

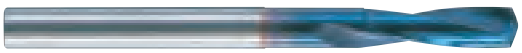
JAPAN STOCK ITEM*

List No.9548 High Performance

h7 AQ Carbide HELIX L 140° 2RAKE+XR

Range 2.0 to 12.0

SOLID CARBIDE AQUA COATED



This drill meets high efficiency drilling of hardened material.
(50~70HRC)

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
2.0	0.0787	12	44	3
2.1	0.0827	12	44	3
2.5	0.0984	14	46	3
2.6	0.1024	14	46	3
3.0	0.1181	16	48	3
3.4	0.1339	20	52	4
3.5	0.1378	20	52	4
4.0	0.1575	22	54	4
4.3	0.1693	24	68	6
4.5	0.1772	24	68	6
5.0	0.1969	26	70	6
5.1	0.2008	26	70	6
5.5	0.2165	28	72	6
6.0	0.2362	28	72	6
6.5	0.2559	31	75	8
6.9	0.2717	34	78	8
7.0	0.2756	34	78	8
7.5	0.2953	34	78	8
8.0	0.3150	37	81	8
8.5	0.3346	37	87	10
8.6	0.3386	40	90	10
9.0	0.3543	40	90	10
9.5	0.3740	40	90	10
10.0	0.3937	43	93	10
10.3	0.4055	43	100	12
10.5	0.4134	43	100	12
11.0	0.4331	47	104	12
11.5	0.4528	47	104	12
12.0	0.4724	51	108	12

1 per tube

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AQUA MICRO DRILLS / METRIC SIZES

JAPAN STOCK ITEM*

List No.9544 High Performance

Range 0.20 to 1.99

SOLID CARBIDE AQUA COATED

This drill is suitable for stable drilling in small diameter on many kind of materials from raw material to hardened material.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
0.20	0.0079	2.5	38	3
0.21	0.0083	2.5	38	3
0.22	0.0087	2.5	38	3
0.23	0.0091	2.5	38	3
0.24	0.0094	2.5	38	3
0.25	0.0098	2.5	38	3
0.26	0.0102	2.5	38	3
0.27	0.0106	2.5	38	3
0.28	0.0110	2.5	38	3
0.29	0.0114	2.5	38	3
0.30	0.0118	3	38	3
0.31	0.0122	3	38	3
0.32	0.0126	3	38	3
0.33	0.0130	3	38	3
0.34	0.0134	3	38	3
0.35	0.0138	4	38	3
0.36	0.0142	4	38	3
0.37	0.0146	4	38	3
0.38	0.0150	4	38	3
0.39	0.0154	4	38	3
0.40	0.0157	5	38	3
0.41	0.0161	5	38	3
0.42	0.0165	5	38	3
0.43	0.0169	5	38	3
0.44	0.0173	5	38	3
0.45	0.0177	5	38	3
0.46	0.0181	5	38	3
0.47	0.0185	5	38	3
0.48	0.0189	5	38	3
0.49	0.0193	5	38	3
0.50	0.0197	6	38	3
0.51	0.0201	6	38	3
0.52	0.0205	6	38	3
0.53	0.0209	6	38	3
0.54	0.0213	6	38	3
0.55	0.0217	6	38	3
0.56	0.0220	6	38	3
0.57	0.0224	6	38	3
0.58	0.0228	6	38	3
0.59	0.0232	6	38	3
0.60	0.0236	7	38	3
0.61	0.0240	7	38	3
0.62	0.0244	7	38	3
0.63	0.0248	7	38	3
0.64	0.0252	7	38	3
0.65	0.0256	7	38	3
0.66	0.0260	7	38	3
0.67	0.0264	7	38	3
0.68	0.0268	7	38	3
0.69	0.0272	7	38	3
0.70	0.0276	9	38	3
0.71	0.0280	9	38	3
0.72	0.0283	9	38	3
0.73	0.0287	9	38	3
0.74	0.0291	9	38	3
0.75	0.0295	9	38	3
0.76	0.0299	9	38	3
0.77	0.0303	9	38	3
0.78	0.0307	9	38	3
0.79	0.0311	9	38	3
0.80	0.0315	10	38	3
0.81	0.0319	10	38	3
0.82	0.0323	10	38	3
0.83	0.0327	10	38	3
0.84	0.0331	10	38	3
0.85	0.0335	10	38	3
0.86	0.0339	10	38	3
0.87	0.0343	10	38	3
0.88	0.0346	10	38	3
0.89	0.0350	10	38	3
0.90	0.0354	11	38	3
0.91	0.0358	11	38	3
0.92	0.0362	11	38	3
0.93	0.0366	11	38	3
0.94	0.0370	11	38	3
0.95	0.0374	11	38	3
0.96	0.0378	11	38	3
0.97	0.0382	11	38	3
0.98	0.0386	11	38	3
0.99	0.0390	11	38	3
1.00	0.0394	12	38	3
1.01	0.0398	12	38	3
1.02	0.0402	12	38	3
1.03	0.0406	12	38	3
1.04	0.0409	12	38	3
1.05	0.0413	12	38	3
1.06	0.0417	12	38	3
1.07	0.0421	12	38	3
1.08	0.0425	12	38	3
1.09	0.0429	12	38	3
1.10	0.0433	14	47	3
1.11	0.0437	14	47	3
1.12	0.0441	14	47	3
1.13	0.0445	14	47	3
1.14	0.0449	14	47	3
1.15	0.0453	14	47	3
1.16	0.0457	14	47	3
1.17	0.0461	14	47	3
1.18	0.0465	14	47	3
1.19	0.0469	14	47	3
1.20	0.0472	15	47	3
1.21	0.0476	15	47	3
1.22	0.0480	15	47	3
1.23	0.0484	15	47	3
1.24	0.0488	15	47	3
1.25	0.0492	15	47	3
1.26	0.0496	15	47	3
1.27	0.0500	15	47	3
1.28	0.0504	15	47	3
1.29	0.0508	15	47	3
1.30	0.0512	15	47	3
1.31	0.0516	15	47	3
1.32	0.0520	15	47	3
1.33	0.0524	15	47	3
1.34	0.0528	15	47	3
1.35	0.0531	15	47	3
1.36	0.0535	15	47	3
1.37	0.0539	15	47	3
1.38	0.0543	15	47	3
1.39	0.0547	15	47	3
1.40	0.0551	15	47	3
1.41	0.0555	15	47	3
1.42	0.0559	15	47	3
1.43	0.0563	15	47	3
1.44	0.0567	15	47	3
1.45	0.0571	15	47	3
1.46	0.0575	15	47	3
1.47	0.0579	15	47	3
1.48	0.0583	15	47	3
1.49	0.0587	15	47	3
1.50	0.0591	15	47	3
1.51	0.0594	15	47	3
1.52	0.0598	15	47	3
1.53	0.0602	15	47	3
1.54	0.0606	15	47	3
1.55	0.0610	15	47	3
1.56	0.0614	15	47	3
1.57	0.0618	15	47	3
1.58	0.0622	15	47	3
1.59	0.0626	15	47	3
1.60	0.0630	15	47	3
1.61	0.0634	15	47	3
1.62	0.0638	15	47	3
1.63	0.0642	15	47	3
1.64	0.0646	15	47	3
1.65	0.0650	15	47	3
1.66	0.0654	15	47	3
1.67	0.0657	15	47	3
1.68	0.0661	15	47	3
1.69	0.0665	15	47	3
1.70	0.0669	15	47	3
1.71	0.0673	15	47	3
1.72	0.0677	15	47	3
1.73	0.0681	15	47	3
1.74	0.0685	15	47	3
1.75	0.0689	15	47	3
1.76	0.0693	15	47	3
1.77	0.0697	15	47	3
1.78	0.0701	15	47	3
1.79	0.0705	15	47	3
1.80	0.0709	15	47	3
1.81	0.0713	15	47	3
1.82	0.0717	15	47	3
1.83	0.0720	15	47	3
1.84	0.0724	15	47	3
1.85	0.0728	15	47	3
1.86	0.0732	15	47	3
1.87	0.0736	15	47	3
1.88	0.0740	15	47	3
1.89	0.0744	15	47	3
1.90	0.0748	15	47	3
1.91	0.0752	15	47	3
1.92	0.0756	15	47	3
1.93	0.0760	15	47	3
1.94	0.0764	15	47	3
1.95	0.0768	15	47	3
1.96	0.0772	15	47	3
1.97	0.0776	15	47	3
1.98	0.0780	15	47	3
1.99	0.0783	15	47	3

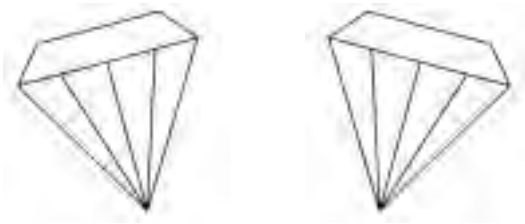
Tolerance of Drill Dia : +0.000
-0.009

1 per tube

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

DIAMOND COATED CARBIDE DRILLS

List No.9501D Diamond Coated



CARBIDE DIAMOND COATED

Size	Decimal Equivalent	Flute Length	Overall Length
1/16	0.0625	7/8	1 7/8
1/8	0.1250	1 5/8	2 3/4
3/16	0.1875	2 5/16	3 1/2
1/4	0.2500	2 3/4	4
5/16	0.3125	3 1/16	4 1/2
3/8	0.3750	3 5/8	5
7/16	0.4375	4 1/16	5 1/2
1/2	0.5000	4 1/2	6

1 per tube

DLC-HSS DRILLS / METRIC SIZES

JAPAN STOCK ITEM*

List No.544 High Performance

h7 | DLC | HSS | HELIX H | 135° | 2RAKE | 3RAKE >1.4

Range 1.0 to 13.0

HSS DLC COATED

High efficiency drilling of Aluminum Alloy is available.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
1.0	0.0394	12	50	3
1.1	0.0433	14	50	3
1.2	0.0472	16	50	3
1.3	0.0512	16	50	3
1.4	0.0551	18	50	3
1.5	0.0591	18	50	3
1.6	0.0630	20	56	3
1.7	0.0669	20	56	3
1.8	0.0709	22	56	3
1.9	0.0748	22	56	3
2.0	0.0787	24	56	3
2.1	0.0827	24	56	3
2.2	0.0866	25	56	3
2.3	0.0906	25	56	3
2.4	0.0945	30	64	3
2.5	0.0984	30	64	3
2.6	0.1024	30	64	3
2.7	0.1063	33	64	3
2.8	0.1102	33	64	3
2.9	0.1142	33	64	3
3.0	0.1181	33	64	3
3.1	0.1220	36	71	4
3.2	0.1260	36	71	4
3.3	0.1299	36	71	4
3.4	0.1339	39	71	4
3.5	0.1378	39	71	4
3.6	0.1417	39	71	4
3.7	0.1457	39	71	4
3.8	0.1496	43	75	4
3.9	0.1535	43	75	4
4.0	0.1575	43	75	4
4.1	0.1614	43	89	6
4.2	0.1654	43	89	6
4.3	0.1693	47	89	6
4.4	0.1732	47	89	6
4.5	0.1772	47	89	6
4.6	0.1811	47	89	6
4.7	0.1850	47	89	6
4.8	0.1890	52	94	6
4.9	0.1929	52	94	6
5.0	0.1969	52	94	6
5.1	0.2008	52	94	6
5.2	0.2047	52	94	6
5.3	0.2087	52	94	6
5.4	0.2126	57	99	6
5.5	0.2165	57	99	6
5.6	0.2205	57	99	6
5.7	0.2244	57	99	6
5.8	0.2283	57	99	6
5.9	0.2323	57	99	6
6.0	0.2362	57	99	6
6.1	0.2402	63	107	8
6.2	0.2441	63	107	8
6.3	0.2480	63	107	8
6.4	0.2520	63	107	8
6.5	0.2559	63	107	8
6.6	0.2598	63	107	8
6.7	0.2638	63	107	8
6.8	0.2677	69	113	8
6.9	0.2717	69	113	8
7.0	0.2756	69	113	8
7.1	0.2795	69	113	8
7.2	0.2835	69	113	8
7.3	0.2874	69	113	8
7.4	0.2913	69	113	8
7.5	0.2953	69	113	8
7.6	0.2992	75	119	8
7.7	0.3031	75	119	8
7.8	0.3071	75	119	8
7.9	0.3110	75	119	8
8.0	0.3150	75	119	8
8.1	0.3189	75	125	10
8.2	0.3228	75	125	10
8.3	0.3268	75	125	10
8.4	0.3307	75	125	10
8.5	0.3346	75	125	10
8.6	0.3386	81	131	10
8.7	0.3425	81	131	10
8.8	0.3465	81	131	10
8.9	0.3504	81	131	10
9.0	0.3543	81	131	10
9.1	0.3583	81	131	10
9.2	0.3622	81	131	10
9.3	0.3661	81	131	10
9.4	0.3701	81	131	10
9.5	0.3740	81	131	10
9.6	0.3780	87	137	10
9.7	0.3819	87	137	10
9.8	0.3858	87	137	10
9.9	0.3898	87	137	10
10.0	0.3937	87	137	10
10.1	0.3976	87	144	12
10.2	0.4016	87	144	12
10.3	0.4055	87	144	12
10.4	0.4094	87	144	12
10.5	0.4134	87	144	12
10.6	0.4173	87	144	12
10.7	0.4213	94	151	12
10.8	0.4252	94	151	12
10.9	0.4291	94	151	12
11.0	0.4331	94	151	12
11.1	0.4370	94	151	12
11.2	0.4409	94	151	12
11.3	0.4449	94	151	12
11.4	0.4488	94	151	12
11.5	0.4528	94	151	12
11.6	0.4567	94	151	12
11.7	0.4606	94	151	12
11.8	0.4646	94	151	12
11.9	0.4685	101	158	12
12.0	0.4724	101	158	12
12.1	0.4764	101	158	12
12.2	0.4803	101	158	12
12.3	0.4843	101	158	12
12.4	0.4882	101	158	12
12.5	0.4921	101	158	12
12.6	0.4961	101	158	12
12.7	0.5000	101	158	12
12.8	0.5039	101	158	12
12.9	0.5079	101	158	12
13.0	0.5118	101	158	12

1 per tube

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

DLC MICRODRILLS / METRIC SIZES

JAPAN STOCK ITEM*

List No.9524 High Performance

h7 DLC Carbide HELIX H 120° 2RAKE

Range 0.5 to 1.9

SOLID CARBIDE DLC COATED

High-speed wet processing and dry processing of Aluminum Alloy are available in small diameter.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Diameter
0.5	0.0197	6	44	3
0.6	0.0236	7	44	3
0.7	0.0276	9	44	3
0.8	0.0315	10	44	3
0.9	0.0354	11	44	3
1.0	0.0394	12	47	3
1.1	0.0433	14	47	3
1.2	0.0472	15	47	3
1.3	0.0512	15	47	3
1.4	0.0551	15	47	3
1.5	0.0591	15	47	3
1.6	0.0630	15	47	3
1.7	0.0669	15	47	3
1.8	0.0709	15	47	3
1.9	0.0748	15	47	3

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

DLC DRILLS REGULAR / METRIC SIZES

JAPAN STOCK ITEM*

List No.9520 High Performance

h7 DLC Carbide HELIX H 118° 2RAKE

Range 2.0 to 12.0

SOLID CARBIDE DLC COATED

High-speed wet processing and dry processing of Aluminum Alloy are available.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Dia.
2.0	0.0787	15	47	3
2.1	0.0827	15	47	3
2.2	0.0866	16	48	3
2.3	0.0906	16	48	3
2.4	0.0945	17	49	3
2.5	0.0984	17	49	3
2.6	0.1024	17	49	3
2.7	0.1063	19	51	3
2.8	0.1102	19	51	3
2.9	0.1142	19	51	3
3.0	0.1181	19	51	3
3.1	0.1220	21	53	4
3.2	0.1260	21	53	4
3.3	0.1299	21	53	4
3.4	0.1339	24	56	4
3.5	0.1378	24	56	4
3.6	0.1417	24	56	4
3.7	0.1457	24	56	4
3.8	0.1496	27	59	4
3.9	0.1535	27	59	4
4.0	0.1575	27	59	4
4.1	0.1614	27	71	6
4.2	0.1654	27	71	6
4.3	0.1693	31	75	6
4.4	0.1732	31	75	6
4.5	0.1772	31	75	6
4.6	0.1811	31	75	6
4.7	0.1850	31	75	6
4.8	0.1890	33	77	6
4.9	0.1929	33	77	6
5.0	0.1969	38	82	6
5.1	0.2008	38	82	6
5.2	0.2047	38	82	6
5.3	0.2087	38	82	6
5.4	0.2126	38	82	6
5.5	0.2165	38	82	6
5.6	0.2205	41	85	6
5.7	0.2244	41	85	6
5.8	0.2283	41	85	6
5.9	0.2323	41	85	6
6.0	0.2362	41	85	6
6.1	0.2402	41	85	8
6.2	0.2441	41	85	8
6.3	0.2480	41	85	8
6.4	0.2520	41	85	8
6.5	0.2559	41	85	8
6.6	0.2598	43	87	8
6.7	0.2638	43	87	8
6.8	0.2677	43	87	8
6.9	0.2717	43	87	8
7.0	0.2756	43	87	8
7.1	0.2795	45	89	8
7.2	0.2835	45	89	8
7.3	0.2874	45	89	8
7.4	0.2913	45	89	8
7.5	0.2953	45	89	8
7.6	0.2992	48	92	8
7.7	0.3031	48	92	8
7.8	0.3071	48	92	8
7.9	0.3110	48	92	8
8.0	0.3150	48	92	8
8.1	0.3189	53	103	10
8.2	0.3228	53	103	10
8.3	0.3268	53	103	10
8.4	0.3307	53	103	10
8.5	0.3346	53	103	10
8.6	0.3386	55	105	10
8.7	0.3425	55	105	10
8.8	0.3465	55	105	10
8.9	0.3504	55	105	10
9.0	0.3543	55	105	10
9.1	0.3583	58	108	10
9.2	0.3622	58	108	10
9.3	0.3661	58	108	10
9.4	0.3701	58	108	10
9.5	0.3740	58	108	10
9.6	0.3780	60	110	10
9.7	0.3819	60	110	10
9.8	0.3858	60	110	10
9.9	0.3898	60	110	10
10.0	0.3937	60	110	10
10.1	0.3976	66	123	12
10.2	0.4016	66	123	12
10.3	0.4055	66	123	12
10.4	0.4094	66	123	12
10.5	0.4134	66	123	12
10.6	0.4173	68	125	12
10.7	0.4213	68	125	12
10.8	0.4252	68	125	12
10.9	0.4291	68	125	12
11.0	0.4331	68	125	12
11.1	0.4370	71	128	12
11.2	0.4409	71	128	12
11.3	0.4449	71	128	12
11.4	0.4488	71	128	12
11.5	0.4528	71	128	12
11.6	0.4567	73	130	12
11.7	0.4606	73	130	12
11.8	0.4646	73	130	12
11.9	0.4685	73	130	12
12.0	0.4724	73	130	12

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

STRAIGHT SHANK JOBBERS LENGTH DRILL / METRIC SIZES

List No.500 General Purpose

h8 | HSS | HELIX N | 108° | 118° >0.55 | S-type >13.0 | Conical

Bright Finish 0.2 to 1.95 mm

Black Oxide 2.0 to 17.5 mm

HIGH SPEED STEEL

Used in wide variety of normal conditions. Will work in a broad range of materials in both machine and portable drilling.

(Unit) : mm

Size	Decimal Equivalent	Flute Length	Overall Length
0.20	0.0079	3	19
0.22	0.0087	3.5	20
0.25	0.0098	3.5	20
0.28	0.0110	3.5	20
0.30	0.0118	3.5	20
0.32	0.0126	5.5	24
0.35	0.0138	5.5	24
0.38	0.0150	5.5	24
0.40	0.0157	5.5	24
0.42	0.0165	7.5	27
0.45	0.0177	7.5	27
0.48	0.0189	7.5	27
0.50	0.0197	7.5	30
0.55	0.0217	8.5	30
0.60	0.0236	8.5	30
0.65	0.0256	10	32
0.70	0.0276	10	32
0.75	0.0295	11	34
0.80	0.0315	11	34
0.85	0.0335	13	36
0.90	0.0354	13	36
0.95	0.0374	18	40
1.00	0.0394	18	40
1.05	0.0413	20	42
1.10	0.0433	20	42
1.15	0.0453	20	42
1.20	0.0472	20	42
1.25	0.0492	22	45
1.30	0.0512	22	45
1.35	0.0531	23	48
1.40	0.0551	23	48
1.45	0.0571	23	48
1.50	0.0591	23	48
1.55	0.0610	25	50
1.60	0.0630	25	50
1.65	0.0650	25	50
1.70	0.0669	25	50
1.75	0.0689	28	52
1.80	0.0709	28	52
1.85	0.0728	28	52
1.90	0.0748	28	52
1.95	0.0768	29	55
2.00	0.0787	29	55
2.05	0.0807	29	55
2.10	0.0827	29	55
2.15	0.0846	29	55
2.20	0.0866	33	58
2.25	0.0886	33	58
2.30	0.0906	33	58
2.35	0.0925	33	58
2.40	0.0945	35	61
2.45	0.0965	35	61
2.50	0.0984	35	61
2.55	0.1004	37	64
2.60	0.1024	37	64
2.65	0.1043	37	64
2.70	0.1063	37	64
2.75	0.1083	39	67

Size	Decimal Equivalent	Flute Length	Overall Length
2.80	0.1102	39	67
2.85	0.1122	39	67
2.90	0.1142	42	71
2.95	0.1161	42	71
3.00	0.1181	42	71
3.10	0.1220	42	71
3.20	0.1260	42	71
3.25	0.1280	42	71
3.30	0.1299	45	73
3.40	0.1339	45	73
3.50	0.1378	45	73
3.60	0.1417	48	76
3.70	0.1457	48	76
3.75	0.1476	48	76
3.80	0.1496	48	76
3.90	0.1535	51	79
4.00	0.1575	54	83
4.10	0.1614	54	83
4.20	0.1654	54	83
4.25	0.1673	54	83
4.30	0.1693	54	83
4.40	0.1732	56	86
4.50	0.1772	56	86
4.60	0.1811	56	86
4.70	0.1850	59	89
4.75	0.1870	59	89
4.80	0.1890	59	89
4.90	0.1929	62	92
5.00	0.1969	62	92
5.10	0.2008	62	92
5.20	0.2047	64	92
5.25	0.2067	64	95
5.30	0.2087	64	95
5.40	0.2126	64	95
5.50	0.2165	64	95
5.60	0.2205	67	98
5.70	0.2244	67	98
5.75	0.2264	67	98
5.80	0.2283	67	98
5.90	0.2323	67	98
6.00	0.2362	70	102
6.10	0.2402	70	102
6.20	0.2441	70	102
6.25	0.2461	70	102
6.30	0.2480	70	102
6.40	0.2520	73	105
6.50	0.2559	73	105
6.60	0.2598	73	105
6.70	0.2638	73	105
6.75	0.2657	73	105
6.80	0.2677	73	105
6.90	0.2717	73	105
7.00	0.2756	73	105
7.10	0.2795	75	108
7.20	0.2835	75	108
7.25	0.2854	75	108
7.30	0.2874	75	108
7.40	0.2913	78	111

Size	Decimal Equivalent	Flute Length	Overall Length
7.50	0.2953	78	111
7.60	0.2992	78	111
7.70	0.3031	81	114
7.75	0.3051	81	114
7.80	0.3071	81	114
7.90	0.3110	81	114
8.00	0.3150	81	114
8.10	0.3189	84	117
8.20	0.3228	84	117
8.25	0.3248	84	117
8.30	0.3268	84	117
8.40	0.3307	87	121
8.50	0.3346	87	121
8.60	0.3386	87	121
8.70	0.3425	87	121
8.75	0.3445	89	124
8.80	0.3465	89	124
8.90	0.3504	89	124
9.00	0.3543	89	124
9.10	0.3583	89	124
9.20	0.3622	92	127
9.25	0.3642	92	127
9.30	0.3661	92	127
9.40	0.3701	92	127
9.50	0.3740	92	127
9.60	0.3780	95	130
9.70	0.3819	95	130
9.75	0.3839	95	130
9.80	0.3858	95	130
9.90	0.3898	95	130
10.00	0.3937	95	130
10.20	0.4016	98	133
10.25	0.4035	98	133
10.50	0.4134	100	137
10.75	0.4232	103	140
10.80	0.4252	103	140
11.00	0.4331	103	140
11.20	0.4409	106	143
11.25	0.4429	106	143
11.50	0.4528	106	143
11.75	0.4626	109	146
11.80	0.4646	109	146
12.00	0.4724	111	149
12.20	0.4803	111	149
12.25	0.4823	111	149
12.50	0.4921	114	152
12.75	0.5020	114	152
12.80	0.5039	114	152
13.00	0.5118	114	152
13.50	0.5315	122	168
14.00	0.5512	122	168
14.50	0.5709	122	168
15.00	0.5906	132	181
15.50	0.6102	132	181
16.00	0.6299	132	181
16.50	0.6496	132	181
17.00	0.6693	143	194
17.50	0.6890	143	194

0.2 to 8.0 in package of 10, 8.1 to 13.0 in package of 5, 13.5 to 17.50 in package of 2

STRAIGHT SHANK COBALT DRILL TYPE I / METRIC SIZES

JAPAN STOCK ITEM*

List No.6520 General Purpose

h8 | HSS Co | HELIX H | 135 | X-type >1.5 | Conical

Bright Finish 0.5 to 1.9 mm

Black Oxide 2.0 to 13.0 mm

HIGH SPEED STEEL COBALT **Black Oxide**

This is general purpose cobalt HSS drills.

(Unit) : mm

Drill Dia.	Decimal Equivalent	Flute Length	Overall Length
0.5	0.0197	5	30
0.6	0.0236	5.5	30
0.7	0.0276	7.5	32
0.8	0.0315	8	34
0.9	0.0354	9	36
1.0	0.0394	10	40
1.1	0.0433	11	42
1.2	0.0472	13	42
1.3	0.0512	13	45
1.4	0.0551	14.5	48
1.5	0.0591	14.5	48
1.6	0.0630	16	50
1.7	0.0669	16	50
1.8	0.0709	17.5	52
1.9	0.0748	17.5	52
2.0	0.0787	20	55
2.1	0.0827	20	55
2.2	0.0866	23	58
2.3	0.0906	23	58
2.4	0.0945	24.5	61
2.5	0.0984	24.5	61
2.6	0.1024	26	64
2.7	0.1063	26	64
2.8	0.1102	27	67
2.9	0.1142	29.5	71
3.0	0.1181	29.5	71
3.1	0.1220	29.5	71
3.2	0.1260	29.5	71
3.3	0.1299	31.5	73
3.4	0.1339	31.5	73
3.5	0.1378	31.5	73
3.6	0.1417	33.5	76
3.7	0.1457	33.5	76
3.8	0.1496	33.5	76
3.9	0.1535	36	79
4.0	0.1575	38	83
4.1	0.1614	38	83
4.2	0.1654	38	83
4.3	0.1693	38	83
4.4	0.1732	39	86
4.5	0.1772	39	86
4.6	0.1811	39	86
4.7	0.1850	41	89
4.8	0.1890	41	89
4.9	0.1929	43	92
5.0	0.1969	43	92
5.1	0.2008	43	92
5.2	0.2047	45	95
5.3	0.2087	45	95
5.4	0.2126	45	95
5.5	0.2165	45	95
5.6	0.2205	47	98
5.7	0.2244	47	98
5.8	0.2283	47	98
5.9	0.2323	47	98
6.0	0.2362	49	102
6.1	0.2402	49	102
6.2	0.2441	49	102
6.3	0.2480	49	102
6.4	0.2520	51	105
6.5	0.2559	51	105
6.6	0.2598	51	105
6.7	0.2638	51	105
6.8	0.2677	51	105
6.9	0.2717	51	105
7.0	0.2756	51	105
7.1	0.2795	53	108
7.2	0.2835	53	108
7.3	0.2874	53	108
7.4	0.2913	55	111
7.5	0.2953	55	111
7.6	0.2992	55	111
7.7	0.3031	57	114
7.8	0.3071	57	114
7.9	0.3110	57	114
8.0	0.3150	57	114
8.1	0.3189	59	117
8.2	0.3228	59	117
8.3	0.3268	59	117
8.4	0.3307	61	121
8.5	0.3346	61	121
8.6	0.3386	61	121
8.7	0.3425	61	121
8.8	0.3465	63	124
8.9	0.3504	63	124
9.0	0.3543	63	124
9.1	0.3583	63	124
9.2	0.3622	65	127
9.3	0.3661	65	127
9.4	0.3701	65	127
9.5	0.3740	65	127
9.6	0.3780	67	130
9.7	0.3819	67	130
9.8	0.3858	67	130
9.9	0.3898	67	130
10.0	0.3937	67	130
10.1	0.3976	69	133
10.2	0.4016	69	133
10.3	0.4055	69	133
10.4	0.4094	69	133
10.5	0.4134	70	137
10.6	0.4173	70	137
10.7	0.4213	70	137
10.8	0.4252	72	140
10.9	0.4291	72	140
11.0	0.4331	72	140
11.1	0.4370	72	140
11.2	0.4409	75	143
11.3	0.4449	75	143
11.4	0.4488	75	143
11.5	0.4528	75	143
11.6	0.4567	77	146
11.7	0.4606	77	146
11.8	0.4646	77	146
11.9	0.4685	77	146
12.0	0.4724	78	149
12.1	0.4764	78	149
12.2	0.4803	78	149
12.3	0.4843	78	149
12.4	0.4882	80	152
12.5	0.4921	80	152
12.6	0.4961	80	152
12.7	0.5000	80	152
12.8	0.5039	80	152
12.9	0.5079	80	152
13.0	0.5118	80	152

0.5 to 7.9 in package 10, 8.0 to 13.0 in package 5

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

G STANDARD DRILLS / METRIC SIZES

JAPAN STOCK ITEM*

List No.520P General Purpose

h8 | HSS | HELIX N | 118° | X-type >3 | Conical

Range 0.5 to 13.0 mm

HIGH SPEED STEEL-TIN COATED

Used for high speed drilling. TiN coated.

(Unit) : mm

Drill Dia.	Decimal Equivalent	Flute Length	Overall Length
0.5	0.0197	6	22
0.6	0.0236	7	24
0.7	0.0276	9	28
0.8	0.0315	10	30
0.9	0.0354	11	32
1.0	0.0394	12	34
1.1	0.0433	14	36
1.2	0.0472	16	38
1.3	0.0512	16	38
1.4	0.0551	18	40
1.5	0.0591	18	40
1.6	0.0630	20	43
1.7	0.0669	20	43
1.8	0.0709	22	46
1.9	0.0748	22	46
2.0	0.0787	24	49
2.1	0.0827	24	49
2.2	0.0866	27	53
2.3	0.0906	27	53
2.4	0.0945	30	57
2.5	0.0984	30	57
2.6	0.1024	30	57
2.7	0.1063	33	61
2.8	0.1102	33	61
2.9	0.1142	33	61
3.0	0.1181	33	61
3.1	0.1220	36	65
3.2	0.1260	36	65
3.3	0.1299	36	65
3.4	0.1339	39	70
3.5	0.1378	39	70
3.6	0.1417	39	70
3.7	0.1457	39	70
3.8	0.1496	43	75
3.9	0.1535	43	75
4.0	0.1575	43	75
4.1	0.1614	43	75
4.2	0.1654	43	75
4.3	0.1693	47	80
4.4	0.1732	47	80
4.5	0.1772	47	80
4.6	0.1811	47	80
4.7	0.1850	47	80
4.8	0.1890	52	86
4.9	0.1929	52	86
5.0	0.1969	52	86
5.1	0.2008	52	86
5.2	0.2047	52	86
5.3	0.2087	52	86
5.4	0.2126	57	93
5.5	0.2165	57	93
5.6	0.2205	57	93
5.7	0.2244	57	93
5.8	0.2283	57	93
5.9	0.2323	57	93
6.0	0.2362	57	93
6.1	0.2402	63	101
6.2	0.2441	63	101
6.3	0.2480	63	101
6.4	0.2520	63	101
6.5	0.2559	63	101
6.6	0.2598	63	101
6.7	0.2638	63	101
6.8	0.2677	69	109
6.9	0.2717	69	109
7.0	0.2756	69	109
7.1	0.2795	69	109
7.2	0.2835	69	109
7.3	0.2874	69	109
7.4	0.2913	69	109
7.5	0.2953	69	109
7.6	0.2992	75	117
7.7	0.3031	75	117
7.8	0.3071	75	117
7.9	0.3110	75	117
8.0	0.3150	75	117
8.1	0.3189	75	117
8.2	0.3228	75	117
8.3	0.3268	75	117
8.4	0.3307	75	117
8.5	0.3346	75	117
8.6	0.3386	81	125
8.7	0.3425	81	125
8.8	0.3465	81	125
8.9	0.3504	81	125
9.0	0.3543	81	125
9.1	0.3583	81	125
9.2	0.3622	81	125
9.3	0.3661	81	125
9.4	0.3701	81	125
9.5	0.3740	81	125
9.6	0.3780	87	133
9.7	0.3819	87	133
9.8	0.3858	87	133
9.9	0.3898	87	133
10.0	0.3937	87	133
10.1	0.3976	87	133
10.2	0.4016	87	133
10.3	0.4055	87	133
10.4	0.4094	87	133
10.5	0.4134	87	133
10.6	0.4173	87	133
10.7	0.4213	94	142
10.8	0.4252	94	142
10.9	0.4291	94	142
11.0	0.4331	94	142
11.1	0.4370	94	142
11.2	0.4409	94	142
11.3	0.4449	94	142
11.4	0.4488	94	142
11.5	0.4528	94	142
11.6	0.4567	94	142
11.7	0.4606	94	142
11.8	0.4646	94	142
11.9	0.4685	101	151
12.0	0.4724	101	151
12.1	0.4764	101	151
12.2	0.4803	101	151
12.3	0.4843	101	151
12.4	0.4882	101	151
12.5	0.4921	101	151
12.6	0.4961	101	151
12.7	0.5000	101	151
12.8	0.5039	101	151
12.9	0.5079	101	151
13.0	0.5118	101	151

0.5 to 1.9 in package 10, 2.0 to 13.0 in package 1

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

STRAIGHT SHANK JOBBERS LENGTH DRILLS / FRACTIONAL SIZES / WIRE GAUGE SIZES / LETTER SIZES

List No.501 General Purpose

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

Fractional : Range 3/64" to 11/16"
Wire : Range #1 to #60
Letter : Range A to Z

HIGH SPEED STEEL **Black Oxide**

Used in wide variety of normal conditions. Will work in a broad range of materials in both machine and portable drilling.

List No.501A General Purpose

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

Fractional : Range 1/64" to 11/16"
Wire : Range #1 to #80
Letter : Range A to Z

HIGH SPEED STEEL **Bright Finish**

Used in wide variety of normal conditions. Will work in a broad range of materials in both machine and portable drilling.

List No.6501 Aircraft NAS907-J

h8 | HSS Co | HELIX N | 135° | X-type >5/64 | Conical

Fractional : Range 1/64" to 1/2"
Wire : Range #1 to #80
Letter : Range A to Z

HIGH SPEED STEEL COBALT **Black Oxide**

Manufactured with 135° Split Point.

List No.501P General Purpose

h8 | G | HSS | HELIX N | 118° | S-type >1/2 | Conical

Fractional : Range 1/16" to 1/2"
Wire : Range #1 to #52

HIGH SPEED STEEL-TIN COATED

Used for high speed drilling. TiN coated.

List No.517P Parabolic

h8 | G | HSS | HELIX H | 135° | XH-type

Fractional : Range 1/16" to 1/2"
Wire : Range #1 to #52

HIGH SPEED STEEL-TIN COATED

Used for drilling for 7D deep holes. Parabolic style gives maximum chip removal with no chip clogging. Suitable for hard material. TiN coated.

Size			Decimal Equivalent	Flute Length	Overall Length
Fractional	Wire	Letter			
	#80		0.0135	1/8	3/4
	#79		0.0145	1/8	3/4
1/64			0.0156	3/16	3/4
	#78		0.0160	3/16	7/8
	#77		0.0180	3/16	7/8
	#76		0.0200	3/16	7/8
	#75		0.0210	1/4	1
	#74		0.0225	1/4	1
	#73		0.0240	5/16	1 1/8
	#72		0.0250	5/16	1 1/8
	#71		0.0260	3/8	1 1/4
	#70		0.0280	3/8	1 1/4
	#69		0.0292	1/2	1 3/8
	#68		0.0310	1/2	1 3/8
1/32			0.0313	1/2	1 3/8
	#67		0.0320	1/2	1 3/8
	#66		0.0330	1/2	1 3/8
	#65		0.0350	5/8	1 1/2
	#64		0.0360	5/8	1 1/2
	#63		0.0370	5/8	1 1/2
	#62		0.0380	5/8	1 1/2
	#61		0.0390	11/16	1 5/8
	#60		0.0400	11/16	1 5/8
	#59		0.0410	11/16	1 5/8
	#58		0.0420	11/16	1 5/8
	#57		0.0430	3/4	1 3/4
	#56		0.0465	3/4	1 3/4
3/64			0.0469	3/4	1 3/4
	#55		0.0520	7/8	1 7/8
	#54		0.0550	7/8	1 7/8
	#53		0.0595	7/8	1 7/8
1/16			0.0625	7/8	1 7/8
	#52		0.0635	7/8	1 7/8
	#51		0.0670	1	2
	#50		0.0700	1	2
	#49		0.0730	1	2
	#48		0.0760	1	2
5/64			0.0781	1	2
	#47		0.0785	1	2
	#46		0.0810	1 1/8	2 1/8
	#45		0.0820	1 1/8	2 1/8
	#44		0.0860	1 1/8	2 1/8
	#43		0.0890	1 1/4	2 1/4
	#42		0.0935	1 1/4	2 1/4
3/32			0.0938	1 1/4	2 1/4
	#41		0.0960	1 3/8	2 3/8
	#40		0.0980	1 3/8	2 3/8
	#39		0.0995	1 3/8	2 3/8
	#38		0.1015	1 7/16	2 1/2
	#37		0.1040	1 7/16	2 1/2
	#36		0.1065	1 7/16	2 1/2
7/64			0.1094	1 1/2	2 5/8
	#35		0.1100	1 1/2	2 5/8
	#34		0.1110	1 1/2	2 5/8

STRAIGHT SHANK JOBBERS LENGTH DRILLS / List No.501, 501A, 6501, 501P, 517P

Size			Decimal Equivalent	Flute Length	Overall Length
Fractional	Wire	Letter			
	#33		0.1130	1 1/2	2 5/8
	#32		0.1160	1 5/8	2 3/4
	#31		0.1200	1 5/8	2 3/4
1/8			0.1250	1 5/8	2 3/4
	#30		0.1285	1 5/8	2 3/4
	#29		0.1360	1 3/4	2 7/8
	#28		0.1405	1 3/4	2 7/8
9/64			0.1406	1 3/4	2 7/8
	#27		0.1440	1 7/8	3
	#26		0.1470	1 7/8	3
	#25		0.1495	1 7/8	3
	#24		0.1520	2	3 1/8
	#23		0.1540	2	3 1/8
5/32			0.1563	2	3 1/8
	#22		0.1570	2	3 1/8
	#21		0.1590	2 1/8	3 1/4
	#20		0.1610	2 1/8	3 1/4
	#19		0.1660	2 1/8	3 1/4
	#18		0.1695	2 1/8	3 1/4
	#16		0.1700	2 3/16	3 3/8
11/64			0.1719	2 1/8	3 1/4
	#17		0.1730	2 3/16	3 3/8
	#15		0.1800	2 3/16	3 3/8
	#14		0.1820	2 3/16	3 3/8
	#13		0.1850	2 5/16	3 1/2
3/16			0.1875	2 5/16	3 1/2
	#12		0.1890	2 5/16	3 1/2
	#11		0.1910	2 5/16	3 1/2
	#10		0.1935	2 7/16	3 5/8
	#9		0.1960	2 7/16	3 5/8
	#8		0.1990	2 7/16	3 5/8
	#7		0.2010	2 7/16	3 5/8
13/64			0.2031	2 7/16	3 5/8
	#6		0.2040	2 1/2	3 3/4
	#5		0.2055	2 1/2	3 3/4
	#4		0.2090	2 1/2	3 3/4
	#3		0.2130	2 1/2	3 3/4
7/32			0.2188	2 1/2	3 3/4
	#2		0.2210	2 5/8	3 7/8
	#1		0.2280	2 5/8	3 7/8
		A	0.2340	2 5/8	3 7/8
15/64			0.2344	2 5/8	3 7/8
		B	0.2380	2 3/4	4
		C	0.2420	2 3/4	4
		D	0.2460	2 3/4	4
		E	0.2500	2 3/4	4
1/4			0.2500	2 3/4	4
		F	0.2570	2 7/8	4 1/8

Size			Decimal Equivalent	Flute Length	Overall Length
Fractional	Wire	Letter			
		G	0.2610	2 7/8	4 1/8
17/64			0.2656	2 7/8	4 1/8
		H	0.2660	2 7/8	4 1/8
		I	0.2720	2 7/8	4 1/8
		J	0.2770	2 7/8	4 1/8
		K	0.2810	2 15/16	4 1/4
9/32			0.2813	2 15/16	4 1/4
		L	0.2900	2 15/16	4 1/4
		M	0.2950	3 1/16	4 3/8
19/64			0.2969	3 1/16	4 3/8
		N	0.3020	3 1/16	4 3/8
5/16			0.3125	3 3/16	4 1/2
		O	0.3160	3 3/16	4 1/2
		P	0.3230	3 5/16	4 5/8
21/64			0.3281	3 5/16	4 5/8
		Q	0.3320	3 7/16	4 3/4
		R	0.3390	3 7/16	4 3/4
11/32			0.3438	3 7/16	4 3/4
		S	0.3480	3 1/2	4 7/8
		T	0.3580	3 1/2	4 7/8
23/64			0.3594	3 1/2	4 7/8
		U	0.3680	3 5/8	5
3/8			0.3750	3 5/8	5
		V	0.3770	3 5/8	5
		W	0.3860	3 3/4	5 1/8
25/64			0.3906	3 3/4	5 1/8
		X	0.3970	3 3/4	5 1/8
		Y	0.4040	3 7/8	5 1/4
13/32			0.4063	3 7/8	5 1/4
		Z	0.4130	3 7/8	5 1/4
27/64			0.4219	3 15/16	5 3/8
7/16			0.4375	4 1/16	5 1/2
29/64			0.4531	4 3/16	5 5/8
15/32			0.4688	4 5/16	5 3/4
31/64			0.4844	4 3/8	5 7/8
1/2			0.5000	4 1/2	6
33/64			0.5156	4 13/16	6 5/8
17/32			0.5313	4 13/16	6 5/8
35/64			0.5469	4 13/16	6 5/8
9/16			0.5625	4 13/16	6 5/8
37/64			0.5781	4 13/16	6 5/8
19/32			0.5938	5 3/16	7 1/8
39/64			0.6094	5 3/16	7 1/8
5/8			0.6250	5 3/16	7 1/8
41/64			0.6406	5 3/16	7 1/8
21/32			0.6563	5 3/16	7 1/8
43/64			0.6719	5 5/8	7 5/8
11/16			0.6875	5 5/8	7 5/8

Fractional sizes : 1/64 to 5/16 in package of 10; 21/64 to 1/2 in packages of 5. 33/64 to 11/16 in package of 2.
Wire gauge sizes : All Sizes in Packages of 10
Letter sizes : A to N in package of 10, O to Z in package of 5

SCREW MACHINE LENGTH / FRACTIONAL SIZES / WIRE GAUGE SIZES / LETTER SIZES

List No.561 General Purpose

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

Fractional : Range 3/64" to 2"
Wire : Range #1 to #60
Letter : Range A to Z

HIGH SPEED STEEL **Bright Finish**

Manufactured with short overall and flute length.

List No.561P General Purpose

h8 | G | HSS | HELIX N | 118° | Conical

Fractional : Range 1/16" to 1/2"
Wire : Range #1 to #52

HIGH SPEED STEEL-TIN COATED

Manufactured with short overall and flute length with TiN coated.

List No.563 Aircraft NAS907-C

h8 | HSS | HELIX N | 135° | X-type >5/64 | Conical

Fractional : Range 3/64" to 1/2"
Wire : Range #1 to #52
Letter : Range A to Z

HIGH SPEED STEEL **Black Oxide**

Standard NAS907 Type C. Manufactured with short overall and flute length.

List No.6563 Aircraft NAS907-C

h8 | HSS Co | HELIX N | 135° | X-type >5/64 >#53 | Conical

Fractional : Bright Finish 3/64 to 7/64
Black Oxide 1/8 to 1/2
Wire : Bright Finish #32 to #52
Black Oxide #1 to #31
Letter : Range A to Z

HIGH SPEED STEEL COBALT

Standard NAS907 Type C. Manufactured with short overall and flute length.

Size			Decimal	Flute	Overall	Shank
Fractional	Wire	Letter	Equivalent	Length	Length	Diameter
	#60		0.0400	1/2	1 3/8	#60
	#59		0.0410	1/2	1 3/8	#59
	#58		0.0420	1/2	1 3/8	#58
	#57		0.0430	1/2	1 3/8	#57
	#56		0.0465	1/2	1 3/8	#56
3/64			0.0469	1/2	1 3/8	3/64
	#55		0.0520	5/8	1 5/8	#55
	#54		0.0550	5/8	1 5/8	#54
	#53		0.0595	5/8	1 5/8	#53
1/16			0.0625	5/8	1 5/8	1/16
	#52		0.0635	11/16	1 11/16	#52
	#51		0.0670	11/16	1 11/16	#51
	#49		0.0730	11/16	1 11/16	#49
	#48		0.0760	11/16	1 11/16	#48
5/64			0.0781	11/16	1 11/16	5/64
	#47		0.0785	3/4	1 3/4	#47
	#46		0.0810	3/4	1 3/4	#46
	#45		0.0820	3/4	1 3/4	#45
	#44		0.0860	3/4	1 3/4	#44
	#43		0.0890	3/4	1 3/4	#43
	#42		0.0935	3/4	1 3/4	#42
3/32			0.0938	3/4	1 3/4	3/32
	#41		0.0960	13/16	1 13/16	#41
	#40		0.0980	13/16	1 13/16	#40
	#39		0.0995	13/16	1 13/16	#39
	#38		0.1015	13/16	1 13/16	#38
	#37		0.1040	13/16	1 13/16	#37
	#36		0.1065	13/16	1 13/16	#36
7/64			0.1094	13/16	1 13/16	7/64
	#35		0.1100	7/8	1 7/8	#35
	#34		0.1110	7/8	1 7/8	#34
	#33		0.1130	7/8	1 7/8	#33
	#32		0.1160	7/8	1 7/8	#32
	#31		0.1200	7/8	1 7/8	#31
1/8			0.1250	7/8	1 7/8	1/8
	#30		0.1285	15/16	1 15/16	#30
	#29		0.1360	15/16	1 15/16	#29
	#28		0.1405	15/16	1 15/16	#28
9/64			0.1406	15/16	1 15/16	9/64
	#27		0.1440	1	2 1/16	#27
	#26		0.1470	1	2 1/16	#26
	#25		0.1495	1	2 1/16	#25
	#24		0.1520	1	2 1/16	#24
	#23		0.1540	1	2 1/16	#23
5/32			0.1563	1	2 1/16	5/32
	#22		0.1570	1 1/16	2 1/8	#22
	#21		0.1590	1 1/16	2 1/8	#21
	#20		0.1610	1 1/16	2 1/8	#20
	#19		0.1660	1 1/16	2 1/8	#19
	#18		0.1695	1 1/16	2 1/8	#18
11/64			0.1719	1 1/16	2 1/8	11/64
	#17		0.1730	1 1/8	2 3/16	#17
	#16		0.1770	1 1/8	2 3/16	#16
	#15		0.1800	1 1/8	2 3/16	#15
	#14		0.1820	1 1/8	2 3/16	#14
	#13		0.1850	1 1/8	2 3/16	#13
3/16			0.1875	1 1/8	2 3/16	3/16
	#12		0.1890	1 3/16	2 1/4	#12

SCREW MACHINE LENGTH / List No.561, 561P, 563, 6563

Size			Decimal	Flute	Overall	Shank
Fractional	Wire	Letter	Equivalent	Length	Length	Diameter
	#11		0.1910	1 3/16	2 1/4	#11
	#10		0.1935	1 3/16	2 1/4	#10
	#9		0.1960	1 3/16	2 1/4	#9
	#8		0.1990	1 3/16	2 1/4	#8
	#7		0.2010	1 3/16	2 1/4	#7
13/64			0.2031	1 3/16	2 1/4	13/64
	#6		0.2040	1 1/4	2 3/8	#6
	#5		0.2055	1 1/4	2 3/8	#5
	#4		0.2090	1 1/4	2 3/8	#4
	#3		0.2130	1 1/4	2 3/8	#3
7/32			0.2188	1 1/4	2 3/8	7/32
	#2		0.2210	1 5/16	2 7/16	#2
	#1		0.2285	1 5/16	2 7/16	#1
		A	0.2340	1 5/16	2 7/16	A
15/64			0.2344	1 5/16	2 7/16	15/64
		B	0.2380	1 3/8	2 1/2	B
		C	0.2420	1 3/8	2 1/2	C
		D	0.2460	1 3/8	2 1/2	D
1/4			0.2500	1 3/8	2 1/2	1/4
		E	0.2500	1 3/8	2 1/2	E
		F	0.2570	1 7/16	2 5/8	F
		G	0.2610	1 7/16	2 5/8	G
17/64			0.2656	1 7/16	2 5/8	17/64
		H	0.2660	1 1/2	2 11/16	H
		I	0.2720	1 1/2	2 11/16	I
		J	0.2770	1 1/2	2 11/16	J
		K	0.2810	1 1/2	2 11/16	K
9/32			0.2813	1 1/2	2 11/16	9/32
		L	0.2900	1 9/16	2 3/4	L
		M	0.2950	1 9/16	2 3/4	M
19/64			0.2969	1 9/16	2 3/4	19/64
		N	0.3020	1 5/8	2 13/16	N
5/16			0.3125	1 5/8	2 13/16	5/16
		O	0.3160	1 11/16	2 15/16	O
		P	0.3230	1 11/16	2 15/16	P
21/64			0.3281	1 11/16	2 15/16	21/64
		Q	0.3320	1 11/16	3	Q
		R	0.3390	1 11/16	3	R
11/32			0.3438	1 11/16	3	11/32
		S	0.3480	1 3/4	3 1/16	S
		T	0.3580	1 3/4	3 1/16	T
23/64			0.3594	1 3/4	3 1/16	23/64
		U	0.3680	1 13/16	3 1/8	U
3/8			0.3750	1 13/16	3 1/8	3/8
		V	0.3770	1 7/8	3 1/4	V
		W	0.3860	1 7/8	3 1/4	W
25/64			0.3906	1 7/8	3 1/4	25/64
		X	0.3970	1 15/16	3 5/16	X
		Y	0.4040	1 15/16	3 5/16	Y
13/32			0.4063	1 5/16	3 5/16	13/32
		Z	0.4130	2	3 3/8	Z
27/64			0.4219	2	3 3/8	27/64
7/16			0.4375	2 1/16	3 7/16	7/16

Size			Decimal	Flute	Overall	Shank
Fractional	Wire	Letter	Equivalent	Length	Length	Diameter
29/64			0.4531	2 1/8	3 9/16	29/64
15/32			0.4688	2 1/8	3 5/8	15/32
31/64			0.4844	2 3/16	3 11/16	31/64
1/2			0.5000	2 1/4	3 3/4	1/2
33/64			0.5156	2 3/8	3 7/8	33/64
17/32			0.5313	2 3/8	3 7/8	17/32
35/64			0.5469	2 1/2	4	35/64
9/16			0.5625	2 1/2	4	9/16
37/64			0.5781	2 5/8	4 1/8	37/64
19/32			0.5938	2 5/8	4 1/8	19/32
39/64			0.6094	2 3/4	4 1/4	39/64
5/8			0.6250	2 3/4	4 1/4	5/8
41/64			0.6406	2 7/8	4 1/2	41/64
21/32			0.6563	2 7/8	4 1/2	21/32
43/64			0.6719	2 7/8	4 5/8	43/64
11/16			0.6875	2 7/8	4 5/8	11/16
	#50		0.7000	11/16	1 11/16	#50
45/64			0.7031	3	4 3/4	45/64
23/32			0.7188	3	4 3/4	23/32
47/64			0.7344	3 1/8	5	47/64
3/4			0.7500	3 1/8	5	3/4
49/64			0.7656	3 1/4	5 1/8	49/64
25/32			0.7813	3 1/4	5 1/8	25/32
51/64			0.7969	3 3/8	5 1/4	51/64
13/16			0.8125	3 3/8	5 1/4	13/16
53/64			0.8281	3 1/2	5 3/8	53/64
27/32			0.8438	3 1/2	5 3/8	27/32
55/64			0.8594	3 1/2	5 1/2	55/64
7/8			0.8750	3 1/2	5 1/2	7/8
57/64			0.8906	3 5/8	5 5/8	57/64
29/32			0.9063	3 5/8	5 5/8	29/32
59/64			0.9219	3 3/4	5 3/4	59/64
15/16			0.9375	3 3/4	5 3/4	15/16
61/64			0.9531	3 7/8	5 7/8	61/64
31/32			0.9688	3 7/8	5 7/8	31/32
63/64			0.9844	4	6	63/64
1			1.0000	4	6	1
1 1/16			1.0625	4	6 1/4	1
1 1/8			1.1250	4	6 3/8	1
1 3/16			1.1875	4 1/4	6 5/8	1
1 1/4			1.2500	4 3/8	6 3/4	1
1 5/16			1.3125	4 3/8	7	1 1/4
1 3/8			1.3750	4 1/2	7 1/8	1 1/4
1 7/16			1.4375	4 3/4	7 3/8	1 1/4
1 1/2			1.5000	4 7/8	7 1/2	1 1/4
1 9/16			1.5625	4 7/8	7 3/4	1 1/2
1 5/8			1.6250	4 7/8	7 3/4	1 1/2
1 11/16			1.6875	5 1/8	8	1 1/2
1 3/4			1.7500	5 1/8	8	1 1/2
1 13/16			1.8125	5 3/8	8 1/4	1 1/2
1 7/8			1.8750	5 5/8	8 1/4	1 1/2
1 15/16			1.9375	5 5/8	8 1/2	1 1/2
2			2.0000	5 5/8	8 1/2	1 1/2

Fractional sizes : Sizes 3/64 to 5/16 in Package of 10: 21/64 to 1/2 in Package of 5
Wire gauge sizes : All sizes in package of 10
Letter sizes : A to N in package of 10; O to Z in package of 5

STRAIGHT SHANK TAPER LENGTH / FRACTIONAL SIZES

List No.531 General Purpose

Range 1/64” to 1/2”

HIGH SPEED STEEL **Black Oxide**

Used in wide range of materials under normal conditions. These drills are longer in length than jobbers drills.

List No.6531 General Purpose

Range 1/16” to 3/4”

HIGH SPEED STEEL COBALT **Black Oxide**

Used in Machining hard material, alloy steel, forgings and cast iron.

List No.545P Parabolic Style

Range 1/16” to 1/2”

HIGH SPEED STEEL-TIN COATED

Used for deep hole drilling. Parabolic design gives maximum chip removal with no chip clogging. TiN coated.

STRAIGHT SHANK TAPER LENGTH / FRACTIONAL SIZES
List No.531, 6531, 545P

Size	Decimal Equivalent	Flute Length	Overall Length
1/64	0.0156	5/16	1 1/2
1/32	0.0313	3/4	2
3/64	0.0469	1 1/8	2 1/4
1/16	0.0625	1 3/4	3
5/64	0.0781	2	3 3/4
3/32	0.0938	2 1/4	4 1/4
7/64	0.1094	2 1/2	4 5/8
1/8	0.1250	2 3/4	5 1/8
9/64	0.1406	3	5 3/8
5/32	0.1563	3	5 3/8
11/64	0.1719	3 3/8	5 3/4
3/16	0.1875	3 3/8	5 3/4
13/64	0.2031	3 5/8	6
7/32	0.2188	3 5/8	6
15/64	0.2344	3 3/4	6 1/8
1/4	0.2500	3 3/4	6 1/8
17/64	0.2656	3 7/8	6 1/4
9/32	0.2813	3 7/8	6 1/4
19/64	0.2969	4	6 3/8
5/16	0.3125	4	6 3/8
21/64	0.3281	4 1/8	6 1/2
11/32	0.3438	4 1/8	6 1/2
23/64	0.3594	4 1/4	6 3/4
3/8	0.3750	4 1/4	6 3/4
25/64	0.3906	4 3/8	7
13/32	0.4063	4 3/8	7
27/64	0.4219	4 5/8	7 1/4
7/16	0.4375	4 5/8	7 1/4
29/64	0.4531	4 3/4	7 1/2
15/32	0.4688	4 3/4	7 1/2
31/64	0.4844	4 3/4	7 3/4
1/2	0.5000	4 3/4	7 3/4
33/64	0.5156	4 3/4	8
17/32	0.5313	4 3/4	8
35/64	0.5469	4 7/8	8 1/4
9/16	0.5625	4 7/8	8 1/4
37/64	0.5781	4 7/8	8 3/4
19/32	0.5938	4 7/8	8 3/4
39/64	0.6094	4 7/8	8 3/4
5/8	0.6250	4 7/8	8 3/4
41/64	0.6406	5 1/8	9
21/32	0.6563	5 1/8	9
43/64	0.6719	5 3/8	9 1/4
11/16	0.6875	5 3/8	9 1/4
45/64	0.7031	5 5/8	9 1/2
23/32	0.7188	5 5/8	9 1/2
47/64	0.7344	5 7/8	9 3/4
3/4	0.7500	5 7/8	9 3/4

Sizes to 1/64 to 5/16 in package of 10; 21/64 to 1/2 in package of 5

STRAIGHT SHANK DRILL-EXTRA LENGTH

List No.551

h8 HSS HELIX N 118° S-type

Range 1/8 to 1"
Overall Length 12" And 18"

HIGH SPEED STEEL **Bright Finish**

Used in general deep hole drilling.

Size	Decimal Equivalent	Overall Length	
		12"	18"
		Flute Length	Flute Length
1/8	0.1250	9	—
9/64	0.1406	9	—
5/32	0.1563	9	—
11/64	0.1719	9	—
3/16	0.1875	9	14
13/64	0.2031	9	14
7/32	0.2188	9	14
15/64	0.2344	9	14
1/4	0.2500	9	14
17/64	0.2656	9	14
9/32	0.2813	9	14
19/64	0.2969	9	14
5/16	0.3125	9	14
21/64	0.3281	9	14
11/32	0.3438	9	14
23/64	0.3594	9	14
3/8	0.3750	9	14
25/64	0.3906	9	14
13/32	0.4063	9	14
27/64	0.4219	9	14
7/16	0.4375	9	14

Size	Decimal Equivalent	Overall Length	
		12"	18"
		Flute Length	Flute Length
29/64	0.4531	9	14
15/32	0.4688	9	14
31/64	0.4844	9	14
1/2	0.5000	9	14
33/64	0.5156	9	14
17/32	0.5313	9	14
35/64	0.5469	9	14
9/16	0.5625	9	14
37/64	0.5781	9	14
19/32	0.5938	9	14
39/64	0.6094	9	14
5/8	0.6250	9	14
21/32	0.6563	9	14
11/16	0.6875	9	14
23/32	0.7188	9	14
3/4	0.7500	9	14
13/16	0.8125	9	14
7/8	0.8750	9	14
15/16	0.9375	9	14
1	1.0000	9	14

1 per box

List No.6551 Parabolic Tang Drive

h8 HSS Co HELIX H 118° XH-type

Range 3/16 to 1/2
Overall Length 10"

HIGH SPEED STEEL COBALT **Black Oxide**

Used in deep hole drilling for tougher high tensile materials.

Size	Decimal Equivalent	Flute Length	Overall Length
3/16	0.1875	7	10
13/64	0.2031	7	10
7/32	0.2188	7	10
15/64	0.2344	7	10
1/4	0.2500	7	10
17/64	0.2656	7	10
9/32	0.2813	7	10
19/64	0.2969	7	10
5/16	0.3125	7	10
21/64	0.3281	7	10
11/32	0.3438	7	10

Size	Decimal Equivalent	Flute Length	Overall Length
23/64	0.3594	7	10
3/8	0.3750	7	10
25/64	0.3906	7	10
13/32	0.4063	7	10
27/64	0.4219	7	10
7/16	0.4375	7	10
29/64	0.4531	7	10
15/32	0.4688	7	10
31/64	0.4844	7	10
1/2	0.5000	7	10

1 per box

OIL HOLE DRILLS / STRAIGHT SHANK

List No.581

h8 HSS Co HELIX N 118° S-type OIL HOLE

Range 3/8 to 1 1/2

M35 COBALT **Bright Finish**

Used in heavy-duty applications. Delivers coolant to the point permit higher speeds and feeds and reduce high temperatures.

Size	Decimal Equivalent	Flute Length	Overall Length
3/8	0.3750	4 1/4	6 3/4
25/64	0.3906	4 3/8	7
13/32	0.4063	4 3/8	7
27/64	0.4219	4 5/8	7 1/4
7/16	0.4375	4 5/8	7 1/4
29/64	0.4531	4 7/8	7 1/2
15/32	0.4688	4 7/8	7 1/2
31/64	0.4844	5	7 3/4
1/2	0.5000	5	7 3/4
33/64	0.5156	5 1/4	8
17/32	0.5313	5 1/4	8
35/64	0.5469	5 3/8	8 1/4
9/16	0.5625	5 3/8	8 1/4
37/64	0.5781	5 5/8	8 1/2
19/32	0.5938	5 5/8	8 1/2
39/64	0.6094	5 3/4	8 3/4
5/8	0.6250	5 3/4	8 3/4
41/64	0.6406	5 7/8	9
21/32	0.6563	5 7/8	9
43/64	0.6719	6	9 1/4
11/16	0.6875	6	9 1/4
45/64	0.7031	6 3/16	9 1/2
23/32	0.7188	6 3/16	9 1/2
47/64	0.7344	6 3/8	9 3/4
3/4	0.7500	6 3/8	9 3/4
49/64	0.7656	6 1/2	9 7/8
25/32	0.7813	6 1/2	9 7/8
51/64	0.7969	6 5/8	10

Size	Decimal Equivalent	Flute Length	Overall Length
13/16	0.8125	6 5/8	10
53/64	0.8281	6 3/4	10 1/4
27/32	0.8438	6 3/4	10 1/4
55/64	0.8594	7	10 1/2
7/8	0.8750	7	10 1/2
57/64	0.8906	7	10 5/8
29/32	0.9063	7	10 5/8
59/64	0.9219	7	10 3/4
15/16	0.9375	7	10 3/4
61/64	0.9531	7 1/8	10 7/8
31/32	0.9688	7 1/8	10 7/8
63/64	0.9844	7 3/16	11
1	1.0000	7 3/16	11
1 1/64	1.0156	7 5/16	11 1/8
1 1/32	1.0313	7 5/16	11 1/8
1 3/64	1.0469	7 3/8	11 1/4
1 1/16	1.0625	7 3/8	11 1/4
1 3/32	1.0938	7 5/8	11 1/2
1 1/8	1.1250	7 7/8	11 3/4
1 5/32	1.1563	8	11 7/8
1 3/16	1.1875	8 1/8	12
1 7/32	1.2188	8 1/8	12 1/8
1 1/4	1.2500	8 1/2	12 1/2
1 5/16	1.3125	9 1/4	14 1/4
1 3/8	1.3750	9 1/2	14 1/2
1 7/16	1.4375	9 5/8	14 3/4
1 1/2	1.5000	9 7/8	15

1 per box

TAPER SHANK DRILLS / REGULAR SHANKS / FRACTIONAL

List No.601 General Purpose

h8 | HSS | HELIX N | 118° | S-type >1/2 | Conical

Range 1/8" to 3 1/2"

HIGH SPEED STEEL **Black Oxide**

Used in cast iron, steel, forgings, and other materials.

	Size	Decimal Equivalent	Flute Length	Overall Length	Taper Shank
*	1/8	0.1250	1 7/8	5 1/8	1
*	9/64	0.1406	2 1/8	5 3/8	1
*	5/32	0.1563	2 1/8	5 3/8	1
*	11/64	0.1719	2 1/2	5 3/4	1
*	3/16	0.1875	2 1/2	5 3/4	1
*	13/64	0.2031	2 3/4	6	1
*	7/32	0.2188	2 3/4	6	1
*	15/64	0.2344	2 7/8	6 1/8	1
*	1/4	0.2500	2 7/8	6 1/8	1
*	17/64	0.2656	3	6 1/4	1
	9/32	0.2813	3	6 1/4	1
	19/64	0.2969	3 1/8	6 3/8	1
	5/16	0.3125	3 1/8	6 3/8	1
	21/64	0.3281	3 1/4	6 1/2	1
	11/32	0.3438	3 1/4	6 1/2	1
	23/64	0.3594	3 1/2	6 3/4	1
	3/8	0.3750	3 1/2	6 3/4	1
	25/64	0.3906	3 5/8	7	1
	13/32	0.4063	3 5/8	7	1
	27/64	0.4219	3 7/8	7 1/4	1
	7/16	0.4375	3 7/8	7 1/4	1
	29/64	0.4531	4 1/8	7 1/2	1
	15/32	0.4688	4 1/8	7 1/2	1
	31/64	0.4844	4 3/8	8 1/4	2
	1/2	0.5000	4 3/8	8 1/4	2
	33/64	0.5156	4 5/8	8 1/2	2
	17/32	0.5313	4 5/8	8 1/2	2
	35/64	0.5469	4 7/8	8 3/4	2
	9/16	0.5625	4 7/8	8 3/4	2
	37/64	0.5781	4 7/8	8 3/4	2
	19/32	0.5938	4 7/8	8 3/4	2
	39/64	0.6094	4 7/8	8 3/4	2
	5/8	0.6250	4 7/8	8 3/4	2
	41/64	0.6406	5 1/8	9	2
	21/32	0.6563	5 1/8	9	2
	43/64	0.6719	5 3/8	9 1/4	2
	11/16	0.6875	5 3/8	9 1/4	2
	45/64	0.7031	5 5/8	9 1/2	2
	23/32	0.7188	5 5/8	9 1/2	2
	47/64	0.7344	5 7/8	9 3/4	2
	3/4	0.7500	5 7/8	9 3/4	2
	49/64	0.7656	6	9 7/8	2
	25/32	0.7813	6	9 7/8	2
	51/64	0.7969	6 1/8	10 3/4	3
	13/16	0.8125	6 1/8	10 3/4	3
	53/64	0.8281	6 1/8	10 3/4	3
	27/32	0.8438	6 1/8	10 3/4	3
	55/64	0.8594	6 1/8	10 3/4	3
	7/8	0.8750	6 1/8	10 3/4	3
	57/64	0.8906	6 1/8	10 3/4	3
	29/32	0.9063	6 1/8	10 3/4	3
	59/64	0.9219	6 1/8	10 3/4	3
	15/16	0.9375	6 1/8	10 3/4	3
	61/64	0.9531	6 3/8	11	3
	31/32	0.9688	6 3/8	11	3
	63/64	0.9844	6 3/8	11	3
	1	1.0000	6 3/8	11	3
	1 1/64	1.0156	6 1/2	11 1/8	3
	1 1/32	1.0313	6 1/2	11 1/8	3
	1 3/64	1.0469	6 5/8	11 1/4	3
	1 1/16	1.0625	6 5/8	11 1/4	3
	1 1/16	1.0625	6 5/8	11 1/4	4
	1 5/64	1.0781	6 7/8	12 1/2	4
	1 3/32	1.0938	6 7/8	12 1/2	4
	1 7/64	1.1094	7 1/8	12 3/4	4
	1 1/8	1.1250	7 1/8	12 3/4	4
	1 9/64	1.1406	7 1/4	12 7/8	4
	1 5/32	1.1563	7 1/4	12 7/8	4
	1 11/64	1.1719	7 3/8	13	4
	1 3/16	1.1875	7 3/8	13	4
	1 13/64	1.2031	7 1/2	13 1/8	4
	1 7/32	1.2188	7 1/2	13 1/8	4
	1 15/64	1.2344	7 7/8	13 1/2	4
	1 1/4	1.2500	7 7/8	13 1/2	4
	1 17/64	1.2656	8 1/2	14 1/8	4
	1 9/32	1.2813	8 1/2	14 1/8	4
	1 19/64	1.2969	8 5/8	14 1/4	4
	1 5/16	1.3125	8 5/8	14 1/4	4
	1 21/64	1.3281	8 3/4	14 3/8	4
	1 11/32	1.3438	8 3/4	14 3/8	4
	1 23/64	1.3594	8 7/8	14 1/2	4
	1 3/8	1.3750	8 7/8	14 1/2	4
	1 25/64	1.3906	9	14 5/8	4
	1 13/32	1.4063	9	14 5/8	4
	1 27/64	1.4219	9 1/8	14 3/4	4
	1 7/16	1.4375	9 1/8	14 3/4	4
	1 29/64	1.4531	9 1/4	14 7/8	4
	1 15/32	1.4688	9 1/4	14 7/8	4
	1 31/64	1.4844	9 3/8	15	4
	1 1/2	1.5000	9 3/8	15	4
	1 33/64	1.5156	9 3/8	16 3/8	5
	1 17/32	1.5313	9 3/8	16 3/8	5
	1 35/64	1.5469	9 5/8	16 5/8	5
	1 9/16	1.5625	9 5/8	16 5/8	5
	1 37/64	1.5781	9 7/8	16 5/8	5
	1 19/32	1.5938	9 7/8	16 7/8	5
	1 39/64	1.6094	10	17	5
	1 5/8	1.6250	10	17	5
	1 41/64	1.6406	10 1/8	17 1/8	5
	1 21/32	1.6563	10 1/8	17 1/8	5
	1 43/64	1.6719	10 1/8	17 1/8	5
	1 11/16	1.6875	10 1/8	17 1/8	5
	1 45/64	1.7031	10 1/8	17 1/8	5
	1 23/32	1.7188	10 1/8	17 1/8	5
	1 47/64	1.7344	10 1/8	17 1/8	5
	1 3/4	1.7500	10 1/8	17 1/8	5
	1 25/32	1.7813	10 1/8	17 1/8	5
	1 13/16	1.8125	10 1/8	17 1/8	5
	1 27/32	1.8438	10 1/8	17 1/8	5
	1 7/8	1.8750	10 3/8	17 3/8	5
	1 29/32	1.9063	10 3/8	17 3/8	5
	1 15/16	1.9375	10 3/8	17 3/8	5
	1 31/32	1.9688	10 3/8	17 3/8	5
	2	2.0000	10 3/8	17 3/8	5
	2 1/32	2.0313	10 3/8	17 3/8	5
	2 1/16	2.0625	10 1/4	17 3/8	5
	2 3/32	2.0938	10 1/4	17 3/8	5
	2 1/8	2.1250	10 1/4	17 3/8	5
	2 5/32	2.1563	10 1/4	17 3/8	5
	2 3/16	2.1875	10 1/4	17 3/8	5
	2 7/32	2.2188	10 1/8	17 3/8	5
	2 1/4	2.2500	10 1/8	17 3/8	5
	2 5/16	2.3125	10 1/8	17 3/8	5
	2 3/8	2.3750	10 1/8	17 3/8	5
	2 7/16	2.4375	11 1/4	18 3/4	5
	2 1/2	2.5000	11 1/4	18 3/4	5
	2 9/16	2.5625	11 7/8	19 1/2	5
	2 5/8	2.6250	11 7/8	19 1/2	5
	2 11/16	2.6875	12 3/4	20 3/8	5
	2 3/4	2.7500	12 3/4	20 3/8	5
	2 13/16	2.8125	13 3/8	21 1/8	5
	2 7/8	2.8750	13 3/8	21 1/8	5
	2 15/16	2.9375	14	21 3/4	5
	3	3.0000	14	21 3/4	5
	3 1/16	3.0625	14 5/8	24 1/2	6
	3 1/8	3.1250	14 5/8	24 1/2	6
	3 3/16	3.1875	14 5/8	24 1/2	6
	3 1/4	3.2500	15 1/2	25 1/2	6
	3 5/16	3.3125	15 1/2	25 1/2	6
	3 3/8	3.3750	15 1/2	25 1/2	6
	3 7/16	3.4375	15 1/2	25 1/2	6
	3 1/2	3.5000	16 3/8	26 1/2	6

* item will be discontinued, after stock has depleted.

1 per box

EXTRA LENGTH DRILLS / TAPER SHANK DRILLS

List No.651 Taper Shank Drills

h8 HSS HELIX N 118° S-type >1/2 Conical

Range 1/4 to 2 1/2
Overall Length 18" and 24"

HIGH SPEED STEEL **Bright Finish**

Used for deep hole drilling with Taper Shank.

Size	Decimal Equivalent	Overall Length		Taper Shank
		18"	24"	
		Flute Length	Flute Length	
1/4	0.2500	14	—	1
17/64	0.2656	14	—	1
9/32	0.2813	14	—	1
19/64	0.2969	14	—	1
5/16	0.3125	14	20	1
21/64	0.3281	14	—	1
11/32	0.3438	14	—	1
23/64	0.3594	14	—	1
3/8	0.3750	14	20	1
25/64	0.3906	14	—	1
13/32	0.4063	14	—	1
27/64	0.4219	14	—	1
7/16	0.4375	14	20	1
29/64	0.4531	14	—	1
15/32	0.4688	14	—	1
31/64	0.4844	14	—	2
1/2	0.5000	14	20	2
33/64	0.5156	14	20	2
17/32	0.5313	14	20	2
35/64	0.5469	14	—	2
9/16	0.5625	14	20	2
37/64	0.5781	14	20	2
19/32	0.5938	14	20	2
39/64	0.6094	14	—	2
5/8	0.6250	14	20	2
41/64	0.6406	14	—	2
21/32	0.6563	14	20	2
43/64	0.6719	14	—	2
11/16	0.6875	14	20	2
45/64	0.7031	14	—	2
23/32	0.7188	14	20	2
47/64	0.7344	14	—	2
3/4	0.7500	14	20	2
49/64	0.7656	14	—	2
25/32	0.7813	14	20	2
51/64	0.7969	13	—	3
13/16	0.8125	13	19	3
53/64	0.8281	13	—	3

Size	Decimal Equivalent	Overall Length		Taper Shank
		18"	24"	
		Flute Length	Flute Length	
27/32	0.8438	13	19	3
55/64	0.8594	13	—	3
7/8	0.8750	13	19	3
57/64	0.8906	13	—	3
29/32	0.9063	13	19	3
59/64	0.9219	13	—	3
15/16	0.9375	13	19	3
61/64	0.9531	13	—	3
31/32	0.9688	13	19	3
63/64	0.9844	13	—	3
1	1.0000	13	19	3
1 1/32	1.0313	13	—	3
1 1/16	1.0625	13	19	3
1 3/32	1.0938	12	—	4
1 1/8	1.1250	12	19	4
1 5/32	1.1563	12	18	4
1 3/16	1.1875	12	18	4
1 7/32	1.2188	12	18	4
1 1/4	1.2500	12	18	4
1 9/32	1.2813	12	—	4
1 5/16	1.3125	12	18	4
1 11/32	1.3438	12	—	4
1 3/8	1.3750	12	18	4
1 13/32	1.4063	12	—	4
1 7/16	1.4375	12	18	4
1 1/2	1.5000	12	18	4
1 9/16	1.5625	10 1/2	17	5
1 5/8	1.6250	10 1/2	17	5
1 11/16	1.6875	10 1/2	17	5
1 3/4	1.7500	10 1/2	17	5
1 7/8	1.8750	10 1/2	17	5
2	2.0000	10 1/2	17	5
2 1/16	2.0625	—	17	5
2 1/8	2.1250	—	17	5
2 1/4	2.2500	—	17	5
2 3/8	2.3750	—	17	5
2 1/2	2.5000	—	17	5

1 per box

OIL HOLE DRILLS / TAPER SHANK

List No.683

h8 | HSS Co | HELIX N | 118° | N-type | OIL HOLE

Range 3/8 to 1 1/2

M35 COBALT **Bright Finish**

Used in heavy-duty applications. Delivers coolant to the point permit higher speeds and feeds and reduce high temperatures.

