

For medium  
hardness  
carbon steel

**MH**  
SERIES

**Z-PRO**



**MHSP**

Spiral fluted taps for blind hole



**MHSL**

Spiral fluted taps for through hole

# Ideal for medium hardness carbon steel machining.

The MH series demonstrates outstanding performance in machining internal threads and center holes in materials that have both strength and toughness.



**MHRZ**  
Roll taps



**MHCDS**  
Center drills



For medium hardness  
carbon steel

# MH

SERIES

Yamawa is proud to announce our MH series, which delivers a high level of reliable machining and excellent performance which are essential for increasing productivity.



**What is medium hardness carbon steel?**

YAMAWA calls the following materials "medium hardness carbon steel".

Material name	Material code	Hardness
Carbon steel for machine structure	S43C~S55C	20~35HRC
Alloy steel for machine structure	SCM	20~35HRC

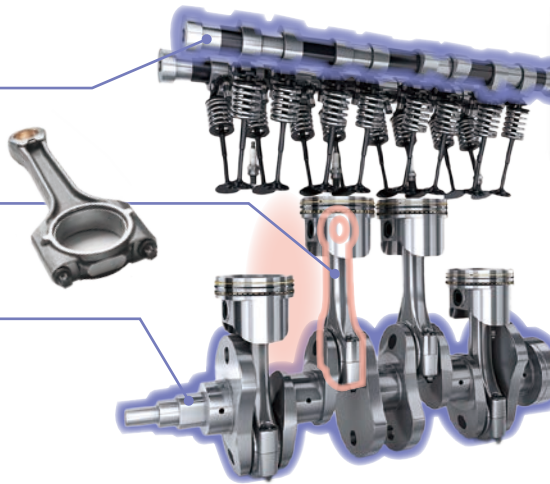
In recent years, automobiles have become lighter to improve fuel efficiency. For important safety components such as hub bearings and crankshafts, carbon steel for machine structures (S43C-S55C, etc.) called medium-hardness steel with high rigidity and durability, which has been refined to about 20-35HRC, and alloy steel for machine structures are used.

Camshaft

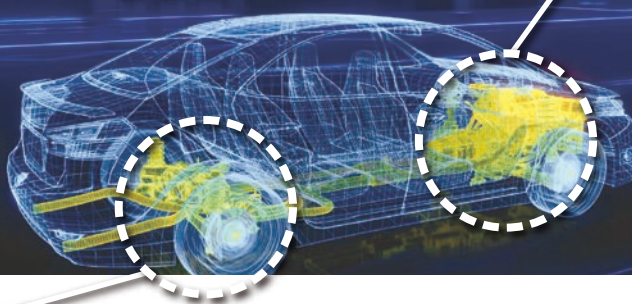
Connecting rod

Crankshaft

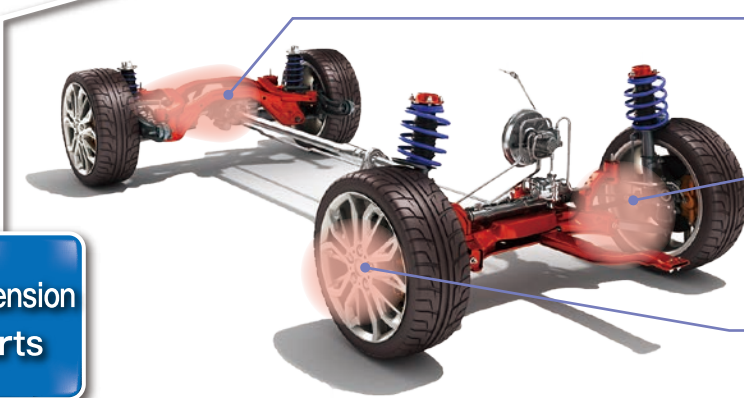
**Engine parts**



**Main examples of medium hardness carbon steel used in the automotive industry.**



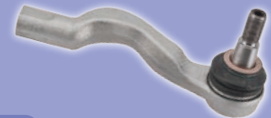
**Suspension parts**



Differential gear

Tie rod end

Hub bearing



**Examples of medium hardness carbon steel used in the construction machinery.**



**Slewing bearing**

Tapping of expensive and large parts, where no mistake are allowed requires precision and accuracy.