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Taper
3/8	0.3750	4 1/4	8 1/8	2
25/64	0.3906	4 3/8	8 1/4	2
13/32	0.4063	4 3/8	8 1/4	2
27/64	0.4219	4 5/8	8 1/2	2
7/16	0.4375	4 5/8	8 1/2	2
29/64	0.4531	4 7/8	8 3/4	2
15/32	0.4688	4 7/8	8 3/4	2
31/64	0.4844	5	9 5/8	3
1/2	0.5000	5	9 5/8	3
33/64	0.5156	5 1/8	9 3/4	3
17/32	0.5313	5 1/8	9 3/4	3
35/64	0.5469	5 1/4	9 7/8	3
9/16	0.5625	5 1/4	9 7/8	3
37/64	0.5781	5 1/2	10 1/8	3
19/32	0.5938	5 1/2	10 1/8	3
39/64	0.6094	5 5/8	10 1/4	3
5/8	0.6250	5 5/8	10 1/4	3
41/64	0.6406	5 3/4	10 3/8	3
21/32	0.6563	5 3/4	10 3/8	3
43/64	0.6719	5 7/8	10 1/2	3
11/16	0.6875	5 7/8	10 1/2	3
45/64	0.7031	6 1/8	10 3/4	3
23/32	0.7188	6 1/8	10 3/4	3
47/64	0.7344	6 1/4	10 7/8	3
3/4	0.7500	6 1/4	10 7/8	3

Size	Decimal Equivalent	Flute Length	Overall Length	Shank Taper
49/64	0.7656	6 3/8	11	3
25/32	0.7813	6 3/8	11	3
51/64	0.7969	6 1/2	11 1/8	3
13/16	0.8125	6 1/2	11 1/8	3
53/64	0.8281	6 5/8	11 1/4	3
27/32	0.8438	6 5/8	11 1/4	3
55/64	0.8594	6 7/8	11 1/2	3
7/8	0.8750	6 7/8	11 1/2	3
57/64	0.8906	6 7/8	11 1/2	3
29/32	0.9063	6 7/8	11 1/2	3
59/64	0.9219	6 7/8	11 1/2	3
15/16	0.9375	6 7/8	11 1/2	3
61/64	0.9531	7	11 5/8	3
31/32	0.9688	7	11 5/8	3
63/64	0.9844	7 1/8	11 3/4	3
1	1.0000	7 1/8	11 3/4	3
1 1/16	1.0625	7 1/4	12 7/8	4
1 1/8	1.1250	7 3/4	13 3/8	4
1 3/16	1.1875	8	13 5/8	4
1 1/4	1.2500	8 1/4	13 7/8	4
1 5/16	1.3125	9 1/8	14 3/4	4
1 3/8	1.3750	9 3/8	15	4
1 7/16	1.4375	9 1/2	15 1/8	4
1 1/2	1.5000	9 3/4	15 3/8	4

1 per box

SILVER AND DEMING DRILLS

List No.575

h8 HSS HELIX N 118° >23/32 S-type Conical

Shank Diameter 1/2" by 2 1/2" long
Range 1/2" to 1 1/2"

HIGH SPEED STEEL **Bright Finish**

Used for general purpose drilling when 1/2" shank is required.
Used in drill presses and portable electric drills.

Size	Decimal Equivalent	Flute Length	Overall Length
1/2	.5000	3 1/8	6
33/64	.5156	3 1/8	6
17/32	.5312	3 1/8	6
35/64	.5469	3 1/8	6
9/16	.5625	3 1/8	6
37/64	.5781	3 1/8	6
19/32	.5938	3 1/8	6
39/64	.6094	3 1/8	6
5/8	.6250	3 1/8	6
41/64	.6406	3 1/8	6
21/32	.6562	3 1/8	6
43/64	.6719	3 1/8	6
11/16	.6875	3 1/8	6
45/64	.7031	3 1/8	6
23/32	.7187	3 1/8	6
47/64	.7344	3 1/8	6
3/4	.7500	3 1/8	6
49/64	.7656	3	6
25/32	.7812	3	6
51/64	.7969	3	6
13/16	.8125	3	6
53/64	.8281	3	6
27/32	.8438	3	6
55/64	.8594	3	6
7/8	.8750	6	6

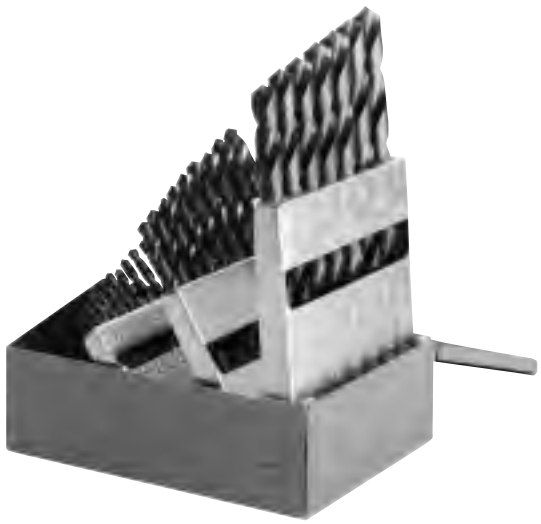
Size	Decimal Equivalent	Flute Length	Overall Length
57/64	.8906	3	6
29/32	.9062	3	6
59/64	.9219	3	6
15/16	.9375	3	6
61/64	.9531	3	6
31/32	.9687	3	6
63/64	.9844	3	6
1	1.0000	3	6
1 1/32	1.0312	3	6
1 1/16	1.0625	3	6
1 3/32	1.0938	3	6
1 1/8	1.1250	3	6
1 5/32	1.1562	3	6
1 3/16	1.1875	3	6
1 7/32	1.2188	3	6
1 1/4	1.1250	3	6
1 9/32	1.2812	2 3/4	6
1 5/16	1.3125	2 3/4	6
1 11/32	1.3438	2 3/4	6
1 3/8	1.3750	2 3/4	6
1 13/32	1.4062	2 3/4	6
1 7/16	1.4375	2 3/4	6
1 15/32	1.4688	2 3/4	6
1 1/2	1.5000	2 3/4	6

1 per box

DRILL SETS / JOBBERS LENGTH

List No.599 General Purpose

Black Oxide or **Bright Finish***
*When ordering please specity



HIGH SPEED DRILLS SETS (L501, L501A)	SET NO.
Fractional Sizes	
1/16" To 1/4" By 64ths	S13
1/16" To 1/2" By 32nds	S15
1/16" To 3/8" By 64ths	S21
1/16" To 1/2" By 64ths	S29
Wire Gauge Sizes	
No.1 To No.60	S60
No.61 To No. 80	S20
Letter Sizes	
A To Z	S26
Combination Sizes	
S29, S60, S26	S115
COBALT DRILL SETS (L6501)	**SET NO.**
Fractional Sizes	
1/16" To 1/2" By 64ths	C29

STANDARD DRILLING CONDITION

SG-ESS Drills List No. 7572P, 7573P

Workpiece Material / Speed (SFM) / Drill Diameter			Strutual Steels, Carbon Steels		Alloy Steels		Mold Steels Stainless Steels 300-400 series		Nickel Alloys, Titanium Alloys		Cast Irons		Aluminum Alloys, Copper Alloys, Nonferrous Alloys	
			115 - 135 SFM		95 - 105 SFM		40 - 50 SFM		20 SFM		130 - 150 SFM		200 - 230 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	2	0.0787	6,000	0.003	4,800	0.002	2,100	0.002	950	0.001	6,800	0.003	10,500	0.003
3/32	2.381	0.0938	5,000	0.003	4,000	0.003	1,800	0.003	800	0.001	5,700	0.004	8,700	0.004
—	3	0.1181	4,000	0.004	3,200	0.004	1,500	0.004	650	0.001	4,500	0.005	7,000	0.005
1/8	3.175	0.1250	3,800	0.005	3,000	0.004	1,400	0.004	600	0.002	4,250	0.006	6,500	0.006
5/32	3.969	0.1563	3,000	0.006	2,400	0.005	1,100	0.004	500	0.002	3,400	0.007	5,200	0.007
3/16	4.763	0.1875	2,500	0.007	2,000	0.005	900	0.004	400	0.002	2,850	0.008	4,300	0.008
—	5	0.1969	2,500	0.007	1,900	0.006	850	0.004	350	0.002	2,700	0.008	4,100	0.008
1/4	6.35	0.2500	1,900	0.008	1,500	0.007	700	0.005	300	0.003	2,100	0.010	3,200	0.009
5/16	7.938	0.3125	1,500	0.009	1,200	0.008	550	0.007	250	0.003	1,750	0.012	2,600	0.011
—	8	0.3150	1,500	0.009	1,200	0.008	550	0.007	250	0.003	1,700	0.012	2,600	0.012
3/8	9.525	0.3750	1,250	0.010	1,000	0.009	450	0.008	200	0.004	1,450	0.012	2,200	0.013
—	10	0.3937	1,200	0.010	950	0.009	450	0.008	200	0.004	1,400	0.013	2,100	0.013
—	12	0.4724	1,000	0.011	800	0.010	350	0.009	150	0.005	1,100	0.014	1,700	0.015
1/2	12.7	0.5000	950	0.011	750	0.010	350	0.009	150	0.005	1,100	0.015	1,650	0.015
—	16	0.6299	750	0.014	600	0.012	250	0.011	120	0.007	850	0.017	1,300	0.017
—	20	0.7874	600	0.016	450	0.014	200	0.012	100	0.008	680	0.020	1,050	0.020
—	25	0.9843	450	0.019	350	0.015	150	0.014	70	0.010	550	0.023	850	0.023
—	32	1.2598	350	0.018	300	0.015	150	0.016	50	0.014	450	0.022	650	0.022

1) The above values apply when coolant is used in vertical machine & horizontal machine.
When drilling in stainless steel and hard to cut material using pecking.
2) Adjust drilling condition when unusual vibration or different sound occurs.
3) Recommended feeds and speeds are starting points only. Actual performance will be determined by specific material, the condition of equipment being used and coolant.

Formulas: $RPM = \frac{SFM \times 3.82}{\text{Drill dia.}}$, Feed Rate (in/min)= RPM x IPR

SG-ES Drills List No. 7570P, 7571P

Workpiece Material / Speed (SFM) / Drill Diameter			Structual Steels, Carbon Steels		Alloy Steels		Die Steels Steels(35-45HRc) 400 Series Stainless Steel		Cast Irons		Aluminum Alloys, Copper Alloys, Nonferrous Alloys	
			115 - 135 SFM		95 - 105 SFM		40 - 50 SFM		130 - 150 SFM		200 - 230 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	2	0.0787	6,000	0.003	4,800	0.002	2,200	0.002	6,800	0.003	10,400	0.003
3/32	2.381	0.0938	5,100	0.003	4,000	0.003	1,800	0.003	5,700	0.004	8,700	0.004
—	3	0.1181	4,100	0.004	3,200	0.004	1,450	0.004	4,500	0.005	6,900	0.005
1/8	3.175	0.1250	3,800	0.005	3,100	0.004	1,375	0.004	4,300	0.006	6,570	0.006
5/32	3.969	0.1563	3,100	0.006	2,450	0.005	1,100	0.004	3,450	0.007	5,300	0.007
3/16	4.763	0.1875	2,550	0.007	2,000	0.005	900	0.004	2,900	0.008	4,400	0.008
—	5	0.1969	2,400	0.007	1,900	0.006	870	0.004	2,700	0.008	4,200	0.008
1/4	6.35	0.2500	1,900	0.008	1,500	0.007	700	0.005	2,100	0.010	3,300	0.009
5/16	7.938	0.3125	1,500	0.009	1,200	0.008	550	0.007	1,750	0.012	2,700	0.011
—	8	0.3150	1,500	0.009	1,200	0.008	550	0.007	1,700	0.012	2,600	0.012
3/8	9.525	0.3750	1,300	0.010	1,000	0.009	500	0.008	1,500	0.012	2,200	0.013
—	10	0.3937	1,200	0.010	950	0.009	450	0.008	1,400	0.013	2,100	0.013
—	12	0.4724	1,000	0.011	800	0.010	400	0.009	1,100	0.014	1,750	0.015
1/2	12.7	0.5000	950	0.011	750	0.010	350	0.009	1,050	0.015	1,650	0.015
—	16	0.6299	750	0.014	600	0.012	300	0.011	850	0.017	1,300	0.017
—	20	0.7874	600	0.016	500	0.014	250	0.012	700	0.020	1,050	0.020
—	25	0.9843	500	0.019	400	0.015	200	0.014	550	0.023	850	0.023
—	32	1.2598	400	0.018	300	0.015	150	0.016	450	0.022	650	0.022

1) SG-ES is not recommended for 300-series Stainless Steels.
2) SG-ES is suitable for driling into 400-series Stainless Steels.
3) Pilot hole required for deep hole drilling applications. It is recommended to use same diameter pilot drill.
The depth of cut for pilot hole is 1 to 2 times drill diameter.
4) Use pecking in hard to cut materials.
5) Recommended feeds and speeds are starting points only. Actual performance will be determined by specific material, the condition of equipment being used and coolant.

Formulas: $RPM = \frac{SFM \times 3.82}{\text{Drill dia.}}$, Feed Rate (in/min)= RPM x IPR

STANDARD DRILLING CONDITION

SG Drills with Oil Hole List No. 7596P, 7591P

Workpiece Material / Speed (SFM) / Drill Diameter			Structual Steels, Carbon Steels		Alloy Steels		Die Steels Hardened Steels (35-45HRc)		Stainless Steels		Cast Irons		Aluminum Alloys, Copper Alloys, Nonferrous Alloys	
			120 - 130 SFM		105 - 110 SFM		40 - 50 SFM		60 - 70 SFM		130 - 150 SFM		200 - 230 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	5	0.1969	2,400	0.007	1,900	0.006	850	0.005	1,200	0.005	2,700	0.009	4,100	0.009
1/4	6.35	0.2500	1,900	0.008	1,500	0.008	650	0.006	1,000	0.006	2,100	0.011	3,300	0.011
5/16	7.938	0.3125	1,500	0.009	1,250	0.008	550	0.007	800	0.007	1,700	0.013	2,650	0.013
—	8	0.3150	1,500	0.009	1,200	0.009	550	0.009	750	0.008	1,700	0.014	2,600	0.014
3/8	9.525	0.3750	1,250	0.010	1,000	0.010	500	0.009	700	0.009	1,500	0.014	2,200	0.014
—	10	0.3937	1,200	0.010	950	0.011	450	0.010	650	0.010	1,400	0.016	2,000	0.016
—	12	0.4724	1,000	0.011	800	0.011	400	0.010	550	0.010	1,200	0.016	1,700	0.016
1/2	12.7	0.5000	950	0.011	750	0.013	350	0.012	500	0.013	1,100	0.019	1,600	0.019
—	16	0.6299	750	0.014	600	0.014	250	0.014	400	0.015	850	0.021	1,300	0.021
—	20	0.7874	600	0.016	450	0.015	200	0.014	300	0.015	650	0.022	1,000	0.021

1) The above values apply when coolant is used in vertical machine & horizontal machine.
When drilling in stainless steel and hard to cut material using pecking.
2) Adjust drilling condition when unusual vibration or different sound occurs.
3) Recommended feeds and speeds are starting points only. Actual performance will be determined by specific material, the condition of equipment being used and coolant.

Formulas: $RPM = \frac{SFM \times 3.82}{\text{Drill dia.}}$, Feed Rate (in/min)= RPM x IPR

UG-Power Drills List No. 6528P, 6517U

Workpiece Material / Speed (SFM) / Drill Diameter			Structual Steels, Carbon Steels		Alloy Steels		Die Steels Hardened Steels (-40HRc)		Cast Irons		Stainless Steels 300 - 400 Series	
			75 - 100 SFM		60 - 80 SFM		45 - 60 SFM		90 - 120 SFM		30 - 40 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	1	0.0394	8,200	0.001	6,800	0.001	4,850	0.001	9,700	0.002	2,900	0.0006
3/64	1.191	0.0469	6,900	0.002	5,700	0.001	4,100	0.001	8,100	0.002	2,400	0.0008
—	2	0.0787	4,100	0.003	3,400	0.002	2,500	0.002	4,800	0.003	1,400	0.0015
3/32	2.381	0.0938	3,400	0.003	2,800	0.003	2,000	0.003	4,000	0.004	1,200	0.0017
—	3	0.1181	2,700	0.004	2,300	0.004	1,600	0.004	3,200	0.005	950	0.002
1/8	3.175	0.1250	2,500	0.005	2,100	0.004	1,500	0.004	3,000	0.006	900	0.002
5/32	3.969	0.1563	2,000	0.006	1,700	0.005	1,200	0.004	2,500	0.007	700	0.003
3/16	4.763	0.1875	1,700	0.007	1,400	0.005	1,000	0.004	2,000	0.008	600	0.003
—	5	0.1969	1,650	0.007	1,300	0.006	950	0.004	1,900	0.008	550	0.004
1/4	6.35	0.2500	1,300	0.008	1,000	0.007	750	0.005	1,500	0.010	450	0.004
5/16	7.938	0.3125	1,000	0.009	900	0.008	600	0.007	1,300	0.012	400	0.005
—	8	0.3150	1,000	0.009	850	0.008	600	0.007	1,200	0.012	400	0.005
3/8	9.525	0.3750	900	0.010	750	0.009	500	0.008	1,100	0.012	350	0.006
—	10	0.3937	850	0.010	700	0.009	450	0.008	1,000	0.013	350	0.006
13/32	10.319	0.4063	800	0.015	650	0.012	450	0.008	950	0.016	330	0.006
7/16	11.113	0.4375	750	0.015	600	0.013	400	0.009	900	0.017	300	0.007
—	12	0.4724	700	0.011	550	0.010	400	0.009	850	0.014	280	0.007
1/2	12.7	0.5000	650	0.011	550	0.010	380	0.009	800	0.015	280	0.007
—	13	0.5118	600	0.016	500	0.014	350	0.010	750	0.017	250	0.008

1) Pilot Hole is required. It is recommended to use same diameter or up to 0.1mm larger than diamter of the long drill.
The depth of cut of the pilot hole is 1 to 2 times diameter of the drill diameter.
2) Use pecking in hard to cut materials like Stainless Steel & hardened Steels.
3) Recommended feeds and speeds are starting points only. Actual performance will be determined by specific material, the condition of equipment being used and coolant.

Formulas: $RPM = \frac{SFM \times 3.82}{\text{Drill dia.}}$, Feed Rate (in/min)= RPM x IPR

STANDARD DRILLING CONDITION

AG-SUS Short Drills List No. 6596P
AG-SUS Regular Drills List No. 6594P, 6595P

Workpiece Material / Speed (SFM) / Drill Diameter			Austenitic Stainless Steels 304, 316		Austenitic Stainless Steels 304N		Martensitic Stainless Steels 420, 440		Ferritic Stainless Steels 405, 430		Low Carbon Steels	
			40 - 50 SFM		30 - 40 SFM		50 - 60 SFM		50 - 65 SFM		100 - 115 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	1	0.0394	4,300	0.001	3,300	0.001	5,300	0.001	5,300	0.001	10,600	0.001
—	2	0.0787	2,100	0.003	1,700	0.002	2,650	0.002	2,650	0.001	5,300	0.003
3/32	2.381	0.0938	1,800	0.003	1,400	0.003	2,240	0.003	2,240	0.001	4,450	0.004
—	3	0.1181	1,400	0.004	1,100	0.004	1,770	0.004	1,750	0.001	3,500	0.005
1/8	3.175	0.1250	1,300	0.005	1,000	0.004	1,680	0.004	1,650	0.002	3,300	0.006
5/32	3.969	0.1563	1,100	0.006	850	0.005	1,340	0.004	1,340	0.002	2,650	0.007
3/16	4.763	0.1875	900	0.007	700	0.005	1,120	0.004	1,120	0.002	2,250	0.008
—	5	0.1969	850	0.007	670	0.006	1,050	0.004	1,060	0.002	2,100	0.008
1/4	6.35	0.2500	650	0.008	530	0.007	840	0.005	840	0.003	1,680	0.010
5/16	7.938	0.3125	550	0.009	420	0.008	670	0.007	650	0.003	1,350	0.012
—	8	0.3150	550	0.009	400	0.008	650	0.007	650	0.003	1,300	0.012
3/8	9.525	0.3750	450	0.010	350	0.009	560	0.008	560	0.004	1,100	0.012
—	10	0.3937	430	0.010	340	0.009	530	0.008	500	0.004	1,000	0.013
—	12	0.4724	360	0.011	280	0.010	440	0.009	450	0.005	850	0.014
1/2	12.7	0.5000	340	0.011	260	0.010	420	0.009	420	0.005	800	0.015
—	16	0.6299	270	0.014	210	0.012	330	0.011	330	0.007	650	0.017
3/4	19.05	0.7500	220	0.016	200	0.015	280	0.016	280	0.016	550	0.015
—	20	0.7874	210	0.016	170	0.014	260	0.012	250	0.008	500	0.020

1) The above values apply when coolant is used in vertical machine & horizontal machine.
2) Adjust drilling condition when unusual vibration or different sound occurs.
3) Recommended feeds and speeds are starting points only. Actual performance will be determined by specific material, the condition of equipment being used and coolant.

Formulas: $RPM = \frac{SFM \times 3.82}{\text{Drill dia.}}$, Feed Rate (in/min)= RPM x IPR

AG-Power Long Drills List No. 6540P, 6541P

Workpiece Material / Speed (SFM) / Drill Diameter			Structual Steels, Carbon Steels		Alloy Steels		Hardened Steels, (-40 HRc), Tool Steels		Stainless Steels 300-400 Series		Cast Irons	
			40 - 80 SFM		25 - 50 SFM		16 - 35 SFM		30 - 40 SFM		42 - 82 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	1	0.0394	5,800	0.0007	3,300	0.0007	2,400	0.0005	2,900	0.0006	6,000	0.0008
—	2	0.0787	2,900	0.002	1,600	0.002	1,200	0.002	1,400	0.0015	3,000	0.002
—	3	0.1181	1,950	0.003	1,100	0.003	800	0.002	950	0.002	2,000	0.003
1/8	3.175	0.1250	1,800	0.003	1,000	0.003	750	0.002	900	0.002	1,800	0.003
3/16	4.763	0.1875	1,200	0.005	700	0.005	500	0.004	600	0.003	1,200	0.005
—	5	0.1969	1,100	0.005	650	0.005	480	0.004	550	0.004	1,200	0.006
—	6	0.2362	970	0.006	550	0.006	400	0.005	450	0.004	1,000	0.007
1/4	6.350	0.2500	900	0.006	500	0.006	350	0.005	450	0.004	950	0.008
9/32	7.144	0.2813	800	0.007	450	0.007	350	0.005	400	0.005	850	0.009
5/16	7.938	0.3125	700	0.008	400	0.008	300	0.006	350	0.006	800	0.010
—	8	0.3150	700	0.008	400	0.008	300	0.006	350	0.006	750	0.009
23/64	9	0.3594	650	0.009	350	0.009	250	0.007	300	0.007	700	0.010
—	10	0.3937	600	0.010	350	0.009	250	0.008	300	0.007	650	0.013
—	13	0.5118	550	0.009	300	0.009	200	0.008	250	0.008	600	0.011

1) Pilot Hole is required. It is recommended to use same diameter or up to 0.1mm larger than diamter of the long drill. The depth of cut of the pilot hole is 1 to 2 times diameter of the drill diameter.
2) Above drilling table is applied to Series 1 & 2. In case of series 3 & 4, reduce the RPM and feed to 80% of table values.
3) Use pecking when drilling in Stainless Steel & Hardened Steels.
4) Recommended feeds and speeds are starting points only. Actual performance will be determined by specific material, the condition of equipment being used and coolant.

Formulas: $RPM = \frac{SFM \times 3.82}{\text{Drill dia.}}$, Feed Rate (in/min)= RPM x IPR

AQUA Drills STUB List No. 9550, 9551

Hi-Speed Wet Drilling

Workpiece Material / Speed (SFM) / Drill Diameter			Carbon Steels Cast Irons		Alloy Steels		Die Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		DuctileCast Irons	
			330 - 495 SFM		260 - 330 SFM		165 - 230 SFM		100 - 165 SFM		260 - 330 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	3	0.1181	16,000	0.004	11,000	0.004	7,400	0.004	5,300	0.004	11,000	0.002
5/32	3.969	0.1563	12,000	0.006	8,100	0.005	5,600	0.005	4,000	0.005	8,100	0.003
3/16	4.763	0.1875	10,000	0.007	6,800	0.006	4,700	0.007	3,400	0.006	6,800	0.004
—	5	0.1969	9,600	0.007	6,400	0.007	4,500	0.007	3,200	0.006	6,400	0.004
1/4	6.35	0.2500	7,500	0.009	5,100	0.008	3,500	0.009	2,500	0.007	5,100	0.005
—	8	0.3150	6,000	0.010	4,000	0.011	2,800	0.011	2,000	0.009	4,000	0.006
3/8	9.525	0.3750	5,000	0.012	3,400	0.013	2,400	0.012	1,700	0.010	3,400	0.007
—	10	0.3937	4,800	0.012	3,200	0.012	2,200	0.013	1,600	0.011	3,200	0.008
—	12	0.4724	4,000	0.015	2,700	0.015	1,900	0.015	1,300	0.012	2,700	0.009
1/2	12.7	0.5000	3,800	0.015	2,500	0.015	1,800	0.015	1,300	0.013	2,500	0.010
—	16	0.6299	3,000	0.017	2,000	0.018	1,400	0.018	1,000	0.015	2,000	0.012

Drilling in Dry Condition

Workpiece Material / Speed (SFM) / Drill Diameter			Carbon Steels Cast Irons		Alloy Steels		Die Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		DuctileCast Irons	
			215 - 260 SFM		165 - 215 SFM		82 - 112 SFM		49 - 83 SFM		165 - 215 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	3	0.1181	8,500	0.003	6,900	0.003	3,700	0.003	2,700	0.002	6,900	0.002
5/32	3.969	0.1563	6,400	0.004	5,200	0.004	2,700	0.004	2,000	0.003	5,200	0.003
3/16	4.763	0.1875	5,300	0.005	4,300	0.005	2,300	0.005	1,700	0.004	4,300	0.004
—	5	0.1969	5,100	0.005	4,100	0.005	2,200	0.005	1,600	0.004	4,100	0.004
1/4	6.35	0.2500	4,000	0.006	3,200	0.006	1,700	0.006	1,300	0.005	3,200	0.005
—	8	0.3150	3,200	0.008	2,600	0.008	1,400	0.008	1,000	0.006	2,600	0.006
3/8	9.525	0.3750	2,700	0.009	2,200	0.009	1,100	0.009	850	0.007	2,200	0.007
—	10	0.3937	2,500	0.009	2,100	0.009	1,100	0.009	800	0.007	2,100	0.007
—	12	0.4724	2,100	0.010	1,700	0.011	900	0.011	700	0.008	1,700	0.009
1/2	12.7	0.5000	2,000	0.011	1,600	0.011	850	0.011	630	0.008	1,600	0.010
—	16	0.6299	1,600	0.013	1,300	0.013	700	0.012	500	0.010	1,300	0.012

1) Drilling Aluminum Alloys, Light Metals, Stainless Steels are not recommended.
2) Use blow air for cooling and chip remuval in dry processes.
3) Due to sparks during cutting, heat by breakage, or hot chips, there is danger of fire. Take fire prevention measures.
4) Adjust drilling condition when unusual vibration or different sound occurs.

AQUA Drills Regular List No. 9552

Hi-Speed Wet Drilling

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels Cast Irons		Alloy Steels		Die Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
		330 - 495 SFM		260 - 330 SFM		165 - 230 SFM		100 - 165 SFM		260 - 330 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
3	0.1181	16,000	0.004	11,000	0.004	7,400	0.004	5,300	0.003	11,000	0.002
5	0.1969	9,600	0.006	6,400	0.006	4,500	0.006	3,200	0.005	6,400	0.004
8	0.3150	6,000	0.010	4,000	0.010	2,800	0.010	2,000	0.008	4,000	0.006
10	0.3937	4,800	0.011	3,200	0.011	2,200	0.011	1,600	0.010	3,200	0.007
12	0.4724	4,000	0.013	2,700	0.013	1,900	0.013	1,300	0.011	2,700	0.008
16	0.6299	3,000	0.016	2,000	0.016	1,400	0.016	1,000	0.013	2,000	0.011

Drilling in Dry Condition

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels Cast Irons		Alloy Steels		Die Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
		215 - 260 SFM		165 - 215 SFM		82 - 112 SFM		49 - 83 SFM		165 - 215 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
3	0.1181	8,500	0.003	6,900	0.003	3,700	0.003	2,700	0.002	6,900	0.002
5	0.1969	5,100	0.004	4,100	0.005	2,200	0.004	1,600	0.004	4,100	0.004
8	0.3150	3,200	0.007	2,600	0.007	1,400	0.007	1,000	0.006	2,600	0.006
10	0.3937	2,500	0.008	2,100	0.008	1,100	0.009	800	0.007	2,100	0.007
12	0.4724	2,100	0.009	1,700	0.009	900	0.010	700	0.007	1,700	0.008
16	0.6299	1,600	0.011	1,300	0.012	700	0.011	500	0.009	1,300	0.011

1) Drilling Aluminum Alloys, Light Metals, Stainless Steels are not recommended.
2) Use blow air for cooling and chip remuval in dry processes.
3) Due to sparks during cutting, heat by breakage, or hot chips, there is danger of fire. Take fire prevention measures.
4) Adjust drilling condition when unusual vibration or different sound occurs.

AQUA Drills 3 Flute List No. 9546

Drilling in Wet Condition

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels Cast Irons		Alloy Steels		Die Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
		215 - 260 SFM		160 - 195 SFM		130 - 165 SFM		98 - 130 SFM		132 - 163 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
3	0.1181	8,500	0.004	6,400	0.004	5,300	0.003	4,200	0.002	5,300	0.002
5	0.1969	5,100	0.006	3,800	0.006	3,200	0.005	2,500	0.004	3,200	0.004
6	0.2362	4,200	0.008	3,200	0.007	2,700	0.006	2,100	0.005	2,700	0.005
8	0.3150	3,200	0.010	2,400	0.009	2,000	0.007	1,600	0.006	2,000	0.006
10	0.3937	2,500	0.011	1,900	0.011	1,600	0.009	1,300	0.007	1,600	0.007
12	0.4724	2,100	0.013	1,600	0.012	1,300	0.010	1,100	0.008	1,300	0.008
14	0.5512	1,820	0.014	1,360	0.014	1,140	0.011	910	0.009	1,140	0.009
16	0.6299	1,600	0.016	1,190	0.015	990	0.013	800	0.009	990	0.010

1) For precision drilling, use in wet condition.
2) In case of dry condition, reduce the rotation and feed to 70% of table values.
3) Use blow air for cooling and chip remuval in dry processes.
4) Due to sparks during cutting, heat by breakage, or hot chips, there is danger of fire. Take fire prevention measures.
5) Adjust drilling condition when unusual vibration or different sound occurs.

AQUA Drills Hard List No. 9548

Workpiece Material / Speed (SFM) / Drill Diameter		Work Hardness							
		50 - 55HRc		55 - 60HRc		60 - 65HRc		65HRc -	
		98 - 130 SFM		65 - 82 SFM		49 - 66 SFM		33 - 50 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
2	0.0787	6,400	0.0020	4,000	0.0016	3,200	0.0012	2,400	0.0011
3	0.1181	4,200	0.0026	2,700	0.0020	2,100	0.0016	1,600	0.0015
4	0.1575	3,200	0.0032	2,000	0.0024	1,600	0.0016	1,200	0.0016
6	0.2362	2,100	0.0039	1,300	0.0030	1,100	0.0020	800	0.0016
8	0.3150	1,600	0.0047	1,000	0.0039	800	0.0020	600	0.0016
10	0.3937	1,300	0.0048	800	0.0047	640	0.0020	480	0.0016
12	0.4724	1,100	0.0047	660	0.0048	530	0.0020	400	0.0016

1) Recommend AQUA Drills Stub, AQUA Drills Regular in drilling work material when hardness is below 50HRc.
2) These table values are used in dry & wet conditions, but work material having over 60HRc hardness requres in wet condition.

AQUA Micro Drills List No. 9544

Drilling in Wet Condition

Workpiece Material / Drill Diameter		Carbon Steels Cast Irons			Alloy Steels			Die Steels Hardened Steels (30-40HRc)			Hardened Steels (40-50HRc)		
Metric mm	Decimal	RPM	Feed (IPR)	Step Feed	RPM	Feed (IPR)	Step Feed	RPM	Feed (IPR)	Step Feed	RPM	Feed (IPR)	Step Feed
0.2	0.0079	31,800	0.0001	0.1D	26,500	0.0001	0.1D	21,200	0.0001	0.1D	12,700	0.0001	0.1D
0.3	0.0118	31,800	0.0001	0.1D	26,500	0.0001	0.1D	21,200	0.0001	0.1D	12,700	0.0001	0.1D
0.4	0.0157	31,800	0.0002	0.1D	25,900	0.0002	0.1D	19,900	0.0002	0.1D	12,700	0.0002	0.1D
0.5	0.0197	31,800	0.0002	0.1D	25,900	0.0002	0.1D	19,100	0.0002	0.1D	12,700	0.0002	0.1D
1.0	0.0394	23,900	0.0006	0.2D-0.5D*5)	15,900	0.0006	0.2D-0.5D*5)	12,700	0.0006	0.2D-0.5D*5)	8,000	0.0005	0.1D
1.5	0.0591	21,200	0.0011	0.2D-0.5D*5)	13,800	0.0011	0.2D-0.5D*5)	9,500	0.0011	0.2D-0.5D*5)	6,400	0.0009	0.1D
1.99	0.0783	19,200	0.0019	0.2D-0.5D*5)	12,800	0.0020	0.2D-0.5D*5)	8,000	0.0020	0.2D-0.5D*5)	5,600	0.0015	0.1D

D: Drill Diameter

Workpiece Material / Drill Diameter		Hardened Steels (50-55HRc)			Ductile Cast Irons			Stainless Steels		
Metric mm	Decimal	RPM	Feed (IPR)	Step Feed	RPM	Feed (IPR)	Step Feed	RPM	Feed (IPR)	Step Feed
0.2	0.0079	10,600	0.0001	0.1D	31,800	0.0001	0.1D	10,600	0.0001	0.1D
0.3	0.0118	10,600	0.0001	0.1D	31,800	0.0001	0.1D	10,600	0.0001	0.1D
0.4	0.0157	9,900	0.0002	0.1D	31,800	0.0002	0.1D	9,500	0.0002	0.1D
0.5	0.0197	9,500	0.0002	0.1D	31,800	0.0002	0.1D	9,500	0.0002	0.1D
1.0	0.0394	5,600	0.0004	0.1D	19,100	0.0006	0.2D-0.5D*5)	5,600	0.0006	0.1D
1.5	0.0591	4,200	0.0006	0.1D	17,000	0.0011	0.2D-0.5D*5)	4,200	0.0012	0.1D
1.99	0.0783	3,600	0.0008	0.1D	16,000	0.0014	0.2D-0.5D*5)	3,600	0.0015	0.1D

D: Drill Diameter

1) These table values are for drilling with water soulble cutting fluid.
2) Drill diameters under 1mm must be used in wet condition.
3) Adjust drilling condition when unusual vibration or different sound occurs.
4) When using low speed machines, use the maximum speed and adjust the feed rate.
5) If drilling a deep hole over 3 times drill diameter, use pecking.

* SFM vary largely according the diameter. It is decided that AQUA Micro does not have SFM information.

AQUA Drills with Mist Hole 3D List No. 9558

Hi-Speed Wet Drilling

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels Cast Irons		Alloy Steels Pre-Hardened Steels		Mold Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
		330 - 495 SFM		260 - 330 SFM		165 - 230 SFM		100 - 165 SFM		260 - 330 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
5	0.1969	9,600	0.007	6,400	0.007	4,500	0.007	3,200	0.006	6,400	0.004
8	0.3150	6,000	0.010	4,000	0.011	2,800	0.011	2,000	0.009	4,000	0.006
10	0.3937	4,800	0.012	3,200	0.012	2,200	0.013	1,600	0.011	3,200	0.008
12	0.4724	4,000	0.015	2,700	0.015	1,900	0.015	1,300	0.012	2,700	0.009
16	0.6299	3,000	0.017	2,000	0.018	1,400	0.018	1,000	0.015	2,000	0.012

Drilling in Semi-Dry (Mist Coolant) Condition

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels Cast Irons		Alloy Steels Pre-Hardened Steels		Mold Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
		260 - 300 SFM		164 - 195 SFM		98 - 135 SFM		82 - 100 SFM		164 - 195 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
5	0.1969	5,800	0.005	3,800	0.005	2,700	0.005	1,900	0.004	3,800	0.004
8	0.3150	3,600	0.008	2,400	0.008	1,700	0.008	1,200	0.007	2,400	0.006
10	0.3937	2,900	0.010	1,900	0.010	1,300	0.010	1,000	0.008	1,900	0.008
12	0.4724	2,400	0.011	1,600	0.011	1,100	0.012	800	0.009	1,600	0.009
16	0.6299	1,800	0.014	1,200	0.014	800	0.013	600	0.011	1,200	0.012

AQUA Drills with Mist Hole 5D List No. 9554

Hi-Speed Wet Drilling

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels Cast Irons		Alloy Steels Pre-Hardened Steels		Mold Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
		330 - 495 SFM		260 - 330 SFM		165 - 230 SFM		100 - 165 SFM		260 - 330 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
5	0.1969	9,600	0.006	6,400	0.006	4,500	0.006	3,200	0.005	6,400	0.004
8	0.3150	6,000	0.010	4,000	0.010	2,800	0.010	2,000	0.008	4,000	0.006
10	0.3937	4,800	0.011	3,200	0.011	2,200	0.011	1,600	0.010	3,200	0.007
12	0.4724	4,000	0.013	2,700	0.013	1,900	0.013	1,300	0.011	2,700	0.008
16	0.6299	3,000	0.016	2,000	0.016	1,400	0.016	1,000	0.013	2,000	0.011

Drilling in Semi-Dry (Mist Coolant) Condition

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels Cast Irons		Alloy Steels Pre-Hardened Steels		Mold Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
		260 - 300 SFM		164 - 195 SFM		98 - 135 SFM		82 - 100 SFM		164 - 195 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
5	0.1969	5,800	0.005	3,800	0.005	2,700	0.005	1,900	0.004	3,800	0.004
8	0.3150	3,600	0.007	2,400	0.008	1,700	0.007	1,200	0.006	2,400	0.006
10	0.3937	2,900	0.009	1,900	0.009	1,300	0.009	1,000	0.007	1,900	0.007
12	0.4724	2,400	0.010	1,600	0.010	1,100	0.011	800	0.008	1,600	0.008
16	0.6299	1,800	0.012	1,200	0.012	800	0.012	600	0.010	1,200	0.011

1) Drilling Aluminum Alloys and Light Metalsare not recommended.
2) Use blow air for cooling and chip remuval in dry processes.
3) Due to sparks during cutting, heat by breakage, or hot chips, there is danger of fire. Take fire prevention measures.
4) Adjust drilling condition when unusual vibration or different sound occurs.

AQUA Drills with Mist Hole 7D List No. 9556, 9569

Hi-Speed Wet Drilling

Workpiece Material / Speed (SFM) / Drill Diameter			Carbon Steels Cast Irons		Alloy Steels		Die Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
			330 - 495 SFM		260 - 330 SFM		165 - 230 SFM		100 - 165 SFM		260 - 330 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
3/16	4.763	0.1875	10,000	0.005	6,700	0.005	4,700	0.005	3,400	0.004	6,700	0.002
—	5	0.1969	9,600	0.005	6,400	0.005	4,500	0.005	3,200	0.004	6,400	0.003
1/4	6.35	0.2500	7,500	0.007	5,000	0.007	3,500	0.007	2,500	0.005	5,000	0.003
—	8	0.3150	6,000	0.008	4,000	0.008	2,800	0.008	2,000	0.006	4,000	0.004
3/8	9.525	0.3750	5,000	0.009	3,400	0.009	2,300	0.009	1,700	0.007	3,400	0.005
—	10	0.3937	4,800	0.009	3,200	0.009	2,200	0.009	1,600	0.008	3,200	0.005
—	12	0.4724	4,000	0.011	2,700	0.011	1,900	0.011	1,300	0.009	2,700	0.006
1/2	12.7	0.5000	3,800	0.011	2,500	0.011	1,800	0.011	1,250	0.009	2,500	0.006
—	16	0.6299	3,000	0.013	2,000	0.013	1,400	0.013	1,000	0.010	2,000	0.008

Drilling in Semi-Dry (Mist Coolant) Condition

Workpiece Material / Speed (SFM) / Drill Diameter			Carbon Steels Cast Irons		Alloy Steels		Die Steels Hardened Steels (30-40HRc)		Hardened Steels (40-50HRc)		Ductile Cast Irons	
			260 - 300 SFM		164 - 195 SFM		98 - 135 SFM		82 - 100 SFM		164 - 195 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
3/16	4.763	0.1875	6,100	0.004	4,000	0.004	2,800	0.004	2,000	0.003	4,000	0.002
—	5	0.1969	5,800	0.004	3,800	0.004	2,700	0.004	1,900	0.003	3,800	0.003
1/4	6.35	0.2500	4,500	0.005	3,000	0.005	2,100	0.005	1,500	0.004	3,000	0.003
—	8	0.3150	3,600	0.006	2,400	0.006	1,700	0.006	1,200	0.005	2,400	0.004
3/8	9.525	0.3750	3,000	0.007	2,000	0.007	1,400	0.007	1,000	0.005	2,000	0.005
—	10	0.3937	2,900	0.007	1,900	0.007	1,300	0.008	1,000	0.006	1,900	0.005
—	12	0.4724	2,400	0.008	1,600	0.008	1,100	0.008	800	0.006	1,600	0.006
1/2	12.7	0.5000	2,300	0.008	1,500	0.008	1,000	0.009	750	0.006	1,500	0.006
—	16	0.6299	1,800	0.009	1,200	0.009	800	0.009	600	0.007	1,200	0.008

1) Drilling Aluminum Alloys and Soft Metals are not recommended.
2) Use blow air for cooling and chip remuval in dry processes.
3) Due to sparks during cutting, heat by breakage, or hot chips, there is danger of fire. Take fire prevention measures.
4) Adjust drilling condition when unusual vibration or different sound occurs.

DIAMOND Coated Carbide drills List No. 9501D

Work Material	Speed (SFM)	Feed Rate (IPR)
Aluminum Alloys	130 - 650	.002 - .008
Hi Si-Aluminum Alloys	130 - 300	.001 - .006
Copper Alloys	130 - 650	.002 - .008
Semi-Sinter Ceremics	60 - 250	.001 - .008
High Polymer Material	130 - 650	.001 - .006

1) Diamond Coated Drills are used in Nonferrous Metals such as Aluminum, Copper Alloys and FRP.
2) Adjust drilling condition when unusual vibration or different sound occurs.

DLC-HSS Drill List No. 544

Drilling in Wet Condition

Workpiece Material / Speed (SFM) / Drill Diameter		Aluminum 1017		Aluminum Alloys: 4032, 6061		Aluminum Alloys: 5052		Aluminum Alloys: 7075		Aluminum Alloy Casting		Copper Alloys	
		330 - 390 SFM		210 - 260 SFM		280 - 330 SFM		210 - 260 SFM		210 - 260 SFM		150 - 200 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
1	0.0394	30,600	0.001	20,400	0.001	25,500	0.001	20,400	0.001	20,400	0.001	15,300	0.001
2	0.0787	19,100	0.002	12,700	0.002	15,900	0.002	12,700	0.002	12,700	0.002	9,600	0.002
3	0.1181	12,700	0.003	8,500	0.003	10,600	0.003	8,500	0.002	8,500	0.002	6,400	0.002
5	0.1969	7,600	0.005	5,100	0.005	6,400	0.005	5,100	0.004	5,100	0.004	3,800	0.004
8	0.3150	4,800	0.008	3,200	0.008	4,000	0.008	3,200	0.006	3,200	0.006	2,400	0.006
10	0.3937	3,800	0.010	2,500	0.010	3,200	0.010	2,500	0.008	2,500	0.008	1,900	0.008
12	0.4724	3,200	0.012	2,100	0.012	2,700	0.012	2,100	0.009	2,100	0.009	1,600	0.009
16	0.6299	2,400	0.013	1,600	0.013	2,000	0.013	1,600	0.010	1,600	0.010	1,200	0.010
20	0.7874	1,900	0.012	1,300	0.012	1,600	0.012	1,300	0.009	1,300	0.009	1,000	0.009

1) The table values are for drilling with water soulble cutting fluid.
2) DLC-HSS Drills are used in Nonferrous Metals such as Aluminum or Copper alloys.
3) Adjust drilling condition when unusual vibration or different sound occurs.
4) If drilling a deep hole over 3 times drill diameter, use pecking.

DLC Microdrills List No. 9524
DLC Drills Regular List No. 9520

Drilling in Wet & Semi Dry (Mist Coolant) Condition

Workpiece Material / Speed (SFM) / Drill Diameter		Aluminum 1017		Aluminum Alloys: 4032, 6061		Aluminum Alloys: 5052		Aluminum Alloys: 7075		Aluminum Alloy Casting		Copper Alloys	
		650 - 820 SFM		330 - 500 SFM		500 - 650 SFM		500 - 650 SFM		430 - 590 SFM		260 - 330 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
0.5	0.0197	60,000	0.0002	58,000	0.0002	60,000	0.0002	60,000	0.0003	60,000	0.0003	38,000	0.0003
1	0.0394	50,000	0.0006	38,000	0.0006	50,000	0.0006	50,000	0.0007	48,000	0.0007	25,000	0.0007
2	0.0787	40,000	0.0014	24,000	0.0014	32,000	0.0015	32,000	0.0016	29,000	0.0016	16,000	0.0016
3	0.1181	26,500	0.0021	16,000	0.0021	21,000	0.0022	21,000	0.0024	19,000	0.0025	10,500	0.0024
5	0.1969	16,000	0.003	9,600	0.004	12,700	0.004	12,700	0.004	11,500	0.004	6,400	0.004
8	0.3150	10,000	0.006	6,000	0.006	8,000	0.006	8,000	0.006	7,200	0.007	4,000	0.006
10	0.3937	8,000	0.007	4,800	0.007	6,400	0.007	6,400	0.008	5,700	0.008	3,200	0.008
12	0.4724	6,600	0.008	4,000	0.008	5,300	0.009	5,300	0.010	4,800	0.010	2,650	0.010

Drilling in Dry Condition

Workpiece Material / Speed (SFM) / Drill Diameter		Aluminum 1017		Aluminum Alloys: 4032, 6061		Aluminum Alloys: 5052		Aluminum Alloys: 7075		Aluminum Alloy Casting		Copper Alloys	
		–		210 - 260 SFM		280 - 330 SFM		330 - 390 SFM		280 - 330 SFM		164 - 196 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
0.5	0.0197	Not Used		30,000	0.0002	38,000	0.0002	45,000	0.0002	38,000	0.0002	22,000	0.0002
1	0.0394			20,000	0.0004	25,000	0.0004	30,000	0.0005	25,000	0.0005	15,000	0.0005
2	0.0787			12,500	0.0010	16,000	0.0010	19,000	0.0012	16,000	0.0012	9,500	0.0012
3	0.1181			8,500	0.0015	10,600	0.0016	12,700	0.0018	10,600	0.0018	6,400	0.0017
5	0.1969			5,100	0.0025	6,400	0.0026	7,600	0.003	6,400	0.003	3,800	0.003
8	0.3150			3,200	0.004	4,000	0.004	4,800	0.005	4,000	0.005	2,400	0.005
10	0.3937			2,550	0.005	3,200	0.005	3,800	0.006	3,200	0.006	1,900	0.006
12	0.4724			2,100	0.006	2,650	0.006	3,200	0.007	2,650	0.007	1,600	0.007

1) DLC Drills are used in Nonferrous Metals such as Aluminum or Copper Alloys.
2) Adjust drilling condition when unusual vibration or different sound occurs.
3) When using low speed machines, use the maximum speed and adjust the feed rate.

STANDARD DRILLING CONDITION

Straight Shank Drills — Jobbers Length — List No. 500, 501, 501A, 599
Screw Machine Length — List No. 561, 563
Taper Length — List No. 531
Straight Shank Cobalt Drills — Jobbers Length — List No. 6501, 6520, 599
Screw Machine Length — List No. 6563
Taper Length — List No. 6531

Workpiece Material / Speed (SFM) / Drill Diameter			Carbon Steels		Alloy Steels Hardened Steels		Mold Steels Stainless Steels		Titanium Alloys [1] High Temperature Alloys [1]		Cast Irons		Aluminum Alloys Nonferrous Metals	
			50 - 65 SFM		40 - 52 SFM		30 - 40 SFM		10 - 20 SFM		55 - 72 SFM		83 - 115 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	1	0.0394	4,800	0.0008	3,800	0.0007	2,900	0.0006	1,500	0.0003	5,300	0.0010	8,100	0.0007
1/16	1.588	0.0625	3,400	0.0013	2,700	0.0011	2,100	0.0009	1,000	0.0005	3,800	0.0015	5,800	0.0011
—	2	0.0787	2,900	0.0016	2,300	0.0013	1,700	0.0012	720	0.0006	3,200	0.0020	4,900	0.0014
—	3	0.1181	2,100	0.0028	1,700	0.0023	1,300	0.0021	480	0.0009	2,300	0.0034	3,600	0.0024
1/8	3.175	0.1250	2,000	0.0029	1,700	0.0023	1,200	0.0022	460	0.0010	2,200	0.0036	3,500	0.0025
—	5	0.1969	1,300	0.0042	1,000	0.0037	760	0.0033	290	0.0015	1,400	0.0053	2,200	0.0038
1/4	6.35	0.2500	1,100	0.0047	800	0.0044	610	0.0038	230	0.0020	1,120	0.0064	1,750	0.0044
—	8	0.3150	800	0.0059	640	0.0050	480	0.0044	180	0.0025	900	0.0074	1,400	0.0051
3/8	9.525	0.3750	680	0.0065	540	0.0055	400	0.0049	160	0.0030	740	0.0082	1,200	0.0054
—	10	0.3937	640	0.0068	510	0.0057	380	0.0050	150	0.0032	700	0.0084	1,100	0.0057
—	12	0.4724	530	0.0074	420	0.0064	320	0.0057	120	0.0040	580	0.0095	900	0.0066
1/2	12.7	0.5000	510	0.0076	400	0.0066	310	0.0057	120	0.0043	550	0.0099	860	0.0069
5/8	15.875	0.6250	410	0.0089	330	0.0076	250	0.0065	100	0.0050	450	0.0115	690	0.0086
—	16	0.6299	400	0.0091	320	0.0078	240	0.0067	90	0.0050	440	0.0116	680	0.0087

1) The cutting condition of Titanium Alloys and Nickel Alloys are for HSS-Co drills only.
2) The above values apply when coolant is used in a vertical machine. In a horizontal machine or deep hole, use pecking.
3) Adjust drilling condition when unusual vibration or different sound occurs.

Straight Shank Drills TiN Coated — Jobbers Length — List No. 501P, 520P
Screw Machine Length — List No. 561P

Workpiece Material / Speed (SFM) / Drill Diameter			Carbon Steels		Alloy Steels		Die Steels Hardened Steels Stainless Steels		Cast Irons		Aluminum Alloys Nonferrous Metals	
			60 - 85 SFM		47 - 65 SFM		36 - 48 SFM		66 - 90 SFM		100 - 140 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	1	0.0394	5,800	0.0008	4,600	0.0007	3,500	0.0006	6,400	0.0010	9,800	0.0007
1/16	1.588	0.0625	4,100	0.0013	3,200	0.0011	2,500	0.0009	4,400	0.0015	7,000	0.0011
—	2	0.0787	3,500	0.0016	2,800	0.0013	2,000	0.0012	3,800	0.0020	5,900	0.0014
—	3	0.1181	2,500	0.0028	2,000	0.0023	1,500	0.0021	2,800	0.0034	4,300	0.0024
1/8	3.175	0.1250	2,400	0.0029	2,000	0.0023	1,400	0.0022	2,600	0.0036	4,200	0.0025
—	5	0.1969	1,600	0.0042	1,200	0.0037	910	0.0033	1,700	0.0053	2,600	0.0038
1/4	6.35	0.2500	1,300	0.0047	1,000	0.0044	730	0.0038	1,300	0.0064	2,100	0.0044
—	8	0.3150	1,000	0.0059	770	0.0050	580	0.0044	1,100	0.0074	1,700	0.0051
3/8	9.525	0.3750	820	0.0065	650	0.0055	480	0.0049	890	0.0082	1,400	0.0054
—	10	0.3937	770	0.0068	610	0.0057	460	0.0050	840	0.0084	1,300	0.0057
—	12	0.4724	640	0.0074	500	0.0064	380	0.0057	700	0.0095	1,100	0.0066
1/2	12.7	0.5000	610	0.0076	490	0.0066	370	0.0057	670	0.0099	1,000	0.0069
5/8	15.875	0.6250	500	0.0089	400	0.0076	300	0.0065	540	0.0115	830	0.0086
—	16	0.6299	480	0.0091	380	0.0078	290	0.0067	530	0.0116	820	0.0087

1) The above values apply when coolant is used in a vertical machine. In a horizontal machine or deep hole, use pecking.
2) Adjust drilling condition when unusual vibration or different sound occurs.

STANDARD DRILLING CONDITION

Straight Shank Drills Parabolic Style TiN Coated Jobbers Length List No. 517P
Taper Length List No. 545P

Workpiece Material / Speed (SFM) / Drill Diameter			Carbon Steels		Alloy Steels		Die Steels Hardened Steels Stainless Steels		Cast Irons	
			60 - 85 SFM		47 - 65 SFM		36 - 48 SFM		66 - 90 SFM	
Fractional	Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
—	1	0.0394	5,800	0.0011	4,600	0.0009	3,500	0.0008	6,400	0.0014
1/16	1.588	0.0625	4,100	0.0018	3,200	0.0014	2,500	0.0012	4,400	0.0021
—	2	0.0787	3,500	0.0023	2,800	0.0017	2,000	0.0015	3,800	0.0028
—	3	0.1181	2,500	0.0039	2,000	0.0030	1,500	0.0027	2,800	0.0048
1/8	3.175	0.1250	2,400	0.0041	2,000	0.0030	1,400	0.0029	2,600	0.0050
—	5	0.1969	1,600	0.0059	1,200	0.0048	910	0.0042	1,700	0.0075
1/4	6.35	0.2500	1,300	0.0066	1,000	0.0057	730	0.0049	1,300	0.0089
—	8	0.3150	1,000	0.0083	770	0.0066	580	0.0058	1,100	0.0104
3/8	9.525	0.3750	820	0.0091	650	0.0072	480	0.0063	890	0.0115
—	10	0.3937	770	0.0095	610	0.0074	460	0.0065	840	0.0118
—	12	0.4724	640	0.0104	500	0.0083	380	0.0074	700	0.0133
1/2	12.7	0.5000	610	0.0107	490	0.0086	370	0.0075	670	0.0139
5/8	15.875	0.6250	500	0.0124	400	0.0099	300	0.0085	540	0.0161
—	16	0.6299	480	0.0127	380	0.0101	290	0.0087	530	0.0163

1) The above values apply when coolant is used in a vertical machine. In a horizontal machine or deep hole, use pecking.
2) Adjust drilling condition when unusual vibration or different sound occurs.

Straight Shank Drills Extra Length List No. 551, 6551
Taper Shank Drills Extra Length List No. 651

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels		Alloy Steels Hardened Steels		Stainless Steels		Cast Irons		Brass Nonferrous Metals	
		44 - 55 SFM		32 - 40 SFM		32 - 40 SFM		52 - 65 SFM		48 - 60 SFM	
Fractional	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
1/16	0.0625	2,700	0.0020	2,000	0.0010	2,000	0.0015	3,200	0.0015	3,000	0.0020
1/8	0.1250	1,600	0.0038	1,200	0.0018	1,200	0.0025	1,800	0.0025	1,700	0.0036
3/16	0.1875	1,200	0.0052	820	0.0025	820	0.0035	1,400	0.0035	1,300	0.0050
1/4	0.2500	850	0.0065	620	0.0030	620	0.0048	1,000	0.0048	1,000	0.0063
5/16	0.3125	680	0.0075	490	0.0035	490	0.0055	800	0.0055	740	0.0078
3/8	0.3750	570	0.0090	410	0.0040	410	0.0060	670	0.0060	620	0.0090
1/2	0.5000	430	0.0110	310	0.0052	310	0.0080	500	0.0080	460	0.0110
5/8	0.6250	340	0.0120	250	0.0060	250	0.0090	400	0.0090	370	0.0120
3/4	0.7500	290	0.0130	210	0.0070	210	0.0100	340	0.0100	310	0.0130
1	1.0000	220	0.0140	160	0.0080	160	0.0110	250	0.0110	230	0.0140

1) The above values apply when coolant is used in a vertical machine. In a horizontal machine or deep hole, use pecking.
2) Adjust drilling condition when unusual vibration or different sound occurs.

Straight Shank Oil Hole Drills / Cobalt List No. 581

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels		Alloy Steels		Die Steels Hardened Steels Stainless Steels		Cast Irons		Aluminum Alloys Nonferrous Metals	
		55 - 66 SFM		44 - 52 SFM		32 - 40 SFM		61 - 73 SFM		94 - 114 SFM	
Fractional	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
1/16	0.0625	3,400	0.0016	2,700	0.0013	2,100	0.0011	3,800	0.0018	5,800	0.0013
1/8	0.1250	2,000	0.0035	1,700	0.0027	1,200	0.0027	2,200	0.0043	3,500	0.0030
1/4	0.2500	1,100	0.0056	800	0.0052	610	0.0046	1,120	0.0076	1,750	0.0053
3/8	0.3750	680	0.0078	540	0.0066	400	0.0058	740	0.0099	1,200	0.0065
1/2	0.5000	510	0.0091	400	0.0079	310	0.0069	550	0.0119	860	0.0082
5/8	0.6250	410	0.0106	330	0.0091	250	0.0079	450	0.0138	690	0.0103

1) The above values apply when coolant is used in a vertical machine. In a horizontal machine or deep hole, use pecking.
2) Adjust drilling condition when unusual vibration or different sound occurs.

STANDARD DRILLING CONDITION

Taper Shank Drills Regular Shank / Core Drills List No. 601
Silver and Deming Drills List No. 575

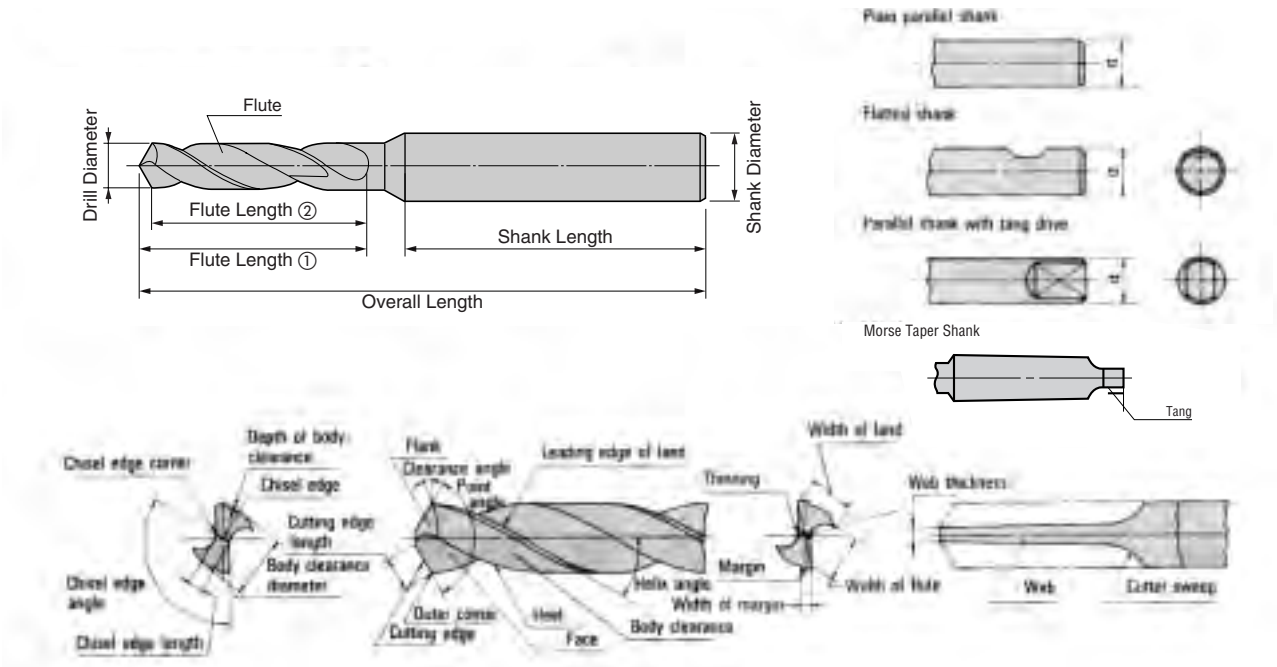
Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels		Alloy Steels		Die Steels Hardened Steels Stainless Steels		Cast Irons		Aluminum Alloys Nonferrous Metals	
		55 - 65 SFM		50 - 60 SFM		35 - 45 SFM		65 - 80 SFM		100 - 110 SFM	
Fractional	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
1/8	0.1250	2,000	0.003	1,900	0.003	1,400	0.002	2,500	0.004	3,400	0.003
3/16	0.1875	1,400	0.004	1,300	0.004	920	0.003	1,700	0.005	2,300	0.005
1/4	0.2500	1,000	0.004	920	0.005	690	0.004	1,300	0.007	1,700	0.006
5/16	0.3125	800	0.004	740	0.005	560	0.005	980	0.008	1,400	0.008
3/8	0.3750	670	0.007	620	0.006	460	0.005	820	0.008	1,200	0.008
7/16	0.4375	570	0.007	530	0.006	400	0.005	700	0.009	970	0.009
1/2	0.5000	500	0.008	460	0.006	350	0.006	620	0.010	850	0.009
5/8	0.6250	400	0.009	370	0.008	280	0.007	490	0.012	680	0.012
3/4	0.7500	340	0.010	310	0.009	230	0.008	410	0.013	570	0.013
7/8	0.8750	290	0.011	270	0.009	200	0.008	350	0.014	490	0.014
1	1.0000	250	0.012	230	0.010	180	0.009	310	0.015	430	0.014
1 1/8	1.1250	230	0.012	210	0.011	160	0.010	280	0.016	380	0.015
1 1/4	1.2500	200	0.014	190	0.011	140	0.010	250	0.016	340	0.016
1 3/8	1.3750	190	0.014	170	0.012	130	0.010	230	0.017	310	0.017
1 1/2	1.5000	170	0.014	160	0.012	120	0.011	210	0.017	290	0.017
1 5/8	1.6250	160	0.015	150	0.013	110	0.011	190	0.017	260	0.017
1 3/4	1.7500	150	0.016	140	0.013	100	0.011	180	0.018	250	0.018
1 7/8	1.8750	140	0.016	130	0.014	100	0.012	170	0.019	230	0.019
2	2.0000	130	0.016	120	0.014	90	0.012	160	0.020	220	0.020

Taper Shank Oil Hole Drills / Cobalt List No. 683

Workpiece Material / Speed (SFM) / Drill Diameter		Carbon Steels		Alloy Steels Hardened Steels		Mold Steels Stainless Steels		Cast Irons		Aluminum Alloys Nonferrous Metals	
		55 - 65 SFM		50 - 60 SFM		35 - 45 SFM		65 - 80 SFM		100 - 110 SFM	
Fractional	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
3/8	0.3750	680	0.008	620	0.007	460	0.006	820	0.010	1,200	0.010
7/16	0.4375	580	0.009	530	0.007	400	0.006	700	0.011	970	0.011
1/2	0.5000	510	0.009	460	0.008	350	0.007	620	0.012	850	0.012
5/8	0.6250	410	0.011	370	0.010	280	0.008	490	0.014	680	0.014
23/32	0.7188	360	0.012	320	0.010	240	0.009	430	0.015	590	0.014
3/4	0.7500	340	0.013	310	0.011	230	0.009	410	0.015	570	0.015
7/8	0.8750	290	0.013	270	0.011	200	0.010	350	0.017	490	0.017
1	1.0000	260	0.014	230	0.012	180	0.011	310	0.018	430	0.018
1 1/4	1.2500	210	0.016	190	0.013	140	0.011	250	0.019	340	0.019
1 1/2	1.5000	170	0.017	160	0.014	120	0.012	210	0.021	290	0.021

1) The above values apply when coolant is used in a vertical machine. In a horizontal machine or deep hole, use pecking.
2) Adjust drilling condition when unusual vibration or different sound occurs.

TERMS FOR DRILLS



Precautions in using drills: 6-point

1. PROPER SELECTION OF DRILLS

Depending on work material and cutting conditions, standard drills can be used for drilling holes in materials. However, to ensure efficient and economical production, it is important that the proper drill is selected for each drilling operation.

2.MAINTENANCE OF DRILLING MACHINE, JIGS AND FIXTURES

For prolonging the drill life and maintaining accurate hole production, both the drilling machine used and jigs and fixtures must preserve high rigidity.

3. CORRECT HOLDING OF DRILLS

Of the time spent in drilling operations, net cutting time is surprisingly short and setting up time is much longer. Consequently, improved efficiency in attaching and detaching of drill from its holder is decidedly important from the point of view of increased productivity.

4.CORRECT CLAMPING OF WORKPIECE

5. PROPER CUTTING SPEED AND FEED RATE

Incorrect cutting speed and feed may cause the drill to wear excessively or even to break and will greatly shorten drill life. Cutting conditions are determined by the shape and machining qualities of the material, condition of the drilling machine, jigs and so forth, select proper values, referring to the cutting conditions. When deep hole drilling, reduce the cutting speed and feed in accordance with table shown in below.

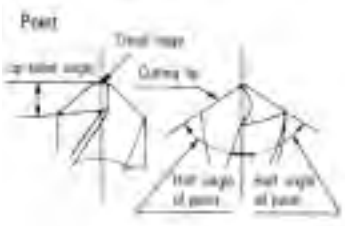
Speed and feed reductions for drilling deep holes

HOLE DEPTH	CUTTING SPEED REDUCTION RATE	FEED REDUCTION RATE
3 Times Diameter	10%	10%
4 Times Diameter	20%	10%
5 Times Diameter	30%	20%
6-8 Times Diameter	35-40%	20%

6. REGRINDING

When a drill is used until it is completely worn and does not cut, disadvantages will accumulate such as decreased production, deterioration of surface finish, reduced accuracy, drill breakage, increased amount of stock removal in regrinding and so forth. It is much better to sharpen a drill before it is worn completely. When correcting regrinding, the following five points should be carefully observed:

a) Completely remove the worn part (rough grind).
b) Center the chisel point.
c) The lengths of each cutting edge must be equal.
d) Regardless of the point angle, each cutting edge must be equally inclined to the axis of the drill.
e) Make the clearance angles proper and each clearance angle identical.

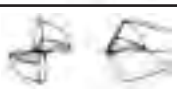
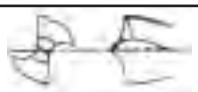


THE MAIN GEOMETRY FACTOR OF DRILLS AND THEIR WORK

CHARACTERISTICS	Cutting Resistance		Rigidity		Chip Removable	Guide Prfrmnc.	Amount of burr at the end	Remark
GEOMETRY FACTORS OF DRILLS	Thrust	Torque	Body	Cutting Edge				
Helix Angle High ↕ Low	Small ↕ Big	Small ↕ Big	Small ↕ Big	Good ↕ Big	Good ↕ Bad		Small ↕ Big	When the helix angle is getting bigger, the cutting resistance is decreased, but the drill's rigidity down. High helix angle is adopted for soft material, and low helix angle is adopted, for brittle material.
Point Angle Big ↕ Small	Big ↕ Small	Small ↕ Big					Small ↕ Big	When the point angle is getting small, thrust is also small, but torque the gets bigger. For general purpose, 118 point angle is adopted. For hard material, or for high-speed cutting, 135 is recommended.
Web Thickness Big ↕ Small	Big ↕ Small	Big ↕ Small	Big ↕ Small		Bad ↕ Good			To increase the drill web thickness, the rigidity of drill should be bigger. But thrust is also increased because of long chisel edge. To decease thrust, the thinning is treated.
Clearance Angle Big ↕ Small	Small ↕ Big			Small ↕ Big			Small ↕ Big	If large clearance angle is taken, thrust is decreased, and flank wear is also decreased, but cutting edge is getting brittle. For hard material, small clearance angle is taken, for soft material, large clearance angle is taken.
Back Taper Big ↕ Small		Small ↕ Big				Bad ↕ Good		When back taper is getting bigger, torque is smaller, and worn margin length is also smaller. But too much back taper has less guide performance, and straightness of hole is decreased

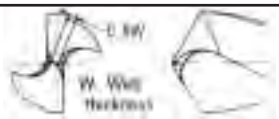
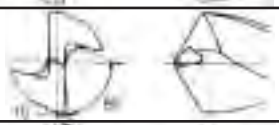
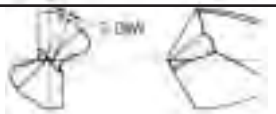
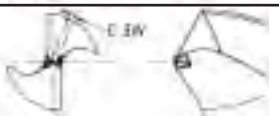
Shape of lip relief

The conical grinding method is broadly adopted as the most normal one. The other lip relieves are chosen according to the application when it is preferable to make the highly accurate holes.

Shape	Features · Effects	Application	Symbol
Conical 	● the most normal grinding method ● The lip relief angle becomes greater as to it approaches to the center from corner because of grinding the lip relief conically.	General purpose	
Flat 	● grind the lip relief planely ● easy grinding	small diameter	
Three-rake 	● having good centripetalability because of no chisel edge ● less enlargement of hole ● need special grinder	drilling high accurate hole and location	
Spiral point 	● lip relief spirally ground makes an S-shaped chisel edge ● brings good centripetalability and high accuracy	drilling high accurate hole	
Radial-lip 	● making load uniformly disperse on curved-edge depending on grinding cutting edges to curved-one ● get good accuracy and surface roughness by this point ● less burr on exit side of through hole ● need special grinder	cast iron, light alloy and steel plate	
Fishtail 	● bring good centripetalability and less shock when penetrate ● less burr when penetrate	thin plate	

Web Thinning

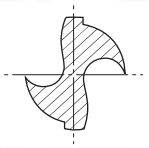
The proportion of drill resistance caused by the various drilling force concentrates on the chisel edge. The thrust force on chisel edge is in the same proportions as that on the lip. Drill-thrust force is very sensitive to variations of chisel-edge length or web thickness. Web thinning reduces drilling thrust and produces other advantages such as reduced cutting temperature, increased drill life and improved hole geometry. In order to recondition the drill properly, it is necessary to reduce this web thickness.

Type	Features · Effects	Application	Symbol
S-type 	● very easy to make thinning	General purpose for steel, cast iron, non-ferrous metal	
X-type (split point) 	● reduce thrust force substantially ● advantage when entering ● This type of thinning is very effective for thick web	● drilling deep hole ex. oil-hole of crankshaft ● material of low-machinability and of machining hardenability	
N-type 	● effective for thick web	● drilling deep hole	
R-type 	● reduce thrust force substantially ● lessen chipping on cutting edges	● heavy duty ● rail or manganese steel	
XS-type 	● easier grinding than x-type ● reduce thrust force substantially ● advantage when entering	● drilling deep hole	
H-type 	● lessen web thickness and strengthen chisel at same time	● heavy duty	

Figures reference only

Chip Breaker

Since continuous chips do not discharge easily, it is necessary to break these forcibly. Particularly, to change the shape of continuous chips generated in the deep hole processing of tough materials, it is desirable that the drill shall be provided with a chipbreraker. Examples of chipbreakers are shown below.

Type	Effect
	The rake angle is decreased by grinding the face flat along the cutting edge, preventing the winding of chips on the drill. In this case, the breaker must not affect the margin.
	The face is ground in the same way as for a chip breaker for a bit. This form of grinding is very difficult and, since there is a danger of breaking the margin, the amount of the breaker must be kept at minimum, care must be exercised to prevent interference with the chip pocket. This chipbreaker effective especially in the processing of deep holes. 
	This nicks on the flank function as chip breakers. Stagger the positions of nicks so that distances of the nicks from the drill axis are not identical. Cut chips become thin and long and they discharged smoothly

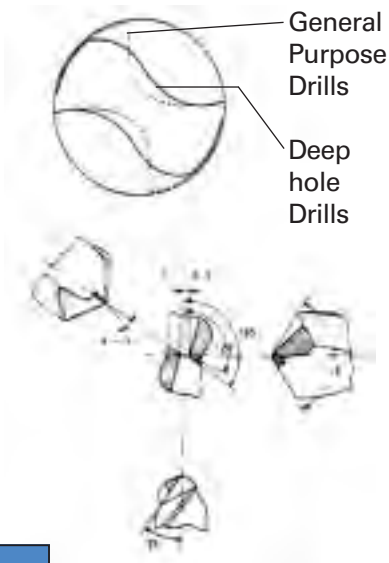
ex. Characteristics of the drills for deep hole

To drill a very deep hole, it is necessary for the drills to have the following four features:

1. Good removal of the cutting chip
2. Good penetration of the cutting coolant
3. Good heat resistance
4. High rigidity

We show the geometries for the drills as shown in the illustration.

The drill has a thick web for strength and proper thinning for less thrust force.



Drilling Terminology

Terms	Descriprions	Formulas
IPM	Inches Per Minutes	**IPR** x **RPM**
IPR	Inches Per Revolution	$\frac{\textbf{IPM}}{\textbf{RPM}}$
RPM	Revolutions Per Minute	$\frac{\textbf{SFM} \times 3.82}{\textbf{D}}$
SFM	Surface Feet Per Minute	**D** x **RPM** x 0.26
D	Drill Diameter	

OPERATING INSTRUCTIONS FOR RE-SHARPENING OF SG-ES & SG-ESS DRILLS

Accurate re-sharpening is one of the most important skills that a qualified worker must have.

SG-ESS RE-SHARPENING

1. DIMENSIONS OF THREE RAKE POINTING

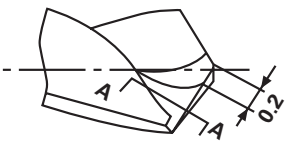
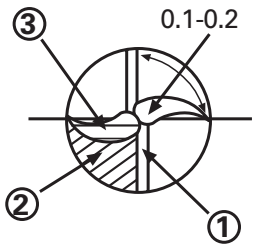
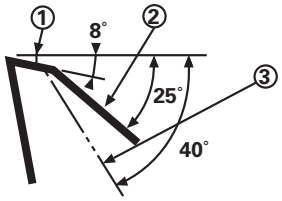


Fig. 1





A-A

2. RE-SHARPENERS

The relief flank is re-sharpened in an ordered sequence.
(1) The cutting tools are held parallel to the table.
(2) The drill swings from the same horizontal plane, about 20 degrees (Fig.2).
(3) The grinding wheel swings from the same number of degrees as the relief angle.
(4) Re-sharpening relief flank (Fig.3).

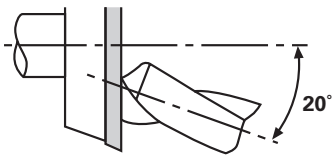


Fig. 2

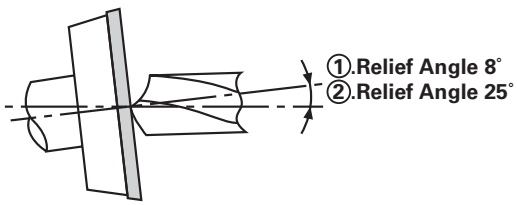


Fig. 3

3. THINNING (3RD RAKE)

The thinning is re-sharpened according to the following stipulations:
(1) The drills rotate about 40 degrees towards the re-sharpening surface (Fig. 4).
(2) The drills swings about 40 degrees (Fig. 5).
(3) The thinning surface must be re-sharpened done at 0.1 to 0.2 mm (0.004-0.008") increments.

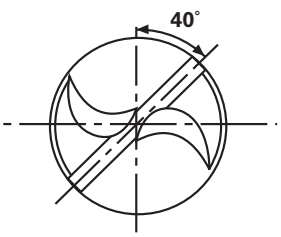


Fig. 4

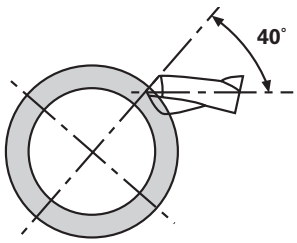
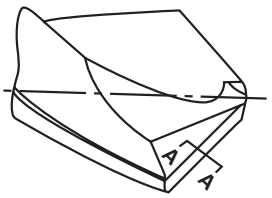
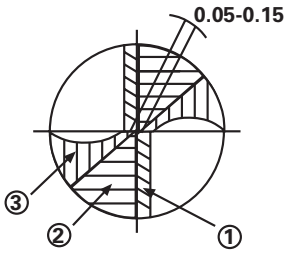


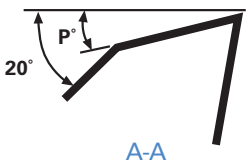
Fig. 5

SG-ES RE-SHARPENING

1. DIMENSIONS OF TWO-RAKE+X-THINNING







A-A

Diameter	P
2.0-5.0 (3/32-3/16)	12°
5.1-13.0 (13/64-1/2)	10°
13.1-20.0 (17/32-3/4)	8°

Table 1

2. GRINDING OF RELIEF FLANK

2-1. Utilize a drill grinder or a universal tool grinder
2-2. Grind relief flank as having 8 – 12 deg. as relief angle shown in Table 1. and Fig. 2.
2-3. Fix the drill after incline it. Then grind relief flank as having 20 deg. as secondary relief.
2-4. At this time, regrind it to meet the edgeline of these two relief in center line (Fig.3).

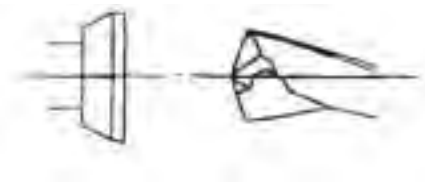


Fig. 1

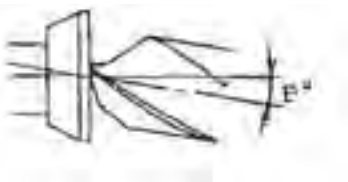


Fig. 2

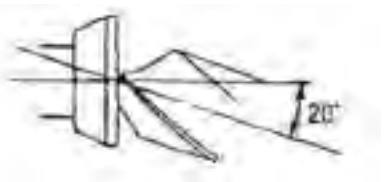
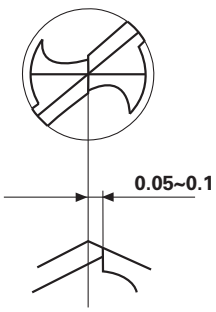


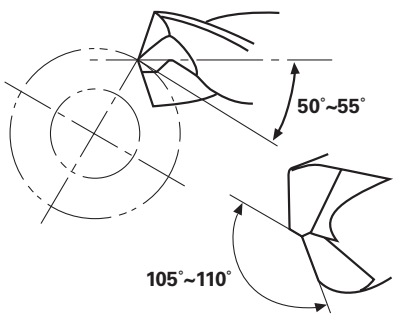
Fig. 3

3. WEB THINNING

3-1. As shown Fig. 4, incline drill in 50-55 deg. then grind the corner of secondary relief remaining .05-.1 mm (.002-.004 in.). At this time, give attention not to grind the center of drill, then remain approx. 0.1 mm (.004 in.).
3-2. Rotate drill in 10 – 15 deg., then grind it. And secure the pocket of 105 – 110 deg.

Fig. 4





4. INSPECTION

Please check the following points before using.

4-1. Lip height exist within 0.02 mm. (0.001 in.).
4-2. No remainder of damage on cutting edges after regrind.
4-3. Burr by regrind is removed.

GUIDELINES FOR TROUBLE SHOOTING TWIST DRILL PROBLEMS

○ Remedial measure is highly effective

● Remedial measure is relatively effective

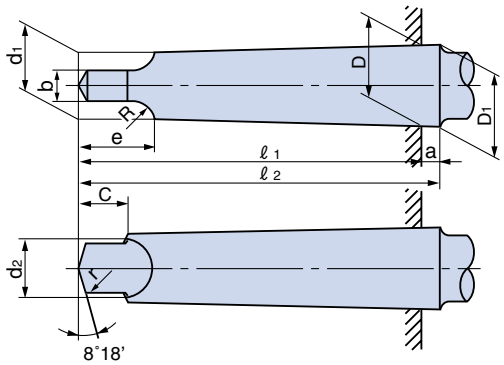
Problems	Solution	Possible Cause: Trouble with device	Faulty jig, clamp, or fixture	Faulty tool (design)	Faulty tool (regrinding)	Faulty tool holder	Defect in workplace	Unsatisfactory cutting conditions	Faulty coolant or lubricating system	Faulty process design
Oversize holes	Reduce material build up on cutting lips and flutes				○22		24		29 30 31 32	
	Reduce difference in cutting resistance between Right and left cutting lips.		○4 ○5B 7	13B	●19 20 ○21	8				
Curved hole or drilled off center	Prevent defective leading	○3	3 ●4 ○5B 7		13A 21	8			26B ○27	6 33
	Increase drill rigidity			○10						
	Reduce difference in cutting resistance between right and left cutting lips.				17B 19					
Distorted Holes	Prevent rifling		●4		18B 19					
	Reduce irregular motion and vibration		3 7	○23	●20 ○21	8		26A		33
	Eliminate clogging with chips			9A 11 14 15						34
Hole position shift			○3 ●4		20 21	8		27		33
Rough Finish or tearing in hole	Reduce galling (material build up on cutting lips)				22		○24		29 30 31 32	
	Reduce wear				13A 19			25B		
	Reduce chatter and vibration	1	4 7	9A ○23	20 21			26A		33
Breakage of drill	Eliminate clogging with chips			9A 11 ○14 15				●26A ○36		34
	Increase drill rigidity			○10 23	17			●26B		
	Reduce feed at breakthrough	1 ○2	○7		○20 18			●28		
	Prevent drill deflection		3 ●4 5B 7		13A 19 21			26B		
Abnormal wear of drill corner edge	Reduce wear			12 16	18A		24	●25B ●26B		
	Prevent chipping	○2	○7					26B		
Wrapping of chip around drill	Increase or decrease helix angle and cutting speed from the recommended angle and speed	○34	5A	9 ●11 14				26A		

GUIDELINES FOR TROUBLE SHOOTING TWIST DRILL PROBLEMS continued

No.	Remedial action and important points
1	Increase rigidity (column and spindle) of machine tool.
2	Take steps to insure a steady feed (particularly components with pneumatic or hydraulic controls).
3	Increase accuracy of alignment of bushing. (Increase alignment of preliminary hole and spindle for hole with large diameter.)
4	Use bushing and reduce bushing clearance.
5 5A: 5B:	Clearance between workpiece to be drilled and bushing Widen this clearance. Narrow this clearance.
6	Rotate workpiece instead of tool.
7	Secure workpiece or replace fixture on the workpiece with fittings that have less clamp distortion.
8	Check contact of drill taper (clean) and reduce run-out of holder and spindle.
9 9A: 9B:	Helix angle Increase this angle. Decrease this angle.
10	Shorten overall length and flute length to Increase rigidity.
11	Provide chipbreaker.
12	Use surface treatment.
13	Point angle
13A: 13B:	Increase this angle Decrease this angle.
14	Increase flute width ratio.
15	Use oil-hole drill.
16	Upgrade material of tool.
17 17A: 17B:	Back taper Increase back taper. Decrease back taper (Check a slight decrease in diameter from point to back).
18 18A: 18B:	Lip relief angle Increase this angle. Decrease this angle.

No.	Remedial action and important points
19	Eliminate relative lip height (difference in cutting resistance between right and left cutting edges).
20	Thinning (take care to prevent excessive thinning).
21	Eliminate unevenly chiseled areas.
22	Rework worn margin completely.
23	Increase web thickness.
24	Check workpiece to be drilled, for proper grain structure and heat treatment. (HB: 180 or more)
25 25A: 25B:	Cutting speed Increase this speed. Decrease this speed.
26 26A: 26B:	Feed Increase feed rate. Decrease feed rate.
27	Decrease feed at entrance to workpiece.
28	Decrease feed at exit from workpiece.
29	Use non-water-soluble coolant.
30	Use sulfuric or chloric extreme-pressure oils.
31	Increase quantity of coolant discharged.
32	Feed oil in correct direction.
33	Drill center hole in preceding process.
34	Effect intermittent feed. (Narrow step for deep holes.)
35	Select such helix angle and end angle that cutting edges will not be shaped like beak.
36	Decrease feed rate for deep holes

TAPER SHANK WITH TENON



Morse taper	Taper		Angle on Side	Taper shank with tenon																
				D(2)	a	D1(3)	d1(3)	d2		ℓ 1		ℓ 2		b		C(4)	e		R	r
								Basic size	Tolerance	Basic size	Tolerance	Basic size	Tolerance	Basic size	Tolerance		Basic size	Tolerance	Max.	
0	1/19.212	0.05205	1°29'27"	9.045	3	9.201	6.104	6	0 −0.3	56.5	0 −1.2	59.5	0 −1.9	3.9	0 −0.180	6.5	10.5	0 −1.1	4	1
1	1/20.047	0.04988	1°25'43"	12.065	3.5	12.240	8.972	8.7	0 −0.3	62.0	0 −1.2	65.5	0 −1.9	5.2	0 −0.180	8.5	13.5	0 −1.1	5	1.2
2	1/20.020	0.04995	1°25'50"	17.780	5	18.030	14.034	13.5	0 −0.43	75.0	0 −1.2	80	0 −1.9	6.3	0 −0.220	10	16	0 −1.1	6	1.6
3	1/19.922	0.05020	1°26'16"	23.825	5	24.076	19.107	18.5	0 −0.52	94.0	0 −1.4	99	0 −2.2	7.9	0 −0.220	13	20	0 −1.3	7	2
4	1/19.254	0.05194	1°29'15"	31.267	6.5	31.605	25.164	24.5	0 −0.52	117.5	0 −1.4	124	0 −2.5	11.9	0 −0.270	16	24	0 −1.3	8	2.5
5	1/19.002	0.05263	1°30'26"	44.399	6.5	44.741	36.531	35.7	0 −0.62	149.5	0 −1.6	156	0 −2.5	15.9	0 −0.270	19	29	0 −1.3	10	3
6	1/19.180	0.05214	1°29'36"	63.348	8	63.765	52.399	51.0	0 −0.74	210.0	0 −1.85	218	0 −2.9	19	0 −0.330	27	40	0 −1.6	13	4

Tolerance of Drill Diameter

Unit : 0.001mm

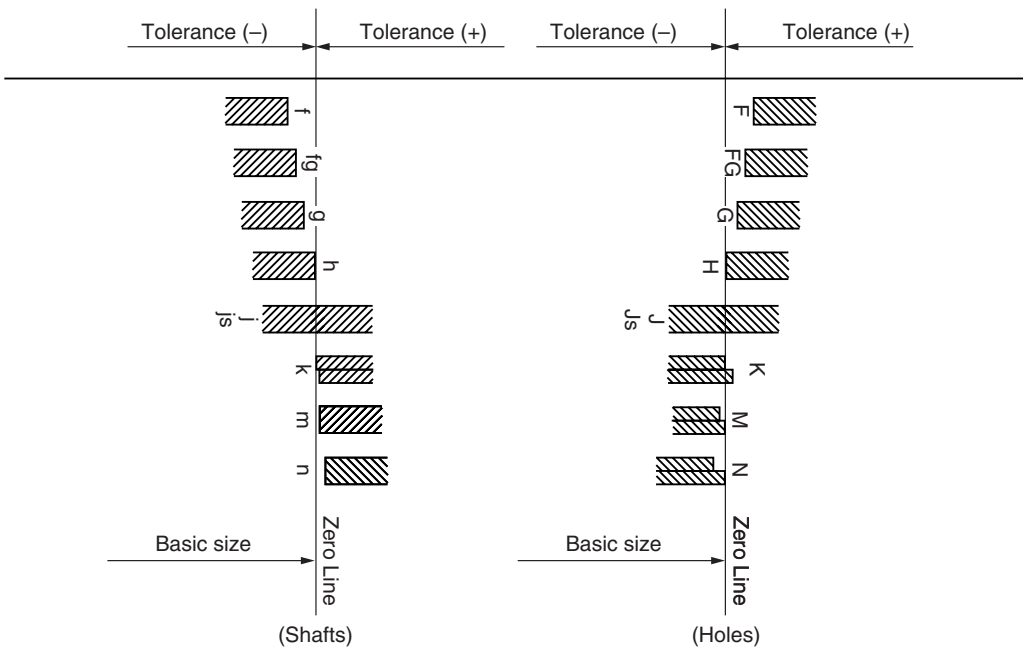
Diameter (mm)		Under 3.0 D≦3	Above 3.0 Under 6.0 3<D≦6	Above 6.0 Under 10 6<D≦10	Above 10 Under 18 10<D≦18	Above 18 Under 30 18<D≦30	Above 30 Under 50 30<D≦50	Above 50 Under 80 50<D≦80	Above 80 Under 120 80<D≦120
Tolerance	js6	±3	±4	±4.5	±5.5	±6.5	±8	±8.5	±11
	h6	0 −6	0 −8	0 −9	0 −11	0 −13	0 −16	0 −19	0 −22
	h7	0 −10	0 −12	0 −15	0 −18	0 −21	0 −25	0 −30	0 −35
	h8	0 −14	0 −18	0 −22	0 −27	0 −33	0 −39	0 −46	0 −54

NUMERICAL VALUES OF STANDARD TOLERANCE IT (JIS B 0401-1 : 1998 EXTRACT)

Unit : 0.001mm

Base size (mm) Above	Base size (mm) Up to and including	Grades IT 1	IT 2	IT 3	IT 4	IT 5	IT 6	IT 7	IT 8	IT 9	IT 10	IT 11	IT 12	IT 13	IT 14
—	3	0.8	1.2	2	3	4	6	10	14	25	40	60	100	140	250
3	6	1	1.5	2.5	4	5	8	12	18	30	48	75	120	180	300
6	10	1	1.5	2.5	4	6	9	15	22	36	58	90	150	220	360
10	18	1.2	2	3	5	8	11	18	27	43	70	110	180	270	430
18	30	1.5	2.5	4	6	9	13	21	33	52	84	130	210	330	520
30	50	1.5	2.5	4	7	11	16	25	39	62	100	160	250	390	620
50	80	2	3	5	8	13	19	30	46	74	120	190	300	460	740
80	120	2.5	4	6	10	15	22	35	54	87	140	220	350	540	870
120	180	3.5	5	8	12	18	25	40	63	100	160	250	400	630	1000
180	250	4.5	7	10	14	20	29	46	72	115	185	290	460	720	1150
250	315	6	8	12	16	23	32	52	81	130	210	320	520	810	1300
315	400	7	9	13	18	25	36	57	89	140	230	360	570	890	1400
400	500	8	10	15	20	27	40	63	97	155	250	400	630	970	1550

TOLERANCE GRADE (JIS B 0401-1 : 1998 EXTRACT)



END MILLS

Features

- Sharp corner type solid carbide end mill.
- Smooth chip flow by GS coat, (New TiAlN coating).
- Multi purpose use and long tool life.

Ra=0.078μm
GS-mill
(Smooth surface !)

Ra=0.171μm
Competitor

Work Materials

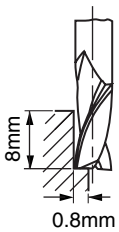
Structural Steels, Carbon Steels, Alloy Steels, Pre-hardened Steels, Hardened Steels, Stainless Steels, Nickel Alloys, Titanium Alloys, Cast Irons

Performance

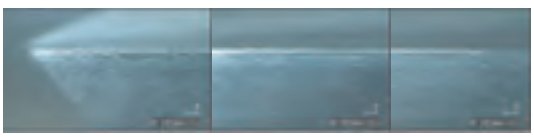
GS-mill Two Flute

Milling Condition

Dia. of Mill : ø8mm
Speed : 2,400min^{-1}
(198 SFM)
Feed : 190mm/min
(7.5 IPM)
Material : Pre-hardened Steels
Coolant : air blow
Milling Length : 30m



GS-mill Two Flute

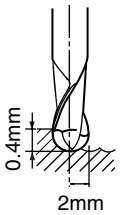


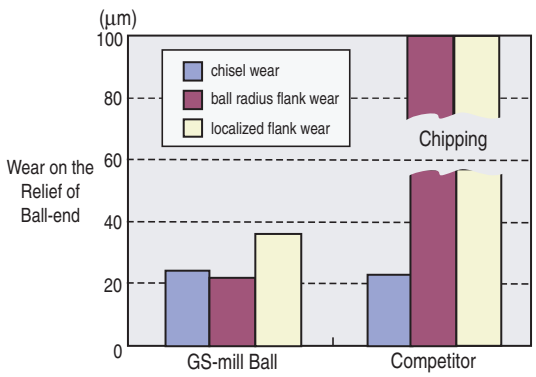
Competitor

GS-mill ball

Milling Condition

Size of Mill : R4
Speed : 12,000min^{-1}
(990 SFM)
Feed : 1,910mm/min
(75.2 IPM)
Material : SCM440 (30HRC)
Coolant : air blow
Milling Length : 7m





Stocked Size

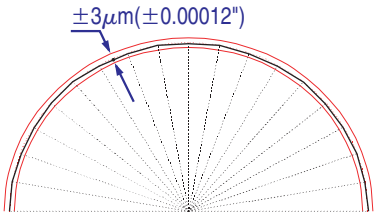
End mills Name	List No.	Page
GS-mills 2-Flute	9382	126
GS-mills 4-Flute	9384	126
GS-mills Ball	9386	127

TECHNICAL INFORMATION / MOLD MEISTER BALL

JAPAN STOCK ITEM*

Features

- Ultra highly precise end mill which realizes polishing less die & mold milling
- Ball tolerance ±3μm, Ball accuracy range 180˚



Enlarged R tolerance range from ball edge to outside cutting edge by seamless processing

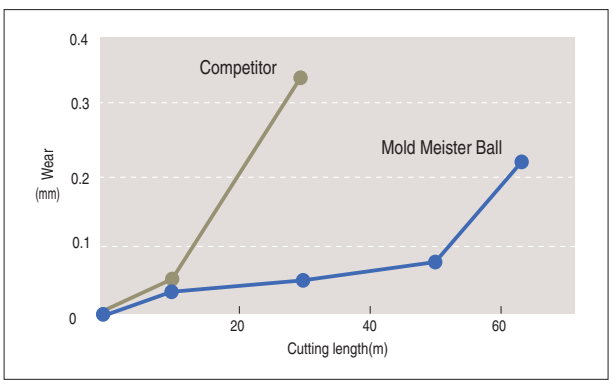
- Combination of X's coat and micro grain hard metal which are saitable for mold & die steel, direct high-speed milling is possible

Work Materials

Mold steels, Pre-Hardened steels, Carbon steels, Alloy steels, Stainless steels, Nickel alloys, Titanium alloys, Cast Irons

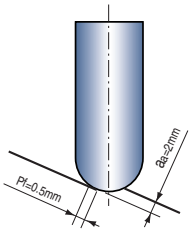
Performance

Wear comparison



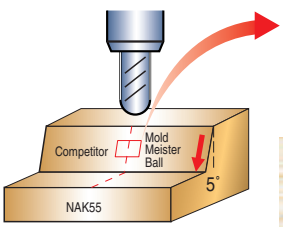
Milling Condition

Tool : R6(R0.236in)
Cutting Speed : 200m/min(656 SFM)
(5,300min⁻¹)
Speed : 1.060mm/min(41.7 IPM)
Work Material : D2(SKD11), 60HRC
Cutting Fluid : Air blow

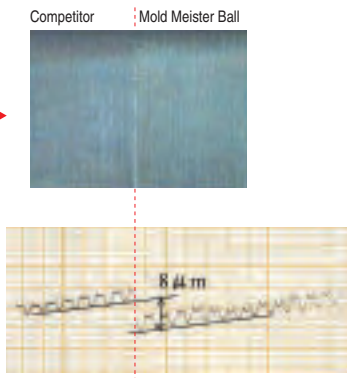


Contour line milling

Gap actual survey value of milling surface



scanning line milling the slope of 85˚



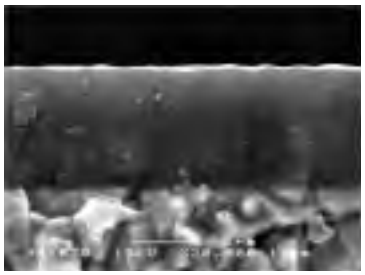
R precision difference ; gap outbreak of 8μm(0.0003")

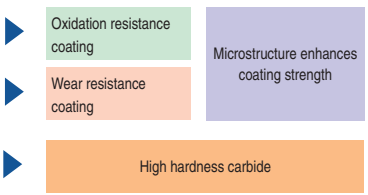
Stocked Size	End mills Name	List No.	Page
	Mold Meister Ball	9408	127 NEW

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

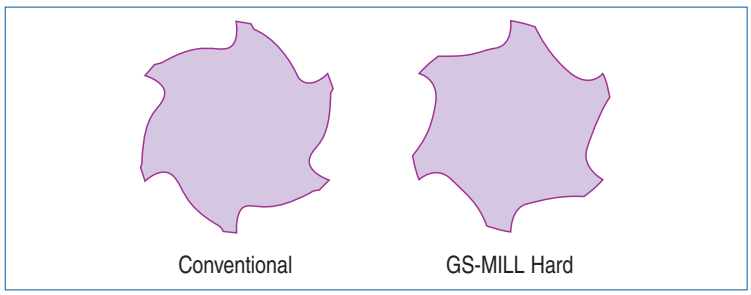
Features

- Realize ultra high speed milling of cutting speed 800m/min (2625 SFM)
- "GS Hard coat" of new development improves in heat resistance and wear resistance in Uitra high speed milling





- Chip removal excellent with smooth carve groove form High rigidity by wide lend width



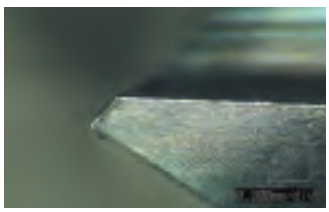
Work Materials

(Herdend steels of 45~70HRC)such as High speed steels, Alloy steels

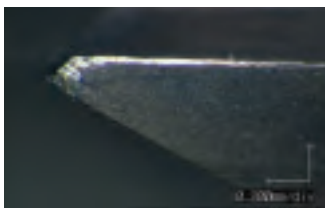
Performance

Ultra-high-speed side milling ø10mm (0.394in)(six flutes)

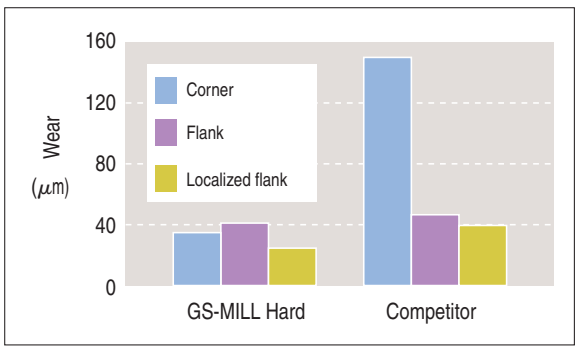
Reduce wear to 1/3 in cutting speed of 800m/min (2625 SFM)



GS MILL Hard

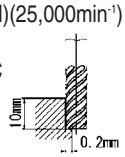


Competitor



Milling condition

Tool : ø10(0.394in)
Cutting Speed : 800m/min(2625 SFM)(25,000min^{-1})
Feed : 10,500mm/min(413 IPM)
Work Material : H13(SKD61), 53HRC
Cutting Fluid : Air Blow
Milling Length : 75m(246FEET)



Stocked Size	End mills Name	List No.	Page
	GS-MILL Hard	9398	128 NEW

TECHNICAL INFORMATION / GS-MILL HARD BALL

JAPAN STOCK ITEM*

Features

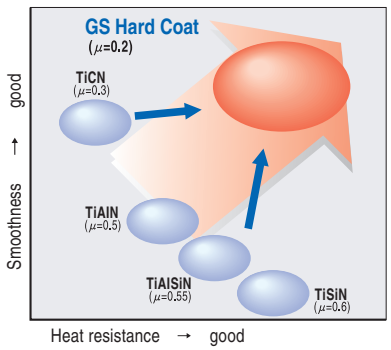
- **Durable tool life by newly developed coating**
  Newly developed smooth coating makes kinetic friction smaller and improves wear resistance.
- **Optimal for hardened steel milling**
  Ultra micro grain carbide with low Cobalt content suppresses micro plastic deformation during milling and increase tool life.
- **High accuracy ball nose +3~-7μm**
  Realize high accuracy ball nose by "One-Pass" grinding process and precise milling is possible.

Work Materials

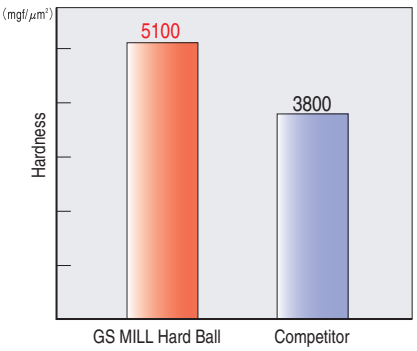
Hardened Steels(45~65HRC), Pre-Hardened Steels, Mold Steels, High Speed Steels

New Coating

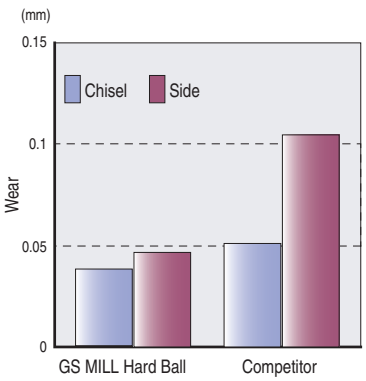
Smoothness and heat resistance are combined



Improves wear resistance



Performance



Milling Condition

Tool	: R3 mm
Cutting Speed	: 213 SFM (65m/min) 3450 RPM
Feed	: 16.3 IPM (414mm/min)
Work Material	: D2 (SKD11) 60HRC
Milling Length	: 197 Feet (60m)
Cutting Fluid	: Dry Air Blow
aa	: 0.012" (0.3mm)
Pf	: 0.012" (0.3mm)

Stocked Size

End mills Name	List No.	Page
GS-MILL Hard Ball	9422	128 NEW

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

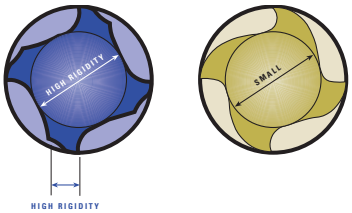
USA & JAPAN STOCK ITEM*

Features

- Utilizes flute geometry resulting in fast groove milling and excellent chip ejection.
- Tough micro grain carbide enables a longer tool life.
- TiAlN coating has high heat resistance that enhances a longer tool life.
- Multi-functional end mill that allows high speed grooving and highly precise side milling.

Chip form to flow smoothly

Cross section of geo mill



Geo Mill

Current 4 Flute End Mill

Work Materials

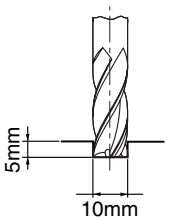
Carbon Steels, Alloy Steels, Pre-Hardened Steels, Hardened Steels, Stainless Steels, Nickel Alloys, Titanium Alloys, Cast Irons

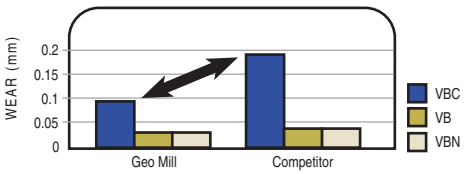
Performance

CUTTING ABILITY- NACHI'S GEO MILL VS. OTHER BRAND

Milling Condition

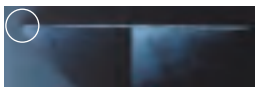
Dia. of Mill : 10mm 4flute
Speed : 1,600min^{-1} (165 SFM)
Feed : 256mm/min (10 IPM)
Material : SKD61 (40HRC)
Coolant : DRY
Cutting Length : 7.5m (25feet)



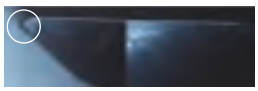


Corner Wear is Reduced by 50%

Geo Mill



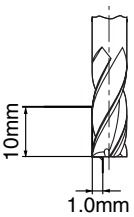
Competitor

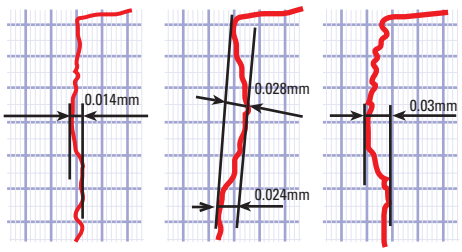


SURFACE ROUGHNESS (UNDULATION & INCLINATION)-NACHI GEO MILL VS. OTHER BRANDS

Milling Condition

Dia. of Mill : 3/8 4flute
Speed : 2,800min^{-1} (275 SFM)
Feed : 1,000mm/min (39.4 IPM)
Material : Carbon (28HRC)
Coolant : DRY
Cutting Length : 27m (90feet)





Geo Brand A Brand B

	Stocked Size	End mills Name	List No.	Page
*		**X's-mill Geo / Metric Sizes**	9322	129
		X's-mill Geo / Inch Sizes	9321	130
*		**X's-mill Geo Radius**	9324	131

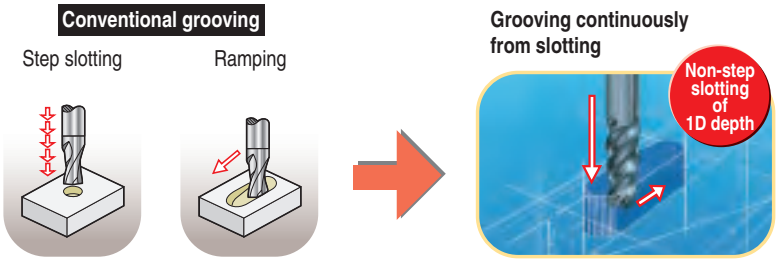
	Stocked Size	End mills Name	List No.	Page
		X's-mill Geo SLOT	9338	132
*		**X's-mill Geo KV**	9366 9368	133

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

Features

- It can be processed into grooving continuously from slotting
- 3-4 times faster grooving than conventional end mill
- By the adoption of the end teeth which has excellent chip flow and well-balanced three flutes, efficient slotting is possible.
- Non-step slotting of 1D depth is possible.

Shape

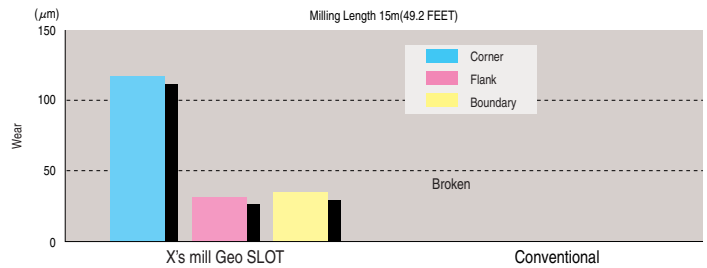


Work Materials

Carbon Steels, Alloy Steels, Pre-hardened Steels, Hardened Steels, Stainless Steels, Nickel Alloys, Titanium Alloys, Cast Irons

Performance

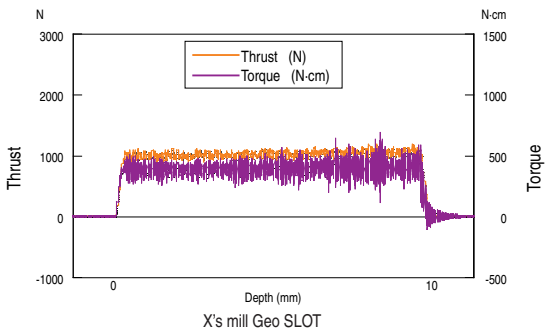
Slotting and grooving

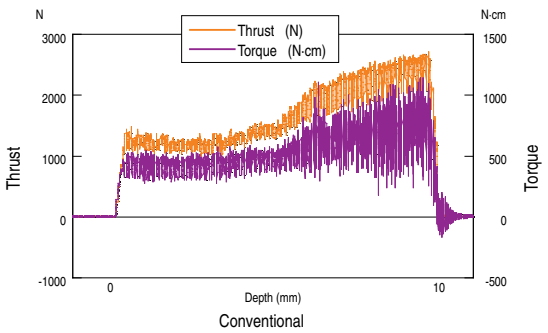


Milling Condition

End Mill	: 10mm (0.394in)
Cutting Speed	: 80m/min (263 SFM) (2,550min^{-1})
Feed	: Slotting 200mm/min (7.9 IPM) (0.08mm/rev)(0.003 IPR) Grooving 1,000mm/min (39.4 IPM) (0.1mm/tooth)(0.004 IPT)
Depth	: 10mm (0.394in)
Milling Length	: 50mm (1.969in)
Nus of Glooves	: 300glooves
Mork Material	: D2(SKD11), 180HB
Cutting Fluid	: Air blow

Cutting resistance when slotted





Stocked Size / End mills Name	List No.	Page
X's-mill Geo SLOT	9338	132

USA & JAPAN STOCK ITEM*

Features

- Excellent surface finish.
  "DLC" (Diamond like carbon) coating has low friction.
- Designed for dry-milling.
  Excellent chip control due to special flute geometry.

Work Materials

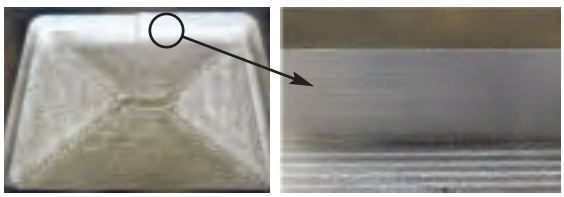
Aluminums, Aluminum Alloys, Aluminum Alloy Casting, Aluminum Alloy Die-casting, Copper Alloys

Performance

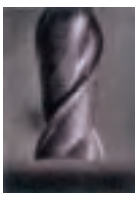
Milling Condition

Dia. of Mill : 10mm
Speed : 10,000min^{-1} (1,030 SFM)
Feed : 1,000mm/min (39.4 IPM)
Material : AA5052
Coolant : Dry

Milled with DLC coated endmill



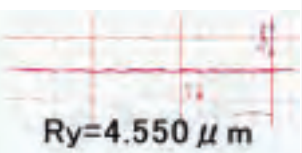
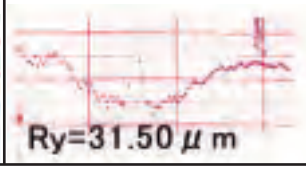
Excellent surface finish without burr



Condition of tool after operation

Breakage

Milling with un-coated carbide end mill

AA5052	DLC mill	Non-coated carbide
Surface Finish		
Surface Roughness	 Ry=4.550 μm	 Ry=31.50 μm

DLC mill maintains very good surface finish!!

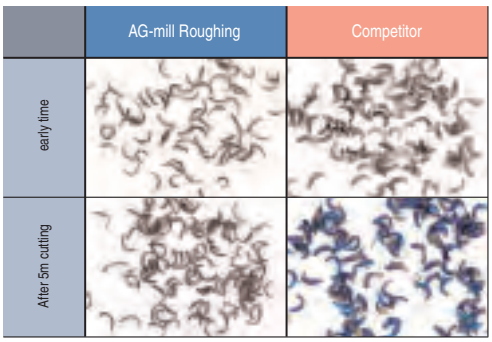
Stocked Size	End mills Name	List No.	Page
	DLC-mill for Aluminum	9330	136
*	**DLC-mill Sharp Corner Two Flute**	9378	136
*	**DLC-mill Radius**	9302	137
*	**DLC-mill Slot Long Shank**	9390	138
*	**DLC-mill Ball**	9360	139
*	**DLC-HSS mill / Metric Sizes**	6450	140
	DLC-HSS mill / Inch Sizes	6231HD	140

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

Features

- Super HSS of new development and AG coating by new process.
- Cost performance of rough, semi-finish milling.
- Fine pitch nick and Heavy nick that a chip break is good, and there is high depth of cut.

Comparison of cutting chips

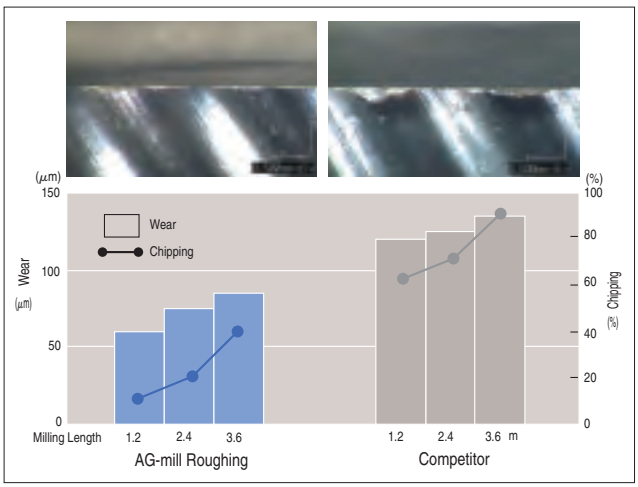


Work Materials

Carbon steels, Alloy steels, Mold Steels, Pre-Hardened steels, Stainless steels, Nickel alloys, Cast Irons, Aluminum alloys

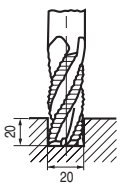
Performance

Excellent chipping-resistant / Wear-resistant



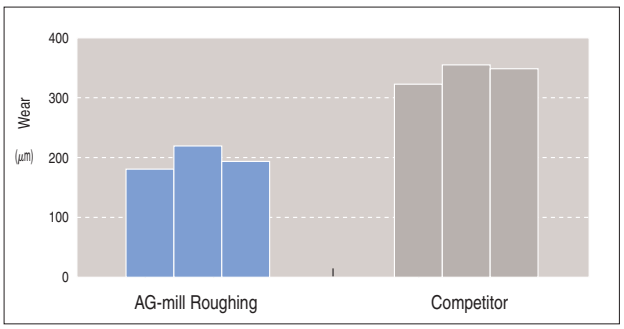
Milling condition

Tool : ø20(0.787in)(AGRERS)
Cutting Speed : 40m/min(131 SFM)
Feed : 0.1mm/tooth(0.004 IPT)
Work Material : 1050(S50C), 180HB
Cutting Fluid : Wet



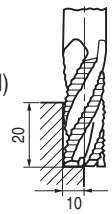
Stocked Size	End mills Name	List No.	Page
	AG-mill Roughing / Inch Sizes	6485	141 (NEW)
	AG-mill Heavy / Inch Sizes	6403	141 (NEW)

Side milling of AG-mill Roughing



Milling condition

Tool : ø20(0.787in)(AGRERS)
Cutting Speed : 355min^{-1}(22m/min)(72.1 SFM)
Feed : 132mm/min(5.20 IPM)
Work Material : D2(SKD11), 210HB
Cutting Fluid : Wet



Stocked Size	End mills Name	List No.	Page
	AG-mill Roughing Short	6406	142 (NEW)
	AG-mill Roughing Regular Length Short	6484	142 (NEW)
	AG-mill Roughing Medium	6486	143 (NEW)
	AG-mill Roughing Long	6488	143 (NEW)
	AG-mill Heavy	6402	144 (NEW)
	AG-mill Heavy Long	6404	145 (NEW)

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery.

Endmills / Selection Chart

HIGH PERFORMANCE END-MILLS

Endmills Name	Material	Coating		Stock Size	Stock USA ● Japan ○	LIST No / Page Size	Page Cutting Condition	
GS-mill 2-Flute	Solid carbide	GS	Metric	0.5 to 12.0	●	*9382*	p.126 / p.160	
GS-mill 4-Flute			Metric	1.0 to 12.0	●	*9384*	p.126 / p.160	
GS-mill Ball			Metric	R0.5 to R6	●	*9386*	p.127 / p.161	
GS-mill Hard		GS Hard	Metric	1.0 to 20.0	●	*9398*	p.128 / p.162	
GS-mill Hard Ball			Metric	R0.2 to R6	○	*9422*	p.128 / p.163	
Mold Meister Ball		X's	Metric	R0.5 to R6	○	*9408*	p.127 / p.166	
X's-mill Geo			Inch	1/8 to 1	●	*9321*	p.130 / p.164	
			Metric	2.0 to 32.0	○	*9322*	p.129 / p.164	
X's-mill Geo Radius			Metric	3.0 to 20.0	○	*9324*	p.131 / p.164	
X's-mill Geo SLOT			Metric	1.0 to 16.0	●	*9338*	p.132 / p.165	
X's-mill Geo KV 2-Flute			Metric	0.5 to 3.0	○	*9366*	p.133 / p.168	
X's-mill Geo KV 4-Flute			Metric	1.0 to 3.0	○	*9368*	p.133 / p.168	
X's-mill Geo Ball			Metric	R0.5 to R15	○	*9340*	p.134 / p.166	
X's-mill Geo Microball			Metric	R0.1 to R2	○	*9332*	p.135 / p.167	
DLC-mill		DLC	Metric	1.0 to 20.0	●	*9330*	p.136 / p.169	
DLC-mill Sharp Corner			Metric	1.0 to 20.0	○	*9378*	p.136 / p.169	
DLC-mill Radius			Metric	2.0 to 20.0	○	*9302*	p.137 / p.169	
DLC-mill Slot Long Shank			Metric	2.0 to 20.0	○	*9390*	p.138 / p.169	
DLC-mill Ball			Metric	R0.5 to R10	○	*9360*	p.139 / p.172	
DLC-HSS mill	HSS-Co		Inch	1/8 to 1	●	*6231HD*	p.140 / p.173	
DLC-HSS mill			Metric	1.0 to 20.0	○	*6450*	p.140 / p.173	

●:Great ○:Good △:OK

	Side Milling			Grooving			Profile Milling	Rib Process	Workpiece Material																		
	Rough	Semi-Finish	Finish	Rough	Semi-Finish	Finish			Structural Steel	Carbon Steel		Alloy Steel	Pre-hardened Steel	Die Steel	Hardend Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron	Aluminum		Copper Alloys	Graphite
										Low Carbon 1010,1018	High Carbon 1045,1065			HRc 30 to 45	HRc 45 to 55	HRc 55 to 60	HRc 60 to 65	Austenitic 300 Series	Martens itic 400 Series				Casting Si ≦ 12%	High Si Si >13%		
		●	●		●	●			●	●	●	●	●	●	●	○		●	●	○	○	○				
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Endmills / Selection Chart

HIGH PERFORMANCE END-MILLS

Endmills Name		Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
AG-mill Roughing	Short	HSS-Co	AG	Inch	1/4 to 2	●	6485	p.141	p.174	
				Metric	6.0 to 50.0	○	6406	p.142	p.174	
	Regular Length Short			Metric	6.0 to 50.0	○	6484	p.142	p.174	
	Medium			Metric	6.0 to 50.0	○	6486	p.143	p.174	
	Long			Metric	6.0 to 50.0	○	6488	p.143	p.174	
AG-mill Heavy				Inch	1/4 to 2	●	6403	p.141	p.175	
				Metric	3.0 to 50.0	○	6402	p.144	p.175	
	Long			Metric	3.0 to 50.0	○	6404	p.145	p.175	

COATED END-MILLS

Endmills Name		Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
GENAC-Mill	2-Flute / Regular	Solid carbide	SG	Inch	1/8 to 1	●	9261X	p.146	p.176	
	2-Flute / Long			Inch	1/8 to 1	●	9265X	p.148	p.176	
	2-Flute / Regular - Ball End			Inch	1/8 to 1	●	9271X	p.146	p.177	
	2-Flute / Long-Ball End			Inch	1/8 to 1	●	9275X	p.148	p.177	
	4-Flute / Regular			Inch	1/8 to 1	●	9263X	p.146	p.176	
	4-Flute / Long			Inch	1/8 to 1	●	9267X	p.148	p.176	
	4-Flute / Regular - Ball End			Inch	1/8 to 1	●	9273X	p.146	p.177	
	4-Flute / Long - Ball End			Inch	1/8 to 1	●	9277X	p.148	p.177	
	Roughing, Regular, Center Cutting			Inch	1/4 to 1-1/4	●	9251X	p.147	p.178	
	High Helix, 3-Flute			Inch	1/8 to 1	●	9221X	p.147	p.178	

●:Great ○:Good △:OK

	Side Milling			Grooving			Profile Milling	Rib Process	Workpiece Material																	
	Rough	Semi-Finish	Finish	Rough	Semi-Finish	Finish			Structural Steel	Carbon Steel		Alloy Steel	Pre-hardened Steel	Die Steel	Hardend Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron	Aluminum		Copper Alloys	Graphite
										Low Carbon 1010,1018	High Carbon 1045,1065			HRc 30 to 45	HRc 45 to 55	HRc 55 to 60	HRc 60 to 65	Austenitic 300 Series	Martensitic 400 Series				Casting Si ≦ 12%	High Si Si >13%		
	●			●					●	●	●	●	○	○				●	●	●	●	○	○		○	
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●:Great ○:Good △:OK

	Side Milling			Grooving			Profile Milling	Rib Process	Workpiece Material																	
	Rough	Semi-Finish	Finish	Rough	Semi-Finish	Finish			Structural Steel	Carbon Steel		Alloy Steel	Pre-hardened Steel	Die Steel	Hardend Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron	Aluminum		Copper Alloys	Graphite
										Low Carbon 1010,1018	High Carbon 1045,1065			HRc 30 to 45	HRc 45 to 55	HRc 55 to 60	HRc 60 to 65	Austenitic 300 Series	Martensitic 400 Series				Casting Si ≦ 12%	High Si Si >13%		
					○	●			○	●	●	●	○	●	△			△	△	△	△	○			△	
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Endmills / Selection Chart

COATED END-MILLS

Endmills Name	Material	Coating		Stock Size	Stock USA ● Japan ○	LIST No Page Size	LIST No Page Cutting Condition	
SG 2-Flute / Regular	HSS-Co	**SG**	Inch	1/8 to 1-1/2	●	***6231X***	p.152	p.179	
SG Multi-Flute / Regular, Center Cutting			Inch	1/8 to 1-1/2	●	***6211X***	p.156	p.180	
SG Roughing & Finishing (Heavy Duty)			Inch	1/4 to 2	●	***6367X***	p.149	p.181	
SG Roughing (Hog)			Inch	1/4 to 2	●	***6303X***	p.150	p.181	

NON COATED END-MILLS

Endmills Name		Material	Coating		Stock Size	Stock USA ● Japan ○	LIST No Page Size	LIST No Page Cutting Condition	
2-Flute Single End	**Regular**	HSS		Inch	1/8 to 2-1/2	●	***231***	p.152	p.182	
		HSS-Co		Inch	1/8 to 2	●	***6231***	p.152	p.182	
	Long			Inch	1/4 to 2	●	***6233***	p.153	p.182	
	Metric - Regular			Metric	1.0 to 50.0	● ○	***6230***	p.155	p.182	
2-Flute Double End	**Regular**	HSS		Inch	1/8 to 1	●	***261***	p.154	p.182	
4-Flute Single End	**Regular - Center Cutting**			Inch	1/8 to 2	●	***211***	p.156	p.183	
	Long - Center Cutting			Inch	1/4 to 2	●	***213***	p.157	p.183	
	Long - Center Cutting	HSS-Co		Inch	1/4 to 1-1/4	●	***6213***	p.157	p.183	
	Extra Long - Center Cutting	HSS		Inch	1/4 to 1-1/4	●	***215***	p.158	p.183	
	Metric - Center Cutting	HSS-Co		Metric	2.5 to 50.0	● ○	***6210***	p.155	p.183	
4-Flute Double End	**Regular - Center Cutting**	HSS		Inch	1/8 to 1	●	***271***	p.159	p.183	
Multi-Flute	**Regular - Center Cutting**			Inch	1/8 to 2	●	***6211M***	p.156	p.183	
Roughing & Finishing (Heavy Duty)				Inch	1/4 to 3	●	***6367***	p.149	p.185	
Roughing (Hog)	**Bright Finish**			Inch	1/4 to 2	●	***6303***	p.150	p.185	
	Fine Pitch			Inch	1/4 to 2	●	***6307***	p.151	p.185	

●:Great ○:Good △:OK

Side Milling			Grooving			Profile Milling	Rib Process	Workpiece Material																	
Rough	Semi-Finish	Finish	Rough	Semi-Finish	Finish			Structural Steel	Carbon Steel		Alloy Steel	Pre-hardened Steel	Die Steel	Hardend Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron	Aluminum		Copper Alloys	Graphite
									Low Carbon 1010,1018	High Carbon 1045,1065			HRc 30 to 45	HRc 45 to 55	HRc 55 to 60	HRc 60 to 65	Austenitic 300 Series	Martensitic 400 Series				Casting Si ≦ 12%	High Si Si >13%		
				○	●			●	●	●	○	○									△	△	△	△	
	○	●						●	●	●	○	○									△	△	△	△	
●	●		●	●				●	●	●	○	○									△	△	△	△	
●			●					●	●	●	○	○									△	△	△	△	

●:Great ○:Good △:OK

Side Milling			Grooving			Profile Milling	Rib Process	Workpiece Material																	
Rough	Semi-Finish	Finish	Rough	Semi-Finish	Finish			Structural Steel	Carbon Steel		Alloy Steel	Pre-hardened Steel	Die Steel	Hardend Steel			Stainless Steel		Titanium Alloys	Nickel Alloys	Cast Iron	Aluminum		Copper Alloys	Graphite
									Low Carbon 1010,1018	High Carbon 1045,1065			HRc 30 to 45	HRc 45 to 55	HRc 55 to 60	HRc 60 to 65	Austenitic 300 Series	Martensitic 400 Series				Casting Si ≦ 12%	High Si Si >13%		
				○	○			△	△	△	△	△									△	△	△	△	
				○	○			○	○	○	○	○									○	△	△	○	
				○	○			○	○	○	○	○									○	△	△	○	
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○			○					○	○	○	○	○									○	△	△	○	

GS-MILL TWO FLUTE
GS-MILL FOUR FLUTE

List No.9382 Two Flute

This end mill having sharp edge corner is suitable for high-speed and long life milling of workpiece materials from raw materials to hardened materials, and is used in grooving.

(Unit) : mm

Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
0.5	3	1.25	38
1	3	2.5	38
1.5	3	3.75	38
2	3	5	38
2.5	3	6.25	38
3	3	7.5	38
4	4	11	45
5	6	13	50
6	6	13	50
8	8	19	60
10	10	22	70
12	12	26	75

1 per tube

Dia. of Mill (mm)		Tolerance (mm)
Above	Up to	
	3	0~−0.015
3		0~−0.030

List No.9384 Four Flute

This end mill having sharp edge corner is suitable for high-speed and long life milling of workpiece materials from raw materials to hardened materials, and is used in side milling.

(Unit) : mm

Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
1	3	2.5	38
2	3	5	38
3	3	7.5	38
4	4	11	45
5	6	13	50
6	6	13	50
8	8	19	60
10	10	22	70
12	12	26	75

1 per tube

Dia. of Mill (mm)		Tolerance (mm)
Above	Up to	
	3	0~−0.015
3		0~−0.030

GS-MILL BALL
MOLD MEISTER BALL

List No.9386 GS-MILL BALL

GS Carbide HELIX N

This end mill is suitable for high-speed and long life milling, and is used in profile milling.

(Unit) : mm

Ball Radius	Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
0.5	1	4	1.5	50
0.75	1.5	4	2.5	50
1	2	6	3	60
1.25	2.5	6	4	60
1.5	3	6	4.5	60
2	4	6	6	70
2.5	5	6	7.5	80
3	6	6	9	80
4	8	8	12	90
5	10	10	15	100
6	12	12	21	110

1 per tube

Tolerance (mm)	
Dia. of Mill	Ball Radius
0~−0.03	±0.01

List No.9408 MOLD MEISTER BALL

X's Carbide HELIX N

This end mill is the best in manual polish less milling of precise die and mold. Ball tolerance ±3μm. Ball accuracy range 180°.

(Unit) : mm

Ball Radius	Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
0.5	1	4	1.5	50
0.75	1.5	4	2.5	50
1	2	6	3	60
1.25	2.5	6	4	60
1.5	3	6	4.5	80
2	4	6	6	80
2.5	5	6	7.5	90
3	6	6	9	100
4	8	8	12	100
5	10	10	15	120
6	12	12	18	120

1 per tube

✻JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

Tolerance (mm)	
Dia. of Mill	Ball Radius
±0.006	±0.003

GS-MILL HARD
GS-MILL HARD BALL

JAPAN STOCK ITEM*

List No.9398 GS-MILL HARD

This end mill is most suitable for super-high-speed machining of hardened material by “GS Hard Coat”.

(Unit) : mm

Dia. of Mill	Shank Dia.	Length of Cut	No. of Flutes	Overall Length
1	6	3	4	50
1.5	6	4	4	50
2	6	6	4	50
3	6	8	6	50
4	6	11	6	50
5	6	13	6	50
6	6	13	6	50
8	8	19	6	60
10	10	22	6	70
12	12	26	6	75
16	16	32	8	90
20	20	38	8	100

1 per tube

Dia. of Mill (mm)		Tolerance (mm)
Above	Up to	
	3	0~−0.015
3		0~−0.030

List No.9422

Suitable for high efficiency and high precision finishing of hardened die and mold.

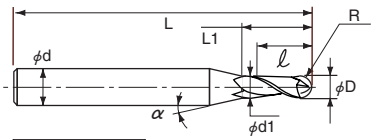
(Unit) : mm

Ball Radius	Dia. of Mill D	Shank Dia.	Length of Cut	L1	α	Overall Length
0.2	0.4	4	0.4	0.6	10°	50
0.3	0.6	4	0.6	0.9	10°	50
0.5	1	4	1	1.5	10°	50
0.75	1.5	4	1.5	2.3	10°	50
1	2	6	2	3	15°	60
1.25	2.5	6	2.5	3.8	15°	60
1.5	3	6	3	4.5	15°	60
2	4	6	4	6	15°	70
2.5	5	6	5	7.5	15°	80
3	6	6	6	—	—	80
4	8	8	8	—	—	90
5	10	10	10	—	—	100
6	12	12	12	—	—	110

Tolerance of Ball Radius : +0.003~-0.007mm

1 per tube

∗JAPAN STOCK ITEM : Please allow 2-3 weeks delivery



D < d1

d1=D+ appro×0.05mm

X'S-MILL GEO / METRIC SIZES

JAPAN STOCK ITEM*

List No.9322

X's Carbide HELIX H

This end mill realizes feed speed of 80 IPM, and is adaptable in workpiece material from Carbon Steels and Mold Steels to Hard-to-cut materials.

(Unit) : mm

Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
2	4	6	50
2.1	4	6	50
2.2	4	6	50
2.3	4	6	50
2.4	4	8	50
2.5	4	8	50
2.6	4	8	50
2.7	4	8	50
2.8	4	8	50
2.9	4	8	50
3	6	8	50
3.1	6	8	50
3.2	6	8	50
3.3	6	8	50
3.4	6	10	50
3.5	6	10	50
3.6	6	10	50
3.7	6	10	50
3.8	6	11	50
3.9	6	11	50
4	6	11	50
4.1	6	11	50
4.2	6	11	50
4.3	6	11	50
4.4	6	11	50
4.5	6	11	50
4.6	6	11	50
4.7	6	11	50
4.8	6	13	60
4.9	6	13	60
5	6	13	60
5.1	6	13	60
5.2	6	13	60
5.3	6	13	60
5.4	6	13	60
5.5	6	13	60
5.6	6	13	60
5.7	6	13	60
5.8	6	13	60
5.9	6	13	60
6	6	13	60
6.1	8	16	70
6.2	8	16	70
6.3	8	16	70
6.4	8	16	70
6.5	8	16	70
6.6	8	16	70
6.7	8	16	70
6.8	8	16	70
6.9	8	16	70
7	8	16	70
7.1	8	16	70
7.2	8	16	70
7.3	8	16	70
7.4	8	16	70
7.5	8	16	70
7.6	8	19	80
7.7	8	19	80
7.8	8	19	80
7.9	8	19	80
8	8	19	80
8.1	10	19	90
8.2	10	19	90
8.3	10	19	90
8.4	10	19	90
8.5	10	19	90
8.6	10	19	90
8.7	10	19	90
8.8	10	19	90
8.9	10	19	90
9	10	19	90
9.1	10	19	90
9.2	10	19	90
9.3	10	19	90
9.4	10	19	90
9.5	10	19	90
9.6	10	22	90
9.7	10	22	90
9.8	10	22	90
9.9	10	22	90
10	10	22	90
10.1	12	22	90
10.2	12	22	90
10.3	12	22	90
10.4	12	22	90
10.5	12	22	90
10.6	12	22	90
10.7	12	22	90
10.8	12	22	90
10.9	12	22	90
11	12	22	90
11.1	12	22	90
11.2	12	22	90
11.3	12	22	90
11.4	12	22	90
11.5	12	22	90
11.6	12	26	90
11.7	12	26	90
11.8	12	26	90
11.9	12	26	90
12	12	26	90
14	16	26	110
15	16	26	110
16	16	32	115
18	20	32	120
20	20	38	125
22	20	50	140
25	25	50	140
28	25	60	165
30	25	60	165
32	32	70	175

Dia. of Mill (mm)		Tolerance of Dia. (mm)
Above	Up to	
	3	−0.014~−0.028
3	6	−0.020~−0.038
6	10	−0.025~−0.047
10		−0.032~−0.059

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

X'S-MILL GEO / INCH SIZES

List No.9321

This end mill realizes feed speed of 80 IPM, and is adaptable in workpiece material from Carbon Steels and Mold Steels to Hard-to-cut materials.

L9321	Dia. of Mill	Shank Diameter	Length of Cut	No. of Flutes	Overall Length
GMS04	1/8	1/8	3/8	4	1-1/2
GMS06	3/16	3/16	5/8	4	2
GMS08	1/4	1/4	1/2	4	2-1/2
GMS10	5/16	5/16	13/16	4	2-1/2
GMS12	3/8	3/8	7/8	4	2-1/2
GMS14	7/16	7/16	1	4	2-3/4
GMS16	1/2	1/2	1	4	3
GMS20	5/8	5/8	1-1/4	4	3-1/2
GMS24	3/4	3/4	1-1/2	4	4
GMS32	1	1	1-1/2	4	4

1 per tube

X'S-MILL GEO RADIUS

JAPAN STOCK ITEM*

List No.9324

This end mill realizes feed speed of 80 IPM. This end mill having corner radius is used for corner radius milling.

(Unit) : mm

Dia. of Mill	Corner Radius	Shank Dia.	Length of Cut	Overall Length
3	0.2	6	8	50
3	0.5	6	8	50
4	0.2	6	11	50
4	0.5	6	11	50
4	1.0	6	11	50
5	0.2	6	13	60
5	0.5	6	13	60
5	1.0	6	13	60
6	0.3	6	13	60
6	0.5	6	13	60
6	1.0	6	13	60
6	1.5	6	13	60
8	0.3	8	19	80
8	0.5	8	19	80
8	1.0	8	19	80
8	1.5	8	19	80
8	2.0	8	19	80
10	0.3	10	22	90
10	0.5	10	22	90
10	1.0	10	22	90
10	1.5	10	22	90
10	2.0	10	22	90
12	0.5	12	26	90
12	1.0	12	26	90
12	1.5	12	26	90
12	2.0	12	26	90
12	3.0	12	26	90
16	1.0	16	32	115
16	1.5	16	32	115
16	2.0	16	32	115
16	3.0	16	32	115
20	1.0	20	38	125
20	1.5	20	38	125
20	2.0	20	38	125
20	3.0	20	38	125

Dia. of Mill (mm)		Tolerance (mm)	
Above	Up to	Dia. of Mill	Corner Radius
	3	−0.014~−0.028	+0.02~−0.01
3	6	−0.020~−0.038	
6	10	−0.025~−0.047	
10		−0.032~−0.059	

1 per tube

*JAPAN STOCK ITEM :
Please allow 2-3 weeks delivery

X'S-MILL GEO SLOT

List No.9338

This end mill is available from plunging to slotting continuously and is used for workpiece materials from raw materials to hardened materials.

(Unit) : mm

Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
1	4	3	50
1.5	4	4	50
2	4	6	50
2.5	4	8	50
3	6	8	50
3.5	6	10	50
4	6	11	50
4.5	6	11	50
5	6	13	60
5.5	6	13	60
6	6	13	60
6.5	8	16	70
7	8	16	70
7.5	8	16	70
8	8	19	80
8.5	10	19	90
9	10	19	90
9.5	10	19	90
10	10	22	90
11	12	22	90
12	12	26	90
13	12	26	100
14	16	26	110
15	16	26	110
16	16	32	115

1 per tube

Dia. of Mill (mm)		Tolerance of Dia. (mm)
Above	Up to	
	3	−0.014~−0.028
3	6	−0.020~−0.038
6	10	−0.025~−0.047
10		−0.032~−0.059

X'S-MILL GEO KV TWO FLUTES
X'S-MILL GEO KV FOUR FLUTES

JAPAN STOCK ITEM*

List No.9366 Two Flute

This end mill is the best in grooving of Fiber optics component, and controls less burr.

Length of Cut : 1.5xD

(Unit) : mm

Dia. of Mill D	Shank Dia.	Length of Cut	L1	Overall Length
0.5	3	0.75	1.2	38
1	3	1.5	2.5	38
1.2	3	1.8	2.8	38
1.5	3	2.25	3.2	38
2	3	3	4	38
2.5	3	3.75	4.7	38
3	3	4.5	—	38

1 per tube

Length of Cut : 2.5xD

(Unit) : mm

Dia. of Mill D	Shank Dia.	Length of Cut	L1	Overall Length
0.5	3	1.25	1.7	38
1	3	2.5	3.5	38
1.2	3	3	4	38
1.5	3	3.75	4.7	38
2	3	5	6	38
2.5	3	6.25	7.2	38
3	3	7.5	—	38

Tolerance of Diameter : 0~−0.015mm

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

List No.9368 Four Flute

This end mill the best in side milling of Fiber optics component, and controls less burr.

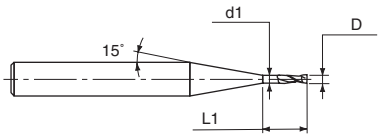
Length of Cut : 1.5xD

(Unit) : mm

Dia. of Mill D	Shank Dia.	Length of Cut	L1	Overall Length
1	3	1.5	2.5	38
1.2	3	1.8	2.8	38
1.5	3	2.25	3.2	38
2	3	3	4	38
2.5	3	3.75	4.7	38
3	3	4.5	—	38

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery



D < d1

d1=D+0.05mm

JAPAN STOCK ITEM*

List No.9340 X'S-MILL GEO BALL

This end mill is suitable for high efficiency and high precision finishing of molding dies, and is adaptable in workpiece material from Carbon Steels and Mold Die Steels to hardened materials.

(Unit) : mm

Ball Radius	Dia. of Mill	Shank Dia.	Length of Cut	L1	α	Overall Length
0.5	1	4	1.5	3	10°	50
0.75	1.5	4	2.5	4	10°	50
1	2	6	3	5	15°	60
1.25	2.5	6	4	6	15°	60
1.5	3	6	4.5	8	15°	80
2	4	6	6	12	15°	80
2.5	5	6	7.5	14	15°	90
3	6	6	9	—	—	100
3.5	7	8	11	20	20°	100
4	8	8	12	—	—	100
4.5	9	10	14	25	20°	120
5	10	10	15	—	—	120
5.5	11	12	17	30	20°	120
6	12	12	18	—	—	120
6.5	13	16	20	35	20°	160
7	14	16	21	38	—	160
7.5	15	16	23	40	20°	160
8	16	16	24	—	—	160
9	18	20	27	50	20°	180
10	20	20	30	—	—	180
12.5	25	25	38	—	—	200
15	30	32	45	80	20°	200

Ball Radius (mm)		Tolerance (mm)	
Above	Up to	Dia. of Mill	Ball Radius
	8	0~−0.030	±0.01
8		0~−0.040	

1 per tube

✻JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

X'S-MILL GEO MICROBALL

JAPAN STOCK ITEM*

List No.9332

This end mill is suitable for high precision and fine milling, and is adaptable in workpiece material from Carbon Steels and Mold Die Steels to hardened materials.

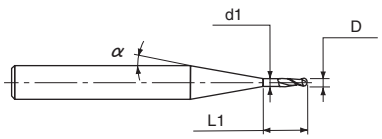
(Unit) : mm

Ball Radius	Dia. of Mill D	Shank Dia.	Length of Cut	L1	α	Overall Length
0.1	0.2	6	0.2	—	13.5°	50
0.15	0.3	6	0.3	—	13.5°	50
0.2	0.4	6	0.4	—	13.5°	50
0.25	0.5	6	0.5	1.5	15°	50
0.3	0.6	6	0.6	1.8	15°	50
0.4	0.8	6	0.8	2.4	15°	50
0.5	1.0	6	1	2.5	15°	50
0.6	1.2	6	1.2	3	15°	50
0.7	1.4	6	1.4	3.5	15°	50
0.75	1.5	6	1.5	3.8	15°	50
0.8	1.6	6	1.6	4	15°	50
0.9	1.8	6	1.8	4.5	15°	50
1	2.0	6	2	5	15°	50
1.25	2.5	6	2.5	5	13°	50
1.5	3.0	6	3	6	13°	50
1.75	3.5	6	3.5	6	10°	50
2	4.0	6	4	6	10°	50

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

Ball Radius (mm)		Tolerance (mm)	
Above	Up to	Dia. of Mill	Ball Radius
	0.2	0~−0.015	0~+0.005
0.2	2.0		±0.010



D > d1

d1=D−β
(β=0.015~0.06mm)

DLC-MILL FOR ALUMINUM / METRIC SIZES
DLC-MILL SHARP CORNER TWO FLUTE

USA & JAPAN STOCK ITEM*

List No.9330 DLC-MILL FOR ALUMINUM / METRIC SIZES

DLC Carbide HELIX H

USA STOCK ITEM

This is suitable for Dry-milling of Aluminum with DLC coat.

(Unit) : mm

Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
1	4	3	40
1.5	4	4	40
2	4	6	40
2.5	4	8	40
3	6	8	45
3.5	6	10	45
4	6	11	45
4.5	6	11	50
5	6	13	50
5.5	6	13	50
6	6	13	50
7	8	16	60
8	8	19	60
9	10	19	70
10	10	22	70
11	12	22	75
12	12	26	75
16	16	32	90
20	20	38	100

Tolerance of Dia. is same as List No.9378

1 per tube

List No.9378 DLC-MILL SHARP CORNER TWO FLUTE

DLC Carbide HELIX N Sharp Corner

JAPAN STOCK ITEM*

This end mill having sharp edge corner is suitable for excellent cutting surface of Aluminum.

(Unit) : mm

Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
1	4	3	40
1.5	4	4	40
2	4	6	40
2.5	4	8	40
3	6	8	45
3.5	6	10	45
4	6	11	45
4.5	6	11	50
5	6	13	50
6	6	13	50
7	8	16	60
8	8	19	60
9	10	19	70
10	10	22	70
11	12	22	75
12	12	26	75
16	16	32	90
20	20	38	100

1 per tube

Dia. of Mill (mm)		Tolerance of Dia. (mm)
Above	Up to	
	3	−0.014~−0.028
3	6	−0.020~−0.038
6	10	−0.025~−0.047
10		−0.032~−0.059

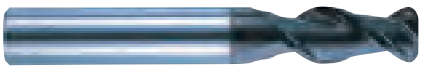
* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

DLC-MILL RADIUS

JAPAN STOCK ITEM*

List No.9302

DLC Carbide HELIX H



This end mill is suitable for used for corner radius milling or copying of Aluminum.

(Unit) : mm

Dia. of Mill	Conrner Radius	Shank Dia.	Length of Cut	Overall Length
2	0.2	4	6	40
3	0.2	6	8	45
3	0.5	6	8	45
4	0.2	6	11	45
4	0.5	6	11	45
5	0.2	6	13	50
5	0.5	6	13	50
6	0.3	6	13	50
6	0.5	6	13	50
6	1.0	6	13	50
7	0.3	8	16	60
7	0.5	8	16	60
7	1.0	8	16	60
8	0.3	8	19	60
8	0.5	8	19	60
8	1.0	8	19	60
10	0.3	10	22	70
10	0.5	10	22	70
10	1.0	10	22	70
12	0.5	12	26	75
12	1.0	12	26	75
12	2.0	12	26	75
16	0.5	16	32	90
16	1.0	16	32	90
16	2.0	16	32	90
16	3.0	16	32	90
20	0.5	20	38	100
20	1.0	20	38	100
20	2.0	20	38	100
20	3.0	20	38	100

Dia. of Mill (mm)		Tolerance of Dia. (mm)
Above	Up to	
	3	−0.014~−0.028
3	6	−0.020~−0.038
6	10	−0.025~−0.047
10		−0.032~−0.059

Corner radius	Tolerance (mm)
0.2	+0.015~0
0.3	
0.5	+0.020~0
1.0	+0.030~0
2.0	+0.050~0
3.0	

1 per tube

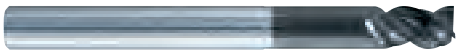
*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

DLC-MILL SLOT LONG SHANK

JAPAN STOCK ITEM*

List No.9390

DLC Carbide HELIX H



This end mill is for slotting and deep pocket milling in Aluminum Alloys.

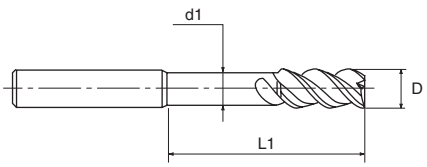
(Unit) : mm

Dia. of Mill D	Shank Dia.	Length of Cut	L1	d1	Overall Length
2	4	3	8	1.9	50
3	6	4.5	12	2.9	60
4	6	6	16	3.8	60
5	6	7.5	20	4.8	60
6	6	9	24	5.8	60
7	6	10.5	—	—	80
8	8	12	34	7.7	80
9	8	13.5	—	—	90
10	10	15	42	9.7	100
11	10	16.5	—	—	120
12	12	18	50	11.7	120
13	12	19.5	—	—	130
16	16	24	66	15.5	160
17	16	25.5	—	—	170
20	20	30	82	19.5	200

1 per tube

✻JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

Dia. of Mill (mm)		Tolerance of Dia. (mm)
Above	Up to	
	3	−0.014~−0.028
3	6	−0.020~−0.038
6	10	−0.025~−0.047
10		−0.032~−0.059



DLC-MILL BALL

JAPAN STOCK ITEM*

List No.9360

DLC Carbide HELIX N

This end mill is used in profile milling of Aluminum.

(Unit) : mm

Ball Radius	Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
0.5	1	4	1.5	50
0.75	1.5	4	2.5	50
1	2	6	3	60
1.25	2.5	6	4	60
1.5	3	6	4.5	80
2	4	6	6	80
2.5	5	6	7.5	90
3	6	6	9	100
3.5	7	8	11	100
4	8	8	12	100
4.5	9	10	14	120
5	10	10	15	120
5.5	11	12	17	120
6	12	12	18	120
6.5	13	16	20	160
7	14	16	21	160
7.5	15	16	23	160
8	16	16	24	160
9	18	20	27	180
10	20	20	30	180

Ball Radius (mm)		Tolerance (mm)	
Above	Up to	Dia. of Mill	Ball Radius
	8	0~−0.030	+0.010
8		0~−0.040	

1 per tube

∗JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

DLC-HSS MILL / METRIC SIZES
DLC-HSS MILL / INCH SIZES

USA & JAPAN STOCK ITEM*

List No.6450 DLC-HSS MILL / METRIC SIZES

DLC HSS Co HELIX H

JAPAN STOCK ITEM*

This end mill is suitable for grooving of Aluminums.

(Unit) : mm

Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
1	6	2	50
1.5	6	3	50
2	6	4	50
2.5	6	5	50
3	6	6	50
3.5	8	8	60
4	8	8	60
4.5	8	10	60
5	8	10	60
5.5	8	12	60
6	8	12	60
6.5	10	14	65
7	10	14	65
7.5	10	14	65
8	10	14	65
8.5	10	18	70
9	10	18	70
9.5	10	18	70
10	10	18	70
11	12	22	80
12	12	22	80
13	16	26	90
14	16	26	90
15	16	30	95
16	16	30	95
17	20	35	105
18	20	35	105
19	20	40	110
20	20	40	110

1 per tube

Dia. of Mill (mm)		Tolerance of Dia. (mm)
Above	Up to	
	10	0~−0.020
10		0~−0.025

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

List No.6231HD DLC-HSS MILL / INCH SIZES

DLC HSS Co HELIX H

USA STOCK ITEM

This end mill is suitable for grooving of Aluminums.

L6231HD	Dia. of Mill	Shank Diameter	Length of Cut	No. of Flutes	Overall Length
PGHDL4	1/8	3/8	3/8	2	2-5/16
PGHDL6	3/16	3/8	7/16	2	2-5/16
PGHDL8	1/4	3/8	5/8	2	2-7/16
PGHDL10	5/16	3/8	3/4	2	2-1/2
PGHDL12	3/8	3/8	3/4	2	2-1/2
PGHDL14	7/16	3/8	1	2	2-11/16
PGHDL16	1/2	1/2	1-1/4	2	3-1/4
PGHDL20	5/8	5/8	1-5/8	2	3-3/4
PGHDL24	3/4	3/4	1-5/8	2	4-1/8
PGHDL32	1	1	2	2	4-1/2

1 per tube

AG-MILL ROUGHING/INCH SIZES
AG-MILL HEAVY/INCH SIZES

List No.6485 ROUGHING/INCH SIZES

AG HSS Co HELIX N

This end mill is most suitable for high-speed rough milling, fine pitch nick is used.

L6485	Dia. of Mill	Shank Diameter	Length of Cut	No. of Flutes	Overall Length
PQFAG8-2	1/4	3/8	5/8	4	2-7/16
PQFAG10-2	5/16	3/8	3/4	4	2-1/2
PQFAG12-2	3/8	3/8	3/4	4	2-1/2
PQFAG16-3	1/2	1/2	1-1/4	4	3-1/4
PQFAG20-4	5/8	5/8	1-5/8	4	3-3/4
PQFAG24-5	3/4	3/4	1-5/8	4	3-7/8
PQFAG28-6	7/8	7/8	1-7/8	5	4-1/8
PQFAG32-7	1	1	2	5	4-1/2
PQFAG40-8	1-1/4	1-1/4	2	6	4-1/2
PQFAG48-8	1-1/2	1-1/4	2	6	4-1/2
PQFAG64-8	2	1-1/4	2	8	4-1/2

1 per tube

List No.6403 HEAVY/INCH SIZES

AG HSS Co HELIX H

This end mill is suitable for high-speed rough milling and semi-finish milling.

L6403	Dia. of Mill	Shank Diameter	Length of Cut	No. of Flutes	Overall Length
PKAG8-2	1/4	3/8	5/8	4	2-7/16
PKAG10-2	5/16	3/8	3/4	4	2-1/2
PKAG12-2	3/8	3/8	3/4	4	2-1/2
PKAG16-3	1/2	1/2	1-1/4	4	3-1/4
PKAG20-4	5/8	5/8	1-5/8	4	3-3/4
PKAG24-5	3/4	3/4	1-5/8	4	3-7/8
PKAG28-6	7/8	7/8	1-7/8	4	4-1/8
PKAG32-7	1	1	2	6	4-1/2
PKAG40-8	1-1/4	1-1/4	2	6	4-1/2
PKAG48-8	1-1/2	1-1/4	2	6	4-1/2
PKAG64-8	2	1-1/4	2	8	4-1/2

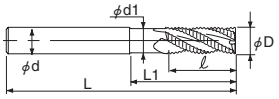
1 per tube

AG-MILL ROUGHING SHORT
AG-MILL ROUGHING REGULAR LENGTH SHORT

JAPAN STOCK ITEM*

List No.6406 SHORT

AG HSS Co HELIX N



This end mill is suitable for high-feed rough milling, fine pitch nick is used.

(Unit) : mm

Dia. of Mill D	Shank Dia. d	Length of Cut ℓ	L1	d1	No. of Flutes	Overall Length L
6	6	11	—	—	4	80
7	8	17	—	—	4	90
8	8	17	—	—	4	90
9	10	22	—	—	4	100
10	10	22	—	—	4	100
11	12	26	—	—	4	110
12	12	26	—	—	4	110
14	12	26	—	—	4	110
15	16	26	45	13.3	4	125
16	16	32	48	14.3	4	125
18	16	32	—	—	4	125
20	20	38	60	18	4	140
22	20	38	—	—	4	140
24	20	45	—	—	5	160
25	25	45	75	23	5	160
28	25	45	—	—	5	160
30	25	45	—	—	5	160
32	32	53	95	29.5	6	180
35	32	53	—	—	6	180
40	32	63	—	—	6	200
45	42	63	—	—	6	200
50	42	75	—	—	6	220

Tolerance of Diameter : ±0.1mm

1 per tube

✻JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

List No.6484 REGULAR LENGTH SHORT

AG HSS Co HELIX N

This end mill is most suitable for high-speed rough milling, fine pitch nick is used.