Spiral fluted Taps for Blind Hole in Medium Hardness Carbon Steel

# Z-PRO MHSP

MH series  
Key to development

When tapping blind holes in heat-treated parts, problems such as wear on the cutting edge or tap's damage by chip jamming are easy to occur, making stable machining difficult with general-purpose taps. MHSP was developed to solve these issues.

**Wear**



**Chipping**



## ● Tapping area

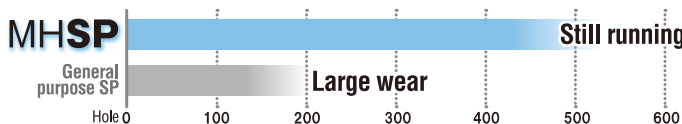
Heat treated high carbon steel	35HRC 25HRC	
Tool steel	SKS SKD	
Alloy steel	SCM SCr	
High carbon steel	S50C	
Medium carbon steel	S45C S25C	
Speed m/min	5 10 15 20 25 30	



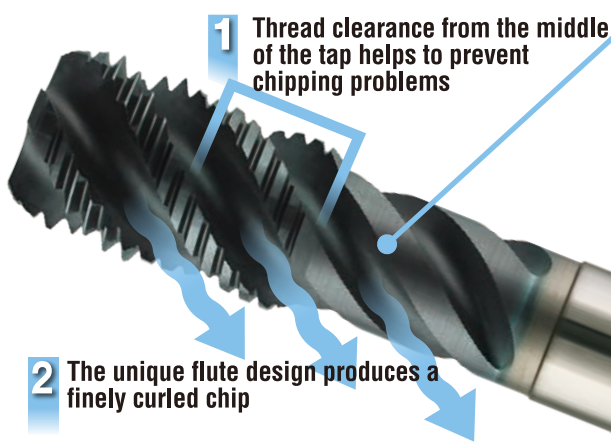
Recommended tapping speed is 5 to 30 m/min for medium and high carbon steel. 5-15m/min for medium hardness carbon steel

## Optimal coating **Tool life increased**

Base material with excellent wear resistance



Size	M8 × 1.25	Tapping length	12mm (Blind Hole)
Workpiece material	SCM440 (Heat treated)/35HRC	Machine	Vertical MC
Tapping speed	15m / min	Tapping fluid	Water-soluble



**1** Thread clearance from the middle of the tap helps to prevent chipping problems

**2** The unique flute design produces a finely curled chip

**3** Adopting full DIN length.  
By adopting to full DIN length which extends the tap away from the holder and spindle an appropriate amount and reduces the interference between the holder and chips. This drastically reduces chip evacuation problems.

## Chip problems are drastically reduced



## Outstanding chip evacuation performance

MHSP	Workpiece material	Tapping condition/Tapping result							(Remarks)
		Size	Material symbol (Hardness)	Hole Size (mm)	Tapping length (mm)(※)	Machine	Tapping speed (m/min)	Feed	
M 8X1.25	S48C (23HRC)	6.8	16 (2D)	Horizontal MC	30	Fully synchronous	Water soluble	1,740	Replaced due to wear at 1,200 holes. * Workpiece name: Flange
M 8X1.25	SS400	6.8	16 (2D)	Vertical MC	30	Fully synchronous	Water soluble	1,000	Replaced due to chipping or breaking at 800 holes. * Workpiece name: Suspension parts
M 8X1.25	S45C (30HRC)	6.9	24 (3D)	Vertical MC	6	Fully synchronous	Oil	300	Replaced due to wear at 90 holes. * Workpiece name: Drum brake
M10X1.5	S45C	8.5	20 (2D)	Vertical MC	25	Fully synchronous	Water soluble	800	Replaced due to chipping or breaking. * Workpiece name: Suspension parts
M16X2	S45C (28HRC)	14	24 (1.5D)	Vertical MC	5	Non synchronous	Water soluble	530	Poor surface finish. * Workpiece name: Rod
M16X2	SCM440 (35HRC)	14	32 (2D)	Horizontal MC	15	Fully synchronous	Water soluble	720	Replaced due to wear at 600 holes. * Workpiece name: Shaft