(Unit) : mm

Dia. of Mill D	Shank Dia.	Length of Cut	No. of Flutes	Overall Length
6	6	15	4	60
7	10	20	4	65
8	10	20	4	65
9	10	25	4	75
10	10	25	4	75
11	12	30	4	80
12	12	30	4	80
14	16	35	4	90
15	16	35	4	90
16	16	40	4	95
18	20	40	4	105
20	20	45	4	110
22	20	45	4	110
24	25	50	5	120
25	25	50	5	120
28	25	55	5	125
30	32	55	5	140
32	32	60	6	145
35	32	60	6	145
40	32	65	6	150
45	42	70	6	155
50	42	70	6	160

Tolerance of Diameter : ±0.1mm

1 per tube

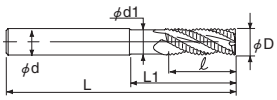
✻JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AG-MILL ROUGHING MEDIUM
AG-MILL ROUGHING LONG

JAPAN STOCK ITEM*

List No.6486 MEDIUM

AG HSS Co HELIX N



This end mill is most suitable for high-speed rough milling, fine pitch nick is used.

(Unit) : mm

Dia. of Mill D	Shank Dia. d	Length of Cut ℓ	L1	d1	No. of Flutes	Overall Length L
6	6	16	—	—	4	80
8	8	25	—	—	4	90
10	10	32	—	—	4	100
12	12	40	—	—	4	110
14	12	40	—	—	4	110
15	16	40	53	13.3	4	125
16	16	48	56	14.3	4	125
18	16	48	—	—	4	125
20	20	56	70	18.0	4	140
22	20	56	—	—	4	140
24	20	67	—	—	5	160
25	25	67	88	23.0	5	160
28	25	67	—	—	5	160
30	25	67	—	—	5	160
32	32	80	112	29.5	6	180
35	32	80	—	—	6	180
40	32	95	—	—	6	200
45	42	95	—	—	6	200
50	42	112	—	—	6	220

Tolerance of Diameter : ±0.1mm

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

List No.6488 LONG

AG HSS Co HELIX N

This end mill is most suitable for high-speed rough milling, fine pitch nick is used.

(Unit) : mm

Dia. of Mill D	Shank Dia.	Length of Cut	No. of Flutes	Overall Length
6	6	26	4	80
8	8	35	4	90
10	10	45	4	100
12	12	53	4	110
14	12	53	4	110
15	16	53	4	125
16	16	63	4	125
18	16	63	4	125
20	20	75	4	140
22	20	75	4	140
24	20	90	5	160
25	25	90	5	160
28	25	90	5	160
30	25	90	5	160
32	32	106	6	180
35	32	106	6	180
40	32	125	6	200
45	42	125	6	230
50	42	150	6	250

Tolerance of Diameter : ±0.1mm

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AG-MILL HEAVY

JAPAN STOCK ITEM*

List No.6402

AG HSS Co H

This end mill is suitable for high-speed rough milling and semi-finish milling.

(Unit) : mm

Dia. of Mill D	Shank Dia.	Length of Cut	No. of Flutes	Overall Length
3	6	9	4	50
4	8	12	4	60
5	8	15	4	60
6	8	15	4	60
7	10	20	4	65
8	10	20	4	65
9	12	25	4	75
10	12	25	4	75
11	12	30	4	80
12	12	30	4	80
13	16	35	4	90
14	16	35	4	90
15	16	40	4	95
16	16	40	4	95
17	20	40	4	105
18	20	40	4	105
19	20	45	4	110
20	20	45	4	110
21	20	45	4	110
22	20	45	4	110
23	25	50	4	120
24	25	50	4	120
25	25	50	4	120
26	25	50	4	120
27	25	55	4	125
28	25	55	6	125
29	25	55	6	125
30	25	55	6	125
32	32	60	6	145
35	32	60	6	145
40	32	65	6	150
45	32	70	6	160
45	42	70	6	160
50	32	70	6	160
50	42	70	6	160

Dia. of Mill (mm)		Tolerance of Dia. (mm)
Above	Up to	
	3	+0.025~0
3	6	+0.030~0
6	10	+0.036~0
10	18	+0.043~0
18	30	+0.052~0
30		+0.062~0

1 per tube

* JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

AG-MILL HEAVY LONG

JAPAN STOCK ITEM*

List No.6404

AG HSS Co HELIX N

This end mill is suitable for high-speed rough milling and semi-finish milling.

(Unit) : mm

Dia. of Mill D	Shank Dia.	Length of Cut	No. of Flutes	Overall Length
3	6	15	4	60
4	8	20	4	60
5	8	25	4	65
6	8	25	4	65
7	10	35	4	80
8	10	35	4	80
9	12	45	4	95
10	12	45	4	95
11	12	55	4	105
12	12	55	4	105
13	16	55	4	110
14	16	55	4	110
15	16	65	4	120
16	16	65	4	120
17	20	65	4	130
18	20	65	4	130
19	20	75	4	140
20	20	75	4	140
22	20	75	4	140
25	25	90	4	160
28	25	90	6	160
30	25	90	6	160
32	32	105	6	190
35	32	105	6	190
40	32	125	6	210
45	32	145	6	230
45	42	145	6	230
50	32	145	6	230
50	42	145	6	230

1 per tube

*JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

GENAC END MILLS "SG" COATED CARBIDE

List No.9261X Regular

Two Flute, Single End

SG COATED CARBIDE

List No.9271X Ball Nose

Two Flute, Ball Nose

SG COATED CARBIDE

L9261X	L9271X	Diameter of Mill	Shank Diameter	Length of Cut	Number of Flutes	Overall Length
CGX4	CRGX4	1/8	1/8	1/2	2	1 1/2
CGX6	CRGX6	3/16	3/16	5/8	2	2
CGX8	CRGX8	1/4	1/4	3/4	2	2 1/2
CGX10	CRGX10	5/16	5/16	13/16	2	2 1/2
CGX12	CRGX12	3/8	3/8	1	2	2 1/2
CGX14	CRGX14	7/16	7/16	1	2	2 3/4
CGX16	CRGX16	1/2	1/2	1	2	3
CGX20	CRGX20	5/8	5/8	1 1/4	2	3 1/2
CGX24	CRGX24	3/4	3/4	1 1/2	2	4
CGX32	CRGX32	1	1	1 1/2	2	4

1 per tube

List No.9263X Regular

Four Flute, Single End

SG COATED CARBIDE

List No.9273X Ball Nose

Four Flute, Ball Nose

SG COATED CARBIDE

L9263X	L9273X	Diameter of Mill	Shank Diameter	Length of Cut	Number of Flutes	Overall Length
CFX4	CRFX4	1/8	1/8	1/2	4	1 1/2
CFX6	CRFX6	3/16	3/16	5/8	4	2
CFX8	CRFX8	1/4	1/4	3/4	4	2 1/2
CFX10	CRFX10	5/16	5/16	13/16	4	2 1/2
CFX12	CRFX12	3/8	3/8	1	4	2 1/2
CFX14	CRFX14	7/16	7/16	1	4	2 3/4
CFX16	CRFX16	1/2	1/2	1	4	3
CFX20	CRFX20	5/8	5/8	1 1/4	4	3 1/2
CFX24	CRFX24	3/4	3/4	1 1/2	4	4
CFX32	CRFX32	1	1	1 1/2	4	4

1 per tube

GENAC END MILLS "SG" COATED CARBIDE

* List No.9221X

High Helix 3 Flute 60 Degree

SG COATED CARBIDE

L9221X	Dia. of Mill	Shank Dia.	Length of Cut	Number of Flutes	Overall Length
CHHX4	1/8	1/8	3/8	3	1 1/2
CHHX6	3/16	3/16	5/8	3	2
CHHX8	1/4	1/4	3/4	3	2 1/2
CHHX10	5/16	5/16	13/16	3	2 1/2
CHHX12	3/8	3/8	7/8	3	2 1/2
CHHX14	7/16	7/16	7/8	3	2 1/2
CHHX16	1/2	1/2	1	3	3
CHHX20	5/8	5/8	1 1/4	3	3 1/2
CHHX24	3/4	3/4	1 1/2	3	4
CHHX32	1	1	1 1/2	3	4

* item will be discontinued, after stock has depleted.
We recommend L9321 GEO fractional as substitution item for L9221X.

1 per tube

List No.9251X

Roughing Center Cutting

SG COATED CARBIDE

	L9251X	Dia. of Mill	Shank Dia.	Length of Cut	Number of Flutes	Overall Length
	CQX8	1/4	1/4	3/4	4	2 1/2
	CQX12	3/8	3/8	7/8	4	2 1/2
	CQX16	1/2	1/2	1	4	3
	CQX16-1	1/2	1/2	2	4	4
	CQX20	5/8	5/8	1 1/4	5	3 1/2
	CQX20-1	5/8	5/8	2 1/2	5	5
	CQX24	3/4	3/4	1 1/2	6	4
	CQX24-1	3/4	3/4	3	6	6
*	CQX32	1	1	2	6	4
*	CQX32-1	1	1	3	6	6
*	CQX40	1 1/4	1 1/4	3	6	6

* item will be discontinued, after stock has depleted.

1 per tube

GENAC END MILLS "SG" COATED CARBIDE LONG SERIES

* List No.9265X

SG Carbide HELIX N

Two Flute
Long, Single End

SG COATED CARBIDE

List No.9267X

SG Carbide HELIX N

Four Flute
Long, Single End

SG COATED CARBIDE

L9265X	L9267X	Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
CGLX4	CFLX4	1/8	1/8	3/4	2 1/4
CGLX6	CFLX6	3/16	3/16	3/4	2 1/2
CGLX8	CFLX8	1/4	1/4	1 1/8	3
CGLX10	CFLX10	5/16	5/16	1 1/8	3
CGLX12	CFLX12	3/8	3/8	1 1/8	3
CGLX14	CFLX14	7/16	7/16	2	4 1/2
CGLX16	CFLX16	1/2	1/2	2	4 1/2
CGLX20	CFLX20	5/8	5/8	2 1/4	5
CGLX24	CFLX24	3/4	3/4	2 1/4	5
CGLX32	CFLX32	1	1	2 1/4	5

1 per tube

* item will be discontinued, after stock has depleted.
We recommend L9267X Genac End Mill Four Flute long as substitution item for L9265X.

* List No.9275X

SG Carbide HELIX N

Two Flute, Ball Nose
Long, Single End

SG COATED CARBIDE

* List No.9277X

SG Carbide HELIX N

Four Flute, Ball Nose
Long, Single End

SG COATED CARBIDE

L9275X	L9277X	Dia. of Mill	Shank Dia.	Length of Cut	Overall Length
CRGLX4	CRFLX4	1/8	1/8	3/4	2 1/4
CRGLX6	CRFLX6	3/16	3/16	3/4	2 1/2
CRGLX8	CRFLX8	1/4	1/4	1 1/8	3
CRGLX10	CRFLX10	5/16	5/16	1 1/8	3
CRGLX12	CRFLX12	3/8	3/8	1 1/8	3
CRGLX14	CRFLX14	7/16	7/16	2	4 1/2
CRGLX16	CRFLX16	1/2	1/2	2	4 1/2
CRGLX20	CRFLX20	5/8	5/8	2 1/4	5
CRGLX24	CRFLX24	3/4	3/4	2 1/4	5
CRGLX32	CRFLX32	1	1	2 1/4	5

1 per tube

* item will be discontinued, after stock has depleted.
We recommend L9340 Geo ball (Metric size) as substitution item for L9275X.
We recommend L9340 Geo ball (Metric size) as substitution item for L9277X.

ROUGHING AND FINISHING (HEAVY DUTY) END MILLS

List No.6367

HSS Co · HELIX N

Surface Treat

8% COBALT HSS

List No.6367X

SG · HSS Co · HELIX N

8% COBALT "SG" COATED

L6367	L6367X	Diameter of Mill	Shank Diameter	Length of Cut	Number of Flutes	Overall Length
PK8-2	PKX8-2	1/4	3/8	5/8	4	2 7/16
PK10-2	PKX10-2	5/16	3/8	3/4	4	2 1/2
PK12-2	PKX12-2	3/8	3/8	3/4	4	2 1/2
PK16-3	PKX16-3	1/2	1/2	1 1/4	4	3 1/4
PK16-3A		1/2	1/2	2	4	4
PK20-4	PKX20-4	5/8	5/8	1 5/8	4	3 3/4
PK20-4A		5/8	5/8	2 1/2	4	4 5/8
PK24-4		3/4	5/8	1 5/8	4	3 3/4
PK24-5	PKX24-5	3/4	3/4	1 5/8	4	3 7/8
PK24-5A		3/4	3/4	3	4	5 1/4
PK28-5		7/8	3/4	1 7/8	4	4 1/8
PK28-6	PKX28-6	7/8	7/8	1 7/8	4	4 1/8
PK28-6A		7/8	7/8	3 1/2	4	5 3/4
PK32-5	PKX32-5	1	3/4	2	6	4 1/2
PK32-7	PKX32-7	1	1	2	6	4 1/2
PK32-7A	PKX32-7A	1	1	4	6	6 1/2
PK36-7		1 1/8	1	2	6	4 1/2
PK40-5		1 1/4	3/4	2	6	4 1/2
PK40-5A		1 1/4	3/4	4	6	6 1/2
PK40-8	PKX40-8	1 1/4	1 1/4	2	6	4 1/2
PK40-8A	PKX40-8A	1 1/4	1 1/4	4	6	6 1/2
PK48-5		1 1/2	3/4	2	6	4 1/2
PK48-5A		1 1/2	3/4	4	6	6 1/2
PK48-8	PKX48-8	1 1/2	1 1/4	2	6	4 1/2
PK48-8A	PKX48-8A	1 1/2	1 1/4	4	6	6 1/2
PK56-8	PKX56-8	1 3/4	1 1/4	2	6	4 1/2
PK56-8A		1 3/4	1 1/4	4	6	6 1/2
PK64-8	PKX64-8	2	1 1/4	2	8	4 1/2
PK64-8A		2	1 1/4	4	8	6 1/2
PK64-11	PKX64-11	2	2	4	8	7 3/4
PK64-11A		2	2	6	8	9 3/4
PK64-11B		2	2	8	8	11 3/4
PK80-11		2 1/2	2	4	8	7 3/4
PK80-11A		2 1/2	2	6	8	9 3/4
PK80-11B		2 1/2	2	8	8	11 3/4
PK80-11C		2 1/2	2	10	8	13 3/4
PK96-12		3	2 1/2	4	10	7 3/4
PK96-12A		3	2 1/2	6	10	9 3/4
PK96-12B		3	2 1/2	8	10	11 3/4
PK96-12C		3	2 1/2	10	10	13 3/4
PK96-12D		3	2 1/2	12	10	15 3/4

Shanks 2" And Larger Have Combination Drive

8 And 10 Flutes Are Not Center Cutting

1 per tube

ROUGHING (HOG) END MILLS

List No.6303

HSS Co · HELIX N

Bright Finish

8% COBALT HSS

List No.6303X

SG · HSS Co · HELIX N

8% COBALT "SG" COATED

L6303	L6303X	Diameter of Mill	Shank Diameter	Length of Cut	Number of Flutes	Overall Length
PQ8-2	PQX8-2	1/4	3/8	5/8	4	2 7/16
PQ8-2A		1/4	3/8	1 1/4	4	3 1/16
PQ10-2	PQX10-2	5/16	3/8	3/4	4	2 1/2
PQ10-2A		5/16	3/8	1 3/8	4	3 1/8
PQ12-2	PQX12-2	3/8	3/8	3/4	4	2 1/2
PQ12-2A		3/8	3/8	1 1/2	4	3 1/4
PQ16-3	PQX16-3	1/2	1/2	1 1/4	4	3 1/4
PQ16-3A	PQX16-3A	1/2	1/2	2	4	4
PQ20-4	PQX20-4	5/8	5/8	1 5/8	4	3 3/4
PQ20-4A	PQX20-4A	5/8	5/8	2 1/2	4	4 5/8
PQ24-4		3/4	5/8	1 5/8	4	3 7/8
PQ24-4A		3/4	5/8	3	4	5 1/4
PQ24-5	PQX24-5	3/4	3/4	1 5/8	4	3 7/8
PQ24-5A	PQX24-5A	3/4	3/4	3	4	5 1/4
PQ28-5	PQX28-5	7/8	3/4	1 7/8	5	4 1/8
PQ28-5A		7/8	3/4	3 1/2	5	5 3/4
PQ28-6	PQX28-6	7/8	7/8	1 7/8	5	4 1/8
PQ28-6A		7/8	7/8	3 1/2	5	5 3/4
PQ32-5	PQX32-5	1	3/4	2	5	4 1/4
PQ32-5A		1	3/4	1	5	3 1/4
PQ32-7	PQX32-7	1	1	2	5	4 1/2
PQ32-7A	PQX32-7A	1	1	4	5	6 1/2
PQ32-7B	PQX32-7B	1	1	3	5	5 1/2
PQ36-7		1 1/8	1	2	5	4 1/2
PQ40-5		1 1/4	3/4	2	6	4 1/2
PQ40-5A		1 1/4	3/4	4	6	6 1/2
PQ40-8	PQX40-8	1 1/4	1 1/4	2	6	4 1/2
PQ40-8A	PQX40-8A	1 1/4	1 1/4	4	6	6 1/2
PQ40-8B	PQX40-8B	1 1/4	1 1/4	3	6	5 1/2
PQ48-5		1 1/2	3/4	2	6	4 1/2
PQ48-5A		1 1/2	3/4	4	6	6 1/2
PQ48-8	PQX48-8	1 1/2	1 1/4	2	6	4 1/2
PQ48-8A	PQX48-8A	1 1/2	1 1/4	4	6	6 1/2
PQ48-8B	PQX48-8B	1 1/2	1 1/4	3	6	5 1/2
PQ56-5		1 3/4	3/4	2	6	4 1/2
PQ56-5A		1 3/4	3/4	4	6	6 1/2
PQ56-8	PQX56-8	1 3/4	1 1/4	2	6	4 1/2
PQ56-8A	PQX56-8A	1 3/4	1 1/4	4	6	6 1/2
PQ56-8B	PQX56-8B	1 3/4	1 1/4	3	6	5 1/2
PQ64-8	PQX64-8	2	1 1/4	2	8	4 1/2
PQ64-8A		2	1 1/4	4	8	6 1/2
PQ64-8B		2	1 1/4	3	8	5 1/2
PQ64-11	PQX64-11	2	2	4	8	7 3/4
PQ64-11A	PQX64-11A	2	2	6	8	9 3/4
PQ64-11B		2	2	8	8	11 3/4
PQ64-11C	PQX64-11C	2	2	3	8	6 3/4

Shanks 2" And Larger Have Combination Drive

All Sizes Are Not Center Cutting

1 per tube

ROUGHING (HOG) END MILLS

List No.6307

HSS Co | HELIX N

Fine Pitch Multi Flute
Non-Center Cutting

8% COBALT HIGH SPEED STEEL

L.6307	Dia. of Mill	Shank Diameter	Length of Cut	Number of Flutes	Overall Length
PQF8-2	1/4	3/8	5/8	3	2 7/16
PQF8-2A	1/4	3/8	1 1/4	3	3 1/16
PQF10-2	5/16	3/8	3/4	3	2 1/2
PQF10-2A	5/16	3/8	1 3/8	3	3 1/8
PQF12-2	3/8	3/8	3/4	3	2 1/2
PQF12-2A	3/8	3/8	1 1/2	3	3 1/4
PQF16-3	1/2	1/2	1 1/4	4	3 1/4
PQF16-3A	1/2	1/2	2	4	4
PQF20-4	5/8	5/8	1 5/8	4	3 3/4
PQF20-4A	5/8	5/8	2 1/2	4	4 5/8
PQF24-4	3/4	5/8	1 5/8	4	3 7/8
PQF24-5	3/4	3/4	1 5/8	4	3 7/8
PQF28-5	7/8	3/4	1 7/8	5	4 1/8
PQF28-6	7/8	7/8	1 7/8	5	4 1/8
PQF32-5	1	3/4	2	5	4 1/4
PQF32-7	1	1	2	5	4 1/2
PQF32-7A	1	1	4	5	6 1/2
PQF32-7B	1	1	3	5	5 1/2
PQF36-7	1 1/8	1	2	5	4 1/2
PQF40-8	1 1/4	1 1/4	2	6	4 1/2
PQF40-8A	1 1/4	1 1/4	4	6	6 1/2
PQF40-8B	1 1/4	1 1/4	3	6	5 1/2
PQF48-8	1 1/2	1 1/4	2	6	4 1/2
PQF48-8A	1 1/2	1 1/4	4	6	6 1/2
PQF48-8B	1 1/2	1 1/4	3	6	5 1/2
PQF56-8	1 3/4	1 1/4	2	6	4 1/2
PQF64-8	2	1 1/4	2	6	4 1/2
PQF64-8A	2	1 1/4	4	6	6 1/2
PQF64-11	2	2	4	6	7 3/4
PQF64-11A	2	2	6	6	9 3/4

Shanks 2” And Larger Have Combination Drive

1 per tube

TWO FLUTE END MILLS / REGULAR-SINGLE END

List No.231

HSS HELIX N

HIGH SPEED STEEL

List No.6231

HSS Co HELIX N

8% COBALT HIGH SPEED STEEL

List No.6231X

SG HSS Co HELIX N

8% COBALT HIGH SPEED STEEL SG COATED

L231	L6231	L6231X	Dia. of Mill	Shank Diameter	Length of Cut	Overall Length
G4	PG4	PGX4	1/8	3/8	3/8	2 5/16
G5	PG5		5/32	3/8	3/8	2 5/16
G6	PG6	PGX6	3/16	3/8	7/16	2 5/16
G7	PG7		7/32	3/8	7/16	2 5/16
G8	PG8	PGX8	1/4	3/8	1/2	2 5/16
G9	PG9		9/32	3/8	1/2	2 5/16
G10	PG10	PGX10	5/16	3/8	9/16	2 5/16
G11	PG11		11/32	3/8	9/16	2 5/16
G12	PG12	PGX12	3/8	3/8	9/16	2 5/16
G13	PG13		13/32	3/8	13/16	2 1/2
G14	PG14	PGX14	7/16	3/8	13/16	2 1/2
G15	PG15		15/32	3/8	13/16	2 1/2
G16	PG16	PGX16	1/2	1/2	1	3
G16X	PG16X		1/2	3/8	13/16	2 1/2
G17	PG17		17/32	1/2	1 1/8	3 1/8
G18	PG18	PGX18	9/16	1/2	1 1/8	3 1/8
G20	PG20	PGX20	5/8	5/8	1 5/16	3 7/16
G20X	PG20X		5/8	1/2	1 1/8	3 1/8
G22	PG22	PGX22	11/16	5/8	1 5/16	3 7/16
G22X	PG22X		11/16	1/2	1 5/16	3 5/16
G24	PG24	PGX24	3/4	5/8	1 5/16	3 7/16
G24X	PG24X		3/4	1/2	1 5/16	3 5/16
G24Y	PG24Y	PGX24Y	3/4	3/4	1 5/16	3 9/16
G26	PG26		13/16	5/8	1 1/2	3 5/8
G26Y			13/16	3/4	1 1/2	3 3/4
G28	PG28	PGX28	7/8	7/8	1 1/2	3 3/4
G28A			7/8	1/2	1 1/2	3 1/2
G28X	PG28X		7/8	5/8	1 1/2	3 5/8
G28Y	PG28Y	PGX28Y	7/8	3/4	1 1/2	3 3/4
G30	PG30		15/16	5/8	1 1/2	3 5/8
G30X			15/16	7/8	1 1/2	3 3/4
G30Y			15/16	3/4	1 1/2	3 3/4
G32	PG32	PGX32	1	1	1 5/8	4 1/8
G32A			1	1/2	1 1/2	3 1/2
G32W	PG32W	PGX32W	1	3/4	1 1/2	3 3/4
G32X	PG32X		1	5/8	1 1/2	3 5/8
G32Y	PG32Y		1	7/8	1 1/2	3 3/4
G36	PG36	PGX36	1 1/8	1	1 5/8	4 1/8
G36W	PG36W		1 1/8	3/4	1 5/8	3 7/8
G36X	PG36X		1 1/8	7/8	1 5/8	3 7/8
G40	PG40		1 1/4	1	1 5/8	4 1/8
G40W	PG40W		1 1/4	3/4	1 5/8	3 7/8
G40X	PG40X		1 1/4	7/8	1 5/8	3 7/8
G40Y	PG40Y	PGX40Y	1 1/4	1 1/4	1 5/8	4 1/8
G44	PG44		1 3/8	1	1 5/8	4 1/8
G44W	PG44W		1 3/8	3/4	1 5/8	3 7/8
G48	PG48		1 1/2	1	1 5/8	4 1/8
G48W	PG48W		1 1/2	3/4	1 5/8	3 7/8
G48X	PG48X	PGX48X	1 1/2	1 1/4	1 5/8	4 1/8
G52			1 5/8	1 1/4	1 5/8	4 1/8
G52W			1 5/8	3/4	1 1/2	3 7/8
G56	PG56		1 3/4	1 1/4	1 5/8	4 1/8
G56W			1 3/4	3/4	1 1/2	3 7/8
G60			1 7/8	1 1/4	1 5/8	4 1/8
G64	PG64		2	1 1/4	1 5/8	4 1/8
G64A			2	1 1/4	2 1/2	5
G64W			2	3/4	1 1/2	3 7/8
G64X			2	2	4	7 3/4
G80-4			2 1/2	2	4	7 5/8
G80-6			2 1/2	2	6	9 5/8

Shanks 2" And Larger Have Combination Drive

1 per tube

TWO FLUTE END MILLS / LONG, SINGLE END

List No.6233

HSS Co | HELIX N

8% COBALT HIGH SPEED STEEL

L6233	Diameter of Mill	Shank Diameter	Length of Cut	Overall Length
PGE8	1/4	3/8	1	3 1/16
PGE10	5/16	3/8	1 1/4	3 5/16
PGE12	3/8	3/8	1 1/2	3 1/4
PGE12A	3/8	3/8	1	2 3/4
PGE16	1/2	1/2	2	4
PGE16A	1/2	1/2	1 1/2	3 1/2
PGE16C	1/2	1/2	3	5
PGE20A	5/8	5/8	2	4 1/8
PGE24C	3/4	3/4	2 1/4	4 1/2
PGE28B	7/8	7/8	2 1/2	4 3/4
PGE32C	1	1	3	5 1/2
PGE36C	1 1/8	1	3	5 1/2
PGE40A	1 1/4	1 1/4	3	5 1/2
PGE48	1 1/2	1 1/4	3	5 1/2
PGE56	1 3/4	1 1/4	3	5 1/2
PGE64	2	1 1/4	3	5 1/2

1 per tube

TWO FLUTE DOUBLE END MILLS

List No.261

HSS HELIX N

HIGH SPEED STEEL

L261	Diameter of Mill	Shank Diameter	Length of Cut	Overall Length
C4	1/8	3/8	3/8	3 1/16
C5	5/32	3/8	7/16	3 1/8
C6	3/16	3/8	7/16	3 1/8
C7	7/32	3/8	1/2	3 1/8
C8	1/4	3/8	1/2	3 1/8
C9	9/32	3/8	9/16	3 1/8
C10	5/16	3/8	9/16	3 1/8
C11	11/32	3/8	9/16	3 1/8
C12	3/8	3/8	9/16	3 1/8
C13	13/32	1/2	13/16	3 3/4
C14	7/16	1/2	13/16	3 3/4
C15	15/32	1/2	13/16	3 3/4
C16	1/2	1/2	13/16	3 3/4
C18	9/16	5/8	1 1/8	4 1/2
C20	5/8	5/8	1 1/8	4 1/2
C22	11/16	3/4	1 5/16	5
C24	3/4	3/4	1 5/16	5
C26	13/16	7/8	1 9/16	5 1/2
C28	7/8	7/8	1 9/16	5 1/2
C30	15/16	1	1 5/8	5 7/8
C32	1	1	1 5/8	5 7/8

1 per tube

METRIC SIZES, REGULAR, SINGLE END

List No.6230

HSS Co HELIX N

Two Flute End Mill

8% COBALT HIGH SPEED STEEL

List No.6210

HSS Co HELIX N

Four Flute Center Cutting

8% COBALT HIGH SPEED STEEL

(Unit) : mm

L6230	L6210	Diameter of Mill	Shank Diameter	Length of Cut	Overall Length
MPG1.0		1.0	6.0	2.0	50.0
MPG1.5		1.5	6.0	3.0	50.0
MPG2.0		2.0	6.0	7.0	50.0
MPG2.5	MPF2.5	2.5	6.0	7.0	50.0
MPG3.0	MPF3.0	3.0	6.0	9.0	50.0
MPG3.5	MPF3.5	3.5	8.0	12.0	60.0
MPG4.0	MPF4.0	4.0	8.0	12.0	60.0
MPG4.5	MPF4.5	4.5	8.0	15.0	60.0
MPG5.0	MPF5.0	5.0	8.0	15.0	60.0
MPG5.5	MPF5.5	5.5	8.0	15.0	60.0
MPG6.0	MPF6.0	6.0	8.0	15.0	60.0
MPG6.5	MPF6.5	6.5	10.0	20.0	65.0
MPG7.0	MPF7.0	7.0	10.0	20.0	65.0
MPG7.5	MPF7.5	7.5	10.0	20.0	65.0
MPG8.0	MPF8.0	8.0	10.0	20.0	65.0
MPG8.5	MPF8.5	8.5	10.0	25.0	75.0
MPG9.0	MPF9.0	9.0	10.0	25.0	75.0
MPG9.5	MPF9.5	9.5	10.0	25.0	75.0
MPG10	MPF10	10.0	10.0	25.0	75.0
✻ MPG11	MPF11	11.0	12.0	30.0	80.0
MPG12	MPF12	12.0	12.0	30.0	80.0
MPG13	MPF13	13.0	16.0	35.0	90.0
MPG14	MPF14	14.0	16.0	35.0	90.0
MPG15	MPF15	15.0	16.0	40.0	95.0
MPG16	MPF16	16.0	16.0	40.0	95.0
MPG17	MPF17	17.0	20.0	40.0	105.0
✻ MPG18	MPF18	18.0	20.0	40.0	105.0
MPG19	MPF19	19.0	20.0	45.0	110.0
MPG20	MPF20	20.0	20.0	45.0	110.0
✻ MPG21	✻ MPF21	21.0	20.0	45.0	110.0
✻ MPG22	✻ MPF22	22.0	20.0	45.0	110.0
✻ MPG23	✻ MPF23	23.0	25.0	50.0	120.0
MPG24	MPF24	24.0	25.0	50.0	120.0
MPG25	✻ MPF25	25.0	25.0	50.0	120.0
MPG26	MPF26	26.0	25.0	50.0	120.0
✻ MPG27	✻ MPF27	27.0	25.0	55.0	125.0
✻ MPG28	MPF28	28.0	25.0	55.0	125.0
✻ MPG29	✻ MPF29	29.0	25.0	55.0	125.0
MPG30	MPF30	30.0	25.0	55.0	125.0
✻ MPG31	✻ MPF31	31.0	32.0	60.0	145.0
✻ MPG32	✻ MPF32	32.0	32.0	60.0	145.0
✻ MPG33	✻ MPF33	33.0	32.0	60.0	145.0
✻ MPG34	✻ MPF34	34.0	32.0	60.0	145.0
✻ MPG35	✻ MPF35	35.0	32.0	60.0	145.0
✻ MPG36	✻ MPF36	36.0	32.0	60.0	145.0
✻ MPG37	✻ MPF37	37.0	32.0	65.0	150.0
✻ MPG38	✻ MPF38	38.0	32.0	65.0	150.0
✻ MPG39	✻ MPF39	39.0	32.0	65.0	150.0
✻ MPG40	✻ MPF40	40.0	32.0	65.0	150.0
✻ MPG42	✻ MPF42	42.0	32.0	65.0	150.0
✻ MPG45	✻ MPF45	45.0	32.0	70.0	155.0
✻ MPG48	✻ MPF48	48.0	32.0	70.0	155.0
✻ MPG50	✻ MPF50	50.0	32.0	70.0	155.0

✻ JAPAN STOCK ITEM : Please allow 2-3 weeks delivery

1 per tube

MULTI FLUTE END MILLS / REGULAR SINGLE END CENTER CUTTING

List No.211

HSS HELIX N

HIGH SPEED STEEL

List No.6211X

SG HSS Co HELIX N

8% COBALT "SG" COATED

List No.6211M

HSS Co HELIX N

8% COBALT HIGH SPEED STEEL

L211	L6211M	L6211X	Diameter of Mill	Shank Diameter	Length of Cut	Number of Flutes	Overall Length
FC4	PFC4	PFCX4	1/8	3/8	3/8	4	2 5/16
FC6	PFC6	PFCX6	3/16	3/8	1/2	4	2 3/8
FC8	PFC8	PFCX8	1/4	3/8	5/8	4	2 7/16
FC10	PFC10	PFCX10	5/16	3/8	3/4	4	2 1/2
FC12	PFC12	PFCX12	3/8	3/8	3/4	4	2 1/2
FC16	PFC16	PFCX16	1/2	1/2	1 1/4	4	3 1/4
	PFC16A	PFCX16A	1/2	1/2	1 1/4	6	3 1/4
FC20	PFC20	PFCX20	5/8	5/8	1 5/8	4	3 3/4
	PFC20A	PFCX20A	5/8	5/8	1 5/8	6	3 3/4
FC22			11/16	5/8	1 5/8	4	3 3/4
FC24	PFC24	PFCX24	3/4	3/4	1 5/8	4	3 7/8
	PFC24A	PFCX24A	3/4	3/4	1 5/8	6	3 7/8
FC28	PFC28	PFCX28	7/8	7/8	1 7/8	4	4 1/8
	PFC28A	PFCX28A	7/8	7/8	1 7/8	6	4 1/8
FC32	PFC32	PFCX32	1	1	2	4	4 1/2
	PFC32A	PFCX32A	1	1	2	6	4 1/2
FC36	PFC36	PFCX36	1 1/8	1	2	4	4 1/2
	PFC36A	PFCX36A	1 1/8	1	2	6	4 1/2
FC40	PFC40	PFCX40	1 1/4	1 1/4	2	4	4 1/2
	PFC40A	PFCX40A	1 1/4	1 1/4	2	6	4 1/2
FC48	PFC48	PFCX48	1 1/2	1 1/4	2	4	4 1/2
	PFC48A	PFCX48A	1 1/2	1 1/4	2	6	4 1/2
FC56			1 3/4	1 1/4	2	4	4 1/2
FC64			2	1 1/4	2	4	4 1/2
	PFC64		2	1 1/4	2	6	4 1/2
	PFC64A		2	1 1/4	4	6	6 1/2

1 per tube

MULTI FLUTE END MILLS / LONG SINGLE END, CENTER CUTTING

List No.213

HSS HELIX N

Long, Single End

HIGH SPEED STEEL

List No.6213

HSS Co HELIX N

Long, Single End

8% COBALT HIGH SPEED STEEL

L213	L6213	Diameter of Mill	Shank Diameter	Length of Cut	No. of Flutes	Overall Length
FLC8	PFLC8	1/4	3/8	1 1/4	4	3 1/16
FLC10	PFLC10	5/16	3/8	1 3/8	4	3 1/8
FLC12	PFLC12	3/8	3/8	1 1/2	4	3 1/4
FLC16	PFLC16	1/2	1/2	2	4	4
FLC20	PFLC20	5/8	5/8	2 1/2	4	4 5/8
FLC24	PFLC24	3/4	3/4	3	4	5 1/4
FLC28	PFLC28	7/8	7/8	3 1/2	4	5 3/4
FLC32	PFLC32	1	1	4	4	6 1/2
FLC40	PFLC40	1 1/4	1 1/4	4	4	6 1/2
FLC48		1 1/2	1 1/4	4	4	6 1/2
FLC56		1 3/4	1 1/4	4	4	6 1/2
FLC64		2	1 1/4	4	4	6 1/2

1 per tube

FOUR FLUTE END MILLS / EXTRA LONG SINGLE END, CENTER CUTTING

List No.215

HSS Co | HELIX N

Extra Long, Single End

HIGH SPEED STEEL

L215	Diameter of Mill	Shank Diameter	Length of Cut	Number of Flutes	Overall Length
FXC8	1/4	3/8	1 3/4	4	3 9/16
FXC10	5/16	3/8	2	4	3 3/4
FXC12	3/8	3/8	2 1/2	4	4 1/4
FXC16	1/2	1/2	3	4	5
FXC20	5/8	5/8	4	4	6 1/8
FXC24	3/4	3/4	4	4	6 1/4
FXC28	7/8	7/8	5	4	7 1/4
FXC32	1	1	6	4	8 1/2
FXC40	1 1/4	1 1/4	6	4	8 1/2

1 per tube

FOUR FLUTE, DOUBLE END END MILLS

List No.271

HSS HELIX N

Center Cutting
Four Flute/Double End

HIGH SPEED STEEL

L271	L6271	Diameter of Mill	Shank Mill	Length of Cut	Number of Flutes	Overall Length
BC4	PBC4	1/8	3/8	3/8	4	3 1/16
BC6	PBC6	3/16	3/8	1/2	4	3 1/4
BC8	PBC8	1/4	3/8	5/8	4	3 3/8
BC10	PBC10	5/16	3/8	3/4	4	3 1/2
BC12	PBC12	3/8	3/8	3/4	4	3 1/2
BC16	PBC16	1/2	1/2	1	4	4 1/8
BC20	PBC20	5/8	5/8	1 3/8	4	5
BC24	PBC24	3/4	3/4	1 5/8	4	5 5/8
BC28	PBC28	7/8	7/8	1 7/8	4	6 1/8
BC32	PBC32	1	1	1 7/8	4	6 3/8

1 per tube

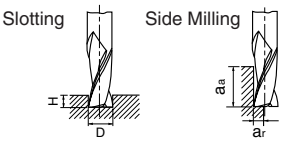
STANDARD MILLING CONDITION

GS-Mill 2 Flute List No. 9382

Work Material / Milling Conditions / Dia. of Mill (mm)		Structural Steels Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HRC		Hardened Steels 35~45HRC		Hardened Steels 45~55HRC		Stainless Steels		Titanium Alloys Ti-6Al-4V		Nickel Alloys Inconel718	
		230 - 280 SFM		215 - 270 SFM		150 - 185 SFM		110 - 135 SFM		110 - 135 SFM		85 - 100 SFM		70 - 85 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
2		11,200	13.4	10,500	9.4	7,300	5.1	5,300	3.1	5,300	3.5	4,100	2.8	3,300	2.0
4		6,400	18.1	6,000	12.6	4,200	7.1	3,000	4.3	3,000	5.1	2,300	3.5	1,900	2.8
6		4,600	21.7	4,300	15.4	3,000	8.3	2,200	5.1	2,200	5.9	1,600	3.9	1,400	3.1
8		3,400	21.7	3,200	15.4	2,200	8.3	1,600	5.1	1,600	5.9	1,200	3.9	1,000	3.1
10		2,800	22.0	2,600	15.4	1,800	8.3	1,300	5.1	1,300	5.9	960	3.9	800	3.1
12		2,300	22.0	2,200	15.7	1,500	8.3	1,100	5.1	1,100	5.9	800	3.9	700	3.1
Depth of Cut	a_a	1.5D						1.0D		1.5D		1.0D			
	a_r	0.1D				0.05D		0.02D		0.1D		0.05D			
	H	0.5D				0.3D		0.05D		0.5D		0.05D			

1) When slotting in Stainless Steels, reduce the RPM 40%, and the feed rate 60% of table values.
2) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
3) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill



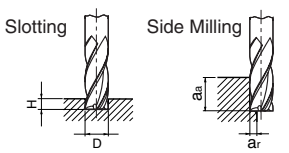
GS-Mill 4 Flute List No. 9384

Conventional Condition

Work Material / Milling Conditions / Dia. of Mill (mm)		Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HRC		Hardened Steels 35~45HRC		Hardened Steels 45~55HRC		Stainless Steels		Titanium Alloys Ti-6Al-4V		Nickel Alloys Inconel718	
		230 - 280 SFM		215 - 270 SFM		150 - 185 SFM		110 - 135 SFM		110 - 135 SFM		85 - 100 SFM		70 - 85 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
2		12,800	22.4	12,000	15.0	8,300	9.1	6,000	5.9	6,000	5.1	4,100	3.1	3,700	2.8
4		6,800	28.7	6,400	19.3	4,400	11.8	3,200	7.9	3,200	6.7	2,100	3.9	2,000	3.5
6		4,600	30.3	4,300	20.5	3,000	12.6	2,200	8.3	2,200	7.1	1,400	3.9	1,400	3.9
8		3,400	30.3	3,200	20.5	2,200	12.6	1,600	8.3	1,600	7.1	1,100	4.3	1,000	3.9
10		2,800	30.7	2,600	20.5	1,800	12.6	1,300	8.3	1,300	7.1	900	4.7	800	3.9
12		2,300	30.7	2,200	20.9	1,500	12.6	1,100	8.3	1,100	7.1	700	3.9	700	3.9
Depth of Cut	a_a	1.5D						1.0D		1.5D		1.0D			
	a_r	0.1D				0.05D		0.02D		0.1D		0.05D			
	H	0.5D				0.2D		0.05D		0.3D		0.1D			

1) When slotting in Stainless Steels, reduce the RPM 40%, and the feed rate 60% of table values.
2) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
3) Adjust milling condition when unusual vibration or sound occurs.

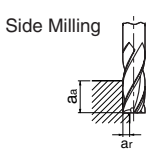
D:Dia. of Mill



High Speed Condition

Work Material / Milling Conditions / Dia. of Mill (mm)		Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HRC		Hardened Steels 35~45HRC		Hardened Steels 45~55HRC		Stainless Steels	
		985 - 990 SFM		985 - 990 SFM		820 - 830 SFM		645 - 655 SFM		325 - 335 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
2		47,800	86.6	47,800	63.0	39,800	47.2	31,800	35.4	15,900	15.7
4		23,900	102.4	23,900	74.8	19,900	55.1	15,900	43.3	8,000	19.3
6		16,000	106.3	16,000	78.7	13,300	59.1	10,600	47.2	5,300	20.1
8		12,000	106.3	12,000	78.7	10,000	59.1	8,000	47.2	4,000	20.5
10		9,600	106.3	9,600	78.7	8,000	59.1	6,400	47.2	3,200	20.5
12		8,000	106.3	8,000	78.7	6,700	59.1	5,300	47.2	2,700	20.5
Depth of Cut	a_a	1.5D						1.0D		1.5D	
	a_r	0.05D						0.02D		0.05D	

1) When slotting in Stainless Steels, reduce the RPM 40%, and the feed rate 60% of table values.
2) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
3) Adjust milling condition when unusual vibration or sound occurs.

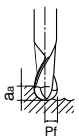


GS-Mill Ball List No. 9386

Conventional Condition

Work Material / Milling Conditions / Ball Radius (mm)		Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HRC		Hardened Steels 35~45HRC		Hardened Steels 45~55HRC		Stainless Steels		Titanium Alloys Ti-6Al-4V		Nickel Alloys Inconel718	
		395 - 495 SFM		265 - 330 SFM		210 - 270 SFM		180 - 235 SFM		180 - 235 SFM		130 - 175 SFM		130 - 175 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R1		19,100	30.3	12,800	14.6	10,200	10.6	8,900	7.5	8,900	8.3	6,400	6.3	6,400	4.7
R2		10,800	43.3	7,200	21.7	5,700	15.7	5,000	11.0	5,000	12.2	3,600	8.3	3,600	7.1
R3		7,700	51.2	5,200	26.0	4,100	18.9	3,600	13.0	3,600	15.0	2,600	9.1	2,600	8.3
R4		6,000	55.1	4,000	27.6	3,200	20.1	2,800	14.2	2,800	15.7	2,000	9.8	2,000	9.1
R5		4,800	55.1	3,200	27.6	2,600	20.5	2,300	14.6	2,300	16.1	1,600	9.8	1,600	9.1
R6		4,000	55.1	2,700	28.0	2,200	20.9	1,900	14.6	1,900	16.1	1,400	9.4	1,400	9.4
Depth of Cut	a_a	0.1D				0.05D				0.1D		0.05D		0.05D	
	Pf	0.2D				0.1D				0.2D		0.1D		0.1D	

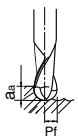
1) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
2) Adjust milling condition when unusual vibration or sound occurs.



High Speed Condition

Work Material / Milling Conditions / Ball Radius (mm)		Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HRC		Hardened Steels 35~45HRC		Hardened Steels 45~55HRC		Stainless Steels	
		1000 - 1050 SFM		820 - 830 SFM		730 - 740 SFM		485 - 495 SFM		735 - 745 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R1		51,000	82.7	39,800	51.2	35,700	37.8	23,700	25.2	35,700	37.8
R2		25,500	106.3	19,900	66.9	17,900	51.2	11,900	32.7	17,900	51.2
R3		17,000	118.1	13,300	74.8	11,900	55.1	7,900	36.2	11,900	55.1
R4		12,800	122.0	10,000	78.7	9,000	59.1	6,000	37.8	9,000	59.1
R5		10,200	122.0	8,000	78.7	7,200	59.1	4,800	37.8	7,200	59.1
R6		8,500	122.0	6,700	78.7	6,000	59.1	4,000	37.8	6,000	59.1
Depth of Cut	a_a	0.05D						0.02D		0.05D	
	Pf	0.1D						0.05D		0.1D	

1) When using low RPM machines, use the maximum RPM and adjust the feed rate.
2) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
3) Adjust milling condition when unusual vibration or sound occurs.



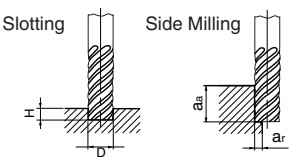
GS Mill Hard List No. 9398

Conventional Condition

Work Material / Milling Conditions / Dia. of Mill (mm)		Carbon Steels, Alloy Steels ~35HRC		Pre-Hardened Steels, Mold Steels 35~45HRC		Hardened Steels, H13 45~55HRC		Hardened Steels, D2 55~60HRC		Hardened Steels, M2 60~65HRC		Hardened Steels, M35, PM 65~70HRC	
		400 - 460 SFM		350 - 420 SFM		280 - 320 SFM		220 - 250 SFM		200 - 220 SFM		140 - 160 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1		20,000	21.3	20,000	15.4	15,600	10.2	12,300	6.3	11,100	5.5	7,800	3.7
2		19,000	43.3	17,200	30.3	13,400	20.9	10,500	12.6	9,500	10.6	6,700	7.5
3		15,000	84.6	13,400	60.6	10,400	41.3	8,200	25.6	7,400	21.3	5,200	15.0
4		11,200	94.5	10,000	68.5	7,800	46.5	6,100	28.7	5,600	23.6	3,900	16.5
5		9,000	106.3	8,000	76.0	6,200	51.2	4,900	31.9	4,400	26.4	3,100	18.5
6		7,500	106.3	6,700	76.0	5,200	51.2	4,100	31.9	3,700	26.4	2,600	18.5
8		5,600	106.3	5,000	76.0	3,900	51.2	3,050	31.9	2,800	26.4	1,950	18.5
10		4,500	106.3	4,000	76.0	3,100	51.2	2,450	31.9	2,200	26.4	1,550	18.5
12		3,750	106.3	3,350	76.0	2,600	51.2	2,050	31.9	1,850	26.4	1,300	18.5
16		2,800	98.4	2,500	70.9	1,950	48.0	1,530	29.9	1,400	24.8	980	17.3
20		2,250	82.7	2,000	60.6	1,550	41.3	1,230	25.6	1,100	21.3	780	15.0
Depth of Cut	a_a	1~1.5D											
	a_r	0.1D				0.05D				0.02D			
	H	0.1D				0.05D				~0.05D Max.0.5mm			

Adjust milling condition when unusual vibration or sound occurs.

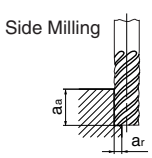
D:Dia. of Mill



High Speed Condition

Work Material / Milling Conditions / Dia. of Mill (mm)		Carbon Steels, Alloy Steels ~35HRC		Pre-Hardened Steels, Mold Steels 35~45HRC		Hardened Steels, H13 45~55HRC		Hardened Steels, D2 55~60HRC		Hardened Steels, M2 60~65HRC	
		800 - 1000 SFM		800 - 1000 SFM		800 - 1000 SFM		600 - 740 SFM		400 - 490 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1		48,000	49.2	48,000	49.2	48,000	49.2	48,000	36.6	38,000	27.6
2		48,000	112.2	48,000	112.2	48,000	112.2	36,000	63.0	24,000	39.4
3		32,000	192.9	32,000	192.9	32,000	192.9	24,000	107.9	16,000	66.9
4		24,000	204.7	24,000	204.7	24,000	204.7	18,000	114.2	12,000	70.9
5		19,200	228.3	19,200	228.3	19,200	228.3	14,300	126.0	9,600	78.7
6		16,000	228.3	16,000	228.3	16,000	228.3	12,000	126.0	8,000	78.7
8		12,000	228.3	12,000	228.3	12,000	228.3	9,000	126.0	6,000	78.7
10		9,600	228.3	9,600	228.3	9,600	228.3	7,200	126.0	4,800	78.7
12		8,000	228.3	8,000	228.3	8,000	228.3	6,000	126.0	4,000	78.7
16		6,000	212.6	6,000	212.6	6,000	212.6	4,500	118.1	3,000	74.8
20		4,800	181.1	4,800	181.1	4,800	181.1	3,600	101.6	2,400	63.0
Depth of Cut	a_a	1~1.5D									
	a_r	0.1D		0.05D				0.02D		0.01D	

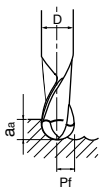
1) When using low RPM machines, use the maximum RPM and adjust the feed rate.
2) Recommend dry machining when high speed milling.
3) Adjust milling condition when unusual vibration or sound occurs.



GS Mill Hard Ball List No. 9422

Work Material / Milling Conditions / Ball Radius (mm)		Mold Steels, Pre-Hardened Steels (40 - 50 HRC)		Hardened Steels (50 - 55 HRC)		Hardened Steels (55 - 60 HRC)		Hardened Steels (60 - 65 HRC)	
		750 - 780 SFM		751 - 780 SFM		550 - 580 SFM		400 - 430 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R0.2		50,000	19.7	50,000	19.7	50,000	19.7	50,000	19.7
R0.3		50,000	31.5	50,000	31.5	50,000	31.5	50,000	27.6
R0.5		50,000	55.1	50,000	55.1	50,000	51.2	42,000	39.4
R0.75		50,000	78.7	50,000	78.7	37,300	55.1	28,000	39.4
R1		38,100	82.7	38,100	82.7	28,000	55.1	21,000	39.4
R1.25		30,500	82.7	30,500	82.7	22,400	55.1	16,800	39.4
R1.5		25,400	82.7	25,400	82.7	18,700	55.1	14,000	39.4
R2		19,100	82.7	19,100	82.7	14,000	55.1	10,500	39.4
R2.5		15,300	82.7	15,300	82.7	11,200	55.1	8,400	39.4
R3		12,700	82.7	12,700	82.7	9,300	55.1	7,000	39.4
R4		9,500	82.7	9,500	82.7	7,000	55.1	5,300	39.4
R5		7,600	82.7	7,600	82.7	5,600	55.1	4,200	39.4
R6		6,400	82.7	6,400	82.7	4,700	55.1	3,500	39.4
Depth of Cut	a_a	0.08D				0.05D			
	Pf	0.25D				0.15D			

D:Dia. of Mill
R:Ball Radius



1) Recommended oil mist process.
2) When depth of the cut is reduced, it can increase feed rate more.
3) When using machine with low RPM, use maximum speed and adjust the feed rate relatively.
4) Adjust milling condition when unusual vibration or sound occurs.

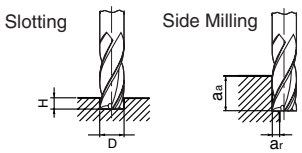
X's-mill Geo List No. 9321

Fractional

Work Material / Milling Conditions / Dia. of Mill (inch)		Structural Steels Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HRC		Hardened Steels 40~50HRC		Stainless Steels		Titanium Alloys Ti-6Al-4V		Nickel Alloys Inconel718	
		285 - 295 SFM		170 - 180 SFM		135 - 145 SFM		155 - 165 SFM		110 -115 SFM		75 - 85 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		9,000	31.5	5,500	17.5	4,500	13.5	5,000	12.5	3,500	6.3	2,500	4.5
3/16		6,000	35.0	3,600	18.0	3,000	14.5	3,200	14.5	2,240	6.3	1,600	4.5
1/4		4,500	37.0	2,700	19.5	2,200	15.0	2,500	19.0	1,750	6.7	1,250	4.8
5/16		3,600	39.0	2,200	24.0	1,800	15.5	2,000	20.0	1,400	7.7	1,000	5.5
3/8		3,000	39.0	1,800	24.0	1,500	15.5	1,600	21.0	1,120	8.7	800	6.2
7/16		2,500	38.0	1,500	22.0	1,200	15.0	1,400	20.5	980	8.4	700	6.0
1/2		2,200	35.0	1,300	20.0	1,100	14.5	1,200	17.5	840	7.7	600	5.5
5/8		1,800	25.0	1,100	17.5	900	11.5	1,000	15.5	700	6.3	500	4.5
3/4		1,500	20.0	900	13.0	750	10.5	800	11.5	560	5.5	400	3.9
1		1,100	19.0	650	11.5	550	9.5	600	11.0	420	5.2	300	3.7
Depth of Cut	a_a	1.5D											
	a_r	0.1D				0.05D		0.1D		0.05D			
	H	1D				0.2D		0.3D		0.2D			

1) When slotting in Stainless Steels, reduce the RPM 40%, and the feed rate 60% of table values.
2) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
3) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill



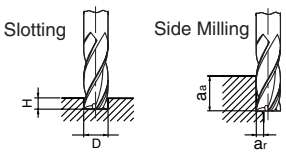
X's-mill Geo, X's-mill Geo Radius List No. 9322, 9324

Metric

Work Material / Milling Conditions / Dia. of Mill (mm)		Structural Steels Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HR		Hardened Steels 40~50HRC		Stainless Steels		Titanium Alloys Ti-6Al-4V		Nickel Alloys Inconel718	
		200 - 295 SFM		125 - 180 SFM		85 - 145 SFM		115 - 165 SFM		80 -115 SFM		55 - 85 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
2		9,900	28.3	6,000	16.9	4,000	12.6	5,500	12.6	3,900	7.1	2,600	4.7
4		6,600	31.5	4,500	17.7	3,000	15.0	4,000	15.0	2,500	5.9	2,000	4.7
6		4,800	37.8	3,000	18.9	2,500	15.0	3,000	15.0	1,800	7.1	1,200	4.7
8		3,600	39.4	2,200	24.0	2,000	15.7	2,000	15.7	1,200	6.7	1,000	5.5
10		2,800	39.4	1,800	24.0	1,500	15.7	1,700	15.7	1,100	8.7	800	6.3
12		2,400	37.4	1,500	21.7	1,200	15.0	1,500	15.0	930	7.5	700	5.5
14		2,200	34.6	1,300	19.3	1,000	14.2	1,200	14.2	800	7.1	600	5.1
16		1,800	25.6	1,100	16.5	800	11.8	1,000	11.8	700	6.7	500	4.7
18		1,600	22.8	1,000	14.2	750	10.6	900	10.6	620	6.3	450	4.3
20		1,400	19.7	900	13.0	700	9.8	820	9.8	560	5.5	400	3.9
Depth of Cut	a_a	1.5D											
	a_r	0.1D				0.05D		0.1D		0.05D			
	H	1D				0.2D		0.3D		0.2D			

1) When slotting in Stainless Steels, reduce the RPM 40%, and the feed rate 60% of table values.
2) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
3) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill



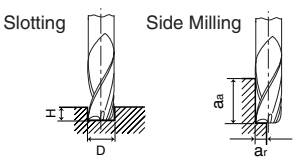
X's-mill Geo Slot List No. 9338

Side Milling & Slotting Condition

Work Material / Milling Conditions / Dia. of Mill (mm)		Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HRC		Hardened Steels 35~45HRC		Stainless Steels 304, 316		Titanium Alloys Ti-6Al-4V		Nickel Alloys Inconel718	
		185 - 300 SFM		125 - 185 SFM		85 - 155 SFM		115 - 185 SFM		80 - 115 SFM		55 - 85 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
2		9,000	21.3	6,000	12.6	4,000	9.4	5,500	9.4	3,900	5.5	2,600	3.5
4		6,600	23.6	4,500	13.4	3,000	11.0	4,000	9.4	2,500	4.7	2,000	3.5
6		4,800	28.3	3,000	14.2	2,500	11.0	3,000	14.2	1,800	5.5	1,200	3.5
8		3,600	29.5	2,200	18.1	2,000	11.8	2,000	15.4	1,200	4.7	1,000	3.9
10		2,800	29.5	1,800	18.1	1,500	11.8	1,700	16.1	1,100	6.7	800	4.7
12		2,400	28.0	1,500	16.1	1,200	11.0	1,500	15.0	930	5.5	700	3.9
14		2,200	26.0	1,300	14.6	1,000	10.6	1,200	12.6	800	5.1	600	3.7
16		1,800	19.3	1,100	12.6	800	9.1	1,000	10.6	700	5.1	500	3.5
Depth of Cut	a_a	1.5D											
	a_r	0.1D				0.05D		0.1D		0.05D		0.05D	
	H	1D				0.2D		0.3D		0.2D		0.2D	

1) When slotting in Stainless Steels, reduce the RPM 40%, and the feed rate 60% of table values.
2) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
3) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill



Plunging Condition

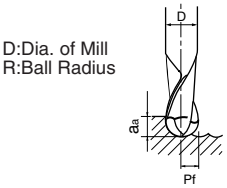
Work Material / Milling Conditions / Dia. of Mill (mm)	Carbon Steels Cast Irons 150~250HB		Alloy Steels Hardened Steels 25~35HRC		Hardened Steels 40~50HRC		Stainless Steels		Titanium Alloys Ti-6Al-4V		Nickel Alloys Inconel718	
	185 - 300 SFM		125 - 185 SFM		85 - 160 SFM		115 - 185 SFM		85 - 115 SFM		55 - 85 SFM	
	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
2	9,000	5.9	6,000	3.9	4,000	2.4	5,500	2.4	5,000	1.6	2,600	0.8
4	6,600	9.8	4,500	6.7	3,000	3.1	4,000	4.3	2,600	2.4	2,000	1.6
6	4,800	11.8	3,000	7.9	2,500	4.3	3,000	4.7	1,600	2.4	1,200	1.6
8	3,600	11.8	2,200	7.9	2,000	4.7	2,000	4.7	1,400	2.8	1,000	2.0
10	2,800	11.8	1,800	7.9	1,500	4.7	1,700	5.1	1,110	2.8	800	2.0
12	2,400	11.8	1,500	7.9	1,200	4.7	1,500	5.1	930	2.8	700	2.0
14	2,200	9.8	1,300	5.9	1,000	3.1	1,200	3.9	800	2.4	600	1.6
16	1,800	7.9	1,100	4.7	800	2.4	1,000	3.1	500	1.2	500	1.2

1) When slotting in Stainless Steels, reduce the RPM 40%, and the feed rate 60% of table values.
2) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
3) Adjust milling condition when unusual vibration or sound occurs.

Mold Meister Ball List No. 9408
X's-mill Geo Ball List No. 9340

Conventional Condition

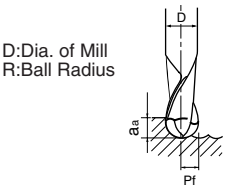
Work Material / Milling Conditions / Ball Radius (mm)		Carbon Steels Cast Irons		Alloy Steels Die Steels		Hardened Steels Pre-Hardened Steels 30~38 HRC		Stainless Steels Hardened Steels 38~45HRC		Hardened Steels 45~55HRC	
		330 - 340 SFM		310 - 320 SFM		260 - 270 SFM		225 - 230 SFM		195- 200 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R 0.5		32,000	32.3	31,000	24.4	25,000	17.3	22,000	13.0	19,000	9.4
R 1		16,000	36.2	15,000	26.8	13,000	20.1	11,000	15.0	9,600	11.0
R 2		8,000	39.4	7,600	29.9	6,400	22.0	5,600	16.9	4,800	12.2
R 3		5,300	39.4	5,100	30.3	4,200	21.7	3,700	16.5	3,200	12.2
R 5		3,200	39.4	3,100	30.7	2,500	21.7	2,200	16.5	1,900	11.8
R 8		2,000	36.2	1,900	26.8	1,600	20.1	1,400	15.0	1,200	11.0
R10		1,600	32.3	1,500	23.6	1,300	18.1	1,100	13.0	960	9.8
R15		1,100	29.1	1,000	20.9	850	15.4	700	11.0	640	8.7
Depth of Cut	a_a	0.05D (R<0.5mm) 0.1D (R>=0.5mm)								0.05D	
	Pf	0.2D								0.1D	



1) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
2) When using low RPM machines, use the maximum RPM and adjust the feed rate.
3) Adjust milling condition when unusual vibration or sound occurs.

High Speed Condition

Work Material / Milling Conditions / Ball Radius (mm)		Carbon Steels Cast Irons		Alloy Steels Die Steels		Hardened Steels Pre-Hardened Steels 30~38 HRC		Stainless Steels Hardened Steels 38~45HRC		Hardened Steels 45~55HRC	
		620 - 1050 SFM		620 - 1000 SFM		620 - 830 SFM		620 - 760 SFM		620 - 740 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R 0.5		60,000	141.7	60,000	141.7	60,000	118.1	60,000	118.1	60,000	94.5
R 1		51,000	200.8	48,000	189.0	40,000	126.0	37,000	118.1	35,000	82.7
R 2		25,000	196.9	24,000	189.0	20,000	126.0	18,000	98.4	18,000	86.6
R 3		17,000	161.4	16,000	149.6	13,000	114.2	12,000	86.6	12,000	74.8
R 5		10,200	122.0	9,600	98.4	8,000	74.8	7,300	59.1	7,000	55.1
R 8		6,400	74.8	6,000	70.9	5,000	47.2	4,600	39.4	4,400	35.4
R 10		5,100	63.0	4,800	55.1	4,000	39.4	3,700	35.0	3,500	27.6
R 15		3,400	43.3	3,200	37.8	2,700	25.6	2,400	23.6	2,300	18.1
Depth of Cut	a_a	0.05D (R<0.5mm) 0.5mm (R>=0.5mm)									
	Pf	0.1D								0.05D	



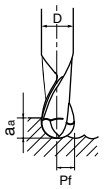
1) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
2) When using low RPM machines, use the maximum RPM and adjust the feed rate.
3) Adjust milling condition when unusual vibration or sound occurs.

X's-mill Geo Micro Ball List No. 9332

Conventional Condition

Work Material / Milling Conditions / Ball Radius (mm)		Carbon Steels Cast Irons		Alloy Steels Die Steels		Hardened Steels Pre-Hardened Steels 30~38 HRC		Stainless Steels Hardened Steels 38~45HRC		Hardened Steels 45~55HRC	
		330 - 660 SFM		330 - 580 SFM		330 - 520 SFM		330 - 455 SFM		330 - 395 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R 0.1		32,000	12.6	32,000	12.6	32,000	11.8	32,000	9.8	32,000	6.3
R 0.15		32,000	18.9	32,000	18.9	32,000	17.7	32,000	14.8	32,000	9.4
R 0.2		32,000	23.6	32,000	23.6	32,000	20.5	32,000	19.7	32,000	12.6
R 0.25		32,000	29.5	32,000	25.6	32,000	24.4	32,000	23.6	32,000	15.7
R 0.3		32,000	35.4	32,000	29.5	32,000	27.6	32,000	25.2	32,000	18.9
R 0.4		32,000	47.2	32,000	39.4	32,000	36.2	32,000	33.5	32,000	25.2
R 0.5		32,000	59.1	32,000	49.2	32,000	45.3	32,000	39.4	32,000	31.5
R 0.75		32,000	86.6	32,000	63.0	32,000	66.9	29,500	55.1	25,500	37.4
R 1		32,000	114.2	28,500	82.7	25,000	70.9	22,000	55.1	19,000	37.4
R 1.5		21,000	114.2	19,000	82.7	17,000	70.9	14,500	55.1	12,500	37.4
R 2		16,000	114.2	14,000	82.7	12,500	70.9	11,000	55.1	9,500	37.4
Depth of Cut	a_a	0.05D (R<0.5mm) 0.1D (R>=0.5)								0.05D	
	Pf	0.2D								0.1D	

D:Dia. of Mill
R:Ball Radius

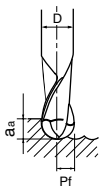


1) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
2) When using low RPM machines, use the maximum RPM and adjust the feed rate.
3) Adjust milling condition when unusual vibration or sound occurs.

High Speed Condition

Work Material / Milling Conditions / Ball Radius (mm)		Carbon Steels Cast Irons		Alloy Steels Die Steels		Hardened Steels Pre-Hardened Steels 30~38 HRC		Stainless Steels Hardened Steels 38~45HRC		Hardened Steels 45~55HRC	
		620 - 990 SFM		620 - 900 SFM		620 - 850 SFM		620 - 780 SFM		495 - 660 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R 0.1		60,000	23.6	60,000	23.6	60,000	22.0	60,000	18.9	48,000	9.4
R 0.15		60,000	35.4	60,000	35.4	60,000	33.1	60,000	27.6	48,000	14.2
R 0.2		60,000	43.3	60,000	43.3	60,000	39.4	60,000	37.0	48,000	18.9
R 0.25		60,000	47.2	60,000	47.2	60,000	45.3	60,000	43.3	48,000	23.6
R 0.3		60,000	55.1	60,000	55.1	60,000	51.2	60,000	47.2	48,000	28.3
R 0.4		60,000	74.8	60,000	74.8	60,000	66.9	60,000	63.0	48,000	37.8
R 0.5		60,000	92.5	60,000	92.5	60,000	84.6	60,000	74.8	48,000	47.2
R 0.75		60,000	118.1	60,000	118.1	55,000	114.2	51,000	94.5	42,500	63.0
R 1		48,000	171.3	45,000	129.9	41,500	114.2	38,000	94.5	32,000	63.0
R 1.5		32,000	171.3	30,000	129.9	27,500	114.2	25,000	94.5	21,000	63.0
R 2		24,000	171.3	22,000	129.9	20,500	114.2	19,000	94.5	16,000	63.0
Depth of Cut	a_a	0.05D									
	Pf	0.1D									

D:Dia. of Mill
R:Ball Radius



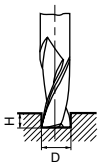
1) Use coolant when machining Stainless Steels, Nickel Alloys and Titanium Alloys.
2) When using low RPM machines, use the maximum RPM and adjust the feed rate.
3) Adjust milling condition when unusual vibration or sound occurs.

X's-mill Geo KV / 2 Flute, 4 Flute List No. 9366, 9368

Slotting

Milling Conditions / Dia. of Mill (mm)		RPM	SFM	Feed (IPM)
0.5		44,000	69	9.8
1.0		22,000	69	11.8
1.5		19,000	90	13.8
2.0		15,000	94	15.7
2.5		9,000	71	15.7
3.0		7,500	71	15.7
Depth of cut	H	Max 0.5D		

D:Dia. of Mill

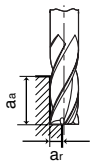


1) Mill using coolants.
2) When using low RPM machines, use the maximum RPM and adjust the feed rate.
3) Adjust milling condition when unusual vibration or sound occurs.

Side Milling

Milling Conditions / Dia. of Mill (mm)		RPM	SFM	Feed (IPM)
0.5		44,000	69	14.8
1.0		22,000	69	17.7
1.5		19,000	90	20.7
2.0		15,000	94	23.6
2.5		9,000	71	23.6
3.0		7,500	71	23.6
Depth of cut	a_a	1D		
	a_r	Max 0.02D		

D:Dia. of Mill



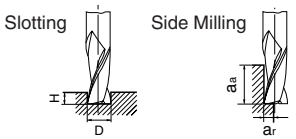
1) Mill using coolants.
2) When using low RPM machines, use the maximum RPM and adjust the feed rate.
3) Adjust milling condition when unusual vibration or sound occurs.

DLC-mill for Aluminum List No. 9330
DLC-mill Radius List No. 9302
DLC-mill Sharp Corner List No. 9378

Work Material / Milling Conditions / Dia. of Mill (mm)		Aluminum 1070		Aluminum Alloys 4032, 6061		Aluminum Alloys 5052		Aluminum Alloys 7075		Aluminum Alloy Casting		Copper Alloys	
		1000 - 1300 SFM		670 - 930 SFM		780 - 990 SFM		780 - 990 SFM		700 - 890 SFM		320 - 390 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
2		50,000	39.4	32,000	25.2	38,000	29.9	38,000	33.1	34,000	29.5	15,300	9.4
3		41,000	47.2	30,000	35.4	32,000	39.4	32,000	43.3	29,000	37.8	12,700	11.8
5		25,000	51.2	18,000	35.4	19,000	39.4	19,000	43.3	17,000	37.8	7,600	12.2
6		21,000	51.2	15,000	35.4	16,000	39.4	16,000	43.3	14,000	37.8	6,400	12.2
8		16,000	51.2	12,000	37.8	12,000	39.4	12,000	43.3	10,700	37.8	4,800	12.2
10		12,000	51.2	9,000	35.4	9,600	39.4	10,000	43.3	8,600	37.8	3,800	12.2
12		10,000	51.2	7,500	35.4	8,000	39.4	8,000	43.3	7,200	37.8	3,200	12.2
16		7,800	51.2	5,600	35.4	6,000	39.4	6,000	43.3	5,400	37.8	2,400	12.2
20		6,200	51.2	4,500	35.4	4,800	39.4	4,800	43.3	4,300	37.8	1,900	12.2
Depth of Cut	a_a	1.5D											
	a_r	0.2D										0.1D	
	H	0.5D (In dry-milling) 1D (In wet-milling)											

1) In case of using DLC Sharp Corner, use in Minimum Quanity of Lubrication (MQL) condition or with coolants.
2) When using low RPM machines, use the maximum RPM and adjust the feed rate.
3) When slotting, reduce the RPM 30%, and the Feed 75% of table values.
4) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill



DLC-mill Slot Long Shank List No. 9390

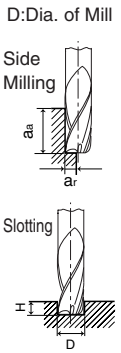
Conventional Condition : Side Milling

Work Material / Milling Conditions / Dia. of Mill (mm)		Aluminum 1070		Aluminum Alloys 4032		Aluminum Alloys 5052		Aluminum Alloys 6061		Aluminum Alloys 7075		Aluminum Alloy Casting Si -12%		Aluminum Alloy Casting Si 12%		Copper Alloys	
		970 - 1070 SFM		560 - 660 SFM		720 - 820 SFM		640 - 740 SFM		630 - 730 SFM		640 - 740 SFM		600 - 700 SFM		300 - 330 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3		34,500	94.5	21,300	51.2	26,600	66.9	23,900	56.7	23,400	52.4	23,900	56.7	22,600	50.8	10,700	18.9
4		25,900	122.0	16,000	63.0	19,900	86.6	18,000	74.8	17,600	67.7	18,000	74.8	17,000	65.4	8,000	27.6
6		17,300	129.9	10,700	66.9	13,300	90.6	12,000	78.7	11,700	71.3	12,000	78.7	11,300	68.5	5,400	27.6
8		13,000	137.8	8,000	70.9	10,000	94.5	9,000	82.7	8,800	75.2	9,000	82.7	8,500	72.4	4,000	27.6
10		10,400	137.8	6,400	70.9	8,000	94.5	7,200	82.7	7,100	75.6	7,200	82.7	6,800	72.4	3,200	27.6
12		8,700	137.8	5,400	70.9	6,700	98.4	6,000	82.7	5,900	75.6	6,000	82.7	5,700	72.8	2,700	27.6
14		7,400	133.9	4,500	66.9	5,700	94.5	5,100	78.7	5,000	74.8	5,100	78.7	4,800	70.9	2,300	27.6
16		6,500	129.9	4,000	63.0	5,000	90.6	4,500	74.8	4,400	70.9	4,500	74.8	4,200	66.9	2,000	23.6
18		5,700	118.1	3,500	59.1	4,400	82.7	4,000	70.9	3,900	66.9	4,000	70.9	3,800	66.9	1,800	23.6
20		5,200	106.3	3,200	55.1	4,000	74.8	3,600	63.0	3,500	59.1	3,600	63.0	3,400	59.1	1,600	19.7
Depth of Cut	a_a	1.2D															
	a_r	0.2D															

STANDARD MILLING CONDITION

Conventional Condition: Slotting

Work Material / Milling Conditions / Dia. of Mill (mm)		Aluminum 1070		Aluminum Alloys								Aluminum Alloy Casting			
				4032		5052		6061		7075		Si -12%		Si 12%	
		970 - 1070 SFM		560 - 660 SFM		720 - 820 SFM		640 - 740 SFM		630 - 730 SFM		640 - 740 SFM		600 - 700 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3		34,500	82.7	21,300	43.3	26,600	59.1	23,900	48.4	23,400	44.9	23,900	48.4	22,600	43.3
4		25,900	90.6	16,000	47.2	19,900	63.0	18,000	55.1	17,600	48.8	18,000	55.1	17,000	47.2
6		17,300	94.5	10,700	47.2	13,300	66.9	12,000	55.1	11,700	50.8	12,000	55.1	11,300	49.2
8		13,000	98.4	8,000	51.2	10,000	66.9	9,000	59.1	8,800	52.8	9,000	59.1	8,500	50.8
10		10,400	98.4	6,400	51.2	8,000	66.9	7,200	59.1	7,100	53.1	7,200	59.1	6,800	50.8
12		8,700	98.4	5,400	51.2	6,700	66.9	6,000	59.1	5,900	52.8	6,000	59.1	5,700	51.2
14		7,400	94.5	4,500	47.2	5,700	66.9	5,100	55.1	5,000	51.2	5,100	55.1	4,800	51.2
16		6,500	90.6	4,000	47.2	5,000	63.0	4,500	55.1	4,400	51.2	4,500	55.1	4,200	47.2
18		5,700	86.6	3,500	43.3	4,400	59.1	4,000	51.2	3,900	47.2	4,000	51.2	3,800	47.2
20		5,200	82.7	3,200	39.4	4,000	55.1	3,600	47.2	3,500	43.3	3,600	47.2	3,400	43.3
Depth of Cut	H	1D													



1) When using low RPM machines, use the maximum RPM and adjust the feed rate.
2) When dry milling, reduce the RPM and the Feed 30% of table values.
3) Adjust milling condition when unusual vibration or sound occurs.

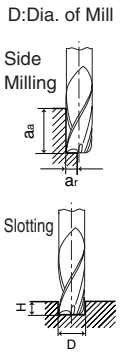
High Speed Condition: Side Milling

Work Material / Milling Conditions / Dia. of Mill (mm)		Aluminum 1070		Aluminum Alloys								Aluminum Alloy Casting				Copper Alloys	
				4032		5052		6061		7075		Si -12%		Si 12%			
		2000 - 2500 SFM		1200 - 1600 SFM		1500 - 2000 SFM		1300 - 1800 SFM		1300 - 1800 SFM		1300 - 1800 SFM		1000 - 1400 SFM		600 - 800 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3		62,100	204.7	38,200	102.4	47,800	145.7	43,000	121.7	42,100	113.0	43,000	121.7	33,500	89.8	19,100	40.2
4		51,800	291.3	31,900	149.6	39,800	204.7	35,900	177.2	35,100	161.4	35,900	177.2	27,900	128.3	16,000	59.1
6		38,000	338.6	23,400	173.2	29,200	236.2	26,300	204.7	25,700	187.0	26,300	204.7	20,500	149.2	11,700	66.9
8		31,100	389.8	19,100	196.9	23,900	271.7	21,500	232.3	21,100	215.4	21,500	232.3	16,800	171.7	9,600	78.7
10		24,900	389.8	15,300	196.9	19,100	271.7	17,200	232.3	16,900	215.7	17,200	232.3	13,400	171.3	7,700	78.7
12		20,700	389.8	12,800	196.9	16,000	275.6	14,400	236.2	14,100	216.1	14,400	236.2	11,200	171.7	6,400	78.7
14		17,700	385.8	10,900	192.9	13,600	271.7	12,300	232.3	12,000	212.6	12,300	232.3	9,500	169.3	5,500	74.8
16		15,500	366.1	9,500	185.0	11,900	255.9	10,700	220.5	10,500	204.7	10,700	220.5	8,400	161.4	4,800	70.9
18		12,600	318.9	7,800	161.4	9,700	224.4	8,800	192.9	8,600	177.2	8,800	192.9	6,800	141.7	3,900	63.0
20		10,300	255.9	6,400	129.9	8,000	181.1	7,200	153.5	7,000	141.7	7,200	153.5	5,600	114.2	3,200	51.2
Depth of Cut	a_a	1.2D															
	a_r	0.2D															

STANDARD MILLING CONDITION

High Speed Condition: Slotting

Work Material / Milling Conditions / Dia. of Mill (mm)	Aluminum 1070		Aluminum Alloys								Aluminum Alloy Casting			
			4032		5052		6061		7075		Si -12%		Si 12%	
	2000 - 2500 SFM		1200 - 1600 SFM		1500 - 2000 SFM		1300 - 1800 SFM		1300 - 1800 SFM		1300 - 1800 SFM		1000 - 1400 SFM	
	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3	62,100	145.7	38,200	74.8	47,800	102.4	43,000	87.0	42,100	80.7	43,000	87.0	33,500	64.2
4	51,800	177.2	31,900	90.6	39,800	126.0	35,900	106.3	35,100	97.2	35,900	106.3	27,900	77.2
6	38,000	204.7	23,400	102.4	29,200	141.7	26,300	122.0	25,700	111.8	26,300	122.0	20,500	89.0
8	31,100	228.3	19,100	114.2	23,900	161.4	21,500	137.8	21,100	126.0	21,500	137.8	16,800	100.4
10	24,900	228.3	15,300	114.2	19,100	161.4	17,200	137.8	16,900	126.0	17,200	137.8	13,400	100.0
12	20,700	228.3	12,800	118.1	16,000	161.4	14,400	137.8	14,100	126.0	14,400	137.8	11,200	100.4
14	17,700	224.4	10,900	114.2	13,600	157.5	12,300	133.9	12,000	126.0	12,300	133.9	9,500	98.4
16	15,500	220.5	9,500	110.2	11,900	153.5	10,700	129.9	10,500	122.0	10,700	129.9	8,400	98.4
18	12,600	192.9	7,800	98.4	9,700	133.9	8,800	114.2	8,600	106.3	8,800	114.2	6,800	82.7
20	10,300	161.4	6,400	82.7	8,000	114.2	7,200	98.4	7,000	90.6	7,200	98.4	5,600	70.9
Depth of Cut H	1D													



1) When using low RPM machines, use the maximum RPM and adjust the feed rate.
2) When dry milling, reduce the RPM and the Feed 30% of table values.
3) Adjust milling condition when unusual vibration or sound occurs.

Plunging

Work Material / Milling Conditions / Dia. of Mill (mm)	Aluminum 1070		Aluminum Alloys								Aluminum Alloy Casting			
			4032		5052		6061		7075		Si -12%		Si 12%	
	970 - 1070 SFM		560 - 660 SFM		720 - 820 SFM		640 - 740 SFM		630 - 730 SFM		640 - 740 SFM		480 - 580 SFM	
	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3	34,500	39.4	21,300	19.7	26,600	27.6	23,900	21.7	23,400	20.1	23,900	21.7	18,600	16.1
4	25,900	43.3	16,000	23.6	19,900	31.5	18,000	27.6	17,600	22.8	18,000	27.6	14,000	18.1
6	17,300	43.3	10,700	23.6	13,300	31.5	12,000	27.6	11,700	24.0	12,000	27.6	9,300	18.9
8	13,000	47.2	8,000	23.6	10,000	31.5	9,000	27.6	8,800	25.2	9,000	27.6	7,000	20.1
10	10,400	47.2	6,400	23.6	8,000	31.5	7,200	27.6	7,100	25.2	7,200	27.6	5,600	20.1
12	8,700	47.2	5,400	23.6	6,700	35.4	6,000	27.6	5,900	25.2	6,000	27.6	4,700	20.1
14	7,400	43.3	4,500	23.6	5,700	31.5	5,100	27.6	5,000	23.6	5,100	27.6	4,000	19.7
16	6,500	43.3	4,000	19.7	5,000	31.5	4,500	23.6	4,400	23.6	4,500	23.6	3,500	19.7
18	5,700	39.4	3,500	19.7	4,400	27.6	4,000	23.6	3,900	23.6	4,000	23.6	3,100	19.7
20	5,200	35.4	3,200	19.7	4,000	23.6	3,600	19.7	3,500	19.7	3,600	19.7	2,800	15.7

1) When using low RPM machines, use the maximum RPM and adjust the feed rate.
2) When dry milling, reduce the RPM and feed rate by 30%. In dry plunging, reduce RPM 30% and Feed 80% of values on table above.
3) Adjust milling condition when unusual vibration or sound occurs.

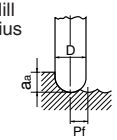
DLC-mill Ball List No. 9360

Conventional Condition

Work Material / Milling Conditions / Ball Radius (mm)		Aluminum 1070		Aluminum Alloys 4032, 6061		Aluminum Alloys 5052		Aluminum Alloys 7075		Aluminum Alloy Casting		Copper Alloys	
		425 - 870 SFM		105 - 205 SFM		330 - 660 SFM		330 - 660 SFM		300 - 620 SFM		135 - 270 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R 0.5		41,000	31.5	10,000	7.9	32,000	23.6	32,000	27.6	29,000	23.6	13,000	7.9
R 1		31,000	47.2	7,000	11.8	24,000	39.4	24,000	43.3	21,000	35.4	10,000	11.8
R 2		21,000	66.9	5,000	15.7	16,000	51.2	16,000	55.1	14,000	47.2	6,000	15.7
R 3		14,000	66.9	3,200	15.7	11,000	51.2	11,000	59.1	10,000	51.2	4,000	15.7
R 5		8,000	63.0	1,900	15.7	6,000	47.2	6,000	51.2	6,000	51.2	2,500	15.7
R 8		5,000	63.0	1,200	15.7	4,000	51.2	4,000	55.1	3,600	51.2	1,600	15.7
R 10		4,000	63.0	1,000	15.7	3,200	51.2	3,200	55.1	2,900	51.2	1,300	15.7
Depth of Cut	a_a	0.1D											
	Pf	0.2D											

1) When using low RPM machines, use the maximum RPM and adjust the feed rate.
2) In dry milling (recommended air blow), reduce the rotation and feed 30% of table values.
3) Adjust milling condition when unusual vibration or sound occurs.

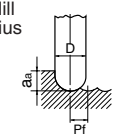
D:Dia. of Mill
R:Ball Radius



High Speed Condition

Work Material / Milling Conditions / Ball Radius (mm)		Aluminum 1070		Aluminum Alloys 4032, 6061		Aluminum Alloys 5052		Aluminum Alloys 7075		Aluminum Alloy Casting		Copper Alloys	
		1100 - 2150 SFM		200 - 495 SFM		720 - 1650 SFM		720 - 1650 SFM		590 - 1490 SFM		260 - 680 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
R 0.5		62,000	47.2	19,000	15.7	60,000	47.2	60,000	51.2	57,000	51.2	25,000	15.7
R 1		54,000	86.6	14,000	23.6	48,000	74.8	48,000	82.7	43,000	74.8	19,000	23.6
R 2		47,000	149.6	11,000	35.4	36,000	114.2	36,000	126.0	32,000	110.2	14,000	35.4
R 3		34,000	161.4	8,000	39.4	27,000	126.0	27,000	141.7	24,000	126.0	11,000	39.4
R 5		21,000	165.4	4,800	39.4	16,000	126.0	16,000	137.8	14,000	122.0	6,400	39.4
R 8		13,000	165.4	3,000	39.4	9,900	126.0	9,900	137.8	9,000	126.0	4,000	39.4
R 10		10,000	157.5	2,400	39.4	8,000	126.0	8,000	137.8	7,200	126.0	3,200	39.4
Depth of Cut	a_a	0.05D											
	Pf	0.1D											

D:Dia. of Mill
R:Ball Radius



DLC-HSS mill / Inch Sizes List No. 6231HD

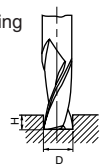
Work Material / Milling Conditions / Dia. of Mill (inch)		Aluminum 1070		Aluminum Alloys					
				4032, 6061		5052		7075	
		960 - 980 SFM		650 - 670 SFM		820 - 825 SFM		650 - 655 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		30,000	31.5	19,900	14.9	25,100	22.6	19,900	11.9
3/16		20,000	38.0	13,300	17.5	16,800	26.5	13,300	14.0
1/4		15,000	39.4	10,000	17.5	12,600	26.5	9,940	13.9
5/16		12,000	39.4	8,000	21.5	10,030	32.0	7,950	16.9
3/8		10,000	45.0	6,700	22.6	8,360	33.9	6,630	17.9
7/16		8,500	47.2	5,700	23.9	7,160	37.6	5,680	19.9
1/2		7,500	47.2	5,000	25.0	6,270	37.6	4,970	19.9
5/8		6,000	47.2	4,000	25.0	5,020	37.7	3,980	19.9
3/4		5,000	47.2	3,400	25.5	4,180	37.6	3,320	19.9
1		3,700	47.2	2,500	25.0	3,140	37.7	2,490	19.9
Depth of Cut	a_a	1.5D							
	a_r	0.2D							
	H	1D							

DLC-HSS mill / Metric List No. 6450

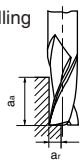
Work Material / Milling Conditions / Dia. of Mill (mm)		Aluminum 1070		Aluminum Alloys					
				4032, 6061		5052		7075	
		960 - 980 SFM		650 - 670 SFM		820 - 825 SFM		650 - 655 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3		32,000	31.5	21,100	15.0	26,600	22.6	21,100	12.0
5		19,200	39.4	12,700	17.5	16,000	26.5	12,700	14.0
6		16,000	39.4	10,600	17.5	13,300	26.4	10,600	14.0
8		12,000	39.4	7,900	21.1	10,000	32.1	7,900	16.9
10		9,600	47.2	6,400	22.7	8,000	34.0	6,400	18.1
12		8,000	47.2	5,300	0.0	6,700	0.0	5,300	20.0
16		6,000	47.2	4,000	0.0	5,000	0.0	4,000	0.0
20		4,800	47.2	3,200	0.0	4,000	0.0	3,200	0.0
Depth of Cut	a_a	1.5D							
	a_r	0.2D							
	H	1D							

D:Dia. of Mill

Slotting



Side Milling



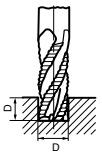
1) Mill using coolants.
2) Recommend to use List No. 9330 in milling of Aluminum Alloy Casting(A380,A390).
3) When slotting, reduce the RPM 40% and the Feed 60% of table values.
4) When using low RPM machines, use the maximum RPM and adjust the feed rate.
5) Adjust milling condition when unusual vibration or sound occurs.

STANDARD MILLING CONDITION

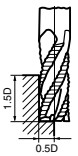
AG-mill Roughing Short List No. 6406, 6485
AG-mill Roughing Regular Length Short List No. 6484

Work Material		Structural Steels, Carbon Steels		Alloy Steels, Pre-Hardened Steels		Mold Steels, Stainless Steels		Nickel Alloys, Titanium Alloys		Cast Irons		Aluminum Alloys, Copper Alloys, Nonferrous Alloys	
Milling Conditions													
Dia. Of Mill		120 - 130 SFM		90 - 100 SFM		70 - 80 SFM		60 - 65 SFM		145 - 150 SFM		280 - 285 SFM	
inch	Metric mm	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
-	6	2,000	10.2	1,500	7.1	1,200	3.9	1,000	3.0	2,400	12.6	4,500	47.2
1/4	6.35	1,900	10.4	1,400	7.3	1,100	4.0	950	3.1	2,200	12.6	4,300	48.3
5/16	7.938	1,500	11.0	1,200	7.5	1,000	4.6	720	3.1	1,800	13.3	3,400	51.3
-	8	1,500	11.0	1,200	7.5	1,000	4.7	720	3.1	1,800	13.4	3,400	51.2
3/8	9.525	1,300	11.0	1,000	7.6	760	4.6	630	3.2	1,500	13.5	2,900	51.7
-	10	1,200	11.0	900	7.5	720	4.7	590	3.1	1,400	13.4	2,700	51.2
-	12	1,000	11.0	800	7.5	600	4.7	490	3.3	1,200	13.4	2,300	51.2
1/2	12.7	950	11.0	720	7.6	570	4.7	470	3.3	1,100	13.5	2,200	51.7
-	15	800	11.0	610	7.5	480	4.7	400	3.3	950	13.4	1,800	51.2
5/8	15.875	760	11.0	570	7.5	460	4.7	380	3.3	900	13.5	1,700	51.3
3/4	19.05	630	11.0	480	7.5	380	4.5	320	3.3	750	13.5	1,400	50.8
-	20	600	11.0	450	7.1	360	4.3	290	3.1	720	13.4	1,400	51.2
7/8	22.225	540	11.8	410	8.6	330	5.3	270	3.6	640	16.3	1,200	59.2
-	25	480	11.4	360	7.9	290	5.1	250	3.4	550	15.4	1,100	55.1
1	25.4	470	11.4	360	7.9	290	5.0	240	3.2	560	15.7	1,100	54.4
-	30	400	10.2	300	7.1	240	4.3	200	3.1	470	14.2	900	51.2
1 1/4	31.75	380	11.4	290	7.7	230	4.8	190	3.5	450	15.2	860	55.6
1 1/2	38.1	320	8.0	240	4.7	190	3.4	160	2.6	370	10.1	720	38.8
-	40	300	6.7	250	4.3	180	2.9	150	2.0	360	9.1	670	33.1
-	50	240	4.3	180	2.8	140	1.8	120	1.3	290	5.9	550	20.5
2	50.8	240	5.3	180	3.7	140	2.5	120	1.7	280	7.2	540	25.9

Slotting



Side Milling

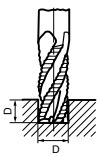


1) In dry miling which is recommended air blow, reduce the RPM and feed to 70% of above table values.
2) Adjust milling condition when unusual vibration or different sound occur.

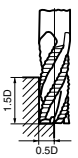
AG-mill Roughing Medium List No. 6486

Work Material	Structural Steels, Carbon Steels		Alloy Steels, Pre-Hardened Steels		Mold Steels, Stainless Steels		Nickel Alloys, Titanium Alloys		Cast Irons		Aluminum Alloys, Copper Alloys, Nonferrous Alloys	
Speed (SFM)	120 - 130 SFM		90 - 100 SFM		70 - 80 SFM		60 - 65 SFM		145 - 150 SFM		280 - 285 SFM	
Milling Conditions												
Dia. of Mill(mm)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
6	2,100	7.1	1,600	4.7	1,300	3.0	1,100	2.0	2,400	8.7	4,500	31.5
8	1,600	7.9	1,200	5.1	1,000	3.1	800	2.2	1,800	9.4	3,400	35.4
10	1,300	7.9	960	5.1	800	3.1	640	2.3	1,400	9.4	2,700	35.4
12	1,100	7.9	800	5.1	660	3.4	530	2.3	1,200	9.4	2,300	36.2
15	850	7.9	640	5.1	530	3.4	420	2.3	960	9.4	1,800	36.2
20	640	7.1	480	4.7	400	3.2	320	2.2	720	9.4	1,400	35.0
25	510	7.5	380	5.1	320	3.3	250	2.3	570	10.2	1,100	37.4
30	420	6.7	320	4.7	270	3.0	210	2.0	480	9.4	900	33.9
40	320	4.3	240	3.0	200	1.9	160	1.3	360	5.9	680	22.0
50	250	2.8	190	1.9	160	1.2	130	0.8	290	3.9	540	13.8

Slotting



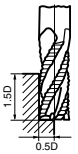
Side Milling



AG-mill Roughing Long List No. 6488

6	2,100	5.1	1,600	2.5	1,300	1.4	1,100	1.0	2,400	5.1	4,500	20.9
8	1,600	5.9	1,200	2.5	1,000	1.4	800	1.0	1,800	5.1	3,400	20.9
10	1,300	5.9	960	2.6	800	1.4	640	1.0	1,400	5.5	2,700	21.7
12	1,100	5.9	800	2.5	660	1.4	530	1.0	1,200	5.1	2,300	21.3
15	850	5.9	640	2.5	530	1.4	420	1.0	960	5.1	1,800	21.3
20	640	5.5	480	2.4	400	1.3	320	0.9	720	5.1	1,400	20.5
25	510	5.9	380	2.2	320	1.3	250	0.9	570	5.1	1,100	19.7
30	420	5.1	320	2.0	270	1.1	210	0.8	480	4.7	900	18.1
40	320	3.3	240	1.3	200	0.7	160	0.5	360	3.0	680	11.8
50	250	2.1	190	0.9	160	0.5	130	0.4	290	2.1	540	7.9

Side Milling

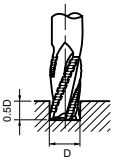


1) In dry miling which is recommended air blow, reduce the RPM and feed to 70% of above table values.
2) Adjust milling condition when unusual vibration or different sound occur.

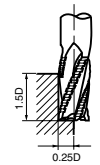
AG-mill Heavy List No. 6402, 6403

Work Material / Milling Conditions		Structural Steels, Carbon Steels		Alloy Steels, Pre-Hardened Steels		Mold Steels, Stainless Steels		Nickel Alloys, Titanium Alloys		Cast Irons		Aluminum Alloys, Copper Alloys, Nonferrous Alloys	
Dia. Of Mill		150 - 155 SFM		115 - 125 SFM		95 - 105 SFM		75 - 80 SFM		175 - 185 SFM		330 - 350 SFM	
inch	Metric mm	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
-	3	5,000	11.4	3,800	7.5	3,200	5.1	2,500	3.5	5,800	30.3	10,800	52.0
-	5	3,000	11.4	2,300	7.5	1,900	5.1	1,600	3.5	3,500	30.3	6,500	52.0
-	6	2,500	11.4	1,900	7.5	1,600	5.1	1,300	3.5	2,900	31.1	5,400	52.0
1/4	6.35	2,300	11.2	1,800	7.7	1,500	5.2	1,200	3.3	2,800	31.1	5,200	53.0
5/16	7.938	1,900	11.5	1,400	7.6	1,200	5.1	1,000	3.5	2,200	31.0	4,100	52.2
-	8	1,900	11.4	1,400	7.5	1,200	5.1	1,000	3.5	2,200	31.1	4,100	52.0
3/8	9.525	1,600	11.5	1,200	7.7	1,000	4.9	790	3.3	1,800	31.6	3,500	53.0
-	10	1,500	11.8	1,200	7.9	1,000	5.1	800	3.5	1,700	31.5	3,200	52.0
-	12	1,300	11.4	1,000	7.9	800	5.1	600	3.5	1,400	31.1	2,800	52.0
1/2	12.7	1,200	11.2	920	7.7	760	5.3	600	3.6	1,400	31.6	2,600	51.9
-	15	1,000	11.4	800	7.9	600	5.1	500	3.5	1,200	31.1	2,200	52.0
5/8	15.875	940	11.2	730	7.7	610	5.3	480	3.5	1,100	30.0	2,100	52.0
3/4	19.05	780	10.5	610	7.7	510	4.7	400	3.1	920	28.9	1,700	52.0
-	20	750	10.2	600	7.9	500	4.7	400	3.1	900	29.1	1,700	52.0
7/8	22.225	670	9.4	520	7.0	440	4.0	340	2.6	790	26.1	1,500	46.7
-	25	600	8.7	500	5.9	400	3.5	300	2.4	700	22.8	1,300	38.6
1	25.4	580	10.5	460	6.3	380	4.1	300	2.7	690	26.8	1,300	46.0
-	30	500	7.9	400	4.7	300	3.1	250	2.0	600	20.1	1,100	33.9
1 1/4	31.75	470	7.4	370	4.4	310	3.2	240	2.5	550	16.9	1,000	29.6
1 1/2	38.1	390	7.0	310	4.1	260	3.2	200	2.1	460	10.3	870	18.7
-	40	370	6.7	300	4.3	220	2.9	180	2.0	450	9.1	800	15.5
-	50	300	4.3	240	2.8	160	1.8	120	1.3	320	5.9	620	10.5
2	50.8	290	5.1	230	3.3	150	2.2	120	1.5	310	7.3	610	13.7

Grooving



Side Milling

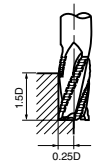


1) In dry miling which is recommended air blow, reduce the RPM and feed to 70% of above table values.
2) Adjust milling condition when unusual vibration or different sound occur.

AG-mill Heavy Long List No. 6404

Work Material / Speed (SFM) / Milling Conditions / Dia. of Mill(mm)	Structural Steels, Carbon Steels		Alloy Steels, Pre-Hardened Steels		Mold Steels, Stainless Steels		Nickel Alloys, Titanium Alloys		Cast Irons		Aluminum Alloys, Copper Alloys, Nonferrous Alloys	
	150 - 155 SFM		115 - 125 SFM		95 - 105 SFM		75 - 80 SFM		175 - 185 SFM		330 - 350 SFM	
	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3	5,000	7.1	3,800	4.7	3,200	3.1	2,500	2.0	5,800	18.5	10,800	33.1
5	3,000	7.1	2,300	4.7	1,900	3.1	1,600	2.0	3,500	18.5	6,500	33.1
6	2,500	7.1	1,900	4.7	1,600	3.1	1,300	2.0	2,900	18.9	5,400	33.1
8	1,900	7.1	1,400	4.7	1,200	3.1	1,000	2.0	2,200	18.9	4,100	33.1
10	1,500	7.1	1,200	4.7	1,000	3.1	800	2.0	1,700	19.3	3,200	33.1
12	1,250	7.1	1,000	4.7	800	3.1	600	2.0	1,400	18.9	2,800	33.1
15	1,000	7.1	800	4.7	600	3.1	500	2.0	1,200	18.9	2,200	31.5
20	750	6.3	600	4.3	500	2.8	400	2.0	900	18.1	1,700	27.6
25	600	5.5	500	3.9	400	2.4	300	1.6	700	13.8	1,300	23.6
30	500	4.7	400	3.5	300	2.4	250	1.6	600	11.8	1,100	22.0

Side Milling



1) In dry miling which is recommended air blow, reduce the RPM and feed to 70% of above table values.
2) Adjust milling condition when unusual vibration or different sound occur.

Genac Endmills 2 Flute Single End Regular List No. 9261X
Long List No. 9265X

Work Material / Milling Conditions		Carbon Steels (up to 30HRc)		Alloy Steels 30~45HRc		Tool Steels 45~55HRC		Cast Iron (up to 200HB)		Cast Iron (200HB~)		Stainless Steels		Titanium Alloys		Aluminum, Nonferrows Metals	
		200 SFM		150 SFM		100 SFM		220 SFM		160 SFM		140 SFM		140 SFM		590 SFM	
Dia. of Mill (inch)		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		6,110	9.8	4,580	4.6	3,060	3.1	6,720	16.1	4,890	4.9	4,280	5.1	4,280	4.3	18,300	25.6
3/16		4,070	8.1	3,060	3.7	2,040	2.4	4,480	13.4	3,260	3.9	2,850	4.0	2,850	3.4	12,200	19.5
1/4		3,060	7.3	2,290	3.2	1,530	2.1	3,360	12.1	2,450	3.4	2,140	3.4	2,140	3.0	9,100	16.4
5/16		2,440	6.3	1,820	2.9	1,220	2.0	2,690	11.8	1,960	3.1	1,700	3.1	1,700	2.7	7,300	14.6
3/8		2,030	6.1	1,540	2.8	1,020	1.8	2,240	11.2	1,620	2.9	1,420	2.8	1,420	2.6	6,100	13.4
7/16		1,740	6.3	1,300	2.6	870	1.7	1,920	10.8	1,400	2.8	1,220	2.7	1,220	2.4	5,200	12.5
1/2		1,530	6.1	1,150	2.3	760	1.5	1,680	10.1	1,220	2.7	1,070	2.6	1,070	2.4	4,500	11.7
5/8		1,220	5.9	910	2.0	610	1.3	1,350	9.5	980	2.4	850	2.4	850	2.0	3,600	10.8
3/4		1,010	5.3	770	1.8	510	1.2	1,120	9.0	810	2.1	710	2.1	710	2.0	3,000	9.6
1		760	4.6	650	2.0	380	1.1	840	7.6	610	1.8	530	1.6	530	1.6	2,200	8.8
Depth of Cut	a_a	1.5D (Long 2.0D)												1.0D (Long 2.0D)		1.5D (Long 2.0D)	
	a_r	0.1D (Long 0.05D)				0.05D (Long 0.02D)		0.1D (Long 0.05D)				0.1D (Long 0.05D)		0.05D (Long 0.2D)		0.2D (Long 0.1D)	
	H	0.5D				0.3D		0.5D				0.3D		0.1D		0.5D	

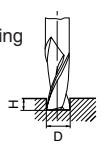
Genac Endmills 4 Flute Single End Regular List No. 9263X
Long List No. 9267X

Work Material / Milling Conditions		Carbon Steels (up to 30HRc)		Alloy Steels 30~45HRc		Tool Steels 45~55HRC		Cast Iron (up to 200HB)		Cast Iron (200HB~)		Stainless Steels		Titanium Alloys		Aluminum, Nonferrows Metals	
		200 SFM		150 SFM		100 SFM		220 SFM		160 SFM		140 SFM		140 SFM		590 SFM	
Dia. of Mill (inch)		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		6,110	19.6	4,580	9.2	3,060	6.1	6,720	32.3	4,890	9.8	4,280	10.3	4,280	8.6	18,300	51.2
3/16		4,070	16.3	3,060	7.3	2,040	4.9	4,480	26.9	3,260	7.8	2,850	8.0	2,850	6.8	12,200	39.0
1/4		3,060	14.7	2,290	6.4	1,530	4.3	3,360	24.2	2,450	6.9	2,140	6.8	2,140	6.0	9,100	32.8
5/16		2,440	12.7	1,820	5.8	1,220	3.9	2,690	23.7	1,960	6.3	1,700	6.1	1,700	5.4	7,300	29.2
3/8		2,030	12.2	1,540	5.5	1,020	3.7	2,240	22.4	1,620	5.8	1,420	5.7	1,420	5.1	6,100	26.8
7/16		1,740	12.5	1,300	5.2	870	3.5	1,920	21.5	1,400	5.6	1,220	5.4	1,220	4.9	5,200	25.0
1/2		1,530	12.2	1,150	4.6	760	3.0	1,680	20.2	1,220	5.4	1,070	5.1	1,070	4.7	4,500	23.4
5/8		1,220	11.7	910	4.0	610	2.7	1,350	18.9	980	4.7	850	4.8	850	4.1	3,600	21.6
3/4		1,010	10.5	770	3.7	510	2.4	1,120	17.9	810	4.2	710	4.3	710	4.0	3,000	19.2
1		760	9.1	650	3.9	380	2.3	840	15.1	610	3.7	530	3.2	530	3.2	2,200	17.6
Depth of Cut	a_a	1.5D (Long 2.0D)												1.0D (Long 2.0D)		1.5D (Long 2.0D)	
	a_r	0.1D (Long 0.05D)				0.05D (Long 0.02D)		0.1D (Long 0.05D)				0.1D (Long 0.05D)		0.05D (Long 0.2D)		0.2D (Long 0.1D)	
	H	0.25D				0.15D		0.25D				0.15D		0.05D		0.25D	

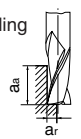
1) Mill using coolants.
2) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill

Slotting



Side Milling



Genac Endmills 2 Flute Ball Nose Regular List No. 9271X
Long List No. 9275X

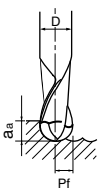
Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels (up to 30HRc)		Alloy Steels 30~45HRc		Tool Steels 45~55HRC		Cast Iron (up to 200HB)		Cast Iron (200HB~)		Stainless Steels		Titanium Alloys		Aluminum, Nonferrows Metals	
		200 SFM		150 SFM		100 SFM		220 SFM		160 SFM		140 SFM		140 SFM		590 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		6,110	11.7	4,580	5.5	3,060	3.7	6,720	19.4	4,890	5.9	4,280	6.2	4,280	5.1	18,300	30.7
3/16		4,070	9.8	3,060	4.4	2,040	2.9	4,480	16.1	3,260	4.7	2,850	4.8	2,850	4.1	12,200	23.4
1/4		3,060	8.8	2,290	3.8	1,530	2.6	3,360	14.5	2,450	4.1	2,140	4.1	2,140	3.6	9,100	19.7
5/16		2,440	7.6	1,820	3.5	1,220	2.3	2,690	14.2	1,960	3.8	1,700	3.7	1,700	3.3	7,300	17.5
3/8		2,030	7.3	1,540	3.3	1,020	2.2	2,240	13.4	1,620	3.5	1,420	3.4	1,420	3.1	6,100	16.1
7/16		1,740	7.5	1,300	3.1	870	2.1	1,920	12.9	1,400	3.4	1,220	3.2	1,220	2.9	5,200	15.0
1/2		1,530	7.3	1,150	2.8	760	1.8	1,680	12.1	1,220	3.2	1,070	3.1	1,070	2.8	4,500	14.0
5/8		1,220	7.0	910	2.4	610	1.6	1,350	11.3	980	2.8	850	2.9	850	2.4	3,600	13.0
3/4		1,010	6.3	770	2.2	510	1.5	1,120	10.8	810	2.5	710	2.6	710	2.4	3,000	11.5
1		760	5.5	650	2.3	380	1.4	840	9.1	610	2.2	530	1.9	530	1.9	2,200	10.6
Depth of Cut	a_a	0.1D				0.05D		0.1D						0.05D		0.1D	
	Pf	0.2D				0.1D		0.2D				0.2D		0.1D		0.2D	

Genac Endmills 4 Flute Ball Nose Regular List No. 9273X
Long List No. 9277X

Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels (up to 30HRc)		Alloy Steels 30~45HRc		Tool Steels 45~55HRC		Cast Iron (up to 200HB)		Cast Iron (200HB~)		Stainless Steels		Titanium Alloys		Aluminum, Nonferrows Metals	
		200 SFM		150 SFM		100 SFM		220 SFM		160 SFM		140 SFM		140 SFM		590 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		6,110	19.6	4,580	9.2	3,060	6.1	6,720	32.3	4,890	9.8	4,280	10.3	4,280	8.6	18,300	51.2
3/16		4,070	16.3	3,060	7.3	2,040	4.9	4,480	26.9	3,260	7.8	2,850	8.0	2,850	6.8	12,200	39.0
1/4		3,060	14.7	2,290	6.4	1,530	4.3	3,360	24.2	2,450	6.9	2,140	6.8	2,140	6.0	9,100	32.8
5/16		2,440	12.7	1,820	5.8	1,220	3.9	2,690	23.7	1,960	6.3	1,700	6.1	1,700	5.4	7,300	29.2
3/8		2,030	12.2	1,540	5.5	1,020	3.7	2,240	22.4	1,620	5.8	1,420	5.7	1,420	5.1	6,100	26.8
7/16		1,740	12.5	1,300	5.2	870	3.5	1,920	21.5	1,400	5.6	1,220	5.4	1,220	4.9	5,200	25.0
1/2		1,530	12.2	1,150	4.6	760	3.0	1,680	20.2	1,220	5.4	1,070	5.1	1,070	4.7	4,500	23.4
5/8		1,220	11.7	910	4.0	610	2.7	1,350	18.9	980	4.7	850	4.8	850	4.1	3,600	21.6
3/4		1,010	10.5	770	3.7	510	2.4	1,120	17.9	810	4.2	710	4.3	710	4.0	3,000	19.2
1		760	9.1	650	3.9	380	2.3	840	15.1	610	3.7	530	3.2	530	3.2	2,200	17.6
Depth of Cut	a_a	0.1D				0.05D		0.1D						0.05D		0.1D	
	Pf	0.2D				0.1D		0.2D				0.2D		0.1D		0.2D	

1) Mill using coolants.
2) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill
R:Ball Radius

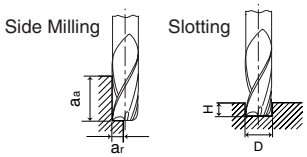


Genac Endmills High Helix 3 Flute 60 Degrees List No. 9221X

Work Material / Milling Conditions		Carbon Steels (up to 30HRc)		Alloy Steels 30~45HRc		Tool Steels 45~55HRC		Cast Iron (up to 200HB)		Cast Iron (200HB~)		Stainless Steels		Titanium Alloys		Nonferrows Metals	
		200 SFM		150 SFM		100 SFM		220 SFM		160 SFM		140 SFM		140 SFM		590 SFM	
Dia. of Mill (inch)		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		6,110	19.1	4,580	8.9	3,060	6.0	6,720	31.4	4,890	9.5	4,280	10.0	4,280	8.3	18,300	50.0
3/16		4,070	15.9	3,060	7.2	2,040	4.8	4,480	26.2	3,260	7.6	2,850	7.8	2,850	6.7	12,200	38.1
1/4		3,060	14.3	2,290	6.3	1,530	4.2	3,360	23.6	2,450	6.7	2,140	6.7	2,140	5.8	9,100	31.9
5/16		2,440	12.4	1,820	5.7	1,220	3.8	2,690	23.1	1,960	6.1	1,700	6.0	1,700	5.3	7,300	28.5
3/8		2,030	11.9	1,540	5.4	1,020	3.6	2,240	21.8	1,620	5.7	1,420	5.5	1,420	5.0	6,100	26.2
7/16		1,740	12.2	1,300	5.1	870	3.4	1,920	21.0	1,400	5.5	1,220	5.2	1,220	4.8	5,200	24.3
1/2		1,530	11.9	1,150	4.5	760	3.0	1,680	19.7	1,220	5.2	1,070	5.0	1,070	4.6	4,500	22.8
5/8		1,220	11.4	910	3.9	610	2.6	1,350	18.4	980	4.6	850	4.6	850	4.0	3,600	21.1
3/4		1,010	10.2	770	3.6	510	2.4	1,120	17.5	810	4.1	710	4.2	710	3.9	3,000	18.7
1		760	8.9	650	3.8	380	2.2	840	14.7	610	3.6	530	3.1	530	3.1	2,200	17.2
Depth of Cut	a_a	1.5D												1.0D		1.5D	
	a_r	0.1D				0.05D		0.1D				0.1D		0.05D		0.2D	
	H	0				0.15D		0.25D				0.15D		0.05D		0.25D	

1) Mill using coolants.
2) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill

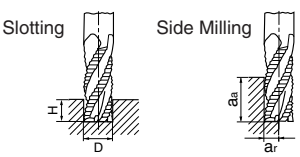


Genac Endmills Roughing Center Cutting List No. 9251X

Work Material / Milling Conditions		Carbon Steels (up to 30HRc)		Alloy Steels 30~45HRc		Tool Steels 45~55HRC		Cast Iron (up to 200HB)		Cast Iron (200HB~)		Stainless Steels		Titanium Alloys		Aluminum, Nonferrows Metals	
		200 SFM		150 SFM		100 SFM		220 SFM		160 SFM		140 SFM		140 SFM		590 SFM	
Dia. of Mill (inch)		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/4		3,060	22.0	2,290	9.6	1,530	6.4	3,360	36.3	2,450	10.3	2,140	10.3	2,140	9.0	9,100	49.1
3/8		2,030	18.3	1,540	8.3	1,020	5.5	2,240	33.6	1,620	8.7	1,420	8.5	1,420	7.7	6,100	40.3
1/2		1,530	18.4	1,150	6.9	760	4.6	1,680	30.2	1,220	8.1	1,070	7.7	1,070	7.1	4,500	35.1
5/8		1,220	22.0	910	7.5	610	5.0	1,350	35.4	980	8.8	850	8.9	850	7.7	3,600	40.5
3/4		1,010	23.6	770	8.3	510	5.5	1,120	40.3	810	9.5	710	9.6	710	8.9	3,000	43.2
1		760	20.5	650	8.8	380	5.1	840	34.0	610	8.2	530	7.2	530	7.2	2,200	39.6
Depth of Cut	a_a	1.5D												1.0D		1.5D	
	a_r	0.5D				0.2D		0.5D				0.25D		0.2D		0.5D	
	H	0.5D				0.2D		0.5D				0.5D		0.2D		0.5D	

1) Mill using coolants.
2) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill



SG 2-Flute End mills List No.6231X

Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		118 SFM		83 SFM		70 SFM		60 SFM		130 SFM		260 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		3,600	5.5	2,600	3.5	2,100	2.2	1,800	1.7	4,000	15.2	8,000	28.0
3/16		2,400	5.5	1,700	3.5	1,400	2.2	1,200	1.6	2,700	15.1	5,300	28.0
1/4		1,800	5.5	1,300	3.5	1,100	2.2	890	1.7	2,000	15.4	4,000	28.0
3/8		1,200	5.5	840	3.6	680	2.2	600	1.7	1,400	15.7	2,700	28.3
1/2		880	5.5	630	3.6	510	2.2	450	1.7	1,000	15.4	2,000	28.3
5/8		710	5.5	510	3.5	410	2.2	360	1.7	800	15.3	1,600	28.0
3/4		590	5.5	420	3.5	340	2.1	300	1.6	670	14.8	1,400	27.2
1		440	3.9	320	2.6	260	1.6	230	1.2	500	11.0	1,000	20.5
1 1/4		360	3.0	260	2.0	210	1.3	180	0.9	400	8.3	800	15.0
1 1/2		300	2.6	210	1.6	170	1.0	150	0.8	340	6.7	700	12.6
Depth of Cut	a_a	1.5D											
	a_r	0.25D											
	H	0.5D											

SG Multi-Flute End mills List No. 6211X

4 Flute

Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		118 SFM		83 SFM		70 SFM		60 SFM		130 SFM		260 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/8		3,600	8.6	2,600	5.2	2,100	2.5	1,800	2.5	4,000	20.8	8,000	38.4
3/16		2,400	6.7	1,700	4.1	1,400	2.2	1,200	1.9	2,700	17.3	5,300	31.8
1/4		1,800	7.9	1,300	4.7	1,100	3.1	900	2.5	2,000	22.4	4,000	36.8
3/8		1,200	6.7	900	4.7	700	2.8	600	2.0	1,400	19.6	2,700	33.5
1/2		880	7.4	630	4.8	510	3.1	450	2.3	1,000	20.0	1,990	37.4
5/8		710	7.4	510	4.5	410	3.0	360	2.2	800	20.8	1,590	34.3
3/4		590	6.6	420	4.4	340	2.7	300	2.0	670	18.5	1,330	31.9
1		440	4.8	320	3.1	260	2.0	230	1.5	500	13.4	1,000	24.8
1 1/4		360	3.8	260	2.5	210	1.6	180	1.2	400	10.2	800	18.9
1 1/2		300	3.1	210	1.9	170	1.2	150	0.9	340	8.2	670	15.0
Depth of Cut	a_a	1.5D											
	a_r	0.25D											

6 Flute

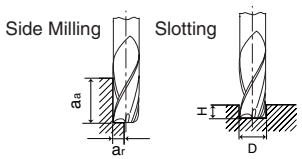
Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		116 SFM		83 SFM		70 SFM		60 SFM		130 SFM		330 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/2		880	11.1	630	7.2	510	4.6	450	3.4	1,000	30.0	2,700	56.1
5/8		710	11.1	510	6.7	410	4.4	360	3.2	800	31.2	1,990	51.5
3/4		590	9.9	420	6.6	340	4.1	300	3.1	670	27.7	1,590	47.9
1		440	7.3	320	4.7	260	3.0	230	2.3	500	20.1	1,330	37.2
1 1/4		360	5.7	260	3.7	210	2.3	180	1.7	400	15.4	1,000	28.3
1 1/2		300	4.6	210	2.9	170	1.8	150	1.4	340	12.2	800	22.5
Depth of Cut	a_a	1.5D											
	a_r	0.25D											

1) The above cutting speeds and feeds apply to regular end mill flute length.
For long fluted end mills please use the following factors below:

Cutting Length	Reduce **Feed** by
2.5 × Diameter	15%
3 × Diameter	25%
4 × Diameter	55%

2) In dry milling , reduce the RPM and Feed 30% of values on table above. (recommended air blow)
3) Adjust drilling condition when unusual vibration or different sound occurs.

D:Dia. of Mill



SG ROUGHING AND FINISHING (HEAVY DUTY) END MILLS List No. 6367X

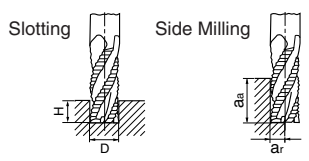
Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		118 SFM		83 SFM		70 SFM		60 SFM		130 SFM		260 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/4		1,800	9.4	1,300	6.8	1,100	4.8	890	2.8	2,000	24.0	4,000	48.0
3/8		1,200	8.6	840	5.4	680	3.5	600	2.4	1,400	22.4	2,700	43.2
1/2		880	8.4	630	5.8	510	3.7	450	2.7	1,000	22.4	2,000	46.4
5/8		710	8.5	510	5.7	410	3.4	360	2.6	800	22.4	1,600	44.8
3/4		590	8.0	420	5.2	340	3.3	300	2.4	670	21.4	1,400	41.4
1		440	8.4	320	6.0	260	3.6	230	2.8	500	24.0	1,000	45.0
1 1/4		360	5.8	260	4.1	210	2.5	180	1.9	400	16.3	800	29.8
1 1/2		300	4.7	210	3.2	170	1.9	150	1.5	340	13.5	700	25.2
1 3/4		260	3.4	180	2.2	150	1.4	130	1.1	290	11.3	600	18.0
Depth of Cut	a_a	1.5D											
	a_r	0.25D											
	H	0.5D											

SG ROUGHING(HOG) END MILLS List No. 6303X

Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		118 SFM		83 SFM		70 SFM		60 SFM		130 SFM		260 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/4		1,800	7.2	1,300	4.7	1,100	3.5	890	2.1	2,000	9.6	4,000	36.8
3/8		1,200	7.2	840	5.0	680	2.7	600	1.9	1,400	9.0	2,700	33.5
1/2		880	7.0	630	4.8	510	2.9	450	2.0	1,000	8.8	2,000	36.0
5/8		710	7.1	510	4.5	410	3.0	360	2.1	800	8.6	1,600	35.2
3/4		590	6.8	420	4.4	340	2.7	300	2.0	670	8.6	1,400	34.7
1		440	7.8	320	5.0	260	3.4	230	2.5	500	11.3	1,000	42.5
1 1/4		360	7.6	260	5.0	210	3.3	180	2.3	400	11.0	800	40.8
1 1/2		300	5.2	210	3.2	170	2.0	150	1.5	340	7.3	700	28.6
1 3/4		260	3.6	180	2.2	150	1.4	130	1.1	290	4.9	600	19.8
—		1,900	7.1	1,300	4.3	1,100	2.8	930	2.1	2,100	8.7	4,200	35.0
Depth of Cut	a_a	1.5D											
	a_r	0.25D											
	H	0.5D											

1) In dry milling , reduce the RPM and feed rate 30% of values on table above. (recommended air blow)
2) Adjust milling condition when unusual vibration or sound occurs.

D:Dia. of Mill



STANDARD MILLING CONDITION

2-Flute End mills

Single End / Regular	List No. 231
Single End / Regular, HSS-Co	List No. 6231
Single End / Long	List No. 6233
Single End / Metric Regular, HSS-Co	List No. 6230
Double End / Regular	List No. 261

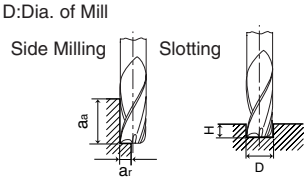
Work Material / Milling Conditions		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		85 SFM		60 SFM		40 SFM		33 SFM		100 SFM		200 SFM	
Dia. of Mill (inch)	(mm)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
—	2	4,000	3.1	2,800	2.0	2,000	1.1	1,600	0.7	4,800	9.1	9,600	16.5
—	3	2,700	3.3	1,900	2.1	1,300	1.2	1,100	0.8	3,200	9.4	6,400	17.7
1/8	3.175	2,600	3.3	1,800	2.1	1,300	1.2	1,100	0.8	3,100	9.4	6,100	17.7
3/16	4.7625	1,700	3.3	1,200	2.1	840	1.2	680	0.8	2,100	9.4	4,100	17.7
—	5	1,600	3.3	1,100	2.1	800	1.2	640	0.8	1,900	9.4	3,800	17.7
—	6	1,300	3.3	930	2.1	660	1.2	530	0.8	1,600	9.4	3,200	17.7
1/4	6.35	1,300	3.3	890	2.1	630	1.2	510	0.8	1,600	9.4	3,100	17.7
—	8	1,000	3.3	700	2.1	500	1.2	400	0.8	1,200	9.4	2,400	17.7
3/8	9.525	850	3.3	600	2.1	420	1.2	340	0.8	1,100	9.4	2,100	17.7
—	10	800	3.4	560	2.1	400	1.2	320	0.8	960	9.4	1,900	17.7
—	12	660	3.3	460	2.1	330	1.2	270	0.8	800	9.4	1,600	17.7
1/2	12.7	640	3.3	450	2.1	320	1.2	260	0.8	800	9.4	1,600	17.7
—	15	530	3.3	370	2.1	270	1.2	210	0.8	640	9.4	1,300	17.7
5/8	15.875	510	3.3	360	2.1	260	1.2	210	0.8	610	9.4	1,300	17.7
3/4	19.05	430	3.2	300	2.0	210	1.1	170	0.7	510	9.1	1,100	16.9
—	20	400	3.1	280	2.0	200	1.1	160	0.7	480	9.1	960	16.5
—	25	320	2.4	220	1.5	160	0.8	130	0.6	380	7.1	760	12.6
1	25.4	320	2.4	230	1.5	160	0.8	130	0.6	380	7.0	770	12.4
—	30	270	1.9	190	1.2	130	0.7	110	0.5	320	5.5	640	10.2
1 1/4	31.75	260	1.8	180	1.1	130	0.6	110	0.5	310	5.1	610	9.8
1 1/2	38.1	220	1.5	150	0.9	110	0.5	90	0.4	260	4.1	510	7.9
—	40	200	1.3	140	0.8	100	0.5	80	0.3	240	3.8	480	7.1
1 3/4	44.45	190	1.1	130	0.6	90	0.4	80	0.3	220	3.0	440	5.9
—	50	160	0.7	110	0.4	80	0.2	60	0.2	190	2.0	380	3.5
2	50.8	160	0.6	120	0.4	80	0.2	70	0.2	190	1.9	390	3.4
Depth of Cut	a_a	1.5D											
	a_r	0.25D											
	H	0.5D											

1) The above cutting speeds and feeds apply to regular end mill flute length.
For long fluted end mills please use the following factors below:

Cutting Length	Reduce **Feed** by
2.5 × Diameter	15%
3 × Diameter	25%
4 × Diameter	55%
5 × Diameter	65%
6 × Diameter	75%

2) In dry milling, reduce the RPM and Feed 30% of values on table above. (recommended air blow)
3) Adjust drilling condition when unusual vibration or different sound occurs.

D:Dia. of Mill



4-Flute and Multi-Flute End mills

Single End		Extra Long - Center Cutting	List No. 215
Regular, Center Cutting	List No. 211		
Regular, Center Cutting, HSS-Co	List No. 6211M	Double End	
Metric Regular HSS-Co	List No. 6210	Regular, Center Cutting	List No. 271
Long, Center Cutting	List No. 213		
Long, Center Cutting, HSS-Co	List No. 6213		

4-Flute

Work Material / Milling Conditions		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		85 SFM		60 SFM		40 SFM		33 SFM		100 SFM		200 SFM	
Dia. of Mill (inch)	(mm)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
—	3	2,700	5.1	1,900	3.1	1,300	1.8	1,100	1.2	3,200	14.2	6,400	26.4
1/8	3.175	2,600	5.1	1,800	3.1	1,300	1.8	1,100	1.2	3,100	14.2	6,100	26.4
3/16	4.7625	1,700	5.1	1,200	3.1	840	1.7	680	1.2	2,100	14.2	4,100	26.4
—	5	1,600	5.1	1,100	3.1	800	1.7	640	1.2	1,900	14.2	3,800	25.6
—	6	1,300	5.1	930	3.1	660	1.7	530	1.2	1,600	14.2	3,200	26.4
1/4	6.35	1,300	5.1	890	3.1	630	1.7	510	1.2	1,600	14.2	3,100	26.4
—	8	1,000	5.1	700	3.1	500	1.7	400	1.2	1,200	14.2	2,400	26.4
3/8	9.525	850	5.1	600	3.1	420	1.8	340	1.2	1,100	14.4	2,100	26.6
—	10	800	5.1	560	3.2	400	1.8	320	1.2	960	14.6	1,900	26.8
—	12	660	5.1	460	3.2	330	1.8	270	1.2	800	14.6	1,600	26.4
1/2	12.7	640	5.1	450	3.2	320	1.8	260	1.2	800	14.6	1,600	26.4
—	15	530	5.1	370	3.1	270	1.8	210	1.2	640	14.6	1,300	26.4
5/8	15.875	510	5.1	360	3.1	260	1.7	210	1.2	610	14.4	1,300	25.6
3/4	19.05	430	4.9	300	3.0	210	1.7	170	1.1	510	13.6	1,100	25.2
—	20	400	4.7	280	3.0	200	1.7	160	1.1	480	13.4	960	24.8
—	25	320	3.6	220	2.3	160	1.3	130	0.9	380	10.2	760	18.9
1	25.4	320	3.5	230	2.3	160	1.3	130	0.9	380	10.0	770	18.7
—	30	270	2.9	190	1.8	130	1.0	110	0.7	320	8.3	640	15.4
1 1/4	31.75	260	2.7	180	1.7	130	1.0	110	0.7	310	7.9	610	14.2
1 1/2	38.1	220	2.2	150	1.4	110	0.8	90	0.5	260	6.1	510	11.4
—	40	200	2.0	140	1.3	100	0.7	80	0.5	240	5.5	480	10.6
1 3/4	44.45	190	1.6	130	1.0	90	0.6	80	0.4	220	4.1	440	8.7
—	50	160	1.0	110	0.6	80	0.4	60	0.2	190	2.9	380	5.5
2	50.8	160	1.0	120	0.6	80	0.3	70	0.2	190	2.8	390	5.3
Depth of Cut	a_a	1.5D											
	a_r	0.25D											

STANDARD MILLING CONDITION

6-Flute

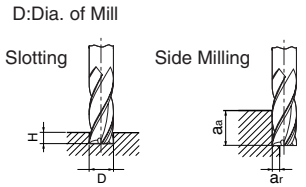
Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		85 SFM		60 SFM		40 SFM		33 SFM		100 SFM		200 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/2		640	7.7	450	4.8	320	2.7	260	1.8	800	21.9	1,600	39.6
5/8		510	7.7	360	4.6	260	2.6	210	1.8	610	21.6	1,300	38.4
3/4		430	7.4	300	4.5	210	2.5	170	1.7	510	20.4	1,100	37.8
7/8		370	6.5	260	4.0	180	2.2	150	1.5	440	17.7	900	33.1
1		320	5.3	230	3.4	160	1.9	130	1.3	380	15.1	770	28.1
1 1/4		260	4.1	180	2.6	130	1.5	110	1.0	310	11.8	610	21.3
1 1/2		220	3.2	150	2.1	110	1.2	90	0.8	260	9.2	510	17.1
2		160	1.5	120	0.9	80	0.5	70	0.3	190	4.1	390	8.0
Depth of Cut	a_a	1.5D											
	a_r	0.25D											

1) The above cutting speeds and feeds apply to regular end mill flute length.
For long fluted end mills please use the following factors below:

Cutting Length	Reduce **Feed** by
2.5 × Diameter	15%
3 × Diameter	25%
4 × Diameter	55%
5 × Diameter	65%
6 × Diameter	75%

2) In dry milling, reduce the RPM and Feed 30% of values on table above. (recommended air blow)
3) Adjust drilling condition when unusual vibration or different sound occurs.

D:Dia. of Mill



Roughing and Finishing (Heavy Duty) End Mills List No. 6367

Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		80 SFM		60 SFM		40 SFM		33 SFM		100 SFM		200 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/4		1,300	5.9	900	3.7	700	2.1	510	1.5	1,600	17.3	3,100	31.5
3/8		820	5.9	600	3.8	410	2.1	340	1.5	1,100	17.7	2,100	32.1
1/2		620	5.9	450	3.8	310	2.1	260	1.5	800	17.3	1,600	31.9
5/8		490	5.9	360	3.7	250	2.1	210	1.5	610	17.1	1,300	31.5
3/4		410	5.6	300	3.6	210	2.0	170	1.4	510	16.3	1,100	31.5
1		310	5.5	230	3.5	160	2.2	130	1.4	380	15.7	800	29.5
1 1/4		250	4.3	180	2.7	130	1.5	110	1.1	310	12.6	700	23.6
1 1/2		210	3.5	150	2.2	110	1.2	90	0.8	260	9.8	600	18.5
1 3/4		180	2.4	130	1.6	90	0.9	80	0.6	220	7.5	500	13.8
2		160	2.0	120	1.4	80	0.7	70	0.5	190	5.9	400	11.0
Depth of Cut	a_a	1.5D											
	a_r	0.25D											
	H	0.5D											

Roughing (HOG) End Mills List No. 6303
Roughing (HOG) End Mills / Fine Pich Multi Flute List No. 6307

Work Material / Milling Conditions / Dia. of Mill (inch)		Carbon Steels		Alloy Steels		Die Steels Stainless Steels		Nickel Alloys Titanium Alloys		Cast Iron		Aluminum Alloys Copper Alloys Nonferrous Alloys	
		80 SFM		60 SFM		40 SFM		33 SFM		100 SFM		200 SFM	
		RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
1/4		1,300	5.1	900	3.1	700	1.7	510	1.2	1,600	6.7	3,100	26.4
3/8		820	5.1	600	3.1	410	1.7	340	1.2	1,100	6.7	2,100	26.4
1/2		620	5.1	450	3.2	310	1.7	260	1.2	800	6.7	1,600	26.4
5/8		490	5.1	360	3.1	250	1.7	210	1.2	610	6.7	1,300	26.4
3/4		410	5.1	300	3.0	210	1.7	170	1.2	510	6.7	1,100	26.4
1		310	5.1	230	3.1	160	1.8	130	1.2	380	6.7	800	26.4
1 1/4		250	4.9	180	3.1	130	1.8	110	1.2	310	6.7	700	26.4
1 1/2		210	3.5	150	2.3	110	1.3	90	0.9	260	5.3	600	21.7
1 3/4		180	2.6	130	1.6	90	0.9	80	0.6	220	3.7	500	15.7
2		160	2.4	120	1.6	80	0.9	70	0.6	190	3.5	400	14.2
Depth of Cut	a_a	1.5D											
	a_r	0.25D											
	H	0.5D											

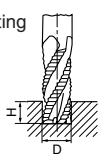
1) The above cutting speeds and feeds apply to regular end mill flute length.
For long fluted end mills please use the following factors below:

Cutting Length	Reduce **Feed** by
2.5 × Diameter	15%
3 × Diameter	25%
4 × Diameter	55%

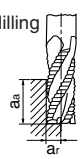
2) In dry milling, reduce the RPM and Feed 30% of values on table above. (recommended air blow)
3) Adjust drilling condition when unusual vibration or sound occurs.

D:Dia. of Mill

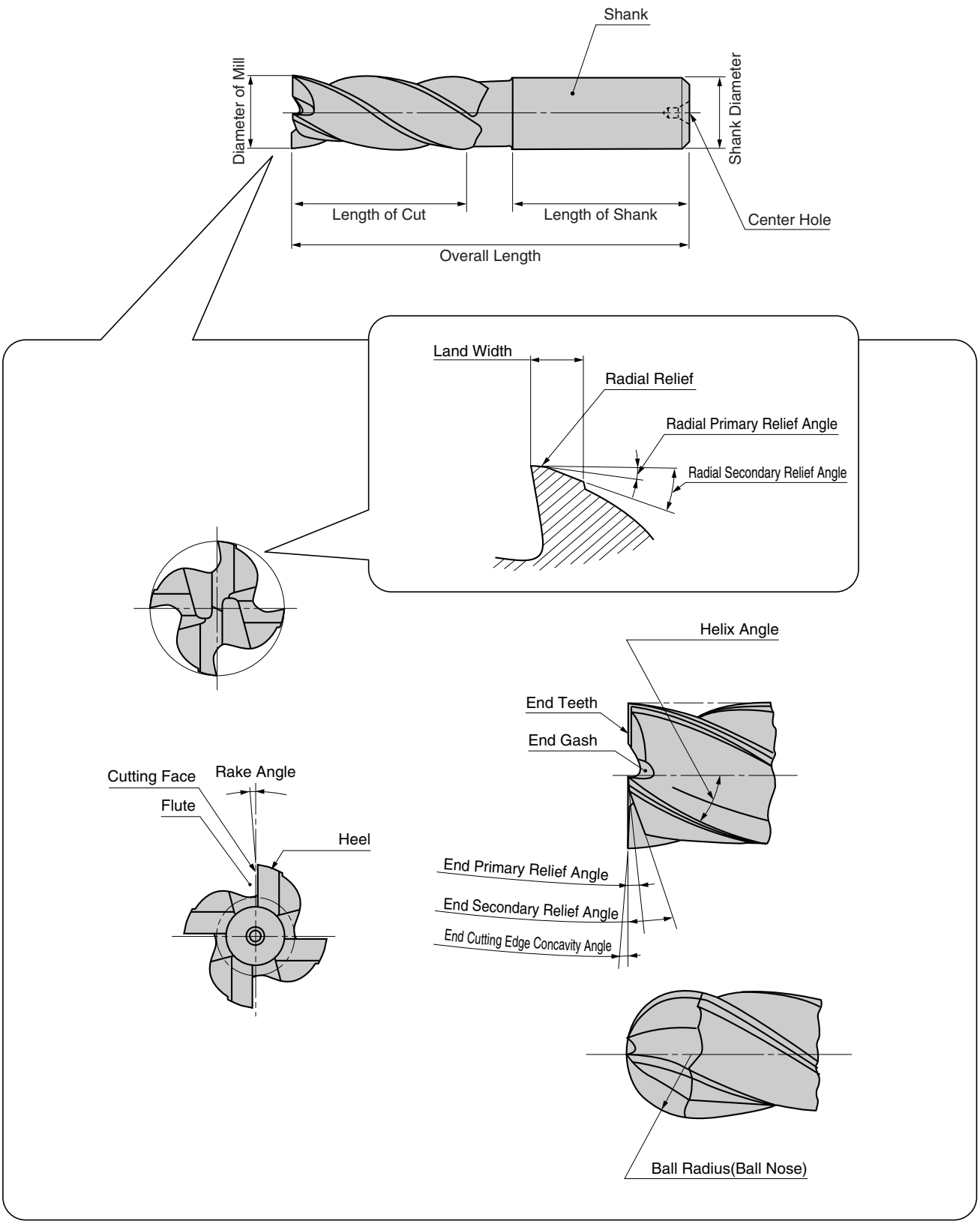
Slotting



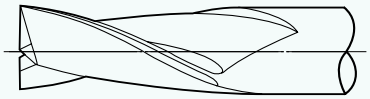
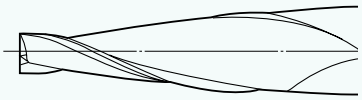
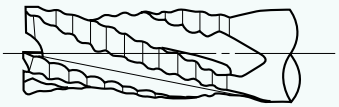
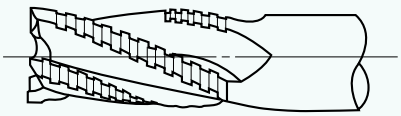
Side Milling



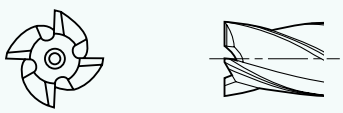
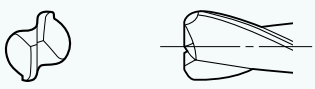
END MILL NOMENCLATURE



THE PERIPHERAL TEETH AND THE FEATURES

Type	Form	Features
Square type		• Used for general purpose, that is slotting, side milling, etc. • Used for every cutting. That is rough cut, semi-finish cut and finish cut.
Tapered type		• Used for milling of draft angle of die components. • The peripheral teeth is taper.
Roughing type (HOG)		• Suitable for rough milling, because of the small cutting resistance, and small cutting chips by the wavy type nicks. • Do not use for finish milling because of too much roughness.
HEAVY type (Roughing and Finishing)		The cutting resistance is larger than roughing endmill, but smaller than square teeth endmill. Suitable for semi-finish milling and the parts which not required accurate tolerance.

THE END TEETH TYPE AND THE FEATURE

Type	Form	Features
Square type with center hole		• Used for general purpose, that is slotting, side milling, etc. • Can not be used for plunge feed.
Square type without center hole		• Used for general purpose, that is slotting, side milling, etc. • Can be used for plunge feed. 2 Flutes is better than multi flutes for plunge cut.
Ball		• Used for contour milling or copy milling of die components. • The center of teeth does not have better cutting performance because of too small chip pocket and cutting speed.
Corner radius		• Suitable for radius shape milling for corner of die components or machine parts. • Suitable for high-speed contour milling because of it's rigidity.

END MILLS / TOLERANCE OF DIAMETER

DESCRIPTION	LIST NO.	Dia. of Mill Above	Dia. of Mill Up to	TOLERANCE (Inch)
2-FLUTE SINGLE END	6230		10(mm)	0/-0.0008
		10(mm)	30(mm)	0/-0.0010
		30(mm)		0/-0.0012
	6231	1/8~2(Inch)		+0.0010/0
	6231X	1/8~1-1/2(Inch)		+0.0010/0
	6231H	1/4~2(Inch)		+0.0030/0
	6233	1/4~2(Inch)		+0.0010/0
	231	1/8~2-1/2(Inch)		+0.0010/0
	291	1/8~2(Inch)		+0.0010/0
	6291	1/8~1-1/2(Inch)		+0.0010/0
	6290	1.5~40.0(mm)		0/-0.0010
	6293	1/4~1-1/4(Inch)		+0.0030/0
2-FLUTE DOUBLE END	261	1/8~1(Inch)		0/-0.0015
	6261	1/8~1(Inch)		0/-0.0015
	295	1/8~1(Inch)		0/-0.0015
	6295	1/8~1(Inch)		0/-0.0015
4-FLUTE SINGLE END	6210		10(mm)	+0.0008/0
		10(mm)	30(mm)	+0.0010/0
		30(mm)		+0.0012/0
	6213	1/4~1-1/4(Inch)		+0.0010/0
	211	1/8~2(Inch)		+0.0010/0
	213	1/4~2(Inch)		+0.0010/0
	215	1/4~1-1/4(Inch)		+0.0010/0
	6281		3/8(Inch)	0/-0.0023
		3/8(Inch)	5/8(Inch)	0/-0.0028
		5/8(Inch)	1(Inch)	0/-0.0033
		1(Inch)		0/-0.0039

DESCRIPTION	LIST NO.	Dia. of Mill Above	Dia. of Mill Up to	TOLERANCE (Inch)
4-FLUTE DOUBLE END	6241	1/8~1(Inch)		+0.0030/0
	271	1/8~1(Inch)		0/-0.0015
	6271	1/8~1(Inch)		0/-0.0015
MULTI-FLUTE SINGLE END	6211M	1/8~2(Inch)		+0.0010/0
	6211X	1/8~1-1/2(Inch)		+0.0010/0
	6201	1/8~2(Inch)		+0.0010/0
	6203	1/4~2(Inch)		+0.0010/0
	6207	1/4~2(Inch)		+0.0010/0
ROUGHING (HOG)	6303	1/4~2(Inch)		±0.0040
	6303P	1/4~2(Inch)		±0.0040
	6305	1/4~2(Inch)		±0.0040
	6307	1/4~2(Inch)		±0.0040
	6304	12.0~50.0(mm)		±0.0040
	6303X	1/4~2(Inch)		±0.0040
ROUGHING AND FINISHING	6367	1/4~3(Inch)		+0.0010/0
	6367P	1/4~2(Inch)		+0.0010/0
	6367X	1/4~2(Inch)		+0.0010/0
PM-HSS HIGH HELIX	7221P	1/4~1-1/2(Inch)		+0.0010/0
GENAC"SG" 2-FLUTE SINGLE END	9261X	1/8~1(Inch)		0/-0.0020
	9265X	1/8~1(Inch)		0/-0.0020
	9271X	1/8~1(Inch)		0/-0.0020
	9275X	1/8~1(Inch)		0/-0.0020
GENAC"SG" 4-FLUTE SINGLE END	9263X	1/8~1(Inch)		0/-0.0020
	9267X	1/8~1(Inch)		0/-0.0020
	9273X	1/8~1(Inch)		0/-0.0020
	9277X	1/8~1(Inch)		0/-0.0020
GENAC"SG"ROUGHING	9251X	1/4~1-1/4(Inch)		0/-0.0020
HIGH HELIX 3-FLUTE	9221X	1/8~1(Inch)		0/-0.0020

Milling Terminology

Terms	Descriprions	Formulas
SFM	**S**urface **F**eet Per **M**inute	**D** × **RPM** × 0.26
RPM	**R**evolutions **P**er **M**inute	$\frac{\textbf{SFM} \times 3.82}{\textbf{RPM}}$
D	Cutter **D**iameter	

1. Correct Selection of End Mills

It is necessary to choose the most suitable end mills considering cutting efficiency, accuracy and so on for high efficient machining.

Tool Material

HSS-Co(equivalent to SKH59) shows excellent performance for cutting normal steel to non-ferrous alloy and cast iron. Select coated HSS, PM-HSS, FAX or Carbide for more efficient and long lasting milling.

Number of Flutes

Generally, 2-Flute is used for slot milling because of its wide chip pocket. 4-Flute is used for side milling because of its high rigidity.

Helix Angle

Generally 30° is used because better surface finish is obtained by helix angle around 30°. Lower helix is good for keyway slotting because the slot inclination is small. The bigger is the helix, the better will be the surface finish so that the high helix end mills will be used for contour milling.

Guidance for no. of flutes selection

Functions	Characteristics	No. of Flutes	
		2-Flt	4-Flt
Strength	Twist rigidity	○	◎
	Bending rigidity	○	◎
Surface Finish	Roughness	○	◎
	Waving	○	◎
	Inclination	○	◎
Tool Life S50C(200HB)	Feed (mm/tooth) Wear	○	◎
	constant Broken	○	◎
SKD11(320HB)	Feed (mm/min.) Wear	○	◎
	constant Broken	○	◎
Chip disposal	Chip jam	○	◎
	Chip exhaust	○	◎
Resharpening	Out dia relief	◎	○
	End teeth	◎	○
Form modify	Ball nose, Taper Form	◎	○

◎Great ○Good

Functions	Characteristics	No. of Flutes	
		2-Flt	4-Flt
Drilling	Counter Sink	◎	○
	Surface Roughness	◎	○
	Enlargement of Holes	◎	○
Cutting	Finishing	○	◎
	Light Duty	○	◎
	Heavy Duty	○	◎
Slotting	Chip exhaust	◎	○
	Enlarge, Eccentricity	◎	○
	Keyway Cutting	◎	○
Side Milling	Milling Accuracy	○	◎
	Chattering Vibration	◎	○
Work Material	Alloy Steel	○	◎
	Cast Iron	○	◎
	Non-ferrous material	◎	○
	Difficult machining	○	◎

◎Great ○Good

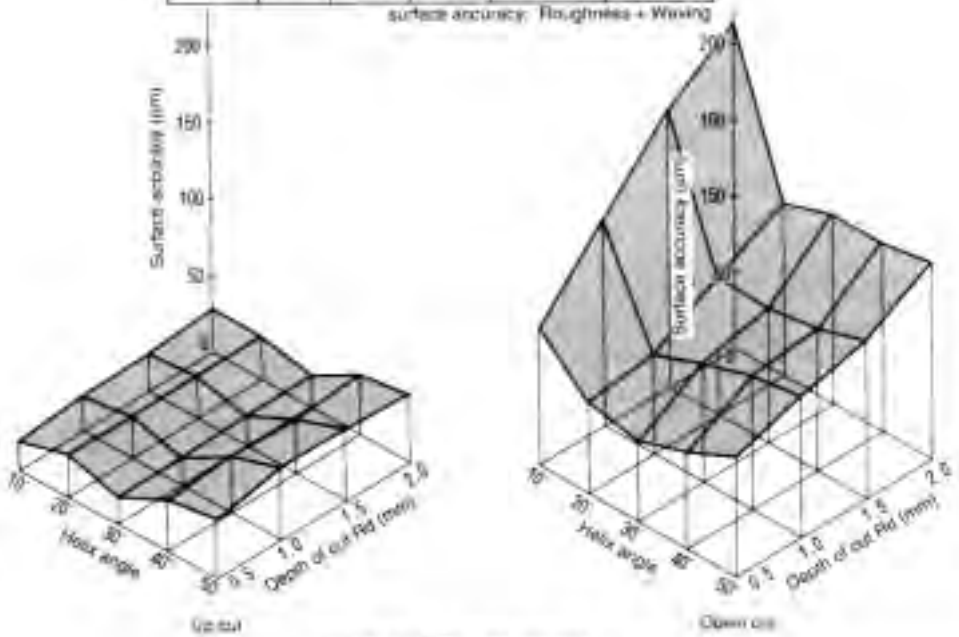
Characteristics of end mill helix

Range of helix angle	Cutting resistance			Surface accuracy			Tool life			Resharpening	
	Torque	Bendg	Thrust	Roughness	Waving	Inclination	Flank Wear	Out dia. Downsize	Breakage	Peripheral Relief	End teeth
Low helix	○	○	●	○	●	●	○	△	○	●	●
Standard helix	●	●	○	●	○	○	●	○	●	●	●
High helix	●	●	△	●	△	○	○	●	○	○	○

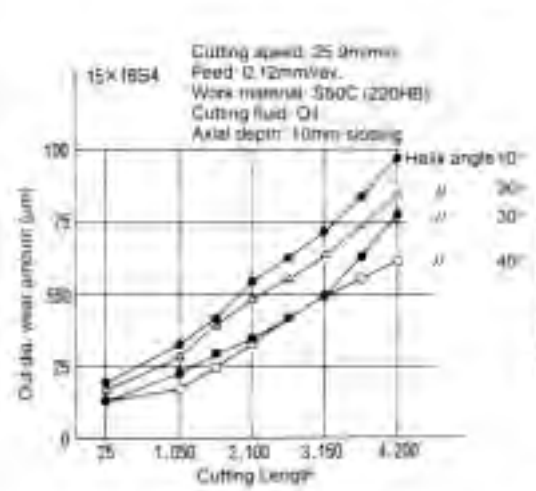
● Great ○ Good △ OK –Judging from usage of end mills

HELIX ANGLE AND SURFACE ACCURACY

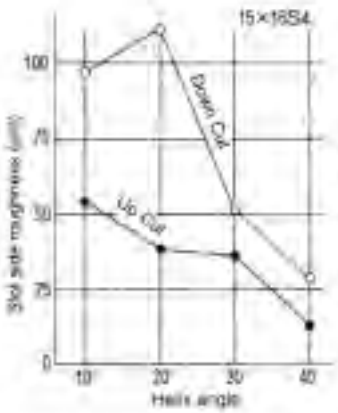
End mill	Speed	Feed	Material	Axial Depth	Cutg. Fluid
1554	20.6 m/min	0.05 mm/Tth	S50C (200HB)	15mm	Oil



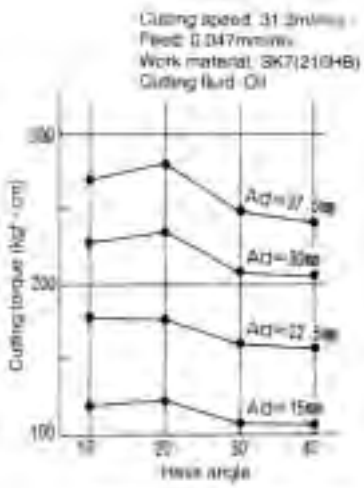
Helix angle & Surface accuracy



Relation between Helix angle and Out dia wear amount



Relation between Helix angle and Slot side roughness



Relation between Helix angle and Cutting torque

2. Maintenance of machine and Fixture

3. Correct Holding of End Mills

It is important for the milling chuck to have the following conditions.

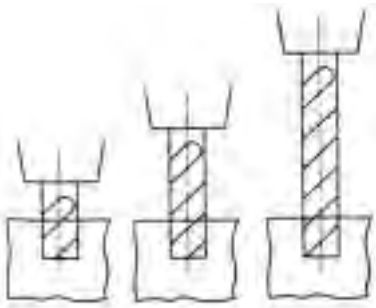
1. Strong chucking force
2. Accurate chucking
3. Rigid chucking
4. Easy handling
5. Excellent safety

4. Firm fixture of the work

5. Proper selection of cutting conditions

6. Proper resharpening

STRENGTH COMPARISON BY FLUTE LENGTH

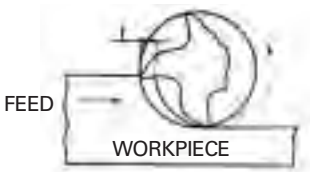


Flute length ratio	1	1.4	2.5
Strength ratio	155	19	1

The best endmill selection is as short as possible

CUTTING DIRECTION

UPCUT



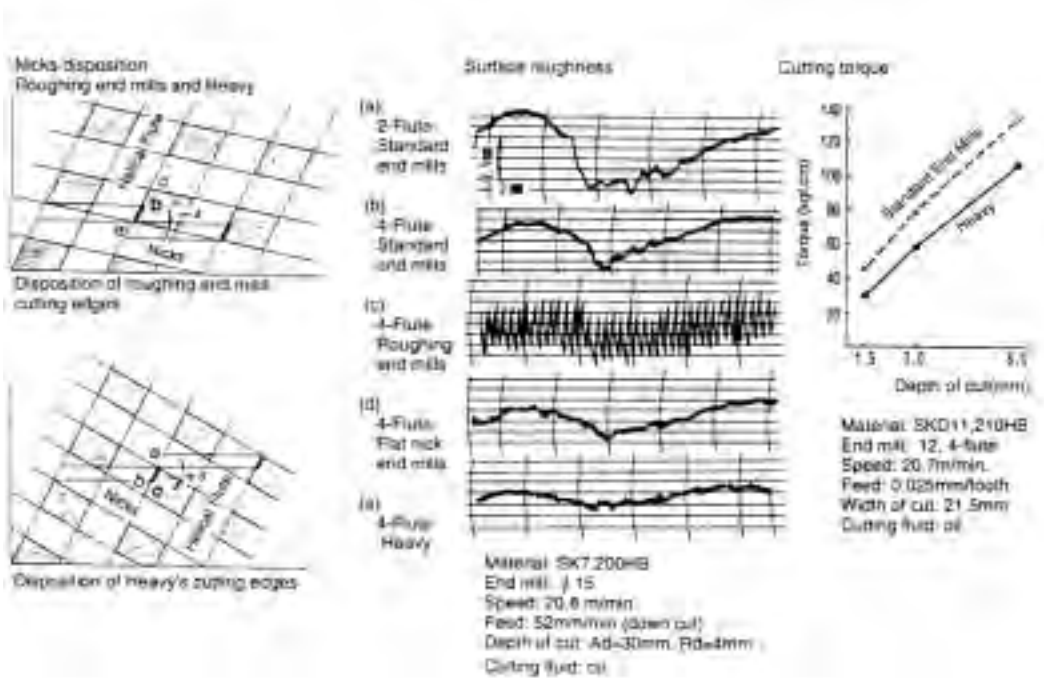
DOWNCUT

	Surface Finish	Tool Life	Application
Upcut	●		Finish
Downcut		●	Rough or Semi Finish

HEAVY'S FEATURES (Rough and Finish)

1. Nachi Heavy is designed with specially formed and disposed nicks so that it may decrease cutting resistance and minimize waviness or vibrations on the surface finish.
2. Diameter rotation generates a straight line. Therefore surface finish is excellent.
3. Chips flow out easily because of their chopped form.
4. Cutting fluid penetration is very smooth.

Example of Heavy and other end mills performances



NACHI THE BETTER END MILL

CNC Tolerances

New Nachi Premium Material End Mills are now made to CNC cutting diameter tolerances. The present close tolerance of Nachi End Mills is now closer than ever, as per table below.

Lead Specified

New Nachi Premium Material End Mills have the lead of spiral marked on the shank. This eliminates measuring the lead when setting up for resharpening and is a real time saver.