\* (D) shows the tapping length as a ratio of tap diameter.

Machining data

Spiral fluted taps for through hole in Medium Hardness Carbon Steel

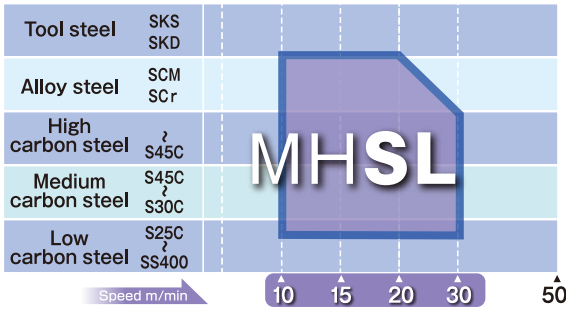
# MHSL

MH series  
Key to development

In through hole tapping of heat treated medium hardness carbon steel, strength, rigidity, and durability are required. Many problems can occur such as wear of taps, chipped edges, and poor surface finish of internal threads. MHSL was developed to solve these tapping problems.



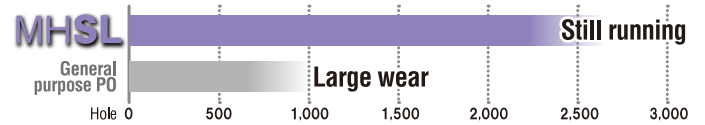
## Tapping area



Recommended tapping speed is 10~20m/min

Base material has excellent durability and wear resistance. Adopting the optimum coating.

## Outstanding durability



Size	M12 × 1.25	Tapping length	12mm (Through Hole)
Workpiece material	S53C (Forging)/25HRC/Hub bearing	Machine	Horizontal MC
Tapping speed	30 m/min	Tapping fluid	Water-soluble

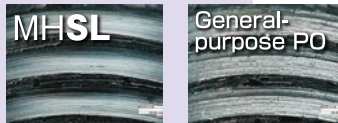
Chip evacuation is forward through the hole

- 1 Left handed flute with right hand cut pushes the chips forward
- 2 Two-stepped flute taper shape

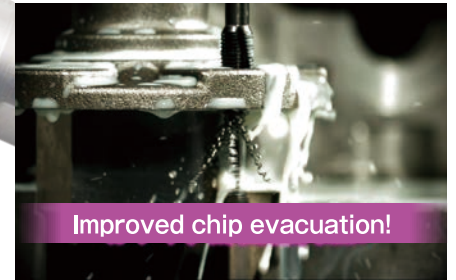
Improved chip evacuation performance. Chips are ejected in a uniform shape, which greatly reduces chipping problems.

Improved surface finish of internal threads!

Highly effective in eliminating burr problems.



## Ensures a stable tapping



Improved chip evacuation!