NACHI CNC TOLERANCE (Cutting Diameter)

+.0010 0				0 -.0010	
List No.	Tool No.	List No.	Tool No.	List No.	Tool No.
6201	PF	6233	PGE	6230	MPG
6203	PFL	6367	PK	6290	MPR
6207	PFX	6367P	PKP	±.0040	
6210	HPF	6367X	PKX	6303	PQ
6211M	PFC	7221P	PHP	6303P	PQP
6211X	PFCX	0 -0.0015		6303X	PQX
6213	PFLC			6304	MPQ
6231	PG	6261	PC	6305	PQA
6231X	PGX	6295	PRR	6307	PQF

*Some items, present stock until depleted.

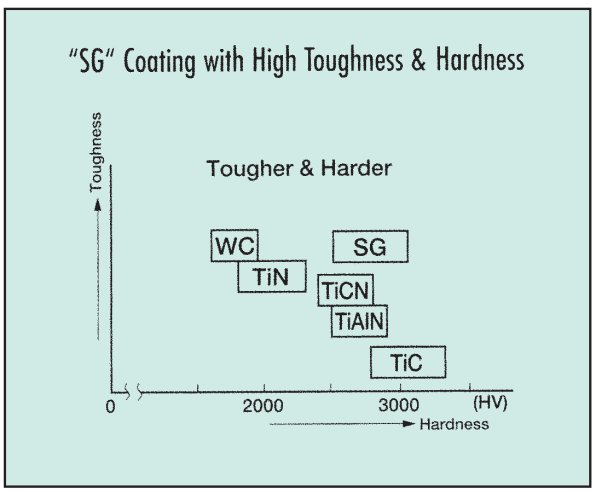
WHEN PERFORMANCE COUNTS, COUNT ON GENAC

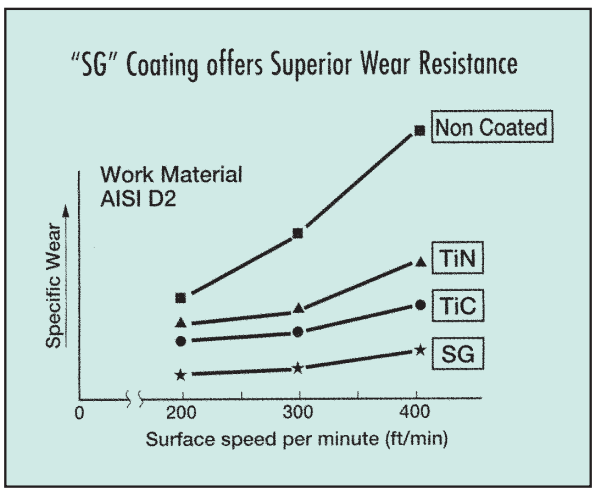
Genac Mills provide

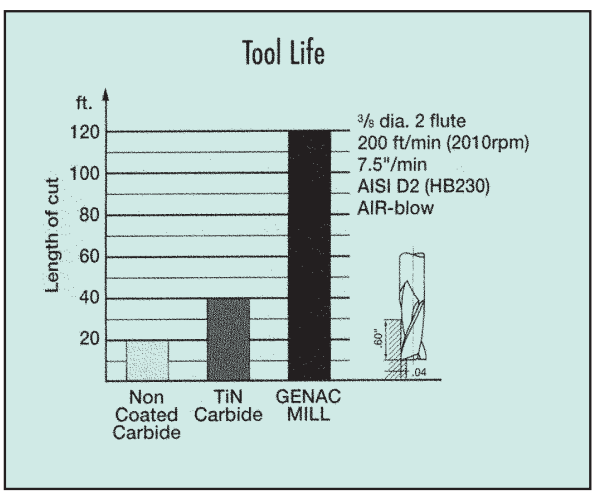
- Higher Productivity
- Greater Cost Efficiency
- Highest Wear Resistance
- 3x Longer Life than TiN Carbide
- Precision Cutting

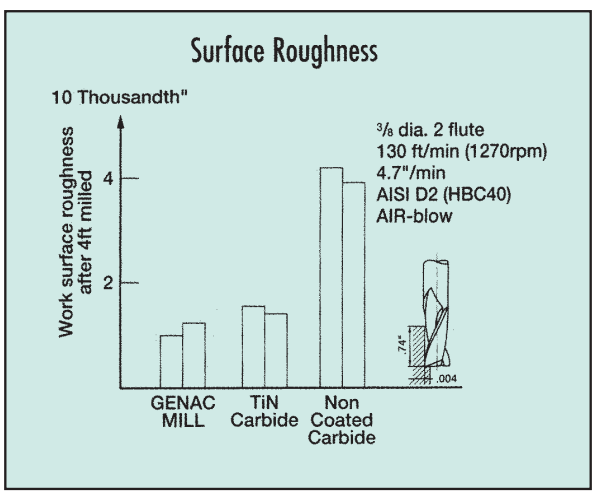
...and unique Nachi Geometry

Plus Nachi's unique start-to-finish total quality control for higher precision, better performance, closer tolerances and greater durability. Genac mills available in six standard types for super cutting performance.
All Competitively Priced!









RESHARPENING OF END MILLS

End mills should be sharpened before wear land exceeds the values shown in table to the right by grinding the cutting surface. Care should be taken to duplicate the original factory rake angle.

Peripheral Primary Relief Wear	Kind of Cutting Operation
.004 - .006	Precision Cutting Keyway Cutting
.012 max.	General Cutting
.020 - .025	Rough Cutting

Grinding Wheel Selections and Grinding Operations

End Mill Material	Application	Shape	Wheel Identification	Wheel (SFPM)	Infeed (.0001″/pass)
Cobalt High Speed Steel	Peripheral Relief	Straight	WA60J, WA60K	3800~5000	Rough 12~24 Finish 4~12
	End Teeth	Flare Cup	WA60~80K		
	Tooth Face	Dish	WA60K, WA80K		
Cobalt Vanadium High Speed Steel	Peripheral Relief	Straight	CBN 120~220	3800~5000	Rough 4~8 Finish 2~4
	End Teeth	Flare Cup	CBN 120~140		
	Tooth Face	Dish	CBN 120~140		
Carbide	Rough	Straight Flare Cup Dish	DA100N	2600~3300	4~8
			GC60~80GmV		12~24
	Finish	Straight Flare Cup Dish	DA150~180N		2~12
			GC100~120GmV		4~12

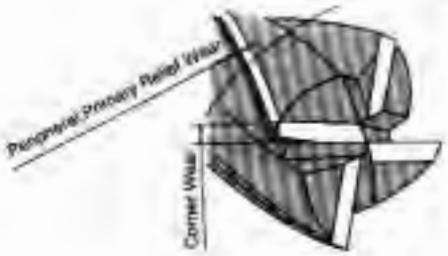
Resharpening Methods

Application for Relief Angle, and Radial Rake Angle

Work Material	Radial Relief		Axial Relief		Tooth Face
	Primary	Secondary	Primary	Secondary	Radial Rake Angle
Steel	6° ~ 10°	20° ~ 25°	3° ~ 7°	10° ~ 25°	15°
Cast Iron	8° ~ 12°	20° ~ 25°	3° ~ 7°	10° ~ 25°	12°
Copper	10° ~ 15°	20° ~ 25°	8° ~ 12°	10° ~ 25°	10° ~ 20°
Light Alloy, Non-Ferrous Metal	10° ~ 15°	20° ~ 25°	8° ~ 12°	10° ~ 25°	15° ~ 20°

As for smaller mill dia. adopt bigger peripheral relief angle.

RESHARPENING OF END MILLS

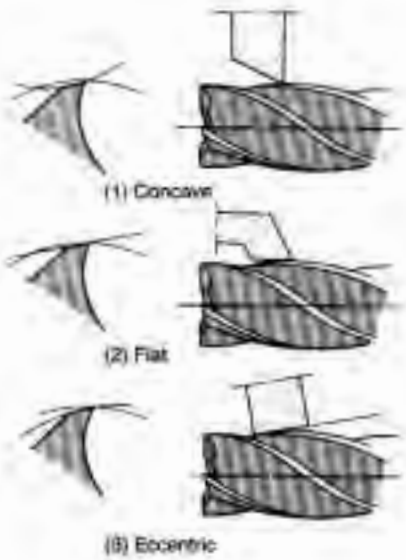


Peripheral Primary Relief Wear(mm)	Kind of Cutting Operation
0.1 ~ 0.15	Precision Cutting Keyway Cutting
0.3	General Cutting
0.5 ~ 0.7	Rough Cutting

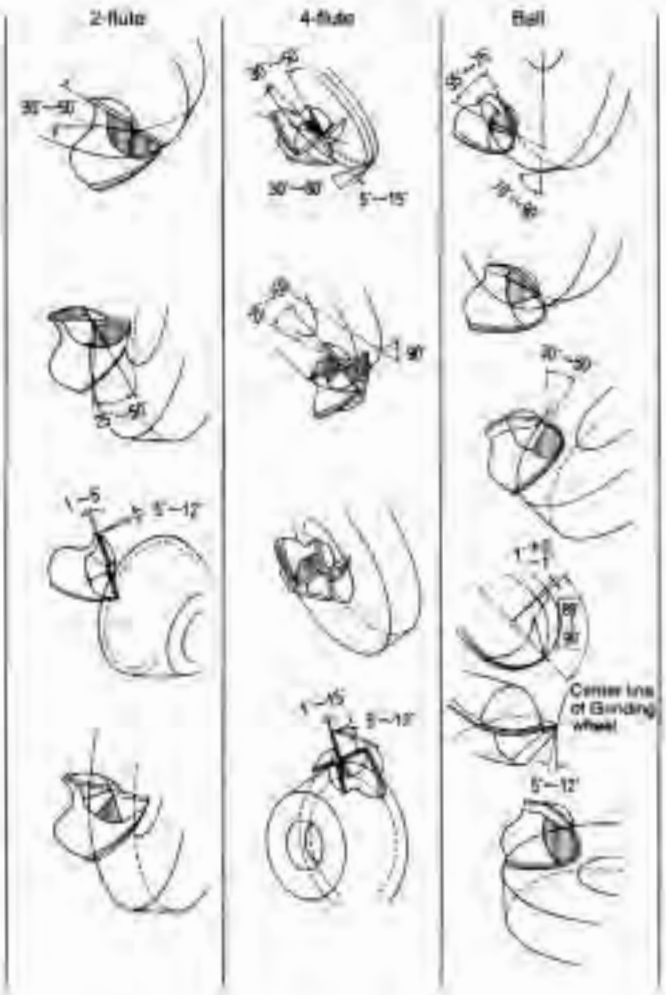
Timing for Resharpening
Proper tooth profile must always be kept to ensure a longer tool life so that a higher prodictivity can be achieved.
Generally, a timing for the resharpening can be observed by a wear on the peripheral primary relief as in shown above.

Resharpening methods of end mills are classified into
(A) Peripheral Primary Relief Grinding for conventional types of end mills
(B) Tooth Face (Rake Face) Grinding for roughing end mills, and coated end mills and formed end mills.
(C) End Tooth Grinding for Keyway end mills.
In case of (A), (C) is also required after 2 - 3 times of regrinding.

Out Dia. Relief Grinding



End Tooth Grinding

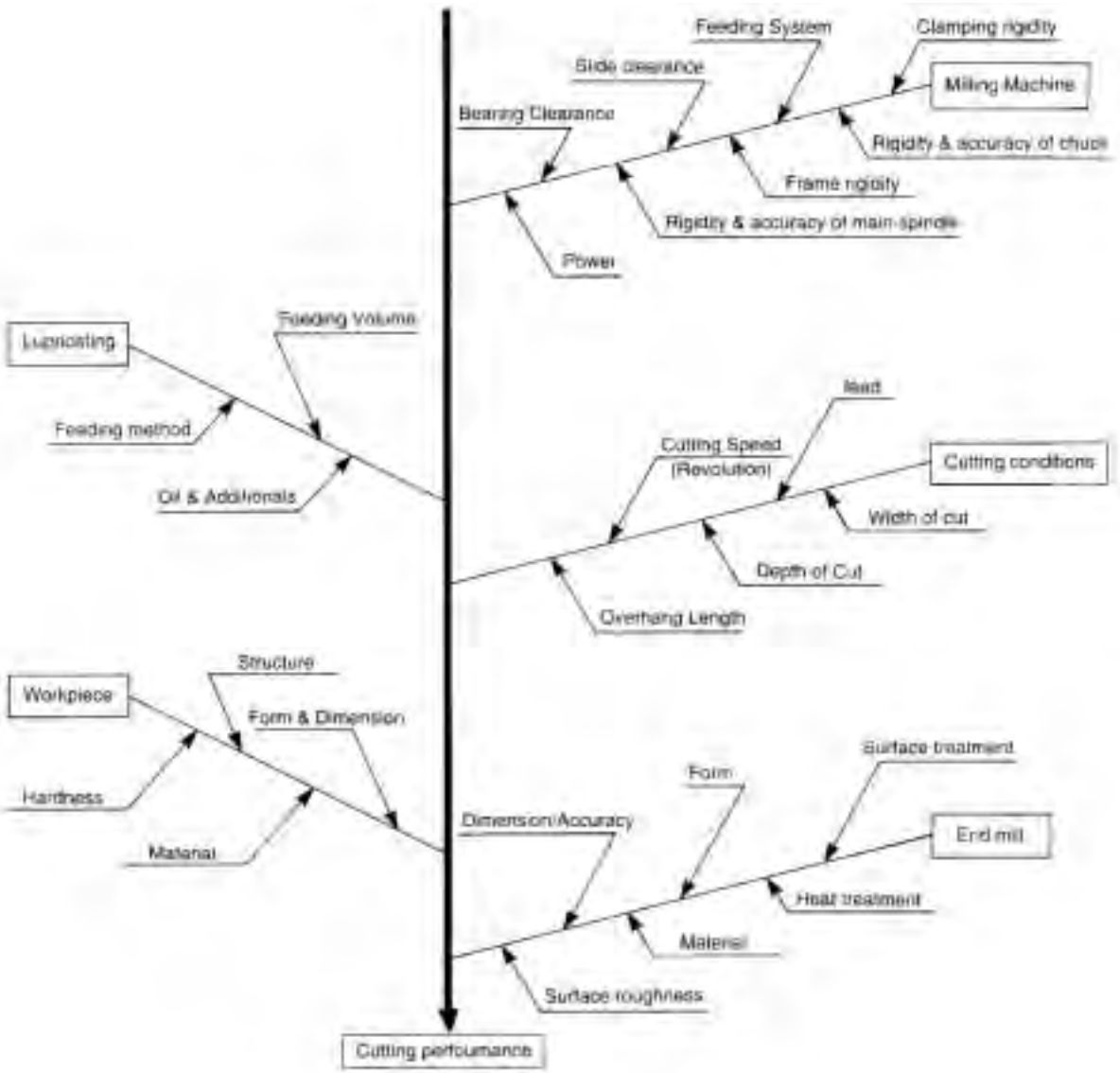


Tooth Face Grinding

In regrinding coated end mills, tooth face (rake face) grinding is desirous.

CAUSES AND REMEDY FOR END MILL PROBLEM

Factors of end mill performance There are such causes which affect the end mill performance as shown in the figure. This so many factors are affecting the performance and end mills can not work well unless every factor is in the best condition.



Cutting Performance	
1. Finished Accuracy	5. Breakage
2. Finished Roughness	6. Cutting noise
3. Wear	7. Burned Chips
4. Chipping	

TROUBLE-SHOOTING GUIDE FOR END MILL PROBLEMS

	Troubles	Factors	Countermeasures
Surface Roughness	Rough Finish	Chatter	• Increase rigidity of workpiece fixture • Check machine condition, horsepower (H,P) • Reduce cutting speed • Consider conventional (up-cut) milling • Use shortest possible length of tool, consider using special long reach holder
		Uneven hardness of workpiece	• Use even hardness material
		Insufficient rake or relief	• Resharpen cutter to correct geometry to suit cutting conditions
		Built-up edge, cold welding	• Remove build-up edge & cold welding • Check deterioration of cutting fluid
		Dull cutting edge	• Provide timely resharpening
		Speed too high	• Reduce cutting speed
		Improper or lack of cutting fluid	• Change cutting fluid or lubricating system
	Torn Finish	Uneven wear on teeth	• Remove wear by regrinding
		Cold welding on teeth	• Remove cold welding • Change cutting fluid
		Bruise on teeth	• Handle end mill carefully
	Waviness	Too small number of flutes Heavy cutting conditions Helix angle too big	• Try multi flute end mill, 2FLfi3FLfi4FL • Reduce amount of radial depth of cut and feed • Use lower helix angle end mill
Form Error	Squareness (Perpendicularity)	Heavy cutting conditions Excessive overhang of cutter or workpiece Angular error of fixture	• Reduce depth of cut and feed • Use shortest possible length of tool, consider using special long reach holder • Correct fixture angle
Tool Life	Short Life per Resharpening	Material too hard	• Provide proper annealing • Reduce feed and use upper gread material end mill
		Incorrect feed	• Define proper feed
		Built-up edge, cold welding	• Remove build-up edge or cold welding • Use activative cutting fluid
		Insufficient coolant	• Use proper cutting fluid • Increase rate of coolant flow
		Incorrect resharpening	• Resharpen cutter to correct geometry to suit cutting conditions
	Total Tool Life Too Short	Less number of resharpening	• Regrind relief angle smaller • Provide proper resharpening amount
		Improper time of resharpening	• Provide timely resharpening
	Excessive Wear	Material defect of workpiece	• Use evenness hardness material
		Improper rake or relief	• Resharpen cutter to correct geometry to suit cutting conditions
		Insufficient performance of end mill	• Use upper grade material end mill • Try to use coated end mill
		Unsuitable cutting fluid	• Select proper cutting fluid • Correct lubricating system
		Improper time of resharpening	• Provide timely resharpening
		Incorrect resharpening	• Improve surface roughness on resharpening • Prevent overheat of cutter grinding • Remove build-up edge and weld deposit
	Chipping or Cracking	Chatter	• Increase rigidity of workpiece fixture
		Material defect or workpiece	• Use even hardness material • Remove abnormal parts such as scale, sandtumbling etc.
		Feed too high	• Reduce feed speed
		Dull cutting edge	• Provide resharpening
		Deterioration of cutting fluid	• Provide new cutting fluid
	Breakage	Lack of rigidity in set-up	• Check component or fixture for security and rigidity
		Dull cutting edge	• Provide Resharpening
		Careless handling	• Handle end mill carefully
		Chip cram	• Remove chips by air-jet cutting fluid

TAPS

Features

1. **Nachi Viper Taflet Taps** are specially engineered for steels, and require less torque than conventional coldform taps. This reduces the chance of breakage.
2. **Nachi Viper Taflet Taps** are steam oxide surface treated to limit adhesion from fusion, and carries coolant to the work area. Bright finish is available when required.
3. **Nachi Viper Taflet Taps** have more radial sections for higher accuracy of internal threads in steel. This compares favorably to coldform internal threads, which aren't always clean and accurate.

VIPER TAFLET

DLC TAFLET

Work Materials

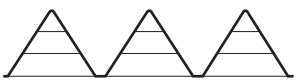
Structural Steels, Carbon Steels, Alloy Steels, Stainless Steels, Aluminum Alloys

Performance

TAFLET
Fiber flow is:
NOT INTERRUPTED.

Female thread cut by a TAFLET

Cutting Tap
Fiber flow is:
INTERRUPTED.



Female thread cut by a cutting tap

Features of TAFLET

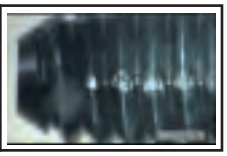
Item	Cutting tap	TAFLET	TAFLET features
Tap breakdown	×	○	Does not break because there is no groove
Trouble caused by chips	×	○	No trouble because there is no chip
Accuracy of female thread	×	○	Little variations because of cold forming tapping
Female thread surface roughness	×	○	Excellent because threads are finished by sliding over the tap surface
Tapping torque	○	×	1.5 through 2.5 times the torque of a cutting tap
Female thread strength	×	○	Excellent because fiber flow is not interrupted in plastic working
Workpiece	○	×	Limited to the material of good malleability

DLC TAFLET

Semi-Dry Tapping

Forming tap with DLC coating can be used in Aluminum, Aluminum Alloys, Die Cast Aluminum.
The tap shown below, M6x1.0, tapped 1,000 holes in A6061 with mist hole lube applied and has minimum adhesion of material.

Size: M6x1.0
Work Material: A6061-T6
Speed: 15m/min (49.2SFM)
Feed: 1.0mm/rev (0.039IPR)
Depth of Thread: 13mm
Coolant: mist lube (25cc x 2 nozzle /h)

1000 Hole	

Stocked Size — Taps Name	List No.	Page
DLC TAFLET THREAD FORMING TAPS / Fractional Sizes	6955	210
DLC TAFLET THREAD FORMING TAPS / Machine Screw Sizes	6957	210
DLC TAFLET THREAD FORMING TAPS / Metric Sizes	6956	211
VIPER TAFLET THREAD FORMING TAPS / Machine Screw Sizes	995	222
VIPER TAFLET THREAD FORMING TAPS / Fractional Sizes	995	223
VIPER TAFLET THREAD FORMING TAPS / Metric Sizes	996	224

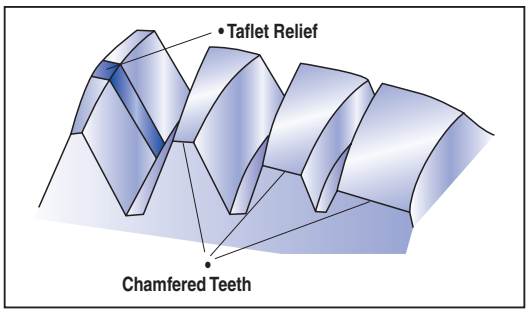
Features

- Viper T Series are suitable for various material.
- "Viper T for STAINLESS" series are the best taps for STAINLESS STEEL.

Work Materials

Structural Steels, Carbon Steels, Alloy Steels, Stainless Steels, Aluminum Alloys

Performance



Nachi TDT Viper T-Series Taps were specifically designed to overcome the major difficulties of spiral fluted taps: oversizing and chip control. An all-new approach to these limitations also provides double-action tapping — ***cutting*** with chamfered teeth, plus ***cold rolled forming*** with a specially engineered shape of thread that we call Taflet Relief.

The results provide two-fold benefits. The first is minimal or no oversized thread diameter over the entire thread length, with smooth thread surfaces. The second is smooth chip ejection, ensuring freedom from chips for trouble-free performance, especially on machining centers and on unattended machining lines.

Conventional Taps T-Series Taps

Stocked Size / Taps Name	List No.	Page
VIPER T / Spiral Flute-Machine Screw Sizes	7981	215
VIPER T / Spiral Flute-Fractional Sizes	7981	215
VIPER T / Spiral Point-Machine Screw Sizes	7971	216
VIPER T / Spiral Point-Fractional Sizes	7971	216
VIPER T / Spiral Flute-Metric Sizes	7980	217
VIPER T / Spiral Point-Metric Sizes	7970	217
VIPER T / Spiral Flute-Machine Screw Sizes	7987	218
VIPER T / Spiral Flute-Fractional Sizes	7987	218
VIPER T FOR STAINLESS STEEL / Spiral Point-Machine Screw	7977	219
VIPER T FOR STAINLESS STEEL / Spiral Point-Fractional Sizes	7977	219
VIPER T FOR STAINLESS STEEL / Spiral Flute-Metric Sizes	7982	220
VIPER T FOR STAINLESS STEEL / Spiral Point-Metric Sizes	7972	220

Taps / Selection Chart

HIGH PERFORMANCE TAPS

Taps Name	Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
DLC TAFLET THREAD FORMING TAPS	HSSE-V	DLC	Fractional	1/4 to 1/2	●	***6955*** p.210	p.242	
			Machine Screw	2 to 12	●	***6957*** p.210	p.242	
			Metric	M2 to M12	●	***6956*** p.211	p.242	
SG Low Spriral TAPS	HSSE	SG	Fractional Machine Screw	2 to 12, 1/4 to 1	●	***6959*** p.212	p.242	
			Metric	M3 to M24	●	***6958*** p.213	p.242	

VIPER T-SERIES FOR GENERAL PURPOSE

Taps Name	Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
VIPER T / Spiral Point	HSSE-V	Black Oxide	Fractional	1/4 to 1	●	***7971*** p.216	p.242	
			Machine Screw	2 to 12	●	***7971*** p.216	p.242	
			Metric	M3 to M24	●	***7970*** p.217	p.242	
VIPER T / Spiral Flute			Fractional	1/4 to 1	●	***7981*** p.215	p.242	
			Machine Screw	2 to 12	●	***7981*** p.215	p.242	
			Metric	M3 to M24	●	***7980*** p.217	p.242	

VIPER T-SERIES FOR STAINLESS STEEL

Taps Name	Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
VIPER T / Spiral Point	HSSE	Black Oxide	Fractional	1/4 to 1	●	***7977*** p.219	p.242	
			Machine Screw	2 to 12	●	***7977*** p.219	p.242	
			Metric	M3 to M24	●	***7972*** p.220	p.242	
VIPER T / Spiral Flute			Fractional	1/4 to 1	●	***7987*** p.218	p.242	
			Machine Screw	2 to 12	●	***7987*** p.218	p.242	
			Metric	M3 to M24	●	***7982*** p.220	p.242	

●:Great ○:Good △:OK

	Hole Condition				Workpiece Material									
	Blind Hole		Through Hole		Structural Steel (SS)	Carbon Steel	Alloy Steel (SCM, SCR)	Pre-Hardened Steel	Die Steel HRc	Hardened Steel HRc		Stainless Steel	Cast Iron	Aluminum Alloy	Copper Alloy
	<1.5 x Dia.	≧ 1.5 x Dia.	<1.5 x Dia.	≧ 1.5 x Dia.					25 to 40	45 to 50	50 to 65				
	●	○	●	○										●	●
	●	○	●	○										●	●
	●	○	●	○										●	●
	●	○	●	○				○	●	△					
	●	○	●	○				○	●	△					

	Hole Condition				Workpiece Material									
	Blind Hole		Through Hole		Structural Steel (SS)	Carbon Steel	Alloy Steel (SCM, SCR)	Pre-Hardened Steel	Die Steel HRc	Hardened Steel HRc		Stainless Steel	Cast Iron	Aluminum Alloy	Copper Alloy
	<1.5 x Dia.	≧ 1.5 x Dia.	<1.5 x Dia.	≧ 1.5 x Dia.					25 to 40	45 to 50	50 to 65				
			●	●	○	○	○	○					○	○	○
			●	●	○	○	○	○					○	○	○
			●	●	○	○	○	○					○	○	○
	●	○	△	△	○	○	○	○					○	○	○
	●	○	△	△	○	○	○	○					○	○	○
	●	○	△	△	○	○	○	○					○	○	○

	Hole Condition				Workpiece Material									
	Blind Hole		Through Hole		Structural Steel (SS)	Carbon Steel	Alloy Steel (SCM, SCR)	Pre-Hardened Steel	Die Steel HRc	Hardened Steel HRc		Stainless Steel	Cast Iron	Aluminum Alloy	Copper Alloy
	<1.5 x Dia.	≧ 1.5 x Dia.	<1.5 x Dia.	≧ 1.5 x Dia.					25 to 40	45 to 50	50 to 65				
			●	○	△	△	△	△				●	△	△	△
			●	○	△	△	△	△				●	△	△	△
			●	○	△	△	△	△				●	△	△	△
	●	○	△	△	△	△	△	△				●	△	△	△
	●	○	△	△	△	△	△	△				●	△	△	△
	●	○	△	△	△	△	△	△				●	△	△	△

Taps / Selection Chart

VIPER TAFLET

Taps Name	Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
VIPER TAFLET THREAD FORMING TAPS	HSSE-V	Black Oxide	Machine Screw	0 to 12	●	***995*** p.222	p.242	
			Fractional	1/4 to 3/4	●	***995*** p.223	p.242	
			Metric	2 to 20	●	***996*** p.224	p.242	

VTP TAPS

Taps Name	Material	Coating		Stock Size	Stock USA ● Japan○	LIST No Page Size	LIST No Page Cutting Condition	
VTP TAPS / Spiral Point	HSSE-V	Black Oxide	Fractional	1/4 to 1	●	***971*** p.227	p.242	
			Machine Screw	2 to 10	●	***973*** p.227	p.242	
			Metric	3 to 18	●	***982*** p.231	p.242	
VTP TAPS / Spiral Flute			Fractional	1/4 to 1	●	***981*** p.226	p.242	
			Machine Screw	2 to 10	●	***983*** p.226	p.242	
			Metric	3 to 18	●	***980*** p.231	p.242	
VTP TAPS / Roll Form	PREMIUM		Fractional	1/4 to 3/4	●	***991*** p.229	p.242	
			Machine Screw	0 to 12	●	***993*** p.228	p.242	

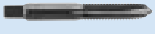
●:Great ○:Good △:OK

	Hole Condition				Workpiece Material									
	Blind Hole		Through Hole		Structural Steel (SS)	Carbon Steel	Alloy Steel (SCM, SCR)	Pre-Hardened Steel	Die Steel HRc	Hardened Steel HRc		Stainless Steel	Cast Iron	Aluminum Alloy	Copper Alloy
	<1.5 x Dia.	≧ 1.5 x Dia.	<1.5 x Dia.	≧ 1.5 x Dia.					25 to 40	45 to 50	50 to 65				
	●	○	●	○	●	●	○					○			
	●	○	●	○	●	●	○					○			
	●	○	●	○	●	●	○					○			

	Hole Condition				Workpiece Material									
	Blind Hole		Through Hole		Structural Steel (SS)	Carbon Steel	Alloy Steel (SCM, SCR)	Pre-Hardened Steel	Die Steel HRc	Hardened Steel HRc		Stainless Steel	Cast Iron	Aluminum Alloy	Copper Alloy
	<1.5 x Dia.	≧ 1.5 x Dia.	<1.5 x Dia.	≧ 1.5 x Dia.					25 to 40	45 to 50	50 to 65				
			●	○	●	●	○	○					○	○	○
			●	○	●	●	○	○					○	○	○
			●	○	●	●	○	○					○	○	○
	●	○	△	△	●	●	○	○					○	○	○
	●	○	△	△	●	●	○	○					○	○	○
	●	○	△	△	●	●	○	○					○	○	○
	●	○	●	○	●	●	○					○			
	●	○	●	○	●	●	○					○			

Taps / Selection Chart

STANDARD TAPS

Taps Name	Material	Coating		Stock Size	Stock USA ● Japan ○	LIST No Page Size	LIST No Page Cutting Condition	
Hand Taps	HSS	Bright	Fractional	1/4 to 1-1/2	●	***911***	p.242	
		TiN	Fractional	1/4 to 1-1/2	●	***911P***	p.242	
		Bright	Machine Screw	0 to 12	●	***913***	p.242	
		TiN	Machine Screw	0 to 12	●	***913P***	p.242	
		Bright	Metric	M2 to M27	●	***910***	p.242	
Hand Taps-Cast Iron Taps		Black Oxide	Inch	1/4 to 3/4	●	***969***	p.242	
Spiral Point		Bright	Machine Screw	0 to 12	●	***923***	p.242	
		TiN	Machine Screw	0 to 12	●	***923P***	p.242	
		Black Oxide	Machine Screw	0 to 12	●	***923S***	p.242	
		Bright	Fractional	1/4 to 3/4	●	***921***	p.242	
		TiN	Fractional	1/4 to 3/4	●	***921P***	p.242	
		Black Oxide	Fractional	1/4 to 3/4	●	***921S***	p.242	
		Bright	Metric	M2.5 to M16	●	***920***	p.242	
Spiral Flute		Bright	Fractional	1/4 to 1-1/2	●	***931***	p.242	
			Machine Screw	3 to 12	●	***933***	p.242	
Fast Spiral Flute		Bright	Fractional	1/4 to 1/2	●	***931H***	p.242	
			Machine Screw	3 to 10	●	***933H***	p.242	
Hand Taps / .005 Oversized		Bright	Machine Screw Fractional	6 to 10 1/4 to 1	●	***915***	p.242	
Spiral Point / .005 Oversized			Machine Screw Fractional	6 to 10 1/4 to 3/4	●	***925***	p.242	

● :Great ○ :Good △:OK

	Hole Condition				Workpiece Material										
	Blind Hole		Through Hole		Structural Steel (SS)	Carbon Steel	Alloy Steel (SCM, SCR)	Pre-Hardened Steel	Die Steel HRc	Hardened Steel HRc		Stainless Steel	Cast Iron	Aluminum Alloy	Copper Alloy
	<1.5 x Dia.	≧ 1.5 x Dia.	<1.5 x Dia.	≧ 1.5 x Dia.					25 to 40	45 to 50	50 to 65				
	●	○	●	○	△	△	△	△					△	△	△
	●	○	●	○	●	●	●	○				○	○	○	○
	●	○	●	○	△	△	△	△					△	△	△
	●	○	●	○	●	●	●	○				○	○	○	○
	●	○	●	○	△	△	△	△					△	△	△
	●	○	●	○	△	△	△	△					●		
			●	○	△	△	△	△					△	△	△
			●	○	●	●	●	○				○	○	○	○
			●	○	△	△	△	△					△	△	△
			●	○	△	△	△	△					△	△	△
			●	○	●	●	●	○				○	○	○	○
			●	○	△	△	△	△					△	△	△
	●	○	●	○	△	△	△	△					△	△	△
	●	○	△	△	△	△	△	△					△	△	△
	●	○	△	△	△	△	△	△					△	△	△
	●	○	△	△	△	△	△	△					△	△	△
	●	○	●	○	△	△	△	△					△	△	△
			●	○	△	△	△	△					△	△	△

Taps / Selection Chart

PIPE TAPS

Taps Name		Material	Coating		Stock Size	Stock USA ● Japan ○	LIST No Page Size	LIST No Page Cutting Condition	
Taper Pipe Taps	**Straight Fluted**	HSS	Bright	NPT	1/16 to 2	●	***941***	p.242	
			TiN	NPT	1/16 to 2	●	***941P***	p.242	
	Spiral Fluted	PREMIUM	Black Oxide	NPT	1/16 to 1	●	***947***	p.242	
	Interrupted	HSS	Bright	NPT	1/8 to 2	●	***943***	p.242	
Taper Pipe Taps / Dry Seal	**Straight Fluted**	HSS	Bright	NPTF	1/16 to 2	●	***941D***	p.242	
	Spiral Fluted	PREMIUM	Black Oxide	NPTF	1/16 to 1	●	***947D***	p.242	
Straight Pipe Taps		HSS	Bright	NPS	1/8 to 1	●	***945***	p.242	
Straight Pipe Tap / Dry Seal				NPSF	1/8 to 1	●	***945D***	p.242	

● :Great ○ :Good △:OK

	Hole Condition				Workpiece Material									
	Blind Hole		Through Hole		Structural Steel (SS)	Carbon Steel	Alloy Steel (SCM, SCR)	Pre-Hardened Steel	Die Steel HRc	Hardened Steel HRc		Stainless Steel	Cast Iron	Aluminum Alloy	Copper Alloy
	<1.5 x Dia.	≧ 1.5 x Dia.	<1.5 x Dia.	≧ 1.5 x Dia.					25 to 40	45 to 50	50 to 65				
	○	△	○	△	△	△	△	△					△	△	△
	●	○	●	○	●	●	●	○				○	○	○	○
	○	△	○	△	○	○	○	○					○	○	○
	○	△	○	△	△	△	△	△					△	△	△
	○	△	○	△	△	△	△	△					△	△	△
	○	△	○	△	○	○	○	○					○	○	○
	○	△	○	△	△	△	△	△					△	△	△
	○	△	○	△	△	△	△	△					△	△	△

DLC TAFLET THREAD FORMING TAPS / FRACTIONAL SIZE
DLC TAFLET THREAD FORMING TAPS / MACHINE SCREW SIZES

List No.6955 Fractional Size

DLC HSSE-V B CHAMFER

Bottoming Style
DLC Coating

Forming TAP with DLC coating can be used in Aluminum Alloy, Die Cast Aluminum and Copper.

Nominal Size	Thread/Inch		E. D. P. Numbers								Dimensions			Std. Pack.
	NC UNC	NF UNF	H2	H3	H4	H5	H6	H7	H8	H10	Overall Length	Length of Thread	Shank Dia.	
1/4	20				97838		97912				2 1/2	0.591	0.255	3
		28			97840		97914				2 1/2	0.591	0.255	3
5/16	18					97873		97931			2 23/32	0.669	0.318	3
		24				97875		97933			2 23/32	0.669	0.318	3
3/8	16					97877		97935			2 15/16	0.748	0.381	3
		24				97879		97937			2 15/16	0.748	0.381	3
7/16	14					97881			97961		3 5/32	0.866	0.323	3
1/2	13					97885			97965		3 3/8	0.984	0.367	3

List No.6957 Machine Screw Sizes

DLC HSSE-V B CHAMFER

Bottoming Style
DLC Coating

Forming TAP with DLC coating can be used in Aluminum Alloy, Die Cast Aluminum and Copper.

Nominal Size	Thread/Inch		E. D. P. Numbers								Dimensions			Std. Pack.
	NC UNC	NF UNF	H2	H3	H4	H5	H6	H7	H8	H10	Overall Length	Length of Thread	Shank Dia.	
2	56		97738	97776							1 3/4	0.437	0.141	3
4	40			97784		97857					1 7/8	0.354	0.141	3
6	32			97792		97865					2	0.433	0.141	3
8	32			97796		97869					2 1/8	0.472	0.168	3
10	24				97830		97904				2 3/8	0.551	0.194	3
		32			97832		97906				2 3/8	0.551	0.194	3
12	24				97834		97908				2 3/8	0.551	0.220	3

DLC TAFLET THREAD FORMING TAPS / METRIC SIZES

List No.6956 Metric Sizes

DLC HSSE-V B CHAMFER

Bottoming Style
DLC Coating

Forming TAP with DLC coating can be used in Aluminum Alloy, Die Cast Aluminum and Copper.

Nominal Size (mm)	Pitch (mm)	E. D. P. Numbers								Dimensions			Std. Pack.
		D3	D4	D5	D6	D7	D8	D9	D10	Overall Length	Length of Thread	Shank Dia.	
2	0.4	91002								1 3/4	0.437	0.119	3
2.5	0.45	91008								1 13/16	0.500	0.119	3
3	0.5	91011								1 15/16	0.394	0.141	3
4	0.7		91017							2 1/8	0.472	0.168	3
5	0.8		91023							2 3/8	0.551	0.194	3
6	1			91026				91027		1 1/2	0.591	0.255	3
8	1.25						91035	91036		2 23/32	0.669	0.318	3
10	1.25						91038			2 15/16	0.748	0.381	3
	1.5							91041		2 15/16	0.748	0.381	3
12	1.75								91047	3 3/8	0.984	0.367	3

SG LO-SPIRAL FLUTED TAPS / MACHINE SCREW SIZES & FRACTIONAL SIZE

List No.6959

SG HSSE TAPS FLUTE L MB CHAMFER

Modified Bottoming Style 2 1/2 to 3 Thread Lead
SG Coating

Nominal Size	Thread/Inch NC UNC	Thread/Inch NF UNF	No. of Flutes	E.D.P. Numbers GT3	GT4	GT5	GT6	GT7	GT8	GT9	Dimensions Overall Length	Length of Thread	Shank Dia.	Std . Pack.
MACHINE SCREW SIZES														
2	56		3	94597							1 3/4	0.437	0.141	3
		64	3	94598							1 3/4	0.437	0.141	3
3	48		3		94599						1 13/16	0.500	0.141	3
		56	3	94600							1 13/16	0.500	0.141	3
4	40		3			94601					1 7/8	0.236	0.141	3
		48	3		94602						1 7/8	0.236	0.141	3
5	40		3			94603					1 15/16	0.236	0.141	3
		44	3			94604					1 15/16	0.236	0.141	3
6	32		3			94605					2	0.276	0.141	3
		40	3			94606					2	0.276	0.141	3
8	32		3			94607					2 1/8	0.276	0.168	3
		36	3			94608					2 1/8	0.276	0.168	3
10	24		3				94609				2 3/8	0.354	0.194	3
		32	3			94610					2 3/8	0.354	0.194	3
12	24		3				94611				2 3/8	0.354	0.220	3
		28	3				94612				2 3/8	0.354	0.220	3
FRACTIONAL SIZES														
1/4	20		3					94613			2 1/2	0.433	0.255	3
		28	3				94614				2 1/2	0.433	0.255	3
5/16	18		3					94615			2 23/32	0.472	0.318	3
		24	3					94616			2 23/32	0.472	0.318	3
3/8	16		3						94617		2 15/16	0.551	0.381	3
		24	3					94618			2 15/16	0.551	0.381	3
7/16	14		3						94619		3 5/32	0.709	0.323	3
		20	3						94620		3 5/32	0.709	0.323	3
1/2	13		3						94621		3 3/8	0.787	0.367	3
		20	3						94622		3 3/8	0.787	0.367	3
9/16	12		3						94623		3 19/32	0.827	0.429	3
		18	3						94624		3 19/32	0.827	0.429	3
5/8	11		3							94625	3 13/16	0.905	0.480	3
		18	3						94626		3 13/16	0.905	0.480	3
3/4	10		4							94627	4 1/4	0.984	0.590	3
		16	4						94628		4 1/4	0.984	0.590	3
7/8	9		4							94629	4 11/16	1.102	0.697	3
		14	4							94630	4 11/16	1.102	0.697	3
1	8		4							94631	5 1/8	1.260	0.800	3
		12	4							94632	5 1/8	1.260	0.800	3

SG LO-SPIRAL FLUTED TAPS / METRIC SIZES

List No.6958 Metric Sizes

SG HSSE TAPS FLUTE L MB CHAMFER

Modified Bottoming Style 2 1/2 to 3 Thread Lead
SG Coating

Nominal Size (mm)	Pitch (mm)	No. Of Flutes	E. D. P. Numbers					Dimensions			Std. Pack.
			GT5	GT6	GT7	GT8	GT9	Overall Length	Length of Thread	Shank Dia.	
METRIC											
3	0.5	3	59615					1 15/16	0.236	0.141	3
4	0.7	3	59617					2 1/8	0.276	0.168	3
5	0.8	3		59619				2 3/8	0.354	0.194	3
6	1	3		59620				2 1/2	0.433	0.255	3
8	1	3		59622				2 23/32	0.472	0.318	3
	1.25	3		59623				2 23/32	0.472	0.318	3
10	1.25	3		59624				2 15/16	0.551	0.381	3
	1.5	3			59625			2 15/16	0.551	0.381	3
12	1.25	3				59626		3 3/8	0.669	0.367	3
	1.75	3				59627		3 3/8	0.669	0.367	3
14	1.5	3				59628		3 19/32	0.787	0.429	3
	2	3				59629		3 19/32	0.787	0.429	3
16	1.5	3				59630		3 13/16	0.787	0.480	3
	2	3				59631		3 13/16	0.787	0.480	3
18	1.5	4				59632		4 1/32	0.984	0.542	3
	2.5	4					59633	4 1/32	0.984	0.542	3
20	1.5	4				59634		4 15/32	0.984	0.652	3
	2.5	4					59635	4 15/32	0.984	0.652	3
22	1.5	4				59636		4 11/16	0.984	0.697	3
	2.5	4					59637	4 11/16	0.984	0.697	3
24	1.5	4				59638		4 29/32	1.181	0.760	3
	3	4					59639	4 29/32	1.181	0.760	3

NACHI VIPER

Viper taps go straight to the heart of tough work with problem-free tapping of stainless steel and other advanced metals. They provide superior threads and less torque, faster chip removal and cooler tapping job after job.

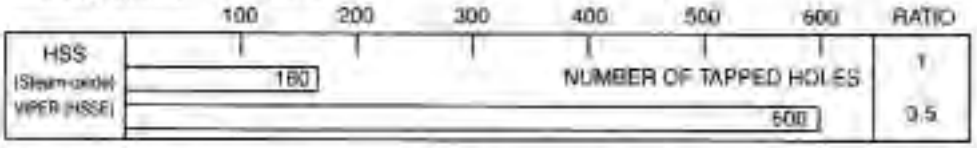
All this because Viper taps are made exclusively of specialty high speed steels, heat treated to maximize the advanced heat resistance characteristics of Cobalt and Tungsten and the wear resistance of Vanadium.

No tap is better engineered than Viper to demonstrate a longer tool life working in advanced materials with less down time and more economy. The special geometry extends tap life and the standard steam oxide maximizes the cooling effect to make rigorous tapping easy. Bright finish taps are also available where required for non-ferrous materials or special coatings as required. CNC manufacturing assures consistent quality time after time.

COMPARISON CHART

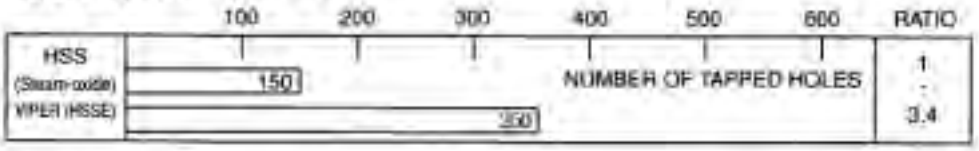
TOOL LIFE COMPARISON TEST RESULT (1)

Tap: Spiral point tap M10 x 1.5 Plug
Material: SUS 630 (HRC=45), Thickness 20mm
Drill: 8.5mm dia.
Tapping speed: 8.8 m/min.



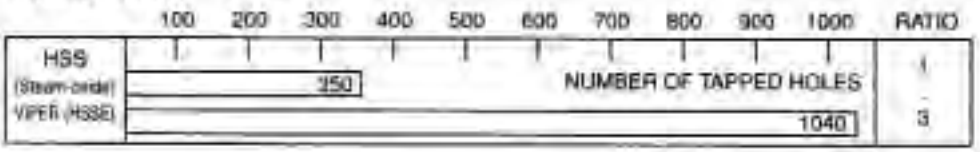
TOOL LIFE COMPARISON TEST RESULT (2)

Tap: Spiral point tap M12 x 1.75 Plug
Material: SUS 304 (HRC=30~35) Cold formed nut, Thickness 15mm
Drill: 10.3mm dia.
Tapping speed: 9.5 m/min.



TOOL LIFE COMPARISON TEST RESULT (3)

Tap: Spiral point tap M8 x 1.25 C2.5P Plug
Material: SUS 304 (HRC=20~25), Thickness 18mm
Drill: 6.7mm dia.
Tapping speed: 8.2 m/min.



VIPER T SERIES-SPIRAL FLUTED / GENERAL PURPOSE

List No.7981

HSSE-V | TAPS FLUTE NH | MB CHAMFER

Modified Bottoming Style, 2 1/2 To 3 Thread Lead
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size	Thread/Inch		No. of Flutes	E.D.P. Numbers							Dimensions			Std . Pack.
	NC UNC	NF UNF		GT3	GT4	GT5	GT6	GT7	GT8	GT9	Overall Length	Length of Thread	Shank Dia.	
MACHINE SCREW SIZES														
2	56		3	97597	—	—	—	—	—	—	1 3/4	0.437	0.141	3
		64	3	97598	—	—	—	—	—	—	1 3/4	0.437	0.141	3
3	48		3	—	97599	—	—	—	—	—	1 13/16	0.500	0.141	3
		56	3	97600	—	—	—	—	—	—	1 13/16	0.500	0.141	3
4	40		3	—	—	97601	—	—	—	—	1 7/8	0.236	0.141	3
		48	3	—	97602	—	—	—	—	—	1 7/8	0.236	0.141	3
5	40		3	—	—	97603	—	—	—	—	1 15/16	0.236	0.141	3
		44	3	—	—	97604	—	—	—	—	1 15/16	0.236	0.141	3
6	32		3	—	—	97605	—	—	—	—	2	0.276	0.141	3
		40	3	—	—	97606	—	—	—	—	2	0.276	0.141	3
8	32		3	—	—	97607	—	—	—	—	2 1/8	0.276	0.168	3
		36	3	—	—	97608	—	—	—	—	2 1/8	0.276	0.168	3
10	24		3	—	—	—	97609	—	—	—	2 3/8	0.354	0.194	3
		32	3	—	—	97610	—	—	—	—	2 3/8	0.354	0.194	3
12	24		3	—	—	—	97611	—	—	—	2 3/8	0.354	0.220	3
		28	3	—	—	—	97612	—	—	—	2 3/8	0.354	0.220	3
FRACTIONAL SIZES														
1/4	20		3	—	97633	—	—	97613	—	—	2 1/2	0.433	0.255	3
		28	3	—	97638	—	97614	—	—	—	2 1/2	0.433	0.255	3
5/16	18		3	—	97643	—	—	97615	—	—	2 23/32	0.472	0.318	3
		24	3	—	97648	—	—	97616	—	—	2 23/32	0.472	0.318	3
3/8	16		3	—	97653	—	—	—	97617	—	2 15/16	0.551	0.381	3
		24	3	—	97658	—	—	97618	—	—	2 15/16	0.551	0.381	3
7/16	14		3	—	97663	—	—	—	97619	—	3 5/32	0.709	0.323	3
		20	3	—	97668	—	—	—	97620	—	3 5/32	0.709	0.323	3
1/2	13		3	—	97673	—	—	—	97621	—	3 3/8	0.787	0.367	3
		20	3	—	97678	—	—	—	97622	—	3 3/8	0.787	0.367	3
9/16	12		3	—	97683	—	—	—	97623	—	3 19/32	0.827	0.429	3
		18	3	—	97688	—	—	—	97624	—	3 19/32	0.827	0.429	3
5/8	11		3	—	97693	—	—	—	—	97625	3 13/16	0.906	0.480	3
		18	3	—	97698	—	—	—	97626	—	3 13/16	0.906	0.480	3
3/4	10		3	—	97705	—	—	—	—	97627	4 1/4	0.984	0.590	3
		16	3	—	97710	—	—	—	97628	—	4 1/4	0.984	0.590	3
7/8	9		4	—	—	97715	—	—	—	97629	4 11/16	1.102	0.697	3
		14	4	—	—	97720	—	—	—	97630	4 11/16	1.102	0.697	3
1	8		4	—	—	97725	—	—	—	97631	5 1/8	1.260	0.800	3
		12	4	—	—	97730	—	—	—	97632	5 1/8	1.260	0.800	3

VIPER T SERIES-SPIRAL POINTED / GENERAL PURPOSE

List No.7971

HSSE-V · TAPS FLUTE SP · P CHAMFER

Plug Style, 4 To 5 Thread
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size	Thread/Inch NC UNC	Thread/Inch NF UNF	No. of Flutes	E.D.P. Numbers GT3	GT4	GT5	GT6	GT7	GT8	GT9	Dimensions Overall Length	Length of Thread	Shank Dia.	Std . Pack.
MACHINE SCREW SIZES														
2	56		2	98597	—	—	—	—	—	—	1 3/4	0.437	0.141	3
		64	2	98598	—	—	—	—	—	—	1 3/4	0.437	0.141	3
3	48		2	—	98599	—	—	—	—	—	1 13/16	0.500	0.141	3
		56	2	98600	—	—	—	—	—	—	1 13/16	0.500	0.141	3
4	40		2	—	—	98601	—	—	—	—	1 7/8	0.354	0.141	3
		48	2	—	98602	—	—	—	—	—	1 7/8	0.354	0.141	3
5	40		3	—	—	98603	—	—	—	—	1 15/16	0.394	0.141	3
		44	3	—	—	98604	—	—	—	—	1 15/16	0.394	0.141	3
6	32		3	—	—	98605	—	—	—	—	2	0.433	0.141	3
		40	3	—	—	98606	—	—	—	—	2	0.433	0.141	3
8	32		3	—	—	98607	—	—	—	—	2 1/8	0.472	0.168	3
		36	3	—	—	98608	—	—	—	—	2 1/8	0.472	0.168	3
10	24		3	—	—	—	98609	—	—	—	2 3/8	0.551	0.194	3
		32	3	—	—	98610	—	—	—	—	2 3/8	0.551	0.194	3
12	24		3	—	—	—	98611	—	—	—	2 3/8	0.551	0.220	3
		28	3	—	—	—	98612	—	—	—	2 3/8	0.551	0.220	3
FRACTIONAL SIZES														
1/4	20		3	—	98633	—	—	98613	—	—	2 1/2	0.591	0.255	3
		28	3	—	98638	—	98614	—	—	—	2 1/2	0.591	0.255	3
5/16	18		3	—	98643	—	—	98615	—	—	2 23/32	0.669	0.318	3
		24	3	—	98648	—	—	98616	—	—	2 23/32	0.669	0.318	3
3/8	16		3	—	98653	—	—	—	98617	—	2 15/16	0.748	0.381	3
		24	3	—	98658	—	—	98618	—	—	2 15/16	0.748	0.381	3
7/16	14		3	—	98663	—	—	—	98619	—	3 5/32	0.984	0.323	3
		20	3	—	98668	—	—	—	98620	—	3 5/32	0.984	0.323	3
1/2	13		3	—	98673	—	—	—	98621	—	3 3/8	1.142	0.367	3
		20	3	—	98678	—	—	—	98622	—	3 3/8	1.142	0.367	3
9/16	12		3	—	98683	—	—	—	98623	—	3 19/32	1.181	0.429	3
		18	3	—	98688	—	—	—	98624	—	3 19/32	1.181	0.429	3
5/8	11		3	—	98693	—	—	—	—	98625	3 13/16	1.260	0.480	3
		18	3	—	98698	—	—	—	98626	—	3 13/16	1.260	0.480	3
3/4	10		3	—	98705	—	—	—	—	98627	4 1/4	1.457	0.590	3
		16	3	—	98710	—	—	—	98628	—	4 1/4	1.457	0.590	3
7/8	9		3	—	—	98715	—	—	—	98629	4 11/16	1.496	0.697	3
		14	4	—	—	98720	—	—	—	98630	4 11/16	1.496	0.697	3
1	8		3	—	—	98725	—	—	—	98631	5 1/8	1.772	0.800	3
		12	4	—	—	98730	—	—	—	98632	5 1/8	1.772	0.800	3

List No.7980 Spiral Fluted

HSSE-V | TAPS FLUTE NH | MB CHAMFER

Modified Bottoming Style, 2 1/2 To 3 Thread
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size (mm)	Pitch (mm)	No. Of Flutes	E.D.P. Number					Dimensions			Std. Pack.
			GT5	GT6	GT7	GT8	GT9	Overall Length	Length of Thread	Shank Dia.	
METRIC											
3	0.5	3	57615	—	—	—	—	1 15/16	0.236	0.141	3
3.5	0.6	3	57616	—	—	—	—	2	0.276	0.141	3
4	0.7	3	57617	—	—	—	—	2 1/8	0.276	0.168	3
5	0.8	3	—	57619	—	—	—	2 3/8	0.354	0.194	3
6	1	3	—	57620	—	—	—	2 1/2	0.433	0.255	3
7	1	3	—	57621	—	—	—	2 23/32	0.472	0.318	3
8	1	3	—	57622	—	—	—	2 23/32	0.472	0.318	3
8	1.25	3	—	57623	—	—	—	2 23/32	0.472	0.318	3
10	1.25	3	—	57624	—	—	—	2 15/16	0.551	0.381	3
10	1.5	3	—	—	57625	—	—	2 15/16	0.551	0.381	3
12	1.25	3	—	—	—	57626	—	3 3/8	0.669	0.367	3
12	1.75	3	—	—	—	57627	—	3 3/8	0.669	0.367	3
14	1.5	3	—	—	—	57628	—	3 19/32	0.787	0.429	3
14	2	3	—	—	—	57629	—	3 19/32	0.787	0.429	3
16	1.5	3	—	—	—	57630	—	3 13/16	0.787	0.480	3
16	2	3	—	—	—	57631	—	3 13/16	0.787	0.480	3
18	1.5	3	—	—	—	57632	—	4 1/32	0.984	0.542	3
18	2.5	3	—	—	—	—	57633	4 1/32	0.984	0.542	3
20	1.5	4	—	—	—	57634	—	4 15/32	0.984	0.652	3
20	2.5	4	—	—	—	—	57635	4 15/32	0.984	0.652	3
22	1.5	4	—	—	—	57636	—	4 11/16	0.984	0.697	3
22	2.5	4	—	—	—	—	57637	4 11/16	0.984	0.697	3
24	1.5	4	—	—	—	57638	—	4 29/32	1.181	0.760	3
24	3	4	—	—	—	—	57639	4 29/32	1.181	0.760	3

List No.7970 Spiral Pointed

HSSE-V | TAPS FLUTE SP | P CHAMFER

Plugstyle, 4 To 5 Thread
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size (mm)	Pitch (mm)	No. Of Flutes	E.D.P. Number					Dimensions			Std. Pack.
			GT5	GT6	GT7	GT8	GT9	Overall Length	Length of Thread	Shank Dia.	
METRIC											
3	0.5	3	58615	—	—	—	—	1 15/16	0.394	0.141	3
3.5	0.6	3	58616	—	—	—	—	2	0.433	0.141	3
4	0.7	3	58617	—	—	—	—	2 1/8	0.472	0.168	3
5	0.8	3	—	58619	—	—	—	2 3/8	0.551	0.194	3
6	1	3	—	58620	—	—	—	2 1/2	0.591	0.255	3
7	1	3	—	58621	—	—	—	2 23/32	0.669	0.318	3
8	1	3	—	58622	—	—	—	2 23/32	0.669	0.318	3
8	1.25	3	—	58623	—	—	—	2 23/32	0.669	0.318	3
10	1.25	3	—	58624	—	—	—	2 15/16	0.748	0.381	3
10	1.5	3	—	—	58625	—	—	2 15/16	0.748	0.381	3
12	1.25	3	—	—	—	58626	—	3 3/8	1.142	0.367	3
12	1.75	3	—	—	—	58627	—	3 3/8	1.142	0.367	3
14	1.5	3	—	—	—	58628	—	3 19/32	1.181	0.429	3
14	2	3	—	—	—	58629	—	3 19/32	1.181	0.429	3
16	1.5	3	—	—	—	58630	—	3 13/16	1.260	0.480	3
16	2	3	—	—	—	58631	—	3 13/16	1.260	0.480	3
18	1.5	3	—	—	—	58632	—	4 1/32	1.457	0.542	3
18	2.5	3	—	—	—	—	58633	4 1/32	1.457	0.542	3
20	1.5	3	—	—	—	58634	—	4 15/32	1.457	0.652	3
20	2.5	3	—	—	—	—	58635	4 15/32	1.457	0.652	3
22	1.5	4	—	—	—	58636	—	4 11/16	1.496	0.697	3
22	2.5	3	—	—	—	—	58637	4 11/16	1.496	0.697	3
24	1.5	4	—	—	—	58638	—	4 29/32	1.772	0.760	3
24	3	3	—	—	—	—	58639	4 29/32	1.772	0.760	3

VIPER T SERIES-SPIRAL FLUTED / FOR STAINLESS STEEL

List No.7987

HSSE · TAPS FLUTE NH · MB CHAMFER

Modified Bottoming Style 2 1/2 To 3 Thread Lead
Surface Treated

COBALT/VANADIUM HIGH SPEED STEEL HSSE

Nominal Size	Thread/Inch		No. of Flutes	E.D.P. Numbers							Dimensions			Std . Pack.
	NC UNC	NF UNF		GT3	GT4	GT5	GT6	GT7	GT8	GT9	Overall Length	Length of Thread	Shank Dia.	
MACHINE SCREW SIZES														
2	56		3	96597	—	—	—	—	—	—	1 3/4	0.437	0.141	3
		64	3	96598	—	—	—	—	—	—	1 3/4	0.437	0.141	3
3	48		3	—	96599	—	—	—	—	—	1 13/16	0.500	0.141	3
		56	3	96600	—	—	—	—	—	—	1 13/16	0.500	0.141	3
4	40		3	—	—	96601	—	—	—	—	1 7/8	0.236	0.141	3
		48	3	—	96602	—	—	—	—	—	1 7/8	0.236	0.141	3
5	40		3	—	—	96603	—	—	—	—	1 15/16	0.236	0.141	3
		44	3	—	—	96604	—	—	—	—	1 15/16	0.236	0.141	3
6	32		3	—	—	96605	—	—	—	—	2	0.276	0.141	3
		40	3	—	—	96606	—	—	—	—	2	0.276	0.141	3
8	32		3	—	—	96607	—	—	—	—	2 1/8	0.276	0.168	3
		36	3	—	—	96608	—	—	—	—	2 1/8	0.276	0.168	3
10	24		3	—	—	—	96609	—	—	—	2 3/8	0.354	0.194	3
		32	3	—	—	96610	—	—	—	—	2 3/8	0.354	0.194	3
12	24		3	—	—	—	96611	—	—	—	2 3/8	0.354	0.220	3
		28	3	—	—	—	96612	—	—	—	2 3/8	0.354	0.220	3
FRACTIONAL SIZES														
1/4	20		3	—	—	—	—	96613	—	—	2 1/2	0.433	0.255	3
		28	3	—	—	—	96614	—	—	—	2 1/2	0.433	0.255	3
5/16	18		3	—	—	—	—	96615	—	—	2 23/32	0.472	0.318	3
		24	3	—	—	—	—	96616	—	—	2 23/32	0.472	0.318	3
3/8	16		3	—	—	—	—	—	96617	—	2 15/16	0.551	0.381	3
		24	3	—	—	—	—	96618	—	—	2 15/16	0.551	0.381	3
7/16	14		3	—	—	—	—	—	96619	—	3 5/32	0.709	0.323	3
		20	3	—	—	—	—	—	96620	—	3 5/32	0.709	0.323	3
1/2	13		3	—	—	—	—	—	96621	—	3 3/8	0.787	0.367	3
		20	3	—	—	—	—	—	96622	—	3 3/8	0.787	0.367	3
9/16	12		3	—	—	—	—	—	96623	—	3 19/32	0.827	0.429	3
		18	3	—	—	—	—	—	96624	—	3 19/32	0.827	0.429	3
5/8	11		3	—	—	—	—	—	—	96625	3 13/16	0.905	0.480	3
		18	3	—	—	—	—	—	96626	—	3 13/16	0.905	0.480	3
3/4	10		3	—	—	—	—	—	—	96627	4 1/4	0.984	0.590	3
		16	3	—	—	—	—	—	96628	—	4 1/4	0.984	0.590	3
7/8	9		4	—	—	—	—	—	—	96629	4 11/16	1.102	0.697	3
		14	4	—	—	—	—	—	—	96630	4 11/16	1.102	0.697	3
1	8		4	—	—	—	—	—	—	96631	5 1/8	1.260	0.800	3
		12	4	—	—	—	—	—	—	96632	5 1/8	1.260	0.800	3

VIPER T SERIES-SPIRAL POINTED / FOR STAINLESS STEEL

List No.7977

HSSE · TAPS FLUTE SP · P CHAMFER

Plug Style, 4 To 5 Thread Lead
Surface Treated

COBALT/VANADIUM HIGH SPEED STEEL HSS

Nominal Size	Thread/Inch NC UNC	Thread/Inch NF UNF	No. of Flutes	E.D.P. Numbers GT3	GT4	GT5	GT6	GT7	GT8	GT9	Dimensions Overall Length	Length of Thread	Shank Dia.	Std . Pack.
MACHINE SCREW SIZES														
2	56		2	95597	—	—	—	—	—	—	1 3/4	0.437	0.141	3
		64	2	95598	—	—	—	—	—	—	1 3/4	0.437	0.141	3
3	48		2	—	95599	—	—	—	—	—	1 13/16	0.500	0.141	3
		56	2	95600	—	—	—	—	—	—	1 13/16	0.500	0.141	3
4	40		2	—	—	95601	—	—	—	—	1 7/8	0.354	0.141	3
		48	2	—	95602	—	—	—	—	—	1 7/8	0.354	0.141	3
5	40		3	—	—	95603	—	—	—	—	1 15/16	0.394	0.141	3
		44	3	—	—	95604	—	—	—	—	1 15/16	0.394	0.141	3
6	32		3	—	—	95605	—	—	—	—	2	0.433	0.141	3
		40	3	—	—	95606	—	—	—	—	2	0.433	0.141	3
8	32		3	—	—	95607	—	—	—	—	2 1/8	0.472	0.168	3
		36	3	—	—	95608	—	—	—	—	2 1/8	0.472	0.168	3
10	24		3	—	—	—	95609	—	—	—	2 3/8	0.551	0.194	3
		32	3	—	—	95610	—	—	—	—	2 3/8	0.551	0.194	3
12	24		3	—	—	—	95611	—	—	—	2 3/8	0.551	0.220	3
		28	3	—	—	—	95612	—	—	—	2 3/8	0.551	0.220	3
FRACTIONAL SIZES														
1/4	20		3	—	—	—	—	95613	—	—	2 1/2	0.591	0.255	3
		28	3	—	—	—	95614	—	—	—	2 1/2	0.591	0.255	3
5/16	18		3	—	—	—	—	95615	—	—	2 23/32	0.669	0.318	3
		24	3	—	—	—	—	95616	—	—	2 23/32	0.669	0.318	3
3/8	16		3	—	—	—	—	—	95617	—	2 15/16	0.748	0.381	3
		24	3	—	—	—	—	95618	—	—	2 15/16	0.748	0.381	3
7/16	14		3	—	—	—	—	—	95619	—	3 5/32	0.984	0.323	3
		20	3	—	—	—	—	—	95620	—	3 5/32	0.984	0.323	3
1/2	13		3	—	—	—	—	—	95621	—	3 3/8	1.142	0.367	3
		20	3	—	—	—	—	—	95622	—	3 3/8	1.142	0.367	3
9/16	12		3	—	—	—	—	—	95623	—	3 19/32	1.181	0.429	3
		18	3	—	—	—	—	—	95624	—	3 19/32	1.181	0.429	3
5/8	11		3	—	—	—	—	—	—	95625	3 13/16	1.260	0.480	3
		18	3	—	—	—	—	—	95626	—	3 13/16	1.260	0.480	3
3/4	10		3	—	—	—	—	—	—	95627	4 1/4	1.457	0.590	3
		16	3	—	—	—	—	—	95628	—	4 1/4	1.457	0.590	3
7/8	9		3	—	—	—	—	—	—	95629	4 11/16	1.496	0.697	3
		14	4	—	—	—	—	—	—	95630	4 11/16	1.496	0.697	3
1	8		3	—	—	—	—	—	—	95631	5 1/8	1.772	0.800	3
		12	4	—	—	—	—	—	—	95632	5 1/8	1.772	0.800	3

VIPER T SERIES METRIC TAPS / FOR STAINLESS STEEL

List No.7982 Spiral Fluted

HSSE · TAPS FLUTE NH · MB CHAMFER

Modified Bottoming Style 2 1/2 To 3 Thread Lead

Surface Treated

COBALT/VANADIUM HIGH SPEED STEEL

Nominal Size (mm)	Pitch (mm)	No. Of Flutes	E.D.P. Number					Dimensions			Std. Pack.
			GT5	GT6	GT7	GT8	GT9	Overall Length	Length of Thread	Shank Dia.	
METRIC											
3	0.5	3	56615	—	—	—	—	1 15/16	0.236	0.141	3
3.5	0.6	3	56616	—	—	—	—	2	0.276	0.141	3
4	0.7	3	56617	—	—	—	—	2 1/8	0.276	0.168	3
5	0.8	3	—	56619	—	—	—	2 3/8	0.354	0.194	3
6	1	3	—	56620	—	—	—	2 1/2	0.433	0.255	3
7	1	3	—	56621	—	—	—	2 23/32	0.472	0.318	3
8	1	3	—	56622	—	—	—	2 23/32	0.472	0.318	3
8	1.25	3	—	56623	—	—	—	2 23/32	0.472	0.318	3
10	1.25	3	—	56624	—	—	—	2 15/16	0.551	0.381	3
10	1.5	3	—	—	56625	—	—	2 15/16	0.551	0.381	3
12	1.25	3	—	—	—	56626	—	3 3/8	0.669	0.367	3
12	1.75	3	—	—	—	56627	—	3 3/8	0.669	0.367	3
14	1.5	3	—	—	—	56628	—	3 19/32	0.787	0.429	3
14	2	3	—	—	—	56629	—	3 19/32	0.787	0.429	3
16	1.5	3	—	—	—	56630	—	3 13/16	0.787	0.480	3
16	2	3	—	—	—	56631	—	3 13/16	0.787	0.480	3
18	1.5	4	—	—	—	56632	—	4 1/32	0.984	0.542	3
18	2.5	4	—	—	—	—	56633	4 1/32	0.984	0.542	3
20	1.5	4	—	—	—	56634	—	4 15/32	0.984	0.652	3
20	2.5	4	—	—	—	—	56635	4 15/32	0.984	0.652	3
22	1.5	4	—	—	—	56636	—	4 11/16	0.984	0.697	3
22	2.5	4	—	—	—	—	56637	4 11/16	0.984	0.697	3
24	1.5	4	—	—	—	56638	—	4 29/32	1.181	0.760	3
24	3	4	—	—	—	—	56639	4 29/32	1.181	0.760	3

List No.7972 Spiral Pointed

HSSE · TAPS FLUTE SP · P CHAMFER

Plug Style, 4 To 5 Thread Lead

Surface Treated

COBALT/VANADIUM HIGH SPEED STEEL HSSE

Nominal Size (mm)	Pitch (mm)	No. Of Flutes	E.D.P. Number					Dimensions			Std. Pack.
			GT5	GT6	GT7	GT8	GT9	Overall Length	Length of Thread	Shank Dia.	
METRIC											
3	0.5	3	55615	—	—	—	—	1 15/16	0.394	0.141	3
3.5	0.6	3	55616	—	—	—	—	2	0.433	0.141	3
4	0.7	3	55617	—	—	—	—	2 1/8	0.472	0.168	3
5	0.8	3	—	55619	—	—	—	2 3/8	0.551	0.194	3
6	1	3	—	55620	—	—	—	2 1/2	0.591	0.255	3
7	1	3	—	55621	—	—	—	2 23/32	0.669	0.318	3
8	1	3	—	55622	—	—	—	2 23/32	0.669	0.318	3
8	1.25	3	—	55623	—	—	—	2 23/32	0.669	0.318	3
10	1.25	3	—	55624	—	—	—	2 15/16	0.748	0.381	3
10	1.5	3	—	—	55625	—	—	2 15/16	0.748	0.381	3
12	1.25	3	—	—	—	55626	—	3 3/8	1.141	0.367	3
12	1.75	3	—	—	—	55627	—	3 3/8	1.141	0.367	3
14	1.5	3	—	—	—	55628	—	3 19/32	1.181	0.429	3
14	2	3	—	—	—	55629	—	3 19/32	1.181	0.429	3
16	1.5	3	—	—	—	55630	—	3 13/16	1.260	0.480	3
16	2	3	—	—	—	55631	—	3 13/16	1.260	0.480	3
18	1.5	3	—	—	—	55632	—	4 1/32	1.457	0.542	3
18	2.5	3	—	—	—	—	55633	4 1/32	1.457	0.542	3
20	1.5	3	—	—	—	55634	—	4 15/32	1.457	0.652	3
20	2.5	3	—	—	—	—	55635	4 15/32	1.457	0.652	3
22	1.5	4	—	—	—	55636	—	4 11/16	1.496	0.697	3
22	2.5	3	—	—	—	—	55637	4 11/16	1.496	0.697	3
24	1.5	4	—	—	—	55638	—	4 29/32	1.772	0.760	3
24	3	3	—	—	—	—	55639	4 29/32	1.772	0.760	3

VIPER TAFLET TAPS (THREAD FORMING)

Taflet Taps for economical and efficient thread forming

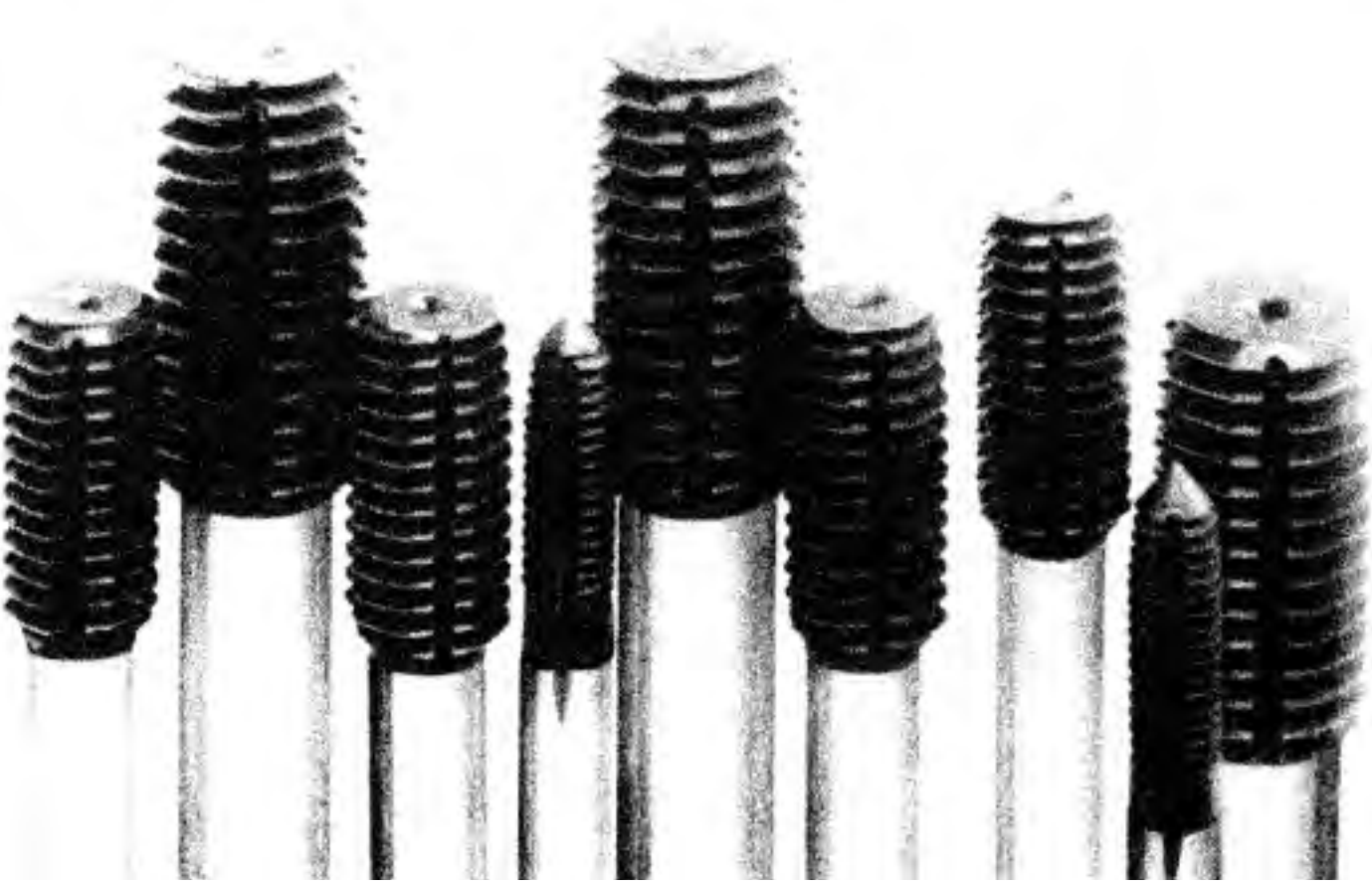
NACHI Viper Taflet taps are designed for economical and efficient tapping of steel. No chips are produced with Taflet taps. The threads are formed by displacement of the metal. Threads produced this way are generally more accurate and stronger than threads produced by conventional tapping.

Advantages of NACHI Viper Taflet Taps

Conventional coldform taps for steel require high torque. NACHI Viper Taflet taps have been specially engineered for steels and require less torque, reducing the chance of breaking.

In conventional coldform threading, rapid wear and adhesion due to high frictional heat may occur. NACHI Viper Taflet tap's steam oxide surface treatment limits adhesion from fusion and carries coolant to the work area. Bright finish is also available when required.

Conventional coldform internal threads aren't always clean and accurate. NACHI Viper Taflet taps have more radial sections for higher accuracy of internal threads in steel.



VIPER TAFLET FOR STEELS

List No.995 Machine Screw Sizes

HSSE-V | P CHAMFER | B CHAMFER

Plug & Bottoming Style
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size	Thread/Inch		Chamfer Style*	E.D.P. Numbers						Dimensions			Std. Pack.
	NC UNC	NF UNF		H2	H3	H4	H5	H6	H10	Overall Length	Length of Thread	Shank Dia.	
0		80	B	77732	—	—	—	—	—	1 5/8	0.311	0.141	3
1	64		B	77734	—	—	—	—	—	1 11/16	0.374	0.141	3
		72	B	77736	—	—	—	—	—	1 11/16	0.374	0.141	3
2	56		B	77738	77776	—	—	—	—	1 3/4	0.437	0.141	3
		64	B	77740	77778	—	—	—	—	1 3/4	0.437	0.141	3
3	48		B	77742	77780	—	—	—	—	1 13/16	0.500	0.141	3
		56	B	—	77782	—	—	—	—	1 13/16	0.500	0.141	3
4	40		P	—	77783	—	77856	—	—	1 7/8	0.354	0.141	3
			B	—	77784	—	77857	—	—	1 7/8	0.354	0.141	3
		48	P	—	77785	—	77858	—	—	1 7/8	0.354	0.141	3
			B	—	77786	—	77859	—	—	1 7/8	0.354	0.141	3
5	40		P	—	77787	—	77860	—	—	1 15/16	0.394	0.141	3
			B	—	77788	—	77861	—	—	1 15/16	0.394	0.141	3
		44	P	—	77789	—	77862	—	—	1 15/16	0.394	0.141	3
			B	—	77790	—	77863	—	—	1 15/16	0.394	0.141	3
6	32		P	—	77791	—	77864	—	77970	2	0.433	0.141	3
			B	—	77792	—	77865	—	77971	2	0.433	0.141	3
		40	P	—	77793	—	77866	—	—	2	0.433	0.141	3
			B	—	77794	—	77867	—	—	2	0.433	0.141	3
8	32		P	—	77795	—	77868	—	77972	2 1/8	0.472	0.168	3
			B	—	77796	—	77869	—	77973	2 1/8	0.472	0.168	3
		36	P	—	77797	—	77870	—	—	2 1/8	0.472	0.168	3
			B	—	77798	—	77871	—	—	2 1/8	0.472	0.168	3
10	24		P	—	—	77829	—	77903	77974	2 3/8	0.551	0.194	3
			B	—	—	77830	—	77904	77975	2 3/8	0.551	0.194	3
		32	P	—	—	77831	—	77905	77976	2 3/8	0.551	0.194	3
			B	—	—	77832	—	77906	77977	2 3/8	0.551	0.194	3
12	24		P	—	—	77833	—	77907	—	2 3/8	0.551	0.220	3
			B	—	—	77834	—	77908	—	2 3/8	0.551	0.220	3
		28	P	—	—	77835	—	77909	—	2 3/8	0.551	0.220	3
			B	—	—	77836	—	77910	—	2 3/8	0.551	0.220	3

✱ **P : Plug, B : Bottom**

VIPER TAFLET FOR STEELS

List No.995 Fractional Sizes

HSSE-V | P CHAMFER | B CHAMFER

Plug & Bottoming Style

Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size	Thread/Inch		Chamfer Style*	E.D.P. Numbers						Dimensions			Std . Pack.
	NC UNC	NF UNF		H4	H5	H6	H7	H8	H10	Overall Length	Length of Thread	Shank Dia.	
1/4	20		P	77837	—	77911	—	—	77978	2 1/2	0.591	0.255	3
			B	77838	—	77912	—	—	77979	2 1/2	0.591	0.255	3
		28	P	77839	—	77913	—	—	77980	2 1/2	0.591	0.255	3
			B	77840	—	77914	—	—	77981	2 1/2	0.591	0.255	3
5/16	18		P	—	77872	—	77930	—	—	2 23/32	0.669	0.318	3
			B	—	77873	—	77931	—	—	2 23/32	0.669	0.318	3
		24	P	—	77874	—	77932	—	—	2 23/32	0.669	0.318	3
			B	—	77875	—	77933	—	—	2 23/32	0.669	0.318	3
3/8	16		P	—	77876	—	77934	—	—	2 15/16	0.748	0.381	3
			B	—	77877	—	77935	—	—	2 15/16	0.748	0.381	3
		24	P	—	77878	—	77936	—	—	2 15/16	0.748	0.381	3
			B	—	77879	—	77937	—	—	2 15/16	0.748	0.381	3
7/16	14		P	—	77880	—	—	77960	—	3 5/32	0.866	0.323	3
			B	—	77881	—	—	77961	—	3 5/32	0.866	0.323	3
		20	P	—	77882	—	—	77962	—	3 5/32	0.866	0.323	3
			B	—	77883	—	—	77963	—	3 5/32	0.866	0.323	3
1/2	13		P	—	77884	—	—	77964	—	3 3/8	0.984	0.367	3
			B	—	77885	—	—	77965	—	3 3/8	0.984	0.367	3
		20	P	—	77886	—	—	77966	—	3 3/8	0.984	0.367	3
			B	—	77887	—	—	77967	—	3 3/8	0.984	0.367	3
9/16	12		P	—	—	—	77946	—	77990	3 19/32	0.984	0.429	3
			B	—	—	—	77947	—	77991	3 19/32	0.984	0.429	3
		18	P	—	—	—	77948	—	77992	3 19/32	0.984	0.429	3
			B	—	—	—	77949	—	77993	3 19/32	0.984	0.429	3
5/8	11		P	—	—	—	77950	—	77994	3 13/16	1.102	0.480	3
			B	—	—	—	77951	—	77995	3 13/16	1.102	0.480	3
		18	P	—	—	—	77952	—	77996	3 13/16	1.102	0.480	3
			B	—	—	—	77953	—	77997	3 13/16	1.102	0.480	3
3/4	10		P	—	—	—	77954	—	77998	4 1/4	1.181	0.590	3
			B	—	—	—	77955	—	77999	4 1/4	1.181	0.590	3
		16	P	—	—	—	77956	—	78000	4 1/4	1.181	0.590	3
			B	—	—	—	77957	—	78001	4 1/4	1.181	0.590	3

* P : Plug, B : Bottom

VIPER TAFLET METRIC TAPS FOR STEELS

List No.996 Metric Sizes

HSSE-V | P CHAMFER | B CHAMFER

Plug & Bottoming Style

Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size (mm)	Pitch (mm)	Chamfer Style*	E.D.P. Numbers									Dimensions			Std . Pack.
			D3	D4	D5	D6	D7	D8	D9	D10	D11	Overall Length	Length of Thread	Shank Dia.	
2	0.4	P	51001	—	—	—	—	—	—	—	—	1 3/4	0.437	0.119	3
		B	51002	—	—	—	—	—	—	—	—	1 3/4	0.437	0.119	3
2.2	0.45	P	51004	—	—	—	—	—	—	—	—	1 3/4	0.437	0.119	3
		B	51005	—	—	—	—	—	—	—	—	1 3/4	0.437	0.119	3
2.5	0.45	P	51007	—	—	—	—	—	—	—	—	1 13/16	0.500	0.119	3
		B	51008	—	—	—	—	—	—	—	—	1 13/16	0.500	0.119	3
3	0.5	P	51010	—	—	—	—	—	—	—	—	1 15/16	0.394	0.141	3
		B	51011	—	—	—	—	—	—	—	—	1 15/16	0.394	0.141	3
3.5	0.6	P	51013	—	—	—	—	—	—	—	—	2	0.433	0.141	3
		B	51014	—	—	—	—	—	—	—	—	2	0.433	0.141	3
4	0.7	P	—	51016	—	—	—	—	—	—	—	2 1/8	0.472	0.168	3
		B	—	51017	—	—	—	—	—	—	—	2 1/8	0.472	0.168	3
4.5	0.75	P	—	51019	—	—	—	—	—	—	—	2 3/8	0.551	0.184	3
		B	—	51020	—	—	—	—	—	—	—	2 3/8	0.551	0.184	3
5	0.8	P	—	51022	—	—	—	—	—	—	—	2 3/8	0.551	0.194	3
		B	—	51023	—	—	—	—	—	—	—	2 3/8	0.551	0.194	3
6	1	P	—	—	51025	—	—	—	—	—	—	1 1/2	0.591	0.255	3
		B	—	—	51026	—	—	—	—	—	—	1 1/2	0.591	0.255	3
7	1	P	—	—	—	51028	—	—	—	—	—	2 23/32	0.669	0.318	3
		B	—	—	—	51029	—	—	—	—	—	2 23/32	0.669	0.318	3
8	1	P	—	—	51031	—	—	—	—	—	—	2 23/32	0.669	0.318	3
		B	—	—	51032	—	—	—	—	—	—	2 23/32	0.669	0.318	3
	1.25	P	—	—	—	—	—	51034	—	—	—	2 23/32	0.669	0.318	3
		B	—	—	—	—	—	51035	—	—	—	2 23/32	0.669	0.318	3
10	1.25	P	—	—	—	—	—	51037	—	—	—	2 15/16	0.748	0.381	3
		B	—	—	—	—	—	51038	—	—	—	2 15/16	0.748	0.381	3
	1.50	P	—	—	—	—	—	—	51040	—	—	2 15/16	0.748	0.381	3
		B	—	—	—	—	—	—	51041	—	—	2 15/16	0.748	0.381	3
12	1.25	P	—	—	—	—	—	—	51043	—	—	3 3/8	0.984	0.367	3
		B	—	—	—	—	—	—	51044	—	—	3 3/8	0.984	0.367	3
	1.75	P	—	—	—	—	—	—	—	51046	—	3 3/8	0.984	0.367	3
		B	—	—	—	—	—	—	—	51047	—	3 3/8	0.984	0.367	3
14	1.5	P	—	—	—	—	—	—	—	51049	—	3 19/32	0.984	0.429	3
		B	—	—	—	—	—	—	—	51050	—	3 19/32	0.984	0.429	3
	2	P	—	—	—	—	—	—	—	—	51052	3 19/32	0.984	0.429	3
		B	—	—	—	—	—	—	—	—	51053	3 19/32	0.984	0.429	3
16	1.5	P	—	—	—	—	—	—	—	51055	—	3 13/16	1.102	0.480	3
		B	—	—	—	—	—	—	—	51056	—	3 13/16	1.102	0.480	3
	2	P	—	—	—	—	—	—	—	—	51058	3 13/16	1.102	0.480	3
		B	—	—	—	—	—	—	—	—	51059	3 13/16	1.102	0.480	3
18	1.5	P	—	—	—	—	—	—	—	51061	—	4 1/32	1.102	0.542	3
		B	—	—	—	—	—	—	—	51062	—	4 1/32	1.102	0.542	3
	2.5	P	—	—	—	—	—	—	—	—	51064	4 1/32	1.102	0.542	3
		B	—	—	—	—	—	—	—	—	51065	4 1/32	1.102	0.542	3
20	1.5	P	—	—	—	—	—	—	—	51067	—	4 15/32	1.181	0.652	3
		B	—	—	—	—	—	—	—	51068	—	4 15/32	1.181	0.652	3
	2.5	P	—	—	—	—	—	—	—	—	51070	4 15/32	1.181	0.652	3
		B	—	—	—	—	—	—	—	—	51071	4 15/32	1.181	0.652	3

✱ **P : Plug, B : Bottom**

THEORETICAL HOLE SIZES

Taflet Taps

Nom. Dia	Threads/Inch		Basic Major Dia.	75%		65%		55%	
	NC UNC	NF UNF		Theoretical Core Hole	Nearest Drill Dia.	Theoretical Core Hole	Nearest Drill Dia.	Theoretical Core Hole	Nearest Drill Dia.
0		80	.0600	.0536	1.35mm	.0545	—	.0553	#54
1	64		.0730	.0650	1.65mm	.0661	—	.0672	#51
		72	.0730	.0659	1.65mm	.0669	1.7mm	.0679	#51
2	56		.0860	.0769	1.95mm	.0781	5/64	.0794	2.0mm
		64	.0860	.0780	5/64	.0791	2.0mm	.0802	—
3	48		.0990	.0884	2.25mm	.0898	#43	.0913	2.3mm
		56	.0990	.0899	#43	.0911	2.3mm	.0924	2.35mm
4	40		.1120	.0993	2.5mm	.1010	#39	.1027	2.6mm
		48	.1120	.1014	#38	.1028	2.6mm	.1166	#37
5	40		.1250	.1123	#34	.1140	#33	.1157	#32
		44	.1250	.1134	#33	.1150	2.9mm	.1166	#32
6	32		.1380	.1221	3.1mm	.1242	—	.1263	3.2mm
		40	.1380	.1253	1/8	.1270	3.2mm	.1287	#30
8	32		.1640	.1481	3.7mm	.1502	#25	.1523	#24
		36	.1640	.1498	#25	.1517	#24	.1537	3.9mm
10	24		.1900	.1688	—	.1716	11/64	.1746	#17
		32	.1900	.1741	#17	.1762	—	.1784	4.5mm
12	24		.2160	.1948	#10	.1976	5.0mm	.2006	5.1mm
		28	.2160	.1978	5.0mm	.2002	#8	.2028	—
1/4	20		.2500	.2245	5.7mm	.2280	#1	.2315	—
		28	.2500	.2318	—	.2342	A	.2368	6.0mm
5/16	18		.3125	.2842	7.2mm	.2879	7.3mm	.2917	7.4mm
		24	.3125	.2913	7.4mm	.2941	M	.2969	19/64
3/8	16		.3750	.3431	11/32	.3474	S	.3516	—
		24	.3750	.3538	9.0mm	.3566	—	.3594	23/64
7/16	14		.4375	.4011	—	.4059	13/32	.4108	—
		20	.4375	.4120	#2	.4154	—	.4188	—
1/2	13		.5000	.4608	—	.4660	—	.4712	12mm
		20	.5000	.4745	—	.4779	—	.4813	—
9/16	12		.5625	.5200	—	.5257	—	.5313	17/32
		18	.5625	.5342	13.5mm	.5379	—	.5417	—
5/8	11		.6250	.5787	37/64	.5848	37/64	.5910	15mm
		18	.6250	.5967	19/32	.6004	—	.6042	—
3/4	10		.7500	.6990	—	.7058	45/64	.7126	—
		16	.7500	.7181	23/32	.7224	—	.7266	—

Nom. Dia	Pitch	Theoretical Core Hole Size						Suggested	Taps
		Min.		Max.					
				5H Class		6H Class			
		Inches	mm	Inches	mm	Inches	mm		
3	0.5	.1071	2.72	.1094	2.79	.1098	2.79	H5	H6
3.5	0.6	.1244	3.16	.1268	3.22	.1276	3.24	H5	H7
4	0.7	.1417	3.60	.1445	3.67	.1453	3.69	H6	H7
5	0.8	.1791	4.55	.1823	4.63	.1831	4.65	H6	H8
6	1	.2142	5.44	.2177	5.53	.2185	5.55	H7	H9
8	1.25	.2870	7.29	.2913	7.40	.2925	7.43	H8	H10
10	1.5	.3602	9.15	.3602	9.27	.3665	9.31	H9	H11
12	1.75	.4335	11.01	.4368	11.14	.4402	11.18	H10	H12
14	2	.5067	12.87	.5126	13.02	.5142	13.06	H11	H13
16	2	.5854	14.87	.5913	15.02	.5929	15.06	H11	H13
20	2.5	.7315	18.58	.7386	18.76	.7409	18.82	H11	H14

VTP SPIRAL FLUTED

List No.983 Machine Screw Sizes

HSSE-V · TAPS FLUTE NH · MB CHAMFER

Modified Bottoming Style 2-1/2 To 3 Thread Lead
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size	Thread/Inch		No. of Flutes	E.D.P. Numbers						Dimensions			Std. Pack.
	NC UNC	NF UNF		H2	H3	H4	H5	H6	H7	Overall Length	Length of Thread	Shank Dia.	
2	56		2	88239	—	—	—	—	—	1 3/4	0.433	0.141	3
3	48		2	88240	—	—	—	—	—	1 13/16	0.500	0.141	3
4	40		2	88241	88242	88243	—	—	—	1 7/8	0.236	0.141	3
5	40		3	88253	—	—	—	—	—	1 15/16	0.236	0.141	3
6	32		3	—	88263	88264	88265	88266	88267	2	0.276	0.141	3
8	32		3	—	88277	88278	88279	88280	88281	2 1/8	0.276	0.168	3
10	24		3	—	88291	—	88292	88293	88294	2 3/8	0.354	0.194	3
		32	3	—	88299	88300	88301	—	88303	2 3/8	0.354	0.194	3

List No.981 Fractional Sizes

HSSE-V · TAPS FLUTE NH · MB CHAMFER

Modified Bottoming Style 2-1/2 To 3 Thread Lead
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size	Thread/Inch		No. of Flutes	E.D.P. Numbers						Dimensions			Std. Pack.
	NC UNC	NF UNF		H2	H3	H4	H5	H6	H7	Overall Length	Length of Thread	Shank Dia.	
1/4	20		3	—	88057	—	88060	—	88062	2 1/2	0.433	0.255	3
		28	3	—	88071	88072	88073	88074	88075	2 1/2	0.433	0.255	3
5/16	18		3	—	88081	—	88083	—	88085	2 23/32	0.472	0.318	3
		24	3	—	88095	88096	88097	—	88098	2 23/32	0.472	0.318	3
3/8	16		3	—	88103	—	88105	—	88107	2 15/16	0.551	0.381	3
		24	3	—	88111	88112	88113	—	88115	2 15/16	0.551	0.381	3
7/16	14		3	—	88117	—	88119	—	—	3 5/32	0.591	0.323	3
		20	3	—	88123	—	88125	—	—	3 5/32	0.591	0.323	3
1/2	13		3	—	88131	—	88133	—	88135	3 3/8	0.630	0.367	3
		20	3	—	88139	—	88141	—	—	3 3/8	0.630	0.367	3
9/16	12		3	—	88145	—	—	—	—	3 19/32	0.709	0.429	3
		18	3	—	88146	—	—	—	—	3 19/32	0.709	0.429	3
5/8	11		3	—	88149	—	88151	—	88153	3 13/16	0.748	0.480	3
		18	3	—	88157	—	88159	—	—	3 13/16	0.748	0.480	3
3/4	10		3	—	88167	—	—	—	88171	4 1/4	0.827	0.590	3
		16	3	—	88175	—	88177	—	—	4 1/4	0.827	0.590	3
7/8	9		4	—	88180	—	—	—	—	4 11/16	0.906	0.697	3
		14	4	—	88185	—	—	—	—	4 11/16	0.906	0.697	3
1	8		4	—	88190	—	—	—	—	5 1/8	0.984	0.800	3

List No.973 Machine Screw Sizes

HSSE-V · TAPS FLUTE SP · P CHAMFER

Plug Style 4 to 5 Threads
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size	Thread/Inch		No. of Flutes	E.D.P. Numbers						Dimensions			Std . Pack.
	NC UNC	NF UNF		H2	H3	H4	H5	H6	H7	Overall Length	Length of Thread	Shank Dia.	
2	56		2	87216	87218	—	—	—	—	1 3/4	0.437	0.141	3
3	48		2	87220	—	—	—	—	—	1 13/16	0.500	0.141	3
4	40		2	87240	87242	87243	87244	—	—	1 7/8	0.354	0.141	3
5	40		2	87252	—	—	—	—	—	1 15/16	0.394	0.141	3
6	32		2	87258	87260	87261	87264	87265	87266	2	0.433	0.141	3
8	32		3	87272	87274	87275	87278	87279	87280	2 1/8	0.472	0.168	3
10	24		3	—	87288	—	87290	—	—	2 3/8	0.551	0.194	3
		32	3	87294	87296	87297	87300	87301	87302	2 3/8	0.551	0.194	3

List No.971 Fractional Sizes

HSSE-V · TAPS FLUTE SP · P CHAMFER

Plug Style 4 to 5 Threads
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size	Thread/Inch		No. of Flutes	E.D.P. Numbers						Dimensions			Std . Pack.
	NC UNC	NF UNF		H2	H3	H4	H5	H6	H7	Overall Length	Length of Thread	Shank Dia.	
1/4	20		3	87052	87056	—	87060	—	87062	2 1/2	0.591	0.255	3
		28	3	87066	87068	87070	87071	87072	87073	2 1/2	0.591	0.255	3
5/16	18		3	—	87080	—	87084	—	87086	2 23/32	0.669	0.318	3
		24	3	—	87094	87096	87097	87098	87099	2 23/32	0.669	0.318	3
3/8	16		3	—	87102	—	87104	—	87106	2 15/16	0.748	0.381	3
		24	3	—	87110	87112	87113	87114	87115	2 15/16	0.748	0.381	3
7/16	14		3	—	87116	—	87120	—	—	3 5/32	0.866	0.323	3
		20	3	—	87122	—	87126	87127	87129	3 5/32	0.866	0.323	3
1/2	13		3	—	87130	—	87134	—	87136	3 3/8	0.984	0.367	3
		20	3	—	87138	—	87140	87141	87142	3 3/8	0.984	0.367	3
9/16	12		3	—	87143	—	—	—	—	3 19/32	0.984	0.429	3
		18	3	—	87144	—	—	—	—	3 19/32	0.984	0.429	3
5/8	11		3	—	87148	—	87152	—	87154	3 13/16	1.102	0.480	3
		18	3	—	87158	—	87159	—	—	3 13/16	1.102	0.480	3
3/4	10		3	—	87164	—	—	—	87167	4 1/4	1.181	0.590	3
		16	3	—	87168	—	87169	—	—	4 1/4	1.181	0.590	3
7/8	9		3	—	87170	—	—	—	—	4 11/16	1.299	0.697	3
		14	3	—	87171	—	—	—	—	4 11/16	1.299	0.697	3
1	8		3	—	87172	—	—	—	—	5 1/8	1.378	0.800	3

VTP ROLL FORM TAPS

✱ **List No.993** Machine Screw Sizes

PREMIUM P CHAMFER B CHAMFER

Surface Treated

PREMIUM TYPE STEEL

Nominal Size	Thread/Inch		Pitch Diameter Limits	E.D.P. Numbers		Dimensions			Std. Pack.
	NC UNC	NF UNF		Plug	Bottom	Overall Length	Length of Thread	Shank Dia.	
0		80	H2		82003	1 5/8	0.311	0.141	3
1	64		H2		82009	1 11/16	0.374	0.141	3
1		72	H2		82015	1 11/16	0.374	0.141	3
2	56		H2		82021	1 3/4	0.437	0.141	3
2	56		H3		82024	1 3/4	0.437	0.141	3
2		64	H2		82030	1 3/4	0.437	0.141	3
2		64	H3		82033	1 3/4	0.437	0.141	3
3	48		H2		82039	1 13/16	0.500	0.141	3
3	48		H3		82042	1 13/16	0.500	0.141	3
3		56	H2		82048	1 13/16	0.500	0.141	3
3		56	H3		82051	1 13/16	0.500	0.141	3
4	40		H3	82056	82057	1 7/8	0.354	0.141	3
4	40		H5	82062	82063	1 7/8	0.354	0.141	3
4		48	H3	82068	82069	1 7/8	0.354	0.141	3
4		48	H5	82074	82075	1 7/8	0.354	0.141	3
5	40		H3	82080	82081	1 15/16	0.394	0.141	3
5	40		H5	82086	82087	1 15/16	0.394	0.141	3
5		44	H3	82092	82093	1 15/16	0.394	0.141	3
5		44	H5	82098	82099	1 15/16	0.394	0.141	3
6	32		H3	82104	82105	2	0.433	0.141	3
6	32		H5	82110	82111	2	0.433	0.141	3
6	32		H10	82119	82120	2	0.433	0.141	3
6		40	H3	82122	82123	2	0.433	0.141	3
6		40	H5	82128	82129	2	0.433	0.141	3
8	32		H3	82140	82141	2 1/8	0.472	0.168	3
8	32		H5	82146	82147	2 1/8	0.472	0.168	3
8	32		H10	82152	82153	2 1/8	0.472	0.168	3
8		36	H3	82158	82159	2 1/8	0.472	0.168	3
8		36	H5	82164	82165	2 1/8	0.472	0.168	3
10	24		H4	82179	82180	2 3/8	0.551	0.194	3
10	24		H6	82185	82186	2 3/8	0.551	0.194	3
10	24		H10	82191	82192	2 3/8	0.551	0.194	3
10		32	H4	82200	82201	2 3/8	0.551	0.194	3
10		32	H6	82206	82207	2 3/8	0.551	0.194	3
10		32	H10	82212	82213	2 3/8	0.551	0.194	3
12	24		H4	82218	82219	2 3/8	0.551	0.220	3
12	24		H6	82224	82225	2 3/8	0.551	0.220	3
12		28	H4	82236	82237	2 3/8	0.551	0.220	3
12		28	H6	82242	82243	2 3/8	0.551	0.220	3

Roll thread forming taps designed with more lobes and lubrication grooves. The extra lobes and grooves reduce tapping torque by allowing more coolant to reach critical contact areas.

✱ **item will be discontinued, after stock has depleted.**
We recommend L995 Viper Taflet for Steels (Machine Screw Sizes) as substitution item for L993.

VTP ROLL FORM TAPS

* **List No.991** Fractional Sizes

PREMIUM · P CHAMFER · B CHAMFER

Surface Treated

PREMIUM TYPE STEEL

Nominal Size	Thread/Inch		Pitch Diameter Limits	E.D.P. Numbers		Dimensions			Std. Pack.
	NC UNC	NF UNF		Plug	Bottom	Overall Length	Length of Thread	Shank Dia.	
1/4	20		H4	82254	82255	2 1/2	0.591	0.255	3
1/4	20		H6	82260	82261	2 1/2	0.591	0.255	3
1/4	20		H10	82266	82267	2 1/2	0.591	0.255	3
1/4		28	H4	82272	82273	2 1/2	0.591	0.255	3
1/4		28	H6	82278	82279	2 1/2	0.591	0.255	3
1/4		28	H10	82284	82285	2 1/2	0.591	0.255	3
5/16	18		H5	82293	82294	2 23/32	0.669	0.318	3
5/16	18		H7	82299	82300	2 23/32	0.669	0.318	3
5/16		24	H5	82311	82312	2 23/32	0.669	0.318	3
5/16		24	H7	82317	82318	2 23/32	0.669	0.318	3
3/8	16		H5	82326	82327	2 15/16	0.748	0.381	3
3/8	16		H7	82332	82333	2 15/16	0.748	0.381	3
3/8		24	H5	82341	82342	2 15/16	0.748	0.381	3
3/8		24	H7	82347	82348	2 15/16	0.748	0.381	3
7/16	14		H5	82356	82357	3 5/32	0.866	0.323	3
7/16	14		H8	82365	82366	3 5/32	0.866	0.323	3
7/16		20	H5	82374	82375	3 5/32	0.866	0.323	3
7/16		20	H8	82383	82384	3 5/32	0.866	0.323	3
1/2	13		H5	82392	82393	3 3/8	0.984	0.367	3
1/2	13		H8	82401	82402	3 3/8	0.984	0.367	3
1/2		20	H5	82410	82411	3 3/8	0.984	0.367	3
1/2		20	H8	82419	82420	3 3/8	0.984	0.367	3
9/16	12		H7	82431	82432	3 19/32	0.984	0.429	3
9/16	12		H10	82437	82438	3 19/32	0.984	0.429	3
9/16		18	H7	82446	82447	3 19/32	0.984	0.429	3
9/16		18	H10	82452	82453	3 19/32	0.984	0.429	3
5/8	11		H7	82461	82462	3 13/16	1.102	0.480	3
5/8	11		H10	82467	82468	3 13/16	1.102	0.480	3
5/8		18	H7	82476	82477	3 13/16	1.102	0.480	3
5/8		18	H10	82482	82483	3 13/16	1.102	0.480	3
3/4	10		H7	82491	82492	4 1/4	1.181	0.590	3
3/4	10		H10	82497	82498	4 1/4	1.181	0.590	3
3/4		16	H7	82506	82507	4 1/4	1.181	0.590	3
3/4		16	H10	82512	82513	4 1/4	1.181	0.590	3

Roll thread forming taps designed with more lobes and lubrication grooves. The extra lobes and grooves reduce tapping torque by allowing more coolant to reach critical contact areas.

* **item will be discontinued, after stock has depleted.**
We recommend L995 Viper Taflet for Steels (Fractional Sizes) as substitution item for L991.

VTP TAP BLANK DIMENSIONS

Nominal Size	Overall Length	Length of Thread			Square Length	Size of Square	Shank Diameter
		971-973	991-993	981-983			
0	1 5/8	0.311	0.311		3/16	0.110	0.141
1	1 11/16	0.374	0.374		3/16	0.110	0.141
2	1 3/4	0.437	0.437		3/16	0.110	0.141
3	1 13/16	0.500	0.500		3/16	0.110	0.141
4	1 7/8	0.354	0.354	0.236	3/16	0.110	0.141
5	1 15/16	0.394	0.394	0.236	3/16	0.110	0.141
6	2	0.433	0.433	0.276	3/16	0.110	0.141
8	2 1/8	0.472	0.472	0.276	3/16	0.131	0.168
10NC	2 3/8	0.551	0.551	0.354	1/4	0.152	0.194
10NF	2 3/8	0.551	0.551	0.354	1/4	0.152	0.194
12	2 3/8	0.551	0.551	0.354	9/32	0.165	0.220
1/4NC	2 1/2	0.591	0.591	0.433	5/16	0.191	0.255
1/4NF	2 1/2	0.591	0.591	0.433	5/16	0.191	0.255
5/16NC	2 23/32	0.669	0.669	0.472	3/8	0.238	0.318
5/16NF	2 23/32	0.669	0.669	0.472	3/8	0.238	0.318
3/8NC	2 15/16	0.748	0.748	0.551	7/16	0.286	0.381
3/8NF	2 15/16	0.748	0.748	0.551	7/16	0.286	0.381
7/16NC	3 5/32	0.866	0.866	0.591	13/32	0.242	0.323
7/16NF	3 5/32	0.866	0.866	0.591	13/32	0.242	0.323
1/2NC	3 3/8	0.984	0.984	0.630	7/16	0.275	0.367
1/2NF	3 3/8	0.984	0.984	0.630	7/16	0.275	0.367
9/16NC	3 19/32	0.984	0.984	0.709	1/2	0.322	0.429
9/16NF	3 19/32	0.984	0.984	0.709	1/2	0.322	0.429
5/8NC	3 13/16	1.102	1.102	0.748	9/16	0.360	0.480
5/8NF	3 13/16	1.102	1.102	0.748	9/16	0.360	0.480
3/4NC	4 1/4	1.181	1.181	0.827	11/64	0.441	0.590
3/4NF	4 1/4	1.181	1.181	0.827	11/64	0.441	0.590

VTP Taps are manufactured from premium type-High Vanadium High Speed Steel.

They have a High Vanadium content for superior wear resistance, and are specially heat-treated for toughness.

The black oxide surface treatment provides extra lubricity and resistance to galling pickup.

Tap geometry designed for optimum cutting performance and close control of tapped holes size.

VTP METRIC TAPS SPIRAL FLUTED
VTP METRIC TAPS SPIRAL POINTED

List No.980 Spiral Fluted

HSSE-V | TAPS FLUTE NH | MB CHAMFER

Modified Bottoming Style 2-1/2 To 3 Thread Lead
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size (mm)	Pitch (mm)	No. Of Flutes	E.D.P. Number					Dimensions			Std. Pack.
			D3	D4	D5	D6	D7	Overall Length	Length of Thread	Shank Dia.	
3	0.5	3	54615	—	—	—	—	1 15/16	0.236	0.141	3
3.5	0.6	3	—	54616	—	—	—	2	0.276	0.141	3
4	0.7	3	—	54617	—	—	—	2 1/8	0.276	0.168	3
5	0.8	3	—	54619	—	—	—	2 3/8	0.354	0.194	3
6	1	3	—	—	54620	—	—	2 1/2	0.433	0.255	3
7	1	3	—	—	54621	—	—	2 23/32	0.472	0.318	3
8	1	3	—	—	54622	—	—	2 23/32	0.472	0.318	3
8	1.25	3	—	—	54623	—	—	2 23/32	0.472	0.318	3
10	1.25	3	—	—	54624	—	—	2 15/16	0.551	0.381	3
10	1.5	3	—	—	—	54625	—	2 15/16	0.551	0.381	3
12	1.25	3	—	—	54626	—	—	3 3/8	0.630	0.367	3
12	1.75	3	—	—	—	54627	—	3 3/8	0.630	0.367	3
14	1.5	3	—	—	—	54628	—	3 19/32	0.551	0.429	3
14	2	3	—	—	—	—	54629	3 19/32	0.709	0.429	3
16	1.5	3	—	—	—	54630	—	3 13/16	0.551	0.480	3
16	2	3	—	—	—	—	54631	3 13/16	0.709	0.480	3
18	1.5	3	—	—	—	54632	—	4 1/32	0.551	0.542	3
18	2.5	3	—	—	—	—	54633	4 1/32	0.874	0.542	3

List No.982 Spiral Pointed

HSSE-V | TAPS FLUTE SP | P CHAMFER

Plug Style, 4 To 5 Thread Lead
Surface Treated

VANADIUM HIGH SPEED STEEL HSSE-V

Nominal Size (mm)	Pitch (mm)	No. Of Flutes	E.D.P. Number					Dimensions			Std. Pack.
			D3	D4	D5	D6	D7	Overall Length	Length of Thread	Shank Dia.	
3	0.5	3	52615	—	—	—	—	1 15/16	0.394	0.141	3
3.5	0.6	3	—	52616	—	—	—	2	0.433	0.141	3
4	0.7	3	—	52617	—	—	—	2 1/8	0.472	0.168	3
5	0.8	3	—	52619	—	—	—	2 3/8	0.551	0.194	3
6	1	3	—	—	52620	—	—	2 1/2	0.591	0.255	3
7	1	3	—	—	52621	—	—	2 23/32	0.669	0.318	3
8	1	3	—	—	52622	—	—	2 23/32	0.669	0.318	3
8	1.25	3	—	—	52623	—	—	2 23/32	0.669	0.318	3
10	1.25	3	—	—	52624	—	—	2 15/16	0.748	0.381	3
10	1.5	3	—	—	—	52625	—	2 15/16	0.748	0.381	3
12	1.25	3	—	—	52626	—	—	3 3/8	0.984	0.367	3
12	1.75	3	—	—	—	52627	—	3 3/8	0.984	0.367	3
14	1.5	3	—	—	—	52628	—	3 19/32	0.984	0.429	3
14	2	3	—	—	—	—	52629	3 19/32	0.984	0.429	3
16	1.5	3	—	—	—	52630	—	3 13/16	1.102	0.480	3
16	2	3	—	—	—	—	52631	3 13/16	1.102	0.480	3
18	1.5	3	—	—	—	52632	—	4 1/32	1.102	0.542	3
18	2.5	3	—	—	—	—	52633	4 1/32	1.102	0.542	3

STANDARD HAND TAPS

List No.911 Fractional Sizes

HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

Bright Finish

HIGH SPEED STEEL

List No.911P Fractional Sizes

G · HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

Titanium Nitride Coated

HIGH SPEED STEEL-TIN COATED

Size	Thread		Pitch Diameter Limits	Number of Flutes	E.D.P.						Dimensions			Std. Pack.
					Taper		Plug		Bottom					
	UNC	UNF			L911	L911P	L911	L911P	L911	L911P	Overall Length	Thread Length	Shank Dia.	
1/4	20		H2	4	64059		64060		64061		2 1/2	1	0.255	3
1/4	20		H3	4	64068	24068	64069	24069	64070	24070	2 1/2	1	0.255	3
1/4	20		H5	4			64075		64076		2 1/2	1	0.255	3
1/4		28	H3	4	64089	24089	64090	24090	64091	24091	2 1/2	1	0.255	3
1/4		28	H4	4			64093		64094		2 1/2	1	0.255	3
5/16	18		H2	4	64098		64099		64100		2 23/32	1 1/8	0.318	3
5/16	18		H3	4	64107	24107	64108	24108	64109	24109	2 23/32	1 1/8	0.318	3
5/16	18		H5	4			64111		64112		2 23/32	1 1/8	0.318	3
5/16		24	H3	4	64122	24122	64123	24123	64124	24124	2 23/32	1 1/8	0.318	3
5/16		24	H4	4			64126		64127		2 23/32	1 1/8	0.318	3
3/8	16		H2	4	64131		64132		64133		2 15/16	1 1/4	0.381	3
3/8	16		H3	4	64137	24137	64138	24138	64139	24139	2 15/16	1 1/4	0.381	3
3/8	16		H5	4			64141		64142		2 15/16	1 1/4	0.381	3
3/8		24	H3	4	64152	24152	64153	24153	64154	24154	2 15/16	1 1/4	0.381	3
3/8		24	H4	4			64156		64157		2 15/16	1 1/4	0.381	3
7/16	14		H3	4	64167	24167	64168	24168	64169	24169	3 5/32	1 7/16	0.323	3
7/16		20	H3	4	64182	24182	64183	24183	64184	24184	3 5/32	1 7/16	0.323	3
1/2	13		H3	4	64197	24197	64198	24198	64199	24199	3 3/8	1 21/32	0.367	3
1/2	13		H5	4			64201		64202		3 3/8	1 21/32	0.367	3
1/2		20	H3	4	64212	24212	64213	24213	64214	24214	3 3/8	1 21/32	0.367	3
1/2		20	H5	4			64216		64217		3 3/8	1 21/32	0.367	3
9/16	12		H3	4	64221	24221	64222	24222	64223	24223	3 19/32	1 21/32	0.429	3
9/16		18	H3	4	64230	24230	64231	24231	64232	24232	3 19/32	1 21/32	0.429	3
5/8	11		H3	4	64242	24242	64243	24243	64244	24244	3 13/16	1 13/16	0.480	3
5/8	11		H5	4			64246		64247		3 13/16	1 13/16	0.480	3
5/8		18	H3	4	64254	24254	64255	24255	64256	24256	3 13/16	1 13/16	0.480	3
5/8		18	H5	4			64258		64259		3 13/16	1 13/16	0.480	3
11/16	11		H3	4	64260		64261		64262		4 1/32	1 13/16	0.542	3
11/16		16	H3	4	64263		64264		64265		4 1/32	1 13/16	0.542	3
3/4	10		H3	4	64272	24272	64273	24273	64274	24274	4 1/4	2	0.590	3
3/4	10		H5	4			64276		64277		4 1/4	2	0.590	3
3/4		16	H3	4	64284	24284	64285	24285	64286	24286	4 1/4	2	0.590	3
3/4		16	H5	4			64288		64289		4 1/4	2	0.590	3
7/8	9		H4	4	64293	24293	64294	24294	64295	24295	4 11/16	2 7/32	0.697	3
7/8		14	H4	4	64302	24302	64303	24303	64304	24304	4 11/16	2 7/32	0.697	3
1	8		H4	4	64311	24311	64312	24312	64313	24313	5 1/8	2 1/2	0.800	3
1		12	H4	4	64314		64315		64316		5 1/8	2 1/2	0.800	3
1		14	H4	4	64320		64321		64322		5 1/8	2 1/2	0.800	3
1 1/8	7		H4	4	64323		64324		64325		5 7/16	2 9/16	0.896	1
1 1/8		12	H4	4	64326		64327		64328		5 7/16	2 9/16	0.896	1
1 1/4	7		H4	4	64329		64330		64331		5 3/4	2 9/16	1.021	1
1 1/4		12	H4	6	64332		64333		64334		5 3/4	2 9/16	1.021	1
1 3/8	6		H4	4	64335		64336		64337		6 1/16	3	1.108	1
1 3/8		12	H4	6	64338		64339		64340		6 1/16	3	1.108	1
1 1/2	6		H4	4	64341		64342		64343		6 3/8	3	1.233	1
1 1/2		12	H4	6	64344		64345		64346		6 3/8	3	1.233	1

Order by EDP Number

STANDARD HAND TAPS

List No.913 Machine Screw Size

HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

Bright Finish

HIGH SPEED STEEL

List No.913P Machine Screw Sizes

G · HSS · TAPS FLUTE ST · P CHAMFER · B CHAMFER

Titanium Nitride

HIGH SPEED STEEL-TIN COATED

Nominal Tap Size	Threads		Pitch Diameter Limits	Number of Flutes	E.D.P. Numbers						Dimensions			Std . Pack.
					Taper		Plug		Bottom					
	NC UNC	NF UNF			L913	L913P	L913	L913P	L913	L913P	Overall Length	Thread Length	Shank Dia.	
0		80	H1	2	64360		64361		64362		1 5/8	5/16	0.141	3
0		80	H2	2			64364	24364	64365	24365	1 5/8	5/16	0.141	3
1	64		H1	2	64366		64367		64368		1 11/16	3/8	0.141	3
1	64		H2	2			64370				1 11/16	3/8	0.141	3
1		72	H1	2	64372		64373		64374		1 11/16	3/8	0.141	3
1		72	H2	2			64376		64377		1 11/16	3/8	0.141	3
2	56		H1	3	64381		64382		64383		1 3/4	7/16	0.141	3
2	56		H2	3	64387	24387	64388	24388	64389	24389	1 3/4	7/16	0.141	3
2		64	H1	3	64390		64391		64392		1 3/4	7/16	0.141	3
2		64	H2	3	64393		64394		64395		1 3/4	7/16	0.141	3
3	48		H1	3			64397				1 13/16	1/2	0.141	3
3	48		H2	3	64402		64403		64404		1 13/16	1/2	0.141	3
3		56	H1	3			64406				1 13/16	1/2	0.141	3
3		56	H2	3	64408		64409		64410		1 13/16	1/2	0.141	3
4	36		H2	3	64411		64412		64413		1 7/8	9/16	0.141	3
4	40		H1	3	64417		64418		64419		1 7/8	9/16	0.141	3
4	40		H2	3	64423	24423	64424	24424	64425	24425	1 7/8	9/16	0.141	3
4		48	H1	3			64427				1 7/8	9/16	0.141	3
4		48	H2	3	64429		64430		64431		1 7/8	9/16	0.141	3
5	40		H1	3			64433		64434		1 15/16	5/8	0.141	3
5	40		H2	3	64438	24438	64439	24439	64440	24440	1 15/16	5/8	0.141	3
5		44	H1	3			64442		64443		1 15/16	5/8	0.141	3
5		44	H2	3	64447		64448		64449		1 15/16	5/8	0.141	3
6	32		H2	3	64459		64460		64461		2	11/16	0.141	3
6	32		H3	3	64465	24465	64466	24466	64467	24467	2	11/16	0.141	3
6	32		H7	3			64469		64470		2	11/16	0.141	3
6		40	H1	3			64472				2	11/16	0.141	3
6		40	H2	3	64477		64478		64479		2	11/16	0.141	3
8	32		H2	4	64495		64496		64497		2 1/8	3/4	0.168	3
8	32		H3	4	64504	24504	64505	24505	64506	24506	2 1/8	3/4	0.168	3
8	32		H7	4			64508		64509		2 1/8	3/4	0.168	3
8		36	H1	4			64515				2 1/8	3/4	0.168	3
8		36	H2	4	64517		64518		64519		2 1/8	3/4	0.168	3
10	24		H2	4	64532		64533		64534		2 3/8	7/8	0.194	3
10	24		H3	4	64541	24541	64542	24542	64543	24543	2 3/8	7/8	0.194	3
10	24		H7	4			64548		64549		2 3/8	7/8	0.194	3
10		32	H2	4	64562		64563		64564		2 3/8	7/8	0.194	3
10		32	H3	4	64571	24571	64572	24572	64573	24573	2 3/8	7/8	0.194	3
10		32	H7	4			64578		64579		2 3/8	7/8	0.194	3
12	24		H3	4	64583	24583	64584	24584	64585	24585	2 3/8	15/16	0.220	3
12		28	H3	4	64589		64590		64591		2 3/8	15/16	0.220	3

Order by EDP Number

STANDARD TAPS SPIRAL POINTED / FRACTIONAL SIZES
STANDARD HAND TAPS / FOR CAST IRON

List No.921 Fractional Sizes

HSS · TAPS FLUTE SP · P CHAMFER · B CHAMFER

Plug Style
Bright Finish
HIGH SPEED STEEL

List No.921P Fractional Sizes

G · HSS · TAPS FLUTE SP · P CHAMFER · B CHAMFER

Plug Style
Titanium Nitride Coated
HIGH SPEED STEEL-TIN COATED

List No.921S Fractional Sizes

HSS · TAPS FLUTE SP · P CHAMFER

Plug Style
Surface Treated
HIGH SPEED STEEL

Nominal Tap Size	Threads per inch NC UNC	Threads per inch NF UNF	Pitch Diameter Limits	Number of Flutes	E.D.P. Numbers Plug L921	E.D.P. Numbers Plug L921S	E.D.P. Numbers Plug L921P	Dimensions Overall Length	Dimensions Thread Length	Dimensions Shank Dia.	Std. Pack.
1/4	20		H3	2	67054	67402	27054	2 1/2	1	0.255	3
1/4	20		H3	3	67056			2 1/2	1	0.255	3
1/4		28	H3	2	67068	67409	27068	2 1/2	1	0.255	3
5/16	18		H3	2	67078	67414	27078	2 23/32	1 1/8	0.318	3
5/16	18		H3	3	67080		27080	2 23/32	1 1/8	0.318	3
5/16		24	H3	2	67092	67421	27092	2 23/32	1 1/8	0.318	3
3/8	16		H2	3	67100			2 15/16	1 1/4	0.381	3
3/8	16		H3	3	67102	67426	27102	2 15/16	1 1/4	0.381	3
3/8	16		H5	3	67104		27106	2 15/16	1 1/4	0.381	3
3/8		24	H3	3	67110	67430	27110	2 15/16	1 1/4	0.381	3
7/16	14		H3	3	67116	67433	27116	3 5/32	1 7/16	0.323	3
7/16		20	H3	3	67122	67436	27122	3 5/32	1 7/16	0.323	3
1/2	13		H3	3	67130	67440	27130	3 3/8	1 21/32	0.367	3
1/2		20	H3	3	67138	67444	27138	3 3/8	1 21/32	0.367	3
9/16	12		H3	3	67142		27142	3 19/32	1 21/32	0.429	3
5/8	11		H3	3	67148	67447	27148	3 13/16	1 13/16	0.480	3
3/4	10		H3	3	67150	67450	27150	4 1/4	2	0.590	3

Order by EDP Number

List No.969 For Cast Iron

HSS · TAPS FLUTE SP · P CHAMFER · B CHAMFER

Surface Treated

HIGH SPEED STEEL

Size	Threads UNC	Threads UNF	Thread Limits	Number of Flutes	E.D.P. Plug	E.D.P. Bottom	Dimensions Overall Length	Dimensions Thread Length	Dimensions Shank Dia.	Std. Pack.
1/4	20		H3	4	76001	76002	2 1/2	1	0.255	12
	20		H5	4	76003	76004	2 1/2	1	0.255	12
		28	H3	4	76005	76006	2 1/2	1	0.255	12
5/16	18		H3	4	76007	76008	2 23/32	1 1/8	0.318	12
	18		H5	4	76009	76010	2 23/32	1 1/8	0.318	12
		24	H3	4	76011	76012	2 23/32	1 1/8	0.318	12
3/8	16		H3	4	76013	76014	2 15/16	1 1/4	0.381	12
	16		H5	4	76015	76016	2 15/16	1 1/4	0.381	12
		24	H3	4	76017	76018	2 15/16	1 1/4	0.381	12
7/16	14		H3	4	76019	76020	3 5/32	1 7/16	0.323	12
	14		H5	4	76021	76022	3 5/32	1 7/16	0.323	12
		20	H3	4	76023	76024	3 5/32	1 7/16	0.323	12
		20	H5	4	76025	76026	3 5/32	1 7/16	0.323	12
1/2	13		H3	4	76027	76028	3 3/8	1 21/32	0.367	12
	13		H5	4	76029	76030	3 3/8	1 21/32	0.367	12
		20	H3	4	76031	76032	3 3/8	1 21/32	0.367	12
		20	H5	4	76033	76034	3 3/8	1 21/32	0.367	12
9/16	12		H3	4	76035	76036	3 19/32	1 21/32	0.429	6
		18	H3	4	76037	76038	3 19/32	1 21/32	0.429	6
5/8	11		H3	4	76039	76040	3 13/16	1 13/16	0.480	6
		18	H3	4	76041	76042	3 13/16	1 13/16	0.480	6
3/4	10		H3	4	76043	76044	4 1/4	2	0.590	6
		16	H3	4	76045	76046	4 1/4	2	0.590	6

STANDARD TAPS SPIRAL POINTED / MACHINE SCREW SIZES

List No.923 Machine Screw Sizes

HSS · TAPS FLUTE SP · P CHAMFER · B CHAMFER

Plug Style
Bright Finish
HIGH SPEED STEEL

List No.923P Machine Screw Sizes

G · HSS · TAPS FLUTE SP · P CHAMFER · B CHAMFER

Plug Style
Titanium Nitride Coated
HIGH SPEED STEEL-TIN COATED

List No.923S Machine Screw Sizes

HSS · TAPS FLUTE SP · P CHAMFER

Plug Style
Surface Treated
HIGH SPEED STEEL

Nominal Tap Size	Threads per inch		Pitch Diameter Limits	Number of Flutes	E.D.P. Numbers			Dimensions			Std. Pack.
					Plug			Overall Length	Thread Length	Shank Dia.	
	NC UNC	NF UNF			L923	L923S	L923P				
0		80	H1	2	67200			1 5/8	5/16	0.141	3
0		80	H2	2	67202		27202	1 5/8	5/16	0.141	3
1	64		H1	2	67206			1 11/16	3/8	0.141	3
1	64		H2	2	67208			1 11/16	3/8	0.141	3
1		72	H1	2	67210			1 11/16	3/8	0.141	3
1		72	H2	2	67212			1 11/16	3/8	0.141	3
2	56		H1	2	67214			1 3/4	7/16	0.141	3
2	56		H2	2	67216		27216	1 3/4	7/16	0.141	3
2		64	H2	2	67224			1 3/4	7/16	0.141	3
3	48		H2	2	67228	67514		1 13/16	1/2	0.141	3
3		56	H2	2	67234	67517		1 13/16	1/2	0.141	3
4	36NS		H2	2	67236			1 7/8	9/16	0.141	3
4	40		H1	2	67238			1 7/8	9/16	0.141	3
4	40		H2	2	67240	67520	27240	1 7/8	9/16	0.141	3
4		48	H2	2	67248	67524		1 7/8	9/16	0.141	3
5	40		H1	2	67250			1 15/16	5/8	0.141	3
5	40		H2	2	67252	67526	27252	1 15/16	5/8	0.141	3
5		44	H2	2	67254	67527		1 15/16	5/8	0.141	3
6	32		H2	2	67258		27258	2	11/16	0.141	3
6	32		H3	2	67260	67530	27260	2	11/16	0.141	3
6	32		H7	2	67264			2	11/16	0.141	3
6		40	H2	2	67268	67534		2	11/16	0.141	3
8	32		H2	2	67272		27272	2 1/8	3/4	0.168	3
8	32		H3	2	67274	67537	27274	2 1/8	3/4	0.168	3
8	32		H7	2	67278			2 1/8	3/4	0.168	3
8		36	H2	2	67282	67541		2 1/8	3/4	0.168	3
10	24		H2	2	67286		27286	2 3/8	7/8	0.194	3
10	24		H3	2	67288	67544	27288	2 3/8	7/8	0.194	3
10	24		H7	2	67290			2 3/8	7/8	0.194	3
10		32	H2	2	67294		27294	2 3/8	7/8	0.194	3
10		32	H3	2	67296	67548	27296	2 3/8	7/8	0.194	3
10		32	H7	2	67300			2 3/8	7/8	0.194	3
12	24		H3	2	67304	67552	27304	2 3/8	15/16	0.220	3

Order by EDP Number

STANDARD TAPS / SPIRAL FLUTED

List No.931 Fractional Sizes

HSS · TAPS FLUTE NH · P CHAMFER · B CHAMFER

Spiral Fluted
Bright Finish

HIGH SPEED STEEL

Nominal Tap Size	Threads Per Inch		Pitch Dia. Limit	Number of Flutes	E.D.P.	Dimensions			Std. Pack.
	UNC	UNF			Bottom	Overall Length	Thread Length	Shank Dia.	
1/4	20		H3	2	68055	2 1/2	1	0.255	3
1/4	20		H3	3	68057	2 1/2	1	0.255	3
1/4		28	H3	2	68069	2 1/2	1	0.255	3
1/4		28	H3	3	68071	2 1/2	1	0.255	3
5/16	18		H3	2	68079	2 23/32	1 1/8	0.318	3
5/16	18		H3	3	68081	2 23/32	1 1/8	0.318	3
5/16		24	H3	2	68093	2 23/32	1 1/8	0.318	3
5/16		24	H3	3	68095	2 23/32	1 1/8	0.318	3
3/8	16		H3	3	68103	2 15/16	1 1/4	0.381	3
3/8		24	H3	3	68111	2 15/16	1 1/4	0.381	3
7/16	14		H3	3	68117	3 5/32	1 7/16	0.323	3
7/16		20	H3	3	68123	3 5/32	1 7/16	0.323	3
1/2	13		H3	3	68131	3 3/8	1 21/32	0.367	3
1/2		20	H3	3	68139	3 3/8	1 21/32	0.367	3

Order by EDP Number

List No.933 Machine Screw Sizes

HSS · TAPS FLUTE NH · P CHAMFER · B CHAMFER

Spiral Fluted
Bright Finish

HIGH SPEED STEEL

Nominal Tap Size	Threads Per Inch		Pitch Dia. Limit	Number of Flutes	E.D.P.	Dimensions			Std. Pack.
	UNC	UNF			Bottom	Overall Length	Thread Length	Shank Dia.	
3	48		H2	2	68229	1 13/16	1/2	0.141	3
3		56	H2	2	68235	1 13/16	1/2	0.141	3
4	40		H2	2	68241	1 7/8	9/16	0.141	3
4		48	H2	2	68249	1 7/8	9/16	0.141	3
5	40		H2	2	68253	1 15/16	5/8	0.141	3
5		44	H2	2	68255	1 15/16	5/8	0.141	3
6	32		H3	2	68261	2	11/16	0.141	3
6		40	H2	2	68269	2	11/16	0.141	3
8	32		H3	2	68275	2 1/8	3/4	0.168	3
8		36	H2	2	68283	2 1/8	3/4	0.168	3
10	24		H3	2	68289	2 3/8	7/8	0.194	3
10		32	H3	2	68297	2 3/8	7/8	0.194	3
12	24		H3	2	68305	2 3/8	15/16	0.220	3
12		28	H3	2	68307	2 3/8	15/16	0.220	3

Order by EDP Number

List No.931H Fractional Sizes

HSS · TAPS FLUTE HH · P CHAMFER · B CHAMFER

High Helix Taps
Fast Spiral Flute
Bright Finish

HIGH SPEED STEEL

Nominal Tap Size	Threads Per Inch		Pitch Dia. Limit	Number of Flutes	E.D.P.	Dimensions			Std. Pack.
	UNC	UNF			Bottom	Overall Length	Thread Length	Shank Dia.	
1/4	20		H3	3	68357	2 1/2	1	0.255	3
1/4		28	H3	3	68371	2 1/2	1	0.255	3
5/16	18		H3	3	68381	2 23/32	1 1/8	0.318	3
5/16		24	H3	3	68395	2 23/32	1 1/8	0.318	3
3/8	16		H3	3	68403	2 15/16	1 1/4	0.381	3
3/8		24	H3	3	68411	2 15/16	1 1/4	0.381	3
7/16	14		H3	3	68417	3 5/32	1 7/16	0.323	3
7/16		20	H3	3	68423	3 5/32	1 7/16	0.323	3
1/2	13		H3	3	68431	3 3/8	1 21/32	0.367	3
1/2		20	H3	3	68439	3 3/8	1 21/32	0.367	3

Order by EDP Number

List No.933H Machine Screw Sizes

HSS · TAPS FLUTE HH · P CHAMFER · B CHAMFER

High Helix Taps
Fast Spiral Flute
Bright Finish

HIGH SPEED STEEL

Nominal Tap Size	Threads Per Inch		Pitch Dia. Limit	Number of Flutes	E.D.P.	Dimensions			Std. Pack.
	UNC	UNF			Bottom	Overall Length	Thread Length	Shank Dia.	
3	48		H2	2	68529	1 13/16	1/2	0.141	3
4	40		H2	2	68541	1 7/8	9/16	0.141	3
5	40		H2	2	68553	1 15/16	5/8	0.141	3
6	32		H3	2	68561	2	1 1/16	0.141	3
8	32		H3	3	68573	2 1/8	3/4	0.168	3
10	24		H3	3	68587	2 3/8	7/8	0.194	3
10		32	H3	3	68595	2 3/8	7/8	0.194	3

Order by EDP Number

STANDARD TAPS / .005 OVERSIZED

List No.915 Fractional Sizes & Machine Screw Sizes — HIGH SPEED STEEL

HSS · TAPS FLUTE ST · P CHAMFER

Hand Taps
Plug Style
.005 Oversized
Bright Finish

Nominal Tap Size	Threads		Pitch Limits	Number of Flutes	E.D.P. Number	Dimensions			Std. Pack.
	UNC	UNF				Overall Length	Thread Length	Shank Dia.	
6	32		H13	3	64612	2	11/16	0.141	3
8	32		H13	4	64614	2 1/8	3/4	0.168	3
10	24		H13	4	64616	2 3/8	7/8	0.194	3
10		32	H13	4	64617	2 3/8	7/8	0.194	3
1/4	20		H13	4	64621	2 1/2	1	0.255	3
1/4		28	H13	4	64622	2 1/2	1	0.255	3
5/16	18		H13	4	64623	2 23/32	1 1/8	0.318	3
5/16		24	H13	4	64624	2 23/32	1 1/8	0.318	3
3/8	16		H13	4	64625	2 15/16	1 1/4	0.381	3
3/8		24	H13	4	64626	2 15/16	1 1/4	0.381	3
7/16	14		H13	4	64627	3 5/32	1 7/16	0.323	3
7/16		20	H13	4	64628	3 5/32	1 7/16	0.323	3
1/2	13		H13	4	64629	3 3/8	1 21/32	0.367	3
1/2		20	H13	4	64630	3 3/8	1 21/32	0.367	3
9/16	12		H13	4	64631	3 19/32	1 21/32	0.429	3
5/8	11		H13	4	64633	3 13/16	1 13/16	0.480	3
3/4	10		H13	4	64637	4 1/4	2	0.590	3
7/8	9		H13	4	64639	4 11/16	2 7/32	0.697	3
1	8		H13	4	64641	5 1/8	2 1/2	0.800	3

Order by EDP Number

List No.925 Fractional & Machine Screw Sizes — HIGH SPEED STEEL

HSS · TAPS FLUTE SP · P CHAMFER

Spiral Pointed
Plug Style
.005 Oversized
Bright Finish

Nominal Tap Size	Threads		Pitch Dia. Limits	Number of Flutes	E.D.P. Number	Dimensions			Std. Pack.
	UNC	UNF				Overall Length	Thread Length	Shank Dia.	
6	32		H13	2	67612	2	11/16	0.141	3
8	32		H13	2	67614	2 1/8	3/4	0.168	3
10	24		H13	2	67616	2 3/8	7/8	0.194	3
10		32	H13	2	67617	2 3/8	7/8	0.194	3
1/4	20		H13	2	67621	2 1/2	1	0.255	3
1/4		28	H13	2	67622	2 1/2	1	0.255	3
5/16	18		H13	2	67623	2 23/32	1 1/8	0.318	3
5/16		24	H13	2	67624	2 23/32	1 1/8	0.318	3
3/8	16		H13	3	67625	2 15/16	1 1/4	0.381	3
3/8		24	H13	3	67626	2 15/16	1 1/4	0.381	3
7/16	14		H13	3	67627	3 5/32	1 7/16	0.323	3
7/16		20	H13	3	67628	3 5/32	1 7/16	0.323	3
1/2	13		H13	3	67629	3 3/8	1 21/32	0.367	3
1/2		20	H13	3	67630	3 3/8	1 21/32	0.367	3
9/16	12		H13	3	67631	3 19/32	1 21/32	0.429	3
5/8	11		H13	3	67633	3 13/16	1 13/16	0.480	3
3/4	10		H13	3	67637	4 1/4	2	0.590	3

TAPER PIPE TAPS / STRAIGHT FLUTED
TAPER PIPE TAPS / INTERRUPTED

List No.941 (NPT)

HSS · TAPS FLUTE ST · TAPER PIPE

Taper Pipe Taps
Bright Finish

HIGH SPEED STEEL

List No.941P (NPT)

G · HSS · TAPS FLUTE ST · TAPER PIPE

Taper Pipe Taps
Titanium Nitride

HIGH SPEED STEEL-TIN COATED

List No.941D (NPTF)

HSS · TAPS FLUTE ST · TAPER PIPE

Dry Seal Taper Pipe Taps
Bright Finish

HIGH SPEED STEEL

Nominal Tap Size	Threads per Inch	Number of Flutes	E.D.P. Number			Dimensions					Std. Pack
			L941	L941D	L941P	Overall Length	Thread Length	Shank Dia.	Square Length	Size of Square	
1/16	27	4	74051	74062	34062	2.1260	0.6890	0.3125	0.3740	0.2339	1
1/8	27	4	74052	74063	34063	2.1260	0.7520	0.4375	0.3740	0.3280	1
1/8SS	27	4	74053	74064	34064	2.1260	0.7520	0.3125	0.3740	0.2339	1
1/4	18	4	74054	74065	34065	2.4370	1.0630	0.5625	0.4370	0.4209	1
3/8	18	4	74055	74066	34066	2.5630	1.0630	0.7	0.5	0.5307	1
1/2	14	4	74056	74067	34067	3.1260	1.3740	0.6875	0.626	0.5150	1
3/4	14	5	74057	74068	34068	3.2520	1.3740	0.9063	0.689	0.6787	1
1	11 1/2	5	74058	74069	34069	3.7520	1.7520	1.125	0.811	0.8429	1
1 1/4	11 1/2	5	74059	74070		4	1.7520	1.3125	0.9370	0.9839	1
1 1/2	11 1/2	7	74060	74071		4.2520	1.7520	1.5	1	1.1248	1
2	11 1/2	7	74061	74072		4.5	1.7520	1.875	1.126	1.4059	1

List No.943 (NPT)

HSS · TAPS FLUTE ST · TAPER PIPE

Interrupted Pipe Taps
Bright Finish

HIGH SPEED STEEL

Nominal Tap Size	Threads per Inch	Number of Flutes	E.D.P. Number	Dimensions					Std. Pack
				Overall Length	Thread Length	Shank Dia.	Square Length	Size of Square	
1/8	27	5	74073	2.126	0.752	0.4375	0.3740	0.3280	1
1/4	18	5	74075	2.437	1.063	0.5625	0.4370	0.4209	1
3/8	18	5	74076	2.563	1.063	0.7	0.5	0.5307	1
1/2	14	5	74077	3.126	1.374	0.6875	0.626	0.5150	1
3/4	14	5	74078	3.252	1.374	0.9063	0.689	0.6787	1
1	11 1/2	5	74079	3.752	1.752	1.125	0.811	0.8429	1
1 1/4	11 1/2	5	74080	4	1.752	1.3125	0.9370	0.9839	1
1 1/2	11 1/2	7	74081	4.252	1.752	1.5	1	1.1248	1
2	11 1/2	7	74082	4.5	1.752	1.875	1.126	1.4059	1

TAPER PIPE TAPS / SPIRAL FLUTED
STRAIGHT PIPE TAPS / STRAIGHT FLUTED

List No.947 (NPT)

PREMIUM · TAPS FLUTE L · TAPER PIPE

Taper Pipe-Spiral Fluted
Surface Treated

PREMIUM TYPE STEEL

List No.947D (NPTF)

PREMIUM · TAPS FLUTE L · TAPER PIPE

Dry Seal Taper Pipe-Spiral Fluted
Surface Treated

PREMIUM TYPE STEEL

Nominal Tap Size	Thread Per Inch	Number of Flutes	E.D.P. Numbers		Dimensions					Std. Pack.
			L947	L947D	Overall Length	Thread Length	Shank Dia.	Square Length	Size of Square	
1/16	27	4	84051	84062	2.126	0.689	0.3125	0.374	0.2339	1
1/8	27	4	84052	84063	2.126	0.752	0.4375	0.374	0.3280	1
1/8SS	27	4	84053	84064	2.126	0.752	0.3125	0.374	0.2339	1
1/4	18	4	84054	84065	2.437	1.063	0.5625	0.437	0.4209	1
3/8	18	4	84055	84066	2.563	1.063	0.7	0.5	0.5307	1
1/2	14	4	84056	84067	3.126	1.374	0.6875	0.626	0.5150	1
3/4	14	5	84057	84068	3.252	1.374	0.9063	0.689	0.6787	1
1	11 1/2	5	84058	84069	3.752	1.752	1.125	0.811	0.8429	1

List No.945 (NPS)

HSS · TAPS FLUTE ST · 2.5P CHAMFER

Straight Pipe Taps
Bright Finish

HIGH SPEED STEEL

List No.945D (NPSF)

HSS · TAPS FLUTE ST · 2.5P CHAMFER

Dry Seal Straight Pipe Taps
Bright Finish

HIGH SPEED STEEL

Nominal Tap Size	Thread Per Inch	Number of Flutes	E.D.P. Numbers		Dimensions					Std. Pack.
			L945	L945D	Overall Length	Thread Length	Shank Dia.	Square Length	Size of Square	
1/8	27	4	74083	74090	2.126	0.752	0.4375	0.3740	0.3280	1
1/8SS	27	4	74084	74091	2.126	0.752	0.3125	0.3740	0.2339	1
1/4	18	4	74085	74092	2.437	1.063	0.5625	0.4370	0.4209	1
3/8	18	4	74086	74093	2.563	1.063	0.7	0.5	0.5307	1
1/2	14	4	74087	74094	3.126	1.374	0.6875	0.626	0.5150	1
3/4	14	5	74088	74095	3.252	1.374	0.9063	0.689	0.6787	1
1	11 1/2	5	74089		3.752	1.752	1.125	0.811	0.8429	1

Order by EDP Number

STANDARD METRIC HAND TAPS
STANDARD METRIC TAPS / SPIRAL POINTED

List No.910

HSS | TAPS FLUTE ST | P CHAMFER | B CHAMFER

Bright Finish

HIGH SPEED STEEL

Nominal Tap Size (mm)	Millimeter Pitch (mm)	Pitch Dia. Limits	Number of Flutes	E.D.P. Numbers			Dimensions			Std. Pack.
				Taper	Plug	Bottom	Overall Length	Thread Length	Shank Dia.	
M2	0.4	D3	3	54056	54057	54058	1 3/4	7/16	0.141	3
M3	0.5	D3	3	54071	54072	54073	1 15/16	5/8	0.141	3
M3.5	0.6	D4	3	54074	54075	54076	2	11/16	0.141	3
M4	0.7	D4	4	54080	54081	54082	2 1/8	3/4	0.168	3
M5	0.8	D4	4	54095	54096	54097	2 3/8	7/8	0.194	3
M6	1.0	D5	4	54107	54108	54109	2 1/2	1	0.255	3
M7	1.0	D5	4	54113	54114	54115	2 23/32	1 1/8	0.318	3
M8	1.25	D5	4	54125	54126	54127	2 23/32	1 1/8	0.318	3
M10	1.5	D6	4	54140	54141	54142	2 15/16	1 1/4	0.381	3
M12	1.75	D6	4	54155	54156	54157	3 3/8	1 21/32	0.367	3
M14	1.25	D5	4	54161	54162	54163	3 19/32	1 21/32	0.429	3
M14	2.0	D7	4	54167	54168	54169	3 19/32	1 21/32	0.429	3
M16	2.0	D7	4	54176	54177	54178	3 13/16	1 13/16	0.480	3
M18	1.5	D7	4	54182	54183	54184	4 1/32	1 13/16	0.542	3
M18	2.5	D7	4	54188	54189	54190	4 1/32	1 13/16	0.542	3
M20	2.5	D7	4	54200	54201	54202	4 15/32	2	0.652	3
M22	2.5	D7	4	54212	54213	54214	4 11/16	2 7/32	0.697	3
M24	3.0	D8	4	54224	54225	54226	4 29/32	2 7/32	0.760	3
M27	3.0	D8	4	54239	54240	54241	5 1/8	2 1/2	0.896	3
M30	3.5	D9	4	54251	54252	54253	5 7/16	2 9/16	1.021	3

Order by EDP Number

List No.920

HSS | TAPS FLUTE SP | P CHAMFER

Bright Finish

HIGH SPEED STEEL

Nominal Tap Size (mm)	Pitch (mm)	Pitch Diameter Limits	Number of Flutes	E.D.P. Numbers	Dimensions			Std. Pack.
					Overall Length	Thread Length	Shank Dia.	
M2.5	0.45	D3	2	57054	1 13/16	1/2	0.141	3
M3	0.50	D3	2	57055	1 15/16	5/8	0.141	3
M4	0.70	D4	2	57058	2 1/8	3/4	0.168	3
M5	0.80	D4	2	57061	2 3/8	7/8	0.194	3
M6	1.00	D5	2	57063	2 1/2	1	0.255	3
M8	1.25	D5	2	57068	2 23/32	1 1/8	0.318	3
M10	1.50	D6	3	57082	2 15/16	1 1/4	0.381	3
M12	1.75	D6	3	57073	3 3/8	1 21/32	0.367	3
M14	2.00	D7	3	57076	3 19/32	1 21/32	0.429	3
M16	2.00	D7	3	57078	3 13/16	1 13/16	0.480	3

Order by EDP Number

TAPPING SPEEDS

SFM : Surface Feet per Minutes
SG LOW SPIRAL TAPS List No. 6958, 6959

Work Materials	Tapping Speed SFM
Structural Steels	15 - 30
Low Carbon Steels (1010, 1018)	25 - 50
Carbon Steels (1045,1055)	15 - 30
Alloy Steels (4140,4130)	15 - 30
Hardened Steels (20~40HRC)	15 - 30
Stainless Steels	13 - 26
Cast Irons	30 - 65
Aluminium Alloys	70 - 100

DLC TAFLET THREAD FORMING TAPS List No. 6955, 6956, 6957

Work Materials	Tapping Speed SFM
Aluminium Alloys	70 - 130

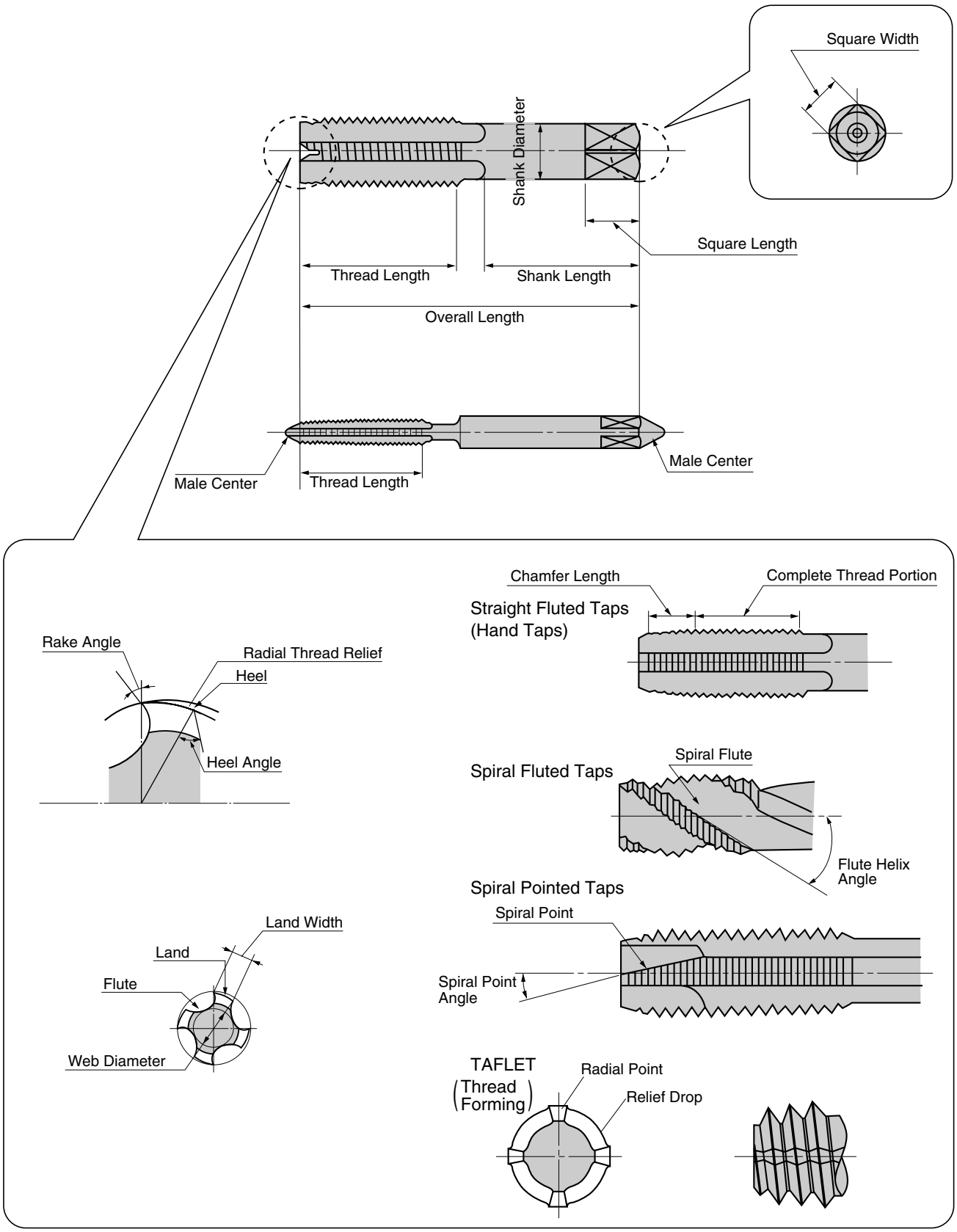
Other TAPS

Material		Tapping Speed SFM
Aluminum Alloys		90-100
Brass		60-100
Bronze		40-60
Copper		40-60
High Temperature Alloys,	Cobalt Base	5-10
	Iron Base	10-15
	Nickel Base	5-10
Iron, Ductile,	Annealed	60
	as Cast	30
	Tempered	15-20
Gray,	Annealed	80
	as Cast	35-60
Malleable		60
	Heat Treated	25-50
Magnesium Alloys	Annealed	175
Manganese		20
Molybdenum Alloys	Stress Relieved	50
Monel	Annealed	20
Nickel Alloys	Annealed	25
Plastics, Reinforced		25
Thermoplastics		50
Thermosetting Plastics		50
Steels, Alloys, Annealed or Cold Drawn		40-60
Quenched & Tempered		15-35
Armor Plate		10

Material		Tapping Speed SFM
(Steels, Cont.)		
Carbon Steel, Plain,	Annealed	40-80
	Tempered	15-40
Cast, Carbon	Annealed	40-50
	Tempered	30
Cast, Corrosion Resistant,	Annealed	20-30
Heat Resistant,	as Cast	20-25
Low Alloy	Annealed	30-45
	Tempered	15-25
Precipitation Hardening,	Treated	10-15
Stainless	Annealed	15-45
	Tempered	15-75
Free Machining,	Annealed	45-75
Tool Steels, High Speed,	Annealed	15-25
Water Hardening,	Annealed	50
Ultra High Strength Steels	Annealed	35
	Normalized	20
	Tempered	3-7
Maraging Steels	Annealed	20-15
	Maraged	5-10
Tantalum Alloys	Stress Relieved	3
Titanium Alloys,		
Commercial Pure,	Annealed	40-60
Alpha & Alpha Beta Alloys,	Annealed	10-25
Tungsten Alloys, Pressed & Sintered		50
Zinc Alloys	Die Cast	150

The material being tapped is the primary factor in determining the most effective **TAPPING SPEED**. However there are a number of other factors which may require consideration. Among these are: thread pitch, thread length, percent of thread, lubrication, tap flute style and chamfer, equipment and method of tapping. The best speed is determined by experiment on the iob. The table below lists speeds which have proven satisfactory under average conditions.

TAP NOMENCLATURE



STANDARDS & DIMENSIONS

Standard System of Marking

General

Taps, dies, and other threading tools will be marked with the nominal size, number of threads per inch, and the proper symbol to identify the thread form. These symbols are in agreement with the ANSIB94.9 1979 Standard on Nomen-clature, Definitions and Letter Symbols for Screw Threads.