## Outstanding chip evacuation performance

MHSL	Workpiece material	Tapping condition/Tapping result							(Remarks)	
		Size	Material symbol (Hardness)	Hole Size (mm)	Tapping length (mm)(※)	Machine	Tapping speed (m/min)	Feed	Tapping fluid	Tool Life (Hole/piece)
M 6X1	S35C	5.1	12 (2D)	Horizontal MC	7.5	Fully synchronous	Oil	10,000	Poor surface finish. <b>*Workpiece name : Shaft</b>	
M 8X1.25	S45C	6.8	8 (1D)	Vertical MC	40	Fully synchronous	Water soluble	9,120	Replaced due to wear at 5,200 holes. <b>*Workpiece name : Shaft</b>	
M 8X1.25	S55C (25HRC)	6.85	12 (1.5D)	Vertical MC	30	Fully synchronous	Water soluble	2,160	Tool Life is unstable. <b>*Workpiece name: Clutch parts</b>	
M10X1.25	S45C (23HRC)	8.8	20 (2D)	Vertical MC	8	Fully synchronous	Water soluble	2,450	Replaced due to wear at 1,600 holes. <b>*Workpiece name: Arm</b>	
M12X1.75	S55C (27HRC)	10.4	12 (1D)	Vertical MC	19	Fully synchronous	Water soluble	2,840	Tool Life is unstable. <b>*Workpiece name: Hub bearing</b>	
M14X1.5	S53C (25HRC)	12.6	14 (1D)	Vertical MC	32	Fully synchronous	Water soluble	4,430	Replaced due to torque over at 3,000 holes. <b>*Workpiece name: Hub bearing</b>	
M14X1.5	S55C (23HRC)	12.6	14 (1D)	Vertical MC	22	Fully synchronous	Water soluble	2,700	Replaced due to wear at 2,000 holes. <b>*Workpiece name: Hub bearing</b>	

\* (D) shows the tapping length as a ratio of tap diameter.

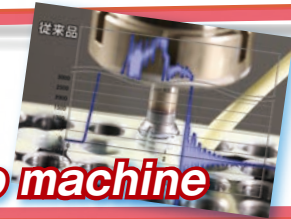
Roll taps  
for medium hardness carbon steel

# MHRZ

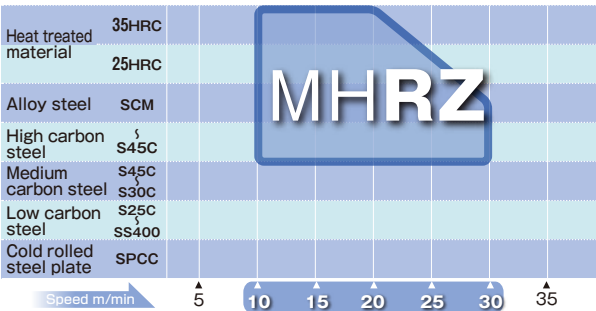
MH series  
Key to development

Roll form tapping on heat treated materials of 25 HRC or more has been considered difficult to achieve stable tapping due to high tapping torque. As a result MHRZ was developed.

**Difficult to machine**



## ● Tapping area

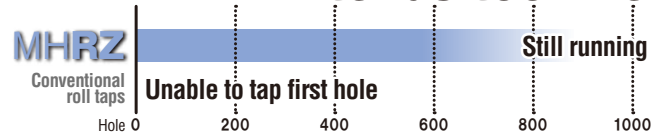


HSS-Co Coating 2~4

Recommended tapping speed is 10 to 20 m/min for medium hardness carbon steel and alloy steel.

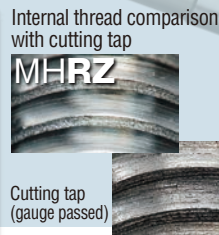
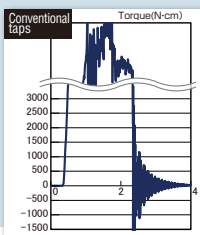
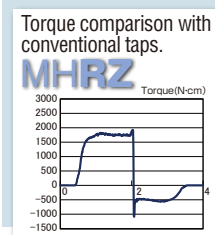
Adopting a base material with excellent durability and wear resistance. Adopting optimum coating.