Symbols used for American Threads are: Symbol Reference

NC	American National Coarse Thread Series
NF	American National Fine Thread Series
NEF	American National Extra Fine Thread Series
N	American National 8,12 and 16 Thread Series (8N, 12N, i6N)
NH	American (National) Hose Coupling and Fire Hose Coupling Threads
NM	National Miniature Screw Thread
NGO	American (National) Gas Outlet Thread
NS	American Special Thread
NPT	American (National) Taper Pipe Thread
NPTF	Dryseal American (National) Taper Pipe Thread
ANPT	Military Aeronautical Pipe Thread Specification MIL-P-71 05
NPS	American (National) Straight Pipe Thread
NPSC	American (National) Straight Pipe Thread in Pipe Couplings
NPSF	Dryseal American (National) Fuel Internal Straight Pipe Thread
NPSH	American (Standard) Straight Pipe Thread for Hose Couplings and Nipples
NPSI	Dryseal American (National) Intermediate Internal Straight Pipe Thread
NPSL	American (National) Internal Straight Pipe Thread for Locknut Connections (Loose Fitting Mechanical Joints)
NPSM	American (National) Internal Straight Pipe Thread for Mechanical Joints (Free Fitting)
NPTR	American (National) Internal Taper Pipe Thread for Railing Joints (Mechanical Joints)
AMO	American Standard Microscope Objective Thread
ACME C	Acme Screw Thread — Centralizing Type
ACME G	Acme Screw Thread — General Purpose Type
STUB ACME	Stub Acme Threads
NBUTT	National Buttress Screw Thread
V	A 60° "V" Thread with Truncated Crests and Roots. The Theoretical "V" Form is usually flatted several thousandths of an inch to the user's specifications.
SB	Manufacturers Stovebolt Standard Thread
STI	Special Threads for Helical Coil Wire Screw Thread Inserts.

Group Thread Taps — Limit Numbers

All standard Ground Thread Taps will be marked with the letter G to designate Ground Thread. The letter G will be followed by the letter H to designate above basic (L below basic) and a numeral to designate the Pitch Diameter limits.

Example: GH3 indicates a Group thread Tap with Pitch Diameter limits .0010 to .0015 over basic.

Pitch Diameter limits for Taps to 1" diameter inclusive.

L1 = Basic to Basic minus .0005
H1 = Basic to Basic plus .0005
H2 = Basic plus .0005 to Basic plus .0010
H3 = Basic plus .0010 to Basic plus .0015
H4 = Basic plus .0015 to Basic plus .0020
H5 = Basic plus .0020 to Basic plus .0025
H6 = Basic plus .0025 to Basic plus .0030

Pitch Diameter limits for Taps over 1" diameter to 1 1/2" diameter inclusive.

H4 = Basic plus .0010 to Basic plus .0020

American National 8, 12, 16 and NEF Thread Series

National 8 pitch Series	1" to 2 1/4" by 1/8ths
	21/4" to 6" by 1/4ths
National 12 pitch Series	1/2" to 1 1/2" 1/16ths
	1 1/2" to 4" by 1/8ths
	4" to 6" by 1/4thS
National 16 pitch Series	3/4" to 2 1/2" by 1/16ths
	2 1/2" to 4" by 1/8ths
	4" to 6" by 1/4ths

National Extra Fine Thread Series

#12	—32	1 1/6"	—18
1/4"	—32	1 1/16"	—18
5/16"	—32	1 1/18"	—18
3/8"	—32	1 3/16"	—18
7/16"	—28	1 1/4"	—18
1/2"	—28	1 5/16"	—18
9/16"	—24	1 3/8"	—18
5/8"	—24	1 7/16"	—18
11/16"	—24	1 1/2"	—18
3/4"	—20	1 9/16"	—18
13/16"	—20	1 5/8"	—18
7/8"	—20	1 11/16"	—18
15/16"	—20	1 3/4"	—16
1"	—20	2"	—16

STANDARD TAP BLANK DIMENSIONS

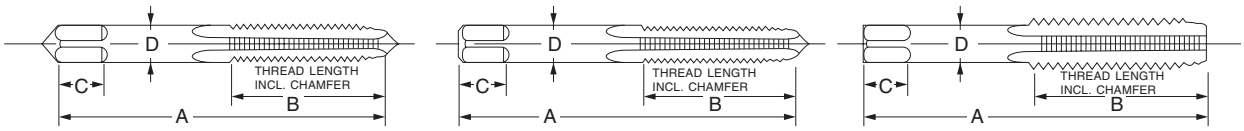


TABLE 302 — GENERAL DIMENSIONS

Nominal Diameter Range - Inches		Mach. Screw 5size No.	Nominal Fractional Diameter Inches	Nominal Metric Diameter Mill.	Style*	Tap Dimensions — Inches				
Over	To (Incl)					Overall Length A	Thread Length B	Square Length C	Shank Diameter D	Size of Square
.052	.065	0	1/16	M1.6	1	1-5/8	5/16	3/16	.141	.110
.065	.078	1		M1.8	1	1-11/16	3/8	3/16	.141	.110
.078	.091	2		M2,MZ2	1	1-3/4	7/16	3/16	.141	.110
.091	.104	3	3/32	M2.5	1	1-13/16	1/2	3/16	.141	.110
.104	.117	4			1	1-7/8	9/16	3/16	.141	.110
.117	.130	5	1/8	M3, M3.15	1	1-15/16	5/8	3/16	.141	.110
.130	.145	6		M3.5	1	2	11/16	3/16	.141	.110
.145	.171	8	5/32	M4	1	2-1/8	3/4	1/4	.168	.131
.171	.197	10	3/16	M4.5, M5	1	2-3/8	7/8	1/4	.194	.152
.197	.223	12	7/32		1	2-3/8	15/16	9/32	.220	.165
.223	.260	14	1/4	M6, M6.3	2	2-1/2	1	5/16	.255	.191
.260	.323		5/16	M7, M8	2	2-23/32	1 1/8	3/8	.318	.238
.323	.385		3/8	M10	2	2-15/16	1 1/4	7/16	.381	.286
.385	.448		7/16		3	3-5/32	1 7/16	13/32	.323	.242
.448	.510		1/2	MI2 M12.5	3	3-3/8	1 21/32	7/16	.367	.275
.510	.573		9/16	M14	3	3-19/32	1 21/32	1/2	.429	.322
.573	.635		5/8	M16	3	3-13/16	1 13/16	9/16	.480	.360
.635	.709		11/16	M18	3	4-1/32	1 13/16	5/8	.542	.406
.709	.760		3/4		3	4-1/4	2	11/16	.590	.442
.760	.823		13/16	M20	3	4-15/32	2	11/16	.652	.489
.823	.885		7/8	M22	3	4-11/16	2 7/32	3/4	.697	.523
.885	.948		15/16	M24	3	4-29/32	2 7/32	3/4	.760	.570
.948	1.010		1	M25	3	5-1/8	2 1/2	13/16	.800	.600
1.010	1.073		1 1/16	M27	3	5-1/8	2 1/2	7/8	.896	.672
1.073	1.135		1 1/8		3	5-7/16	2 9/16	7/8	.896	.672
1.135	1.198		1 3/16	M30	3	5-7/16	2 9/16	1	1.021	.766
1.198	1.260		1 1/4		3	5-3/4	2 9/16	1	1.021	.766
1.260	1.323		1 5/16	M33	3	5-3/4	2 9/16	1 1/16	1.108	.831
1.323	1.385		1 3/8		3	6-1/16	3	1 1/16	1.108	.831
1.385	1.448		1 7/16	M36	3	6-1/16	3	1 1/8	1.233	.925
1.448	1.510		1 1/2		3	6-3/8	3	1 1/8	1.233	.925
1.510	1.635		1 5/8	M39	3	6-11/16	3 3/16	1 1/8	1.305	.979
1.635	1.760		1 3/4	M42	3	7	3 3/16	1 1/4	1.430	1.072
1.760	1.885		1 7/8		3	7-5/16	3 9/16	1 1/4	1.519	1.139
1.885	2.010		2	M48	3	7-5/8	3 9/16	1 3/8	1.644	1.233
2.010	2.135		2 1/8		3	8	3 9/16	1 3/8	1.769	1.327
2.135	2.260		2 1/4	M56	3	8 1/4	3 9/16	1 7/16	1.894	1.420
2.260	2.385		2 3/8		3	8 1/2	4	1 7/16	2.019	1.514
2.385	2.510		2 1/2		3	8 3/4	4	1 1/2	2.100	1.575
2.510	2.635		2 5/8	M64	3	8 3/4	4	1 1/2	2.225	1.669
2.635	2.760		2 3/4		3	9 1/4	4	1 9/16	2.350	1.762
2.760	2.885		2 7/8	M72	3	9 1/4	4	1 9/16	2.475	1.856
2.885	3.010		3		3	9 3/4	4 9/16	1 5/8	2.543	1.907
3.010	3.135		3 1/8		3	9 3/4	4 9/16	1 5/8	2.668	2.001
3.135	3.260		3 1/4	M80	3	10	4 9/16	1 3/4	2.793	2.095
3.260	3.385		3 3/8		3	10	4 9/16	1 3/4	2.883	2.162
3.385	3.510		3 1/2		3	10 1/4	4 15/16	2	3.008	2.256
3.510	3.635		3 5/8	M90	3	10 1/4	4 15/16	2	3.133	2.350
3.635	3.760		3 3/4		3	10 1/2	5 5/16	2 1/8	3.217	2.413
3.760	3.885		3 7/8		3	10 1/2	5 5/16	2 1/8	3.342	2.506
3.885	4.010		4	M100	3	10 3/4	5 5/16	2 1/4	3.467	2.600

* Styles shown are for ground thread taps

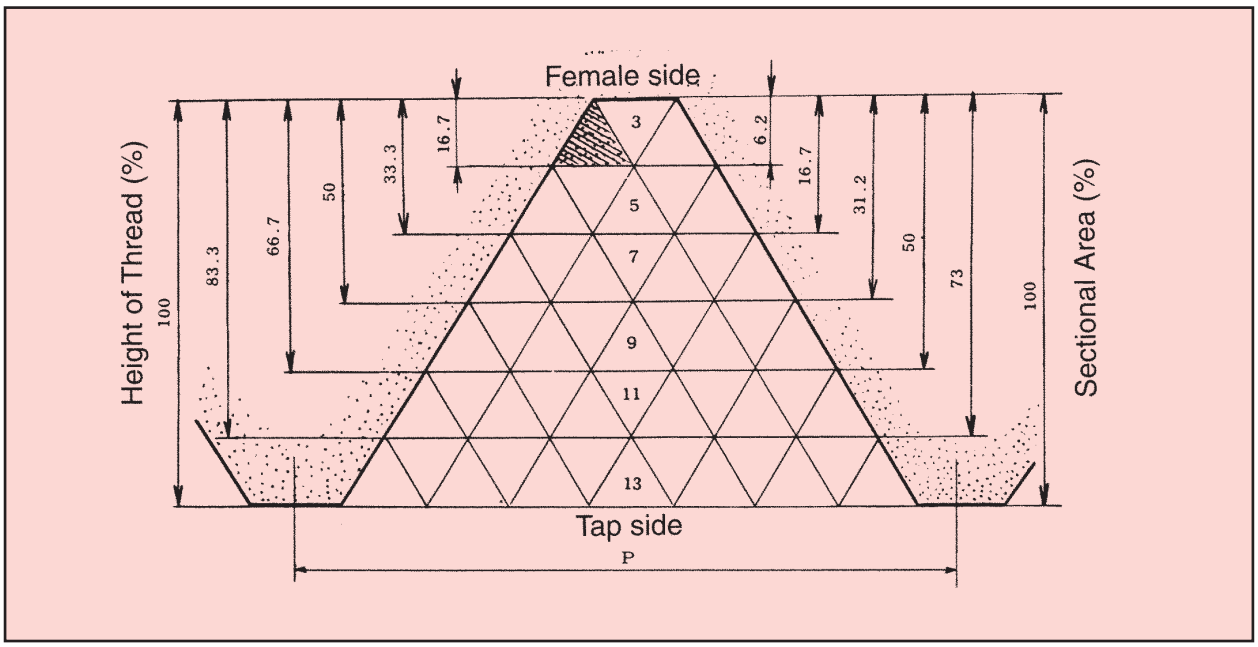
TAP RECOMMENDATION FOR CLASSES 2B & 3B UNIFIED INCH SCREW THREADS

Size	Threads Per Inch		Recommended Tap Limits		Internal Thread Pitch Diameter Units		
	NC UNC	NF UNF	Class 2B	Class 3B	Min. All Classes (BASIC)	Max. Class 2B	Max. Class 3B
0	–	80	H2	H1	.0519	.0542	.0536
1	64	–	H2	H1	.0629	.0655	.0648
1	–	72	H2	H1	.0640	.0665	.0659
2	56	–	H2	H1	.0744	.0772	.0765
2	–	64	H2	H1	.0759	.0786	.0779
3	48	–	H2	H1	.0855	.0885	.0877
3	–	56	H2	H1	.0874	.0902	.0895
4	40	–	H2	H2	.0958	.0991	.0982
4	–	48	H2	H1	.0985	.1016	.1008
5	40	–	H2	H2	.1088	.1121	.1113
5	–	44	H2	H1	.1102	.1134	.1126
6	32	–	H3	H2	.1177	.1214	.1204
6	–	40	H2	H2	.1218	.1252	.1243
8	32	–	H3	H2	.1437	.1475	.1465
8	–	36	H2	H2	.1460	.1496	.1487
10	24	–	H3	H3	.1629	.1672	.1661
10	–	32	H3	H2	.1697	.1736	.1726
12	24	–	H3	H3	.1889	.1933	.1922
12	–	28	H3	H3	.1928	.1970	.1959
1/4	20	–	H5	H3	.2175	.2223	.2211
1/4	–	28	H4	H3	.2268	.2311	.2300
5/16	18	–	H5	H3	.2764	.2817	.2803
5/16	–	24	H4	H3	.2854	.2902	.2890
3/8	16	–	H5	H3	.3344	.3401	.3387
3/8	–	24	H4	H3	.3479	.3528	.3516
7/16	14	–	H5	H3	.3911	.3972	.3957
7/16	–	20	H5	H3	.4050	.4104	.4091
1/2	13	–	H5	H3	.4500	.4565	.4548
1/2	–	20	H5	H3	.4675	.4731	.4717
9/16	12	–	H5	H3	.5084	.5152	.5135
9/16	–	18	H5	H3	.5264	.5323	.5308
5/8	11	–	H5	H3	.5660	.5732	.5714
5/8	–	18	H5	H3	.5889	.5949	.5934
3/4	10	–	H5	H5	.6850	.6927	.6907
3/4	–	16	H5	H3	.7094	.7159	.7143
7/8	9	–	H6	H4	.8028	.8110	.8089
7/8	–	14	H6	H4	.8286	.8356	.8339
1	8	–	H6	H4	.9188	.9276	.9254
1	–	12	H6	H4	.9459	.9535	.9516
1	14 NS		H6	H4	.9536	.9609	.9590
1 1/8	7	–	H8	H4	1.0332	1.0416	1.0393
1 1/8	–	12	H6	H4	1.0709	1.0787	1.0768
1 1/4	7	–	H8	H4	1.1572	1.1668	1.1644
1 1/4	–	12	H6	H4	1.1959	1.2039	1.2019
1 3/8	6	–	H8	H4	1.2667	1.2771	1.2745
1 3/8	–	12	H6	H4	1.3209	1.3291	1.3270
1 1/2	6	–	H8	H4	1.3917	1.4022	1.3996
1 1/2	–	12	H6	H4	1.4459	1.4542	1.4522

The above recommended taps normally produce the Class of Thread indicated average materials when used with reasonable care. However, if the tap specified does not give a satisfactory gage fit in the work, a choice of some other limit tap will be necessary.

PRE-TAPPING DRILLING SIZES

Drilling size is strictly concerned Percent of Thread. The following picture shows the relations between the height of the female thread and its sectional area. Here, it's very important to choose the minimized Percent of Thread as possible the thread needs. Because too much Percent of Thread brings increased cutting torque which causes excess wear and breakage of the taps.



$$\text{Percent of Thread} = \frac{\text{Basic thread OD.} \times \text{Pre-Tapping Diameter}}{2 \times (\text{Basic Height of Thread})} \times 100\%$$

- Pre-tapping diameter for Cutting Taps

$$\text{Pre-tapping Diameter} = \text{Basic thread OD.} - \frac{.01299 \times \text{Percent of Thread}}{\text{No. of threads per inch}}$$

- Pre-tapping Diameter for Roll Forming Taps

$$\text{Pre-tapping Diameter} = \text{Basic thread OD.} - \frac{.0068 \times \text{Percent of Thread}}{\text{No. of threads per inch}}$$

TAP DRILL SIZES

The following tables show the Theoretical Percentage of Thread obtained from stock sizes of drills and also the Probable Percentage after allowance for oversize drilling.

Tap	Tap Drill	Decimal Equiv. of Tap Drill	Probable Hole Size	Percent of Thread	Tap	Tap Drill	Decimal Equiv. of Tap Drill	Probable Hole Size	Percent of Thread	Tap	Tap Drill	Decimal Equiv. of Tap Drill	Probable Hole Size	Percent of Thread
0-80	56	.0465	.0480	74	8-32	29	.1360	.1389	62	3/8-16	5/16	.3125	.3160	72
	3/64	.0469	.0484	71		28	.1405	.1434	51		O	.3160	.3204	68
1-64	54	.0550	.0565	81	8-36	29	.1360	.1389	70		P	.3230	.3274	59
	53	.0595	.0610	59		28	.1405	.1434	57	3/8-24	21/64	.3281	.3325	79
1-72	53	.0595	.0610	67		9/64	.1406	.1435	57		Q	.3320	.3364	71
	1/16	.0625	.0640	50	10-24	27	.1440	.1472	79		R	.3390	.3434	58
2-56	51	.0670	.0687	74		26	.1470	.1502	74	7/16-14	T	.3580	.3626	81
	50	.0700	.0717	62		25	.1495	.1527	69		23/64	.3594	.3640	79
	49	.0730	.0747	49		24	.1520	.1552	64		U	.3680	.3726	70
2-64	50	.0700	.0717	70		23	.1540	.1572	61		3/18	.3750	.3796	62
	49	.0730	.0747	56		5/32	.1563	.1595	56		V	.3770	.3816	60
3-48	48	.0760	.0779	78		22	.1570	.1602	55	7/16-20	W	.3860	.3906	72
	5/64	.0781	.0800	70	10-32	5/32	.1563	.1595	75		25/64	.3906	.3952	65
	47	.0785	.0804	69		22	.1570	.1602	73		X	.3970	.4016	55
	46	.0810	.0829	60		21	.1590	.1622	68	1/2-13	27/64	.4219	.4216	73
	45	.0820	.0839	56		20	.1610	.1642	64		7/16	.4375	.4422	58
3-56	46	.0810	.0829	69		19	.1660	.1692	51	1/2-20	29/64	.4531	.4578	65
	45	.0820	.0839	65	12-24	11/64	.1719	.1754	75	9/16-12	15/32	.4688	.4736	82
	44	.0860	.0879	48		17	.1730	.1765	73		31/64	.4844	.4892	68
4-40	44	.0860	.0880	74		16	.1770	.1805	66	9/16-18	1/2	.5000	.5048	80
	43	.0890	.0910	65		15	.1800	.1835	60		33/64	.5156	.5204	58
	42	.0935	.0955	55		14	.1820	.1855	56	5/8-11	17/32	.5313	.5362	75
	3/32	.0938	.0958	50	12-28	16	.1770	.1805	77		35/64	.5469	.5518	62
4-48	42	.0935	.0955	61		15	.1800	.1835	70	5/8-18	9/16	.5625	.5674	80
	3/32	.0938	.0958	60		14	.1820	.1855	66		37/64	.5781	.5831	58
	41	.0960	.0980	52		13	.1850	.1885	59	3/4-10	41/64	.6406	.6456	80
5-40	40	.0980	.1003	76		3/16	.1875	.1910	54		21/32	.6563	.6613	68
	39	.0995	.1018	71	1/4-20	9	.1960	.1998	77	3/4-16	11/16	.6875	.6925	71
	38	.1015	.1038	65		8	.1990	.2028	73	7/8-9	49/64	.7656	.7708	72
	37	.1040	.1063	58		7	.2010	.2048	70		25/32	.7812	.7864	61
5-44	38	.1015	.1038	72		13/64	.2031	.2069	66	7/8-14	51/64	.7969	.8021	79
	37	.1040	.1063	63		6	.2040	.2078	65		13/16	.8125	.8177	62
	36	.1065	.1088	55		5	.2055	.2093	63	1"-8	55/64	.8594	.8653	83
6-32	37	.1040	.1063	78		4	.2090	.2128	57		7/8	.8750	.8809	73
	36	.1065	.1091	71	1/4-28	3	.2130	.2168	72		57/64	.8906	.8965	64
	7/64	.1094	.1120	64		7/32	.2188	.2226	59		29/32	.9063	.9122	54
	35	.1100	.1126	63		2	.2210	.2248	55	1"-12	29/32	.9063	.9123	81
	34	.1110	.1136	60	5/16-18	F	.2570	.2608	72		59/64	.9219	.9279	67
	33	.1130	.1156	55		G	.2610	.2651	66		15/16	.9375	.9435	52
6-40	34	.1110	.1136	75		17/64	.2656	.2697	59	1"-14	59/64	.9219	.9279	78
	33	.1130	.1156	69		H	.2660	.2701	59		15/16	.9375	.9435	61
	32	.1160	.1186	60	5/16-24	H	.2660	.2701	78					
						I	.2720	.2761	67					

FORMULA FOR OBTAINING TAP DRILL SIZES

(Select nearest commercial stock drill)

$$\left\{\begin{array}{c}\text{Outside Diam.}\\ \text{of Thread}\end{array}\right\} \quad \text{minus} \quad \left\{\frac{.01299 \quad \text{Amount of percentage of full thread}}{\text{Number of threads per inch}}\right\} \quad = \quad \begin{array}{l}\text{Drilled}\\ \text{Hole Size}\end{array}$$

$$\left\{\begin{array}{c}\text{No. of Threads}\\ \text{per inch}\end{array}\right\} \quad \text{x} \quad \left\{\frac{\text{Outside Diam. of thread–Selected Drill Diam}}{.01299}\right\} \quad = \quad \begin{array}{l}\text{Percentage of}\\ \text{full Thread}\end{array}$$

TAP DRILL SIZES

For Thread Forming Taps

Nominal Size	Threads per Inch		75% THREAD			70% THREAD			65% THREAD			60% THREAD		
	NC UNC	NF UNF	Theor. Hole Core Size	Nearest Drill Size	Dec. Equly.	Theor. Hole Core Size	Nearest Drill Size	Dec. Equiv.	Theor. Hole Core Size	Nearest Drill Size	Dec. Equly.	Theor. Hole Core Size	Nearest Drill Size	Dec. Equly.
0	—	80	.0536	1.35mm	.0531	.0540	1.35mm	.0531	.0545	—	—	.0549	54	.0550
1	64	—	.0650	1.65mm	.0650	.0655	1.65mm	.0650	.0661	—	—	.0666	—	—
1	—	72	.0659	1.65mm	.0650	.0663	—	—	.0669	1.7mm	.0669	.0673	51	.0670
2	56	—	.0769	1.95mm	.0768	.0774	1.95mm	.0768	.0781	3/64	.0781	.0787	47	.0785
2	—	64	.0780	5/64	.0781	.0785	47	.0785	.0791	2.0mm	.0787	.0796	2.0mm	.0787
3	48	—	.0884	2.25mm	.0886	.0890	43	.0890	.0898	43	.0890	.0905	2.3mm	.0906
3	—	56	.0899	43	.0890	.0904	—	—	.0911	2.3mm	.0906	.0917	2.3mm	.0906
4	40	—	.0993	2.5mm	.0984	.1000	39	.0995	.1010	39	.0995	.1018	38	.1015
4	—	48	.1014	38	.1015	.1020	38	.1015	.1028	2.6mm	.1024	.1035	2.6mm	.1024
5	40	—	.1123	34	.1110	.1130	33	.1130	.1140	33	.1130	.1148	2.9mm	.1142
5	—	44	.1134	33	.1130	.1141	2.9mm	.1142	.1150	2.9mm	.1142	.1157	—	—
6	32	—	.1221	2.1mm	.1220	.1230	3.1mm	.1220	.1243	—	—	.1252	1/8	.1250
6	—	40	.1253	1/8	.1250	.1260	3.2mm	.1260	.1270	3.2mm	.1260	.1278	3.25mm	.1280
8	32	—	.1481	3.75mm	.1476	.1490	—	—	.1503	25	.1495	.1512	3.8mm	.1496
8	—	36	.1498	25	.1495	.1507	3.8mm	.1496	.1518	24	.1520	.1526	24	.1520
10	24	—	.1688	—	—	.1700	18	.1695	.1717	11/64	.1719	.1729	11/64	.1719
10	—	32	.1741	17	.1730	.1750	—	—	.1763	—	—	.1772	16	.1770
12	24	—	.1948	10	.1935	.1960	9	.1960	.1977	5.0mm	.1968	.1989	8	.1990
12	—	28	.1978	5.0mm	.1968	.1989	8	.1990	.2003	8	.1990	.2014	7	.2010
1/4	20	—	.2245	5.7mm	.2244	.2260	—	—	.2280	1	.2280	.2295	1	.2280
1/4	—	28	.2318	—	—	.2329	5.9mm	.2323	.2343	A	.2340	.2354	15/64	.2344
5/16	18	—	.2842	7.2mm	.2835	.2861	7.25mm	.2854	.2879	7.3mm	.2874	.2898	L	.2900
5/16	—	24	.2912	7.4mm	.2913	.2927	—	—	.2941	M	.2950	.2955	7.5mm	.2953
3/8	16	—	.3431	11/32	.3437	.3452	8.75mm	.3445	.3474	S	.3480	.3495	8.9mm	.3504
3/8	—	24	.3537	9.0mm	.3543	.3552	9.0mm	.3543	.3566	—	—	.3580	T	.3580
7/16	14	—	.4011	—	—	.4035	Y	—	.4059	13/32	—	.4084	—	—
7/16	—	20	.4120	Z	—	.4137	10.5mm	—	.4154	—	—	.4171	—	—
1/2	13	—	.4608	—	—	.4634	—	—	.4660	—	—	.4686	15/32	—
1/2	—	20	.4745	—	—	.4762	—	—	.4779	—	—	.4796	—	—
9/16	12	—	.5200	—	—	.5229	—	—	.5257	—	—	.5285	—	—
9/16	—	18	.5342	13.5mm	.5315	.5361	—	—	.5380	—	—	.5398	—	—
5/8	11	—	.5787	37/64	.5781	.5817	37/64	.5781	.5848	—	—	.5879	—	—
5/8	—	18	.5967	19/32	.5937	.5986	—	—	.6004	—	—	.6023	—	—
3/4	10	—	.6990	—	—	.7024	—	—	.7058	45/64	.7031	.7092	18.0mm	.7087
3/4	—	16	.7181	23/32	.7187	.7202	23/32	.7187	.7224	—	—	.7245	—	—

For Pipe Taps

Nominal Pipe Size	Threads Per Inch	NPT–NPTF (When Drilled Only)		NPT–NPTF–ANPT (When Taper Reamed)		NPS–NPSF	
		Dr. Size	Dec. Equiv.	Dr. Size	Dec. Equiv.	Dr. Size	Dec. Equiv.
1/16	27	D	.2460	15/64	.2344	1/4	.2500
1/8	27	R	.3390	21/64	.3281	11/32	.3438
1/4	18	7/16	.4375	27/64	.4219	7/16	.4375
3/8	18	37/64	.5781	9/16	.5625	37/64	.5781
1/2	14	45/64	.7031	11/16	.6875	23/32	.7188
3/4	14	59/64	.9219	57/64	.8906	59/64	.9218
1	11-1/2	1 5/32	1.1562	1 1/8	1.1250	1 5/32	1.1562
1 1/4	11-1/2	1 1/2	1.5000	1 15/32	1.4688		
1 1/2	11-1/2	1 47/64	1.7344	1 45/64	1.7031		
2	11-1/2	2 7/32	2.2188	2 3/16	2.1875		

TAP DRILL SIZES (METRIC)

For Cutting Taps

Unit : mm

Nominal size	Pitch	Percentage of thread engagement hole diameter				Minor dia of internal thread
		100%	90%	80%	70%	
M2	0.4	1.57	1.61	1.65	1.7	1.567~1.679
M3	0.5	2.46	2.51	2.57	2.62	2.459~2.599
M3.5	0.6	2.85	2.92	2.98	3.05	2.850~3.010
M4	0.7	3.24	3.32	3.39	3.47	3.242~3.422
M5	0.8	4.13	4.22	4.31	4.39	4.134~4.334
M6	1	4.92	5.03	5.13	5.24	4.917~5.153
M7	1	5.92	6.03	6.13	6.24	5.917~6.153
M8	1.25	6.65	6.78	6.92	7.05	6.647~6.912
	1	6.92	7.03	7.13	7.24	6.917~7.153
M10	1.5	8.38	8.54	8.7	8.86	8.376~8.676
	1.25	8.65	8.78	8.92	9.05	8.647~8.912
M12	1.75	10.11	10.3	10.5	10.7	10.106~10.441
	1.25	10.65	10.78	10.92	11.05	10.647~10.912
M14	2	11.8	12.1	12.3	12.5	11.835~12.210
	1.25	12.65	12.78	12.92	13.05	12.647~19.912

Nominal size	Pitch	Percentage of thread engagement hole diameter				Minor dia of internal thread
		100%	90%	80%	70%	
M16	2	13.8	14.1	14.3	14.5	13.835~14.210
	1.5	14.38	14.54	14.7	14.86	14.376~14.676
M18	2.5	15.3	15.6	15.8	16.1	15.294~15.744
	1.5	16.38	16.54	16.7	16.86	16.376~16.676
M20	2.5	17.3	17.6	17.8	18.1	17.294~17.744
	1.5	18.38	18.54	18.7	18.86	18.376~18.676
M22	2.5	19.3	19.6	19.8	20.1	19.264~19.744
	1.5	20.38	20.54	20.7	20.86	20.367~20.676
M24	3	20.8	21.1	21.4	21.7	20.752~21.252
	1.5	22.38	22.54	22.7	22.86	22.376~22.676
M27	3	23.8	24.1	24.4	24.7	23.752~24.252
M30	3.5	26.2	26.6	27.0	27.3	26.211~26.711

For Thread Forming Taps

Unit : mm

Nominal size	Pitch	Percentage of thread engagement hole diameter			
		100%	90%	80%	70%
M2	0.4	1.77	1.80	1.82	1.84
M2.2	0.45	1.94	1.97	2.00	2.02
M2.5	0.45	2.24	2.27	2.30	2.32
M3	0.5	2.72	2.74	2.77	2.80
M3.5	0.6	3.16	3.19	3.23	3.26
M4	0.7	3.60	3.64	3.68	3.72
M4.5	0.75	4.07	4.12	4.16	4.20
M5	0.8	4.55	4.59	4.64	4.68
M6	1	5.43	5.49	5.55	5.60
M7	1	6.43	6.49	6.55	6.60
M8	1.25	7.29	7.36	7.43	7.50
	1	7.43	7.49	7.55	7.60

Nominal size	Pitch	Percentage of thread engagement hole diameter			
		100%	90%	80%	70%
M10	1.5	9.15	9.23	9.32	9.40
	1.25	9.29	9.36	9.43	9.50
M12	1.75	11.01	11.11	11.21	11.31
	1.25	11.29	11.36	11.43	11.50
M14	2	12.87	12.98	13.09	13.21
	1.5	13.15	13.23	13.32	13.40
M16	2	14.87	14.98	15.09	15.21
	1.5	15.15	15.23	15.32	15.40
M18	2.5	16.58	16.72	16.87	17.01
	1.5	17.15	17.23	17.32	17.40
M20	2.5	18.58	18.72	18.87	19.01
	1.5	19.15	19.23	19.32	19.40

Note:
1.Determine hole diameter by tapping test. The dimensions in this table are for reference only.

THE MANY ADVANTAGES OF NACHI TDT VIPER T-SERIES TAPS

These tops are made of high vanadium E grade high speed steel (HSSEV), which is primarily used for heavy duty taps. The taps are heat treated, followed by a special steam oxide treatment that prevents adhesion. This results in the ability to obtain suitable internal threads from the start, which also extends tap life to more than double that of other taps!

The Specific Advantages

1. Less Oversizing

Taflet Relief reforms cut threads and controls the thrust of the tap completely. Even if tapped material is mild steel, cutting stops within one thread! High precision uniformity of the tapped limit is obtainable with little oversizing, regardless of the rigidity of the tapping mechanism. Even when slight oversizing occurs, the chip-bite between taps and internal threads gets hard so tap breakage and/or torn threads are reduced.

2. Ideal Flute Shape

All cutting edges on the chamfered portion are at exactly the same angle, so the chip shape is consistent. Smaller than conventional curvature on the bottom flute stretching from the cutting face results in small curled chips. In addition, Nachi Viper T-Series Taps release chips smoothly, thanks to their specially designed helix angle.

3. Shorter Thread Length

Shorter than conventional thread lengths prevent chips from clogging the flutes; reduce bite, twine-round and breakage of the cutting edge. Flute length also provides for excellent chip ejection.

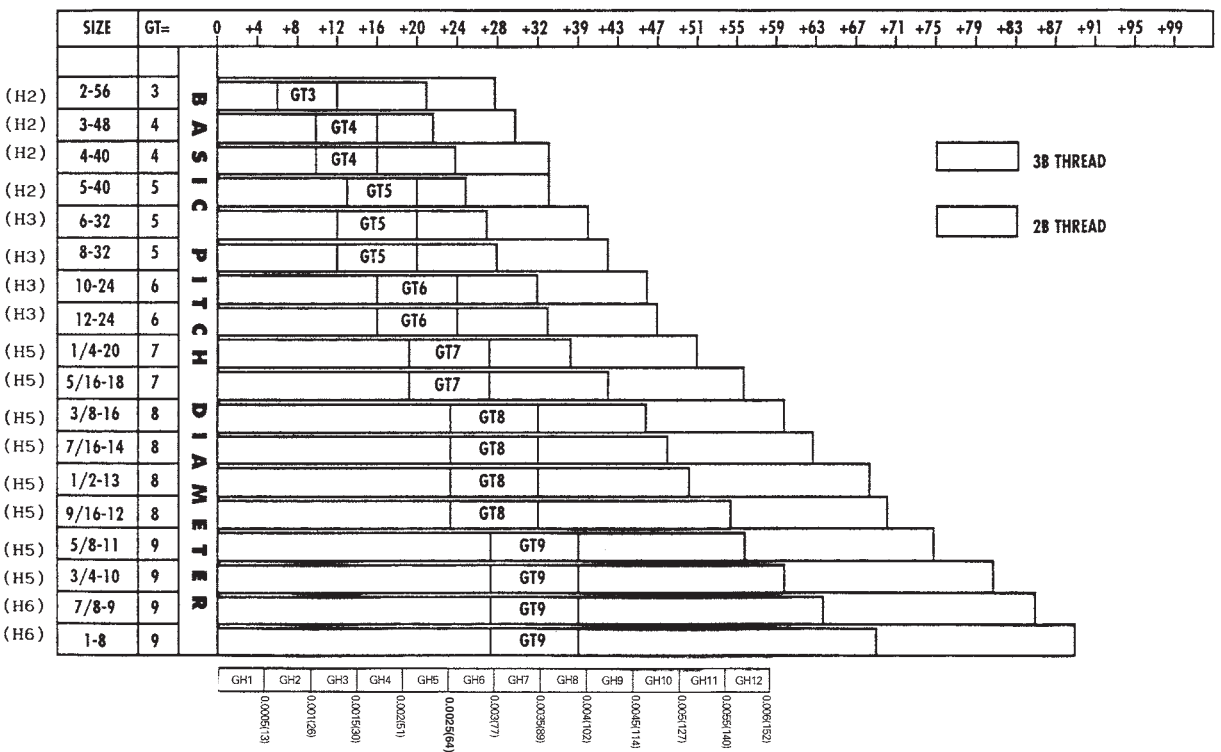
4. GT System For Thread Limit

Instead of the usual GH limits, GT limits are applied to Nachi Viper T-Series Taps. Each top has just one GT number instead of several GH numbers, eliminating troublesome limit selection (see Comparison Chart, below, for details).

COMPARISON OF NACHI GT AND ANSI GH NUMBERS

THREAD TOLERANCE IN TEN THOUSANDTHS OF AN INCH (.0001")

COMPARISON OF NACHI GT AND ANSI GH NUMBERS
THREAD TOLERANCE IN TEN THOUSANDTHS OF AN INCH (.0001")



TAP TOLERANCE TABLE

GT Limits Table

Fractional, Machine screw, and Metric Taps
Over 42 TPI, or less than 0.6mm pitch

Class	MIN	MAX
GT2	0.0002	0.0008
GT3	0.0006	0.0012
GT4	0.0010	0.0016
GT5	0.0014	0.0020
GT6	0.0018	0.0024
GT7	0.0022	0.0028

Fractional, Machine screw, and Metric Taps
Less than 42 TPI, or over 0.6mm pitch

Class	MIN	MAX
GT2	0.0000	0.0008
GT3	0.0004	0.0012
GT4	0.0008	0.0016
GT5	0.0012	0.0020
GT6	0.0016	0.0024
GT7	0.0020	0.0028
GT8	0.0024	0.0031
GT9	0.0028	0.0035
GT10	0.0031	0.0039

GT LIMITS CONVERSION CHART

Recommended tap limits for 2B and 3B

TAP SIZE	CLASS 2B		CLASS 3B	
	H LIMITS	GT LIMITS	H LIMITS	GT LIMITS
2-56	H2	GT3	H1	-
2-64	H2	GT3	H1	-
3-48	H2	GT4	H1	-
3-56	H2	GT3	H1	-
4-40	H2	GT5	H2	-
4-48	H2	GT4	H1	-
5-40	H2	GT5	H2	-
5-44	H2	GT5	H2	-
6-32	H3	GT5	H2	-
6-40	H2	GT5	H2	-
8-32	H3	GT5	H2	-
8-36	H2	GT5	H2	-
10-24	H3	GT6	H3	-
10-32	H3	GT5	H2	-
12-24	H3	GT6	H3	-
12-28	H3	GT6	H3	-
1/4-20	H5	GT7	H3	GT4
1/4-28	H4	GT6	H3	GT4
5/16-18	H5	GT7	H3	GT4
5/16-24	H4	GT7	H3	GT4
3/8-16	H5	GT8	H3	GT4
3/8-24	H4	GT7	H3	GT4
7/16-14	H5	GT8	H3	GT4
7/16-20	H5	GT8	H3	GT4
1/2-13	H5	GT8	H3	GT4
1/2-20	H5	GT8	H3	GT4
9/16-12	H5	GT8	H3	GT4
9/16-18	H5	GT8	H3	GT4
5/8-11	H5	GT9	H3	GT4
5/8-18	H5	GT8	H3	GT4
3/4-10	H5	GT9	H5	GT4
3/4-16	H5	GT8	H3	GT4
7/8-9	H6	GT9	H4	GT5
7/8-14	H6	GT9	H4	GT5
1-8	H6	GT9	H4	GT5
1-12	H6	GT9	H4	GT5

TAP TOLERANCE TABLE

H Limits Table
Fractional and Machine screw types

Class	MIN	MAX
H1	0.0000	0.0005
H2	0.0005	0.0010
H3	0.0010	0.0015
H4	0.0015	0.0020
H5	0.0020	0.0025
H6	0.0025	0.0030
H7	0.0030	0.0035
H8	0.0035	0.0040
H9	0.0040	0.0045
H10	0.0045	0.0050
H11	0.0050	0.0055
H12	0.0055	0.0060

D Limits Table
Metric Taps

Tap Size	D Class	MIN	MAX
M2X0.4	D3	0.0009	0.0015
M2.5X0.45	D3	0.0009	0.0015
M3X0.5	D3	0.0009	0.0015
M3.5X0.6	D4	0.0012	0.0020
M4X0.7	D4	0.0012	0.0020
M5X0.8	D4	0.0012	0.0020
M6X1	D5	0.0015	0.0025
M7X1	D5	0.0015	0.0025
M8X1	D5	0.0015	0.0025
M8X1.25	D5	0.0013	0.0025
M10X1.25	D5	0.0013	0.0025
M10X1.5	D6	0.0018	0.0030
M12X1.25	D5	0.0013	0.0025
M12X1.75	D6	0.0018	0.0030
M14X1.5	D6	0.0018	0.0030
M14X2	D7	0.0019	0.0035
M16X1.5	D6	0.0018	0.0030
M16X2.0	D7	0.0019	0.0035
M18X1.50	D6	0.0018	0.0030
M18X2.5	D7	0.0019	0.0035
M20X2.5	D7	0.0019	0.0035
M22X2.5	D7	0.0019	0.0035
M24X3.0	D8	0.0024	0.0040
M27X3.0	D8	0.0024	0.0040
M30X3.5	D9	0.0025	0.0045

RESHARPENING OF TAPS

When to Resharpen Taps

1. **When the taps get or appear to be damaged.**
2. **When the dimensions of the tapped threads begin to get out of tolerance.**
3. **When the surface roughness on threads decreases.**
4. **When the cutting torque starts to increase.**
5. **When the taps start to make a squealing noise.**
6. **When the shape of the tapping chips begin to change.**

A. Flute Grinding Way

1. **The following table shows the common grinding condition for resharpening the taps.**

Item	General	Mass Production
Wheel Dimension	WA 60–80K	CBN 120–170
Wheel Speed	1970 ft/mm	4,900–5,900 ft/mm
Depth of Grinding	.0012"	.0004–.002"
Feed Rate	3.3 ft/mm	3.3–10.0 ft/min
Coolant	Wet	Wet

The depth of regrind can be 2—3 times the thread height; it is not necessary to regrind full depth of the flute. However, it must be as smooth as possible from the ground rake face position to the root radius.

2. Setting the rake angle

To grind the rake face is to remove wear and the damaged portion.

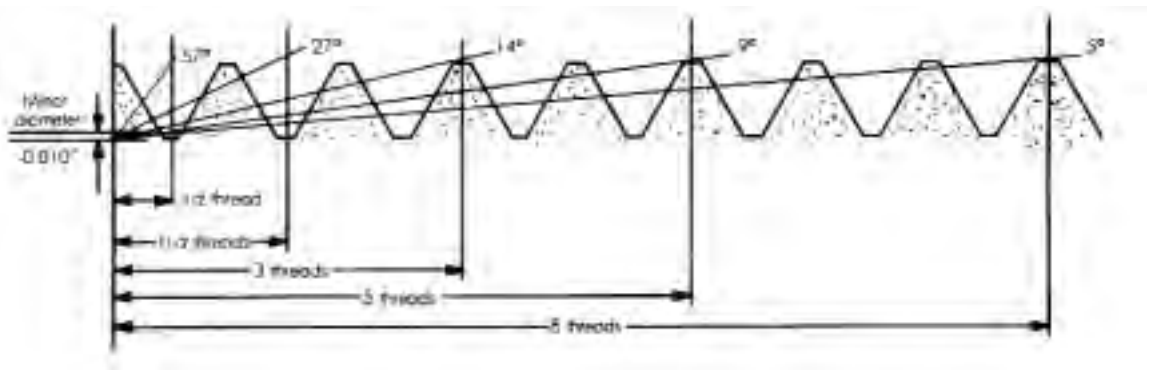
It is very important to set the rake angle very carefully, otherwise it brings unstable accuracy of female thread, bad surface roughness, short tool life and chipping. The following picture indicates two types of resharpening, which are Grinding Hook Angle by Formed wheel and Grinding Rake Angle by Disk Type wheel.

RESHARPENING OF TAPS

B. Chamfer Grinding Way

The Chamfer Grinding is carried out by some chamfer grinding machines with being held by collet or between centers. Chamfer length and angle are specified as follows:

Kind of Taps	Chamfer Length	Chamfer Angle
hand taps (Taper)	8~9 threads	≈4˚~5˚
hand taps (Plug)	5 threads	≈7.5˚
hand taps (Bottoming)	1.5 threads	≈24˚
taper pipe taps	2.5 threads	≈15˚
parallel pipe taps	4 threads	≈11˚
spiral fluted taps	2.5 threads	≈15˚
spiral pointed taps	4 threads	≈9.5˚



Relation between length and angle of taper

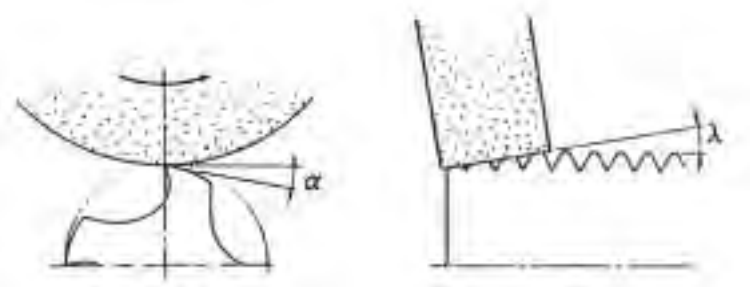
Relief Angle (α) is calculated as next.

$\alpha = \tan^{-1}(P \times \tan\lambda / \pi\delta) \geqq \alpha_0$

α : relief angle on taper
P : pitch
λ : taper angle
d : basic minor diameter
α_0 : effective minimum relief angle

α_0 is decided as table

Material	Relief Angle
steel	4 ~ 5
hard steel	2 ~ 3
stainless steel	5˚
cast iron	3˚
aluminum	6˚



Resharpening of taper

TROUBLE-SHOOTING GUIDE FOR TAPPING PROBLEMS

	Troubles	Factors	Countermeasures
Surface Roughness	Torn or Rough Thread	Chamfer length too short	• Increase chamfer length
		Wrong cutting angle	• Apply proper cutting angle
		Galling	• Use thread relieved taps • Reduce land width • Apply surface treatment such as steam oxide or chrome • Use proper cutting lubricant • Reduce tapping speed • Use larger drill size • Obtain proper alignment between tap and work
		Chip packing	• Use spiral pointed or spiral fluted taps • Use larger drill size
	Chattering on Tapped Thread	Too free cutting	• Avoid too narrow land width • Reduce amount of thread relief
		Tool condition	• Reduce cuffing angle • Do not grind the bottom of the flute
Dimensional Error	Oversize Pitch Diameter	Incorrect Taps	• Use proper GH limits • Use longer chamfered taps
		Chip Packing	• Use spiral point or spiral fluted taps • Reduce number of flutes to provide extra chip room • Use National fine pitch, if applicable • Use larger drill size • If tapping a blind hole, allow deeper hole where applicable or shorten the thread length of the parts • Use proper lubricant
		Galling	• Apply proper surface treatment such as steamoxide • Use proper cutting lubricant • Reduce tapping speed • Use proper cutting angle in accordance with material being tapped. • Use larger drill size
		Operating Conditions	• Apply proper tapping speed • Correct alignment of tap and drill hole • Free cutting either tap or workpiece • Use proper tapping speed to avoid torn or rough thread • Use lead screw tapper • Use proper tapping machine with suitable power • Avoid misalignment of tap and drill hole from loose spindle or worn holder
		Tool Conditions	• Obtain proper indexing angle for the flutes at the cutting edge • Grind proper indexing angle and chamfer angle • Avoid too narrow land width • Remove burrs from reground edge
	Oversize Internal Diameter	Drill Hole Size	• Use minimum size drill hole • Avoid tapered hole • Use proper chamfered taps
		Galling	• Galling solutions I through 4 above can be applied to this specific problem

	Troubles	Factors	Countermeasures
Dimensional Error	Undersize Pitch Diameter	Incorrect Tap Selection	• Use one oversize taps 1) Use for cuffing materials such as copper alloy, aluminum alloy, and cast iron 2) Use for cuffing tubing which will have "spring back" action after tapping • Apply proper chamfer angle • Increase cutting angle
		Damaged Thread	• Use proper reversing speed to avoid damaging tapped thread on the way out of the hole
		Left over Chips	• Increase cutting performance to avoid any leftover chip in the hole • Remove leftover chip from the hole for gauge checking
	Undersize Internal Diameter	Drill Hole size	• Use maximum drill size
Tool Life	Breakage	Incorrect Tap Selection	• Use high speed steel taps • Avoid chip packing in the flutes or the bottom of hole • Use spiral pointed or spiral fluted taps or Roll Taps • Apply correct surface treatment such as steam oxide or other coating
		Excessive Tapping Torque	• Use larger drill size • Try to shorten thread length • Apply National Fine Pitch if applicable • Increase cutting angle • Apply a tap with more thread relief and reduced land width • Use spiral pointed or spiral fluted taps
		Operating Conditions	• Reduce tapping speed • Avoid misalignment between tap and the hole and tapered hole • Use floating type of tapping holder • Use tapping holder with torque adjustment • Avoid hitting bottom of the hole with tap
		Tool Condition	• Do not grind the bottom of the flutes • Avoid too narrow a land width • Do not leave sections on the reground flutes which tapping wear still remains • Regrind tool more frequently
	Chipping	Incorrect Tap Selection	• Reduce cutting angle • Use a different kind of high speed steel taps • Reduce hardness of the taps • Increase chamfer length • Avoid chip packing in the flutes or the bottom of the hole by using spiral pointed or fluted taps
		Operating Conditions	• Reduce tapping speed • Avoid misalignment between tap and hole • Avoid sudden return or reverse in blind hole tapping • Avoid galling • Use larger drill size
	Wear	Incorrect Tap Selection	• Apply specially designed taps for tapping heat treated material • Change to a type of high speed steel material contained vanadium • Apply special surface treatment such as nitriding or TiN • Increase chamfer length
		Operating Conditions	• Reduce tapping speed • Apply proper cutting lubricants • Avoid work hardened hole • Use larger drill size
		Tool Condition	• Grind proper cutting angle • Avoid hardness reduction from grind process

MATERIAL SYMBOL CHART BY STANDARD

Description	U.S.A.		Japan	Germany	ISO
	ASTM	AISI	JIS	DIN	
General structural Steel			SM490A		
			SM490B		
	C		SM570		
			SS400		
	A		SS330	St33	
	B				
	C				
	30				
	33				
	36				
	40				
	70		SS490	St52-3	
	C		SS540		
	D		SM490A		
	E		SM490B		
	A		SM490C		
	B		SM490Y		
	50W		SM520		
	A		SV330	Ust36	
	B		SV400		
Carbon Steel		1015	S15C	CK15	C15E4
				C15	
		1025	S25C	CK25	C25
				C25	C25E4
		1045	S45C	CK45	C45
		1046		C45	C45E4
		1050	S50C	CK50	C50
				C50	C50E4
	60		SB410	HII	P7
	65		SB450	17Mn4	P11
	A		SB450M		P28
	70		SB480		
	B		SB480M		
Alloy Steel			SCM415		
			SCM415H		
			SCM415TK		
			SCM418		18CrMo4
			SCM418H		18CrMo4
			SCM418TK		
			SCM420		
			SCM420H		
			SCM420TK		
			SCM421		
		4130	SCM430		
			SCM430TK		
			SCM432		
		4135	SCM435	34CrMo4	34CrMo4
		4137			
		4135H	SCM435H	34CrMo4	34CrMo4
		4137H			
			SCM435TK		
		4140		42CrMo4	
		4142			
		4140H	SCM440H	42CrMo4	42CrMo4
		4142H			
			SCM440TK		
		4145	SCM445		
		4147			
		4145H	SCM445H		
		4147H	SCM822		
			SCM822H		
			SCr415		16MnCr5
			SCr415H		16MnCr5
			SCr420		16MnCr5
			SCr420H		16MnCr5
			SCr420TK		
		5130	SCr430	34Cr4	34Cr4
		5132			
		5130H	SCr430H	34Cr4	34Cr4
		5132H			
		5135	SCr435	34Cr4	34Cr4
				37Cr4	37Cr4
		5135H	SCr435H	34Cr4	34Cr4
				37Cr4	37Cr4
		5140	SCr440	37Cr4	37Cr4
				41Cr4	41Cr4
		5140H	SCr440H	37Cr4	37Cr4
				41Cr4	41Cr4
		5147	SCr445		
		1522	SMn420		22Mn6
		1522H	SMn420H		22Mn6
			SMn433		
		1541H	SMn433H		36Mn6
		1541	SMn438		36Mn6
		1541H	SMn438H		36Mn6

Description	U.S.A.		Japan	Germany	ISO
	ASTM	AISI	JIS	DIN	
Alloy Steel			SMn443		
		1541H	SMn443H		42Mn6
			SNC326		
			SNC415		
			SNC415H		
			SNC631		
			SNC631H		
			SNC815		
			SNC815H		15NiCr13
			SNC836		
		8615	SNCM220		20NiCrMo2
		8617			
		8620			
		8622			
		8617H	SNCM220H		20NiCrMo2
		8620H			
		8622H			
		8637	SNCM240		41CrNiMo2
		8640			
			SNCM415		
		4320	SNCM420		
		4320H	SNCM420H		
			SNCM431		
		4340	SNCM439		
			SNCM447		
			SNCM616		
			SNCM625		
			SNCM630		
			SNCM815		
Carbon Tool Steel			SK1		TC140
	W1-111/2		SK2		TC120
	W1-10		SK3	C105W1	TC105
	W1-9		SK4		TC90
	W1-8		SK5	C80W1	TC90
			SK6	C80W1	TC80
					TC70
			SK7	C70W2	
			SKS2	105WCr6	105WCr1
			SKS3		
			SKS4		
			SKS5		
			SKS6		
			SKS7		
			SKS8		
	F2		SKS11		
			SKS21		
			SKS31	105WCr6	105WCr1
			SKS41		
	W2-91/2		SKS43		TCV105
	W2-81/2		SKS44		
	L6		SKS51		
			SKS93		
			SKS94		
			SKS95		
	52100		SUJ2	100Cr6	1
Die Steel	D2		SKD11		
	H13		SKD61	X40CrMoV51	40CrMoV5
Tool Steel			SKT3		
			SKT4	55NiCrMoV6	55NiCrMoV2
Pipe Steel			STAM290GB	St28	
	TypeF		SGP	St33	
	1008		STKM11A	St34-2	
	A		STPT370	St35.8	
			STB340	St35.8	
				St37.8	
	E-A		STPG370	St37.0	
	A				
			STS370	St37.4	
	B		STPT410	St42.8	
	C		STB410	St42.8	
	A-1			St45.8	
	E-B		STPG410	St44.0	
	B			St44.0	
			STK400	St44-2	TS9
			STKM12B	St44-2	
			STKR400	St44-2	
			STAM390G	St44-2	
			STS410	St44.4	
			STKM14A	St45	
	1020		STKM13C	St45	
			STKM18C	St52	
			STKM19A	St52	
			STKM19C	St52	
			STK490	St52-3	TS18
			STKR490	St52-3	

MATERIAL SYMBOL CHART BY STANDARD

Description	U.S.A.		Japan	Germany	ISO
	ASTM	AISI	JIS	DIN	
Pipe Steel			STS480	St52.4	
			STKM12A		R33
			STKM12C		
			STKM13B		
	1026		STKM14B		
	1025				
	1026		STKM14C		
			STKM15A		
			STKM15C		
			STKM16A		
			STKM16C		
	1050		STKM17A		
			STKM17C		
			STKM18A		
			STKM18B		R50
			STKM20A		
Heat Resistant steel	S65007		SUH1		
			SUH3		
			SUH4		
			SUH11		
			SUH21		
			SUH31		
			SUH35		
	S63008		SUH36		
	S63017		SUH37		
			SUH38		
	S30900		SUH309		
	S31000		SUH310		
	N08330		SUH330		
	S40900		SUH409	X6CrTi12	1Ti
			SUH409L		
	S44600		SUH446		H7
			SUH600		
	S42200		SUH616		
	S66286		SUH660		
	R30155		SUH661		
Free cutting steel		1110	SUM11		
		1108	SUM12		
		1212	SUM21		9S20
		1213	SUM22	9SMn28	11SMn28
			SUM22L	9SMnPb28	11SMnPb
		1215	SUM23		
			SUM23L		
		12L14	SUM24L	9SMnPb28	11SMnPb28
			SUM25	9SMn36	12SMn35
		1117	SUM31	15S10	
			SUM31L		
			SUM32		
		1137	SUM41		
		1141	SUM42		
		1144	SUM43		44SMn28
Spring steel		1075	SUP3		
		1078			
			SUP6		1
		9260	SUP7		1
		5155	SUP9	55Cr3	5
		5160	SUP9A		
		6150	SUP10	50CrV4	9
		51B60	SUP11A		7
			SUP12	54SiCr6	4
		4161	SUP13		8
Stainless steel	S30400		SUS304	X5CrNi1810	11
	S40500		SUS405	X6CrAl13	2
	S42020		SUS420F		
	S43000		SUS430	X6Cr17	8
	S44002		SUS440A		
	S17400		SUS630		1
	S17700		SUS631	X7CrNiAl177	2
	S41000		SUS410	X10Cr13	3
Cast steel	HT		SCH15		
Cast Iron	40		FC250		
	45		FC300		
Ductile Cast Iron	60-40-18		FCD400		
	80-55-06		FCD600	GGG-60	
Aluminum Alloy			A1080	Al99.8	
			A1070	Al99.7	
			A1050	Al99.5	Al99.5
	1100		A1100		Al99.0Cu
			A1200	Al99	Al99.0
	2014		A2014	AlCuSiMn	Al-Cu4SiMg
			A2017	AlCuMg1	Al-Cu4MgSi
	2014		A2017	AlCuSiMn	Al-Cu4SiMg
	2024		A2024BD	AlCuMg2	AlCu4Mg1
	2024		A2024BE	AlCuMg2	AlCu4Mg1
	2024		A2024 P	EN AW-2024	AlCu4Mg1

Description	U.S.A.		Japan	Germany	ISO
	ASTM	AISI	JIS	DIN	
Aluminum Alloy	2024		A2024 S	AlCuMg2	AlCu4Mg1
	2024		A2024 TD	AlCuMg2	
	2024		A2024 TE	AlCuMg2	AlCu4Mg1
	2024		A2024 W	AlCuMg2	AlCu4Mg1
	3003		A3003		
	5052		A5052 BD	AlMg2.5	AlMg2.5
	5052		A5052 BE		
			A5052 FH		
	5052		A5052 P	EN AW-5052	AlMg2.5
	5052		A5052 S		
	5052		A5052 TD		AlMg2.5
	5052		A5052 TE		
	5052		A5052 W	AlMg2.5	AlMg2.5
			A5056	AlMg5	
	5083		A5083	AlMg4.5Mn	Al-Mg4.5Mn0.7
	6061		A6061		Al-Mg1SiCu
	6063		A6063		Al-Mg0.7Si
	7075		A7075 BD	AlZnMgCu1.5	AlZn5.5MgCu
	7075		A7075 BE	AlZnMgCu1.5	AlZn5.5MgCu
	7075		A7075 FD	AlZnMgCu1.5	
	7075		A7075 FH	AlZnMgCu1.5	
	7075		A7075 P	EN AW-7075	AlZn5.5MgCu
	7075		A7075 S	AlZnMgCu1.5	AlZn5.5MgCu
	7075		A7075 TD	AlZnMgCu1.5	AlZn5.5MgCu
	7075		A7075 TE	AlZnMgCu1.5	AlZn5.5MgCu
Aluminum Alloy Casting	295.0		AC1A	G(GK)-AlCu4Ti	
	204.0		AC1B	G(GK)-AlCu4TiMg	Al-Cu4MgTi
			AC2A		Al-Si5Cu3
	319.0		AC2B		Al-Si6Cu4
			AC3A	G(GK)AlSi2	Al-Sil2
			AC4A	G(GK)-AlSi10Mg	Al-Si10Mg
	333.0		AC4B	G(GK)-AlSiCu3	
	356.0		AC4C		Al-Si7Mg
	A356.0		AC4CH	G(GK)AlSi7Mg	Al-Si7Mg
	355.0		AC4D		Al-Si5Cu1Mg
	242.0		AC5A		Al-Cu4Ni2Mg2
	514.0		AC7A	G(GK)-AlMg5	
	520.0		AC7B		Al-Mg10
	336.0		AC8A		
			AC8B		
	332.0		AC8C		
			AC9A		
			AC9B		
	A413.0		ADC1	GD-AlSi12(Cu)	Al-Sil2CuFe
	A360.0		ADC3	GD-AlSi10Mg	
	518.0		ADC5	GD-AlMg9	
			ADC6		
	A380.0		ADC10	GD-AlSi9Cu3	Al-Si8Cu3Fe
	A380.0		ADC10Z	GD-AlSi9Cu3	Al-Si9Cu3Fe
	383.0		ADC12		
	383.0		ADC12Z		
	A390.0		ADC14		
Magnesium Alloy	AZ91A		MD1A	DG-MgAl9Zn1	
	AZ91B		MD1B	DG-MgAl9Zn1	
	AZ91D		MD1D		
	AZ60A				
	AZ60B				
	AZ41A				
	AZ80A		MB3	MgAl8Zn	Mg-Al8Zn
	AM20A				
	AM50A				
	AM60B		MD2B		
	AS22A				
	AS41B				
	AE42A				
Copper, Copper Casting	C10200(B187:94)		C1020 B	OF-Cu	Cu-OF
	C10200(B152:94)		C1020 P	OF-Cu	Cu-OF
	C10200(B152:94)		C1020 R	OF-Cu	Cu-OF
Brass, Brass Casting	C26000(B36:95)		C2600 B	CuZn30 17660:83	426/I:83 CuZn30
	C26000(B36:95)		C2600 P	CuZn30 17660:83	426/I:83 CuZn30
	C26000(B36:95)		C2600 R	CuZn30 17660:83 CuZn30 17670:83	426/I:83 CuZn30
	C26000(B135:95)		C2600 T	CuZn30	CuZn30
	C26000(B134:93)		C2600 W	CuZn30	CuZn30
Bronze, Bronze Casting	C61400(B169:95)		C6140 P		428:83 CuAl 8Fe3

COMPARISON CHART SCALE FOR HARDNESS

Approximate relationship between various hardness scales

(HRC) Rockwell hardness C scale 150kg Brale	(HV) Diamond Pyramid hardness number, Vickers	(HB) Brinell hardness 29.42kN			Rockwell hardness			Rockwell hardness			(Hs) Shore scleroscope hardness number	Approx. tensile strength N/mm²	(HRC) Rockwell hardness C scale 150kg Brale
		Standard 10mm ball	Hultgren 10mm ball	Tungsten carbide 10mm	(HRA) A scale 588.4N (60kg) Brale	(HRB) B scale 980.7N (100kg) 1/16" in Ball	(HRD) D scale 980.7N (100kg) Brale	15N Superficial Load 147.1N	30N Superficial Load 294.2N	45N Superficial Load 441.3N			
68	940	—	—	—	85.6	—	76.9	93.2	84.4	75.4	97	—	68
67	900	—	—	—	85.0	—	76.1	92.9	83.6	74.2	95	—	67
66	865	—	—	—	84.5	—	75.4	92.5	82.8	73.3	92	—	66
65	832	—	—	739	83.9	—	74.5	92.2	81.9	72.0	91	—	65
64	800	—	—	722	83.4	—	73.8	91.8	81.1	71.0	88	—	64
63	772	—	—	705	82.8	—	73.0	91.4	80.1	69.9	87	—	63
62	746	—	—	688	82.3	—	72.2	91.1	79.3	68.8	85	—	62
61	720	—	—	670	81.8	—	71.5	90.7	78.4	67.7	83	—	61
60	697	—	613	654	81.2	—	70.7	90.2	77.5	66.6	81	—	60
59	674	—	599	634	80.7	—	69.9	89.8	76.6	65.5	80	—	59
58	653	—	587	615	80.1	—	69.2	89.3	75.7	64.3	78	—	58
57	633	—	575	595	79.6	—	68.5	88.9	74.8	63.2	76	—	57
56	613	—	561	577	79.0	—	67.7	88.3	73.9	62.0	75	—	56
55	595	—	546	560	78.5	—	66.9	87.9	73.0	60.9	74	2079	55
54	577	—	534	543	78.0	—	66.1	87.4	72.0	59.8	72	2010	54
53	560	—	519	525	77.4	—	65.4	86.9	71.2	58.6	71	1952	53
52	544	500	508	512	76.8	—	64.6	86.4	70.2	57.4	69	1883	52
51	528	487	494	496	76.3	—	63.8	85.9	69.4	56.1	68	1824	51
50	513	475	481	481	75.9	—	63.1	85.5	68.5	55.0	67	1755	50
49	498	464	469	469	75.2	—	62.1	85.0	67.6	53.8	66	1687	49
48	484	451	455	455	74.7	—	61.4	84.5	66.7	52.5	64	1638	48
47	471	442	443	443	74.1	—	60.8	83.9	65.8	51.4	63	1579	47
46	458	432	432	432	73.6	—	60.0	83.5	64.8	50.3	62	1530	46
45	446	421	421	421	73.1	—	59.2	83.0	64.0	49.0	60	1481	45
44	434	409	409	409	72.5	—	58.5	82.5	63.1	47.8	58	1432	44
43	423	400	400	400	72.0	—	57.7	82.0	62.2	46.7	57	1383	43
42	412	390	390	390	71.5	—	56.9	81.5	61.3	45.5	56	1334	42
41	402	381	381	381	70.9	—	56.2	80.9	60.4	44.3	55	1294	41
40	392	371	371	371	70.4	—	55.4	80.4	59.5	43.1	54	1245	40
39	382	362	362	362	69.9	—	54.6	79.9	58.6	41.9	52	1216	39
38	372	353	353	353	69.4	—	53.8	79.4	57.7	40.8	51	1177	38
37	363	344	344	344	68.9	—	53.1	78.8	56.8	39.6	50	1157	37
36	354	336	336	336	68.4	(109.0)	52.3	78.3	55.9	38.4	49	1118	36
35	345	327	327	327	67.9	(108.5)	51.5	77.7	55.0	37.2	48	1079	35
34	336	319	319	319	67.4	(108.0)	50.8	77.2	54.2	36.1	47	1059	34
33	327	311	311	311	66.8	(107.5)	50.0	76.6	53.3	34.9	46	1030	33
32	318	301	301	301	66.3	(107.0)	49.2	76.1	52.1	33.7	44	1000	32
31	310	294	294	294	65.8	(106.0)	48.4	75.6	51.3	32.5	43	981	31
30	302	286	286	286	65.3	(105.5)	47.7	75.0	50.4	31.3	42	951	30
29	294	279	279	279	64.7	(104.5)	47.0	74.5	49.5	30.1	41	932	29
28	286	271	271	271	64.3	(104.0)	46.1	73.9	48.6	28.9	41	912	28
27	279	264	264	264	63.8	(103.0)	45.2	73.3	47.7	27.8	40	883	27
26	272	258	258	258	63.3	(102.5)	44.6	72.8	46.8	26.7	38	863	26
25	266	253	253	253	62.8	(101.5)	43.8	72.2	45.9	25.5	38	843	25
24	260	247	247	247	62.4	(101.0)	43.1	71.6	45.0	24.3	37	824	24
23	254	243	243	243	62.0	100.0	42.1	71.0	44.0	23.1	36	804	23
22	248	237	237	237	61.5	99.0	41.6	70.5	43.2	22.0	35	785	22
21	243	231	231	231	61.0	98.5	40.9	69.9	42.3	20.7	35	775	21
20	238	226	226	226	60.5	97.8	40.1	69.4	41.5	19.6	34	755	20
(18)	230	219	219	219	—	96.7	—	—	—	—	33	736	(18)
(16)	222	212	212	212	—	95.5	—	—	—	—	32	706	(16)
(14)	213	203	203	203	—	93.9	—	—	—	—	31	677	(14)
(12)	204	194	194	194	—	92.3	—	—	—	—	29	647	(12)
(10)	196	187	187	187	—	90.7	—	—	—	—	28	618	(10)
(8)	188	179	179	179	—	89.5	—	—	—	—	27	598	(8)
(6)	180	171	171	171	—	87.1	—	—	—	—	26	579	(6)
(4)	173	165	165	165	—	85.5	—	—	—	—	25	549	(4)
(2)	166	158	158	158	—	83.5	—	—	—	—	24	530	(2)
(0)	160	152	152	152	—	81.7	—	—	—	—	24	520	(0)

In the above chart, figures with ( ) are not commonly used.

METRIC CONVERSION TABLE

Decimal	Fraction	Wire, Letter	mm	Tap Sizes To be used with drills as indicated
.0059		97	.15	
.0063		96	.16	
.0067		95	.17	
.0071		94	.18	
.0075		93	.19	
.0079		92	.2	
.0083		91		
.0087		90	.22	
.0091		89		
.0095		88		
.0098			.25	
.0100		87		
.0105		86		
.0110		85	.28	
.0115		84		
.0118			.3	
.0120		83		
.0125		82		
.0126			.32	
.0130		81		
.0135		80		
.0138			.35	
.0145		79		
.0150			.38	
.0156	1/64			
.0157			.4	
.0160		78		
.0177			.45	
.0180		77		
.0197			.5	
.0200		76		
.0210		75		
.0217			.55	
.0225		74		
.0236			.6	
.0240		73		
.0250		72		
.0256			.65	
.0260		71		
.0276			.7	
.0280		70		
.0292		69		
.0295			.75	M1x0.25
.0310		68		
.0312	1/32			
.0315			.8	
.0320		67		
.0330		66		
.0335			.85	M1.1x0.25
.0350		65		
.0354			.9	
.0360		64		
.0370		63		
.0374			.95	M1.2x0.25
.0380		62		
.0390		61		
.0394			1.0	
.0400		60		
.0410		59		
.0413			1.05	
.0420		58		
.0430		57		
.0433			1.1	M1.4x0.3
.0453			1.15	
.0465		56		
.0469	3/64			No.0-80
.0472			1.2	
.0492			1.25	M1.6x0.35
.0512			1.3	
.0520		55		
.0531			1.35	
.0550		54		
.0551			1.4	
.0571			1.45	M1.8x0.35
.0591			1.5	
.0595		53		No.1-64 No.1-72
.0610			.155	
.0625	1/16			
.0630			1.6	M2x0.4
.0635		52		
.0650			1.65	
.0669			1.7	
.0670		51		
.0689			1.75	M2.2x0.45
.0700		50		No.2-56 No.2-64
.0709			1.8	
.0728			1.85	
.0730		49		
.0748			1.9	
.0760		48		
.0768			1.95	
.0781	5/64			
.0785		47		
.0787			2.0	
.0807			2.05	M2.5x0.45
.0810		46		
.0820		45		No.3-56
.0827			2.1	
.0846			2.15	
.0860		44		
.0866			2.2	
.0886			2.25	
.0890		43		No.4-40
.0906			2.3	
.0925			2.35	
.0935		42		No.4-48
.0938	3/32			
.0945			2.4	
.0960		41		
.0965			2.45	
.0980		40		
.0984			2.5	M3x0.5
.0995		39		
.1015		38		No.5-40
.1024			2.6	
.1040		37		No.5-44
.1063			2.7	
.1065		36		No.6-32
.1094	7/64			
.1100		35		
.1102			2.8	
.1110		34		
.1130		33		No.6-40
.1142			2.9	M3.5x0.6
.1160		32		
.1181			3.0	
.1200		31		
.1220			3.1	
.1250	1/8			
.1260			3.2	
.1285		30		
.1299			3.3	M4x0.7
.1339			3.4	
.1360		29		No.8-32 No.8-36
.1378			3.5	
.1405		28		
.1406	9/64			
.1417			3.6	
.1440		27		
.1457			3.7	M4.5x0.75
.1470		26		
.1495		25		No.10-24
.1496			3.8	
.1520		24		
.1535			3.9	
.1540		23		
.1562	5/32			
.1570		22		
.1575			4.0	
.1590		21		No.10-32
.1610		20		
.1614			4.1	
.1654			4.2	M5x0.8
.1660		19		
.1693			4.3	
.1695		18		
.1719	11/64			
.1730		17		
.1732			4.4	
.1770		16		No.12-24
.1772			4.5	
.1800		15		
.1811			4.6	
.1820		14		No.12-28
.1850		13	4.7	No.12-32
.1875	3/16			
.1890		12	4.8	
.1910		11		
.1929			4.9	
.1935		10		
.1960		9		
.1969			5.0	M6x1
.1990		8		
.2008			5.1	
.2010		7		1/4-20
.2031	13/64			
.2040		6		
.2047			5.2	
.2055		5		
.2087			5.3	
.2090		4		
.2126			5.4	
.2130		3		
.2165			5.5	
.2188	7/32			1/4-28 1/4-32
.2205			5.6	
.2210		2		
.2244			5.7	
.2280		1		
.2283			5.8	
.2323			5.9	
.2340		A		
.2344	15/64			
.2362			6.0	M7x1
.2380		B		
.2402			6.1	
.2420		C		
.2441			6.2	
.2460		D		
.2480			6.3	
.2500	1/4	E		
.2520			6.4	
.2559			6.5	
.2570		F		5/16-18
.2598			6.6	
.2610		G		
.2638			6.7	
.2656	17/64			5/16-20
.2660		H		
.2677			6.8	M8x1.25
.2717			6.9	
.2720		I		5/16-24
.2756			7.0	
.2770		J		5/16-28
.2795			7.1	
.2810		K		
.2812	9/32			5/16-32
.2835			7.2	
.2874			7.3	
.2900		L		
.2913			7.4	
.2950		M		
.2953			7.5	
.2969	19/64			
.2992			7.6	
.3020		N		
.3031			7.7	
.3071			7.8	M9x1.25
.3110			7.9	
.3125	5/16			3/8-16
.3150			8.0	
.3160		O		
.3189			8.1	
.3228			8.2	
.3230		P		
.3268			8.3	
.3281	21/64			3/8-20
.3307			8.4	
.3320		Q		
.3346			8.5	M10x1.5
.3386			8.6	
.3390		R		3/8-24
.3425			8.7	
.3438	11/32			3/8-28 3/8-32
.3465			8.8	
.3480		S		
.3504			8.9	
.3543			9.0	
.3580		T		
.3583			9.1	
.3594	23/64			
.3622			9.2	
.3661			9.3	
.3680		U		7/16-14
.3701			9.4	
.3740			9.5	
.3750	3/8			7/16-16
.3770		V		
.3780			9.6	
.3819			9.7	
.3858			9.8	
.3860		W		
.3898			9.9	
.3906	25/64			7/16-20
.3937			10.0	
.3970		X		
.4016			10.2	M12x1.75
.4040		Y		7/16-28
.4062	13/32			7/16-32
.4130		Z		
.4134			10.5	
.4219	27/64			1/2-13
.4252			10.8	
.4331			11.0	
.4375	7/16			1/2-16
.4409			11.2	
.4528			11.5	
.4531	29/64			1/2-20
.4646			11.8	
.4688	15/32			1/2-28 1/2-32
.4724			12.0	M14x2
.4803			12.2	
.4844	31/64			9/16-12
.4921			12.5	
.5000	1/2			9/16-16
.5039			12.8	
.5118			13.0	
.5156	33/64			9/16-18 9/16-20
.5197			13.2	
.5312	17/32			9/16-24 9/16-28 9/16-32 5/8-11
.5315			13.5	
.5433			13.8	
.5469	35/64			5/8-12
.5512			14.0	M16x2
.5610			14.25	
.5625	9/16			5/8-16
.5709			14.5	
.5781	37/64			5/8-18 5/8-20
.5807			14.75	
.5906			15.0	
.5938	19/32			5/8-24 5/8-28 5/8-32
.6004			15.25	
.6094	39/64			11/16-12
.6102			15.5	M18x2.5
.6201			15.75	
.6250	5/8			11/16-16
.6299			16.0	
.6398			16.25	
.6406	41/64			11/16-20
.6496			16.5	
.6562	21/32			11/16-24 11/16-28 11/16-32 3/4-10
.6594			16.75	
.6693			17.0	
.6719	43/64			3/4-12
.6791			17.25	
.6875	11/16			3/4-16
.6890			17.5	M20x2.5
.7031	45/64			3/4-20
.7087			18.0	
.7188	23/32			3/4-28 3/4-32
.7283			18.5	
.7344	47/64			13/16-12
.7480			19.0	
.7500	3/4			13/16-16
.7656	49/64			13/16-20 7/8-9
.7677			19.5	M22x2.5
.7812	25/32			13/16-28 13/16-32
.7874			20.0	
.7969	51/64			7/8-12
.8071			20.5	
.8125	13/16			7/8-14 7/8-16
.8268			21.0	M24x3
.8281	53/64			7/8-20
.8438	27/32			7/8-28 7/8-32
.8465			21.5	
.8594	55/64			15/16-12
.8661			22.0	
.8750	7/8			15/16-16 1-8
.8858			22.5	
.8906	57/64			15/16-20
.9055			23.0	
.9062	29/32			15/16-28 15/16-32
.9219	59/64			1-12
.9252			23.5	
.9375	15/16			1-16 1 1/16-8
.9449			24.0	M27x3
.9531	61/64			1-20
.9646			24.5	
.9688	3/64			1-28 1-32
.9843			25.0	
.9844	63/64			1 1/16-12 1 1/8-7
1.0000	1			1 1/16-16 1 1/8-8

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