## Extends tool life

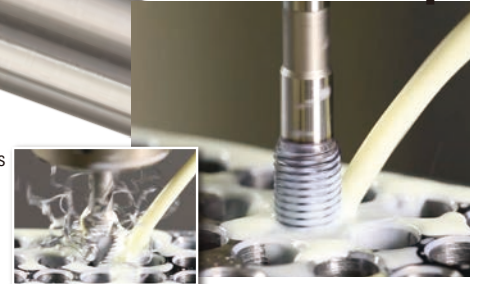


Size	M12×1.5	Tapping length	18mm (Through hole)
Workpiece material	SCM440(Heat treated)/35HRC	Machine	MC(Fully synchronous)
Tapping speed	20m/min	Tapping fluid	Water-soluble
Hole diameter	Φ11.3mm	Hole	800 holes

1 Originally developed thread part specifications. Success in reducing torque.



## Consistent tapping with roll taps



## Thread forming is now possible on medium hardness carbon steel with MHRZ

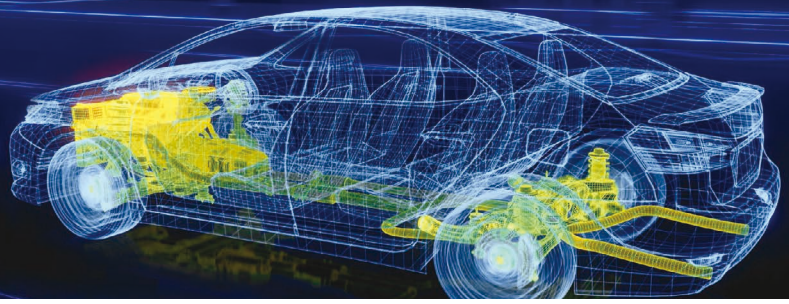
MHRZ	Workpiece material	Tapping condition/Tapping result							(Remarks)
		Material symbol (Hardness)	Hole Size (mm)	Tapping length (mm)(※)	Machine	Tapping speed (m/min)	Feed	Tapping fluid	
M 6 X 1	SUS316	5.6	9 (1.5D)	CNC	28	Fully synchronous	Oil	10,000	Screw plug gauge OUT at 5,000 holes. *Workpiece name: Automotive parts
M 6 X 1	S55CNN	5.55	15 (2.5D)	MC	26	Fully synchronous	Water soluble	6,000	Breaks randomly. *Workpiece name: Compressor shaft
M 6 X 1	SCM420H	5.55	6 (1D)	MC	20	Fully synchronous	Water soluble	2,000	Bad surface finish occurs on the internal screw. *Workpiece name: Parking gear
M 6 X 1	SCM435 (30HRC)	5.55	6 (1D)	MC	10	Fully synchronous	Oil	4,800	Replaced due to premature wear. *Workpiece name: Automotive parts
M 8 X 1.25	Aluminum alloy casting	7.5	16 (2D)	MC	30	Fully synchronous	Water soluble	16,000	Chipping occurs at 15,000 holes. *Workpiece name: Automotive parts
M10 X 1.5	20Cr (30HRC)	9.4	35 (3.5D)	MC	10	Fully synchronous	Oil	860	Chipping occurs at 80 holes. *Workpiece name: Automotive parts

\* (D) shows the tapping length as a ratio of tap diameter.

Machining data

Center Drills for Carbon Steels of Medium Hardness for High Speed machining

# MHCDS

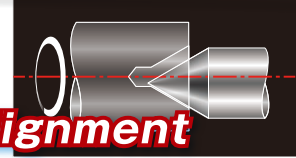


MH series

Key to development

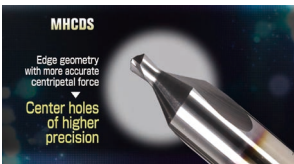


The center hole is the standard for cylindrical workpieces. The chamfered part of the center hole is infinitely round, and ideally there is no misalignment. At high speeds and feeds, runout problems are more significant. MHCDS was developed to combat these issues.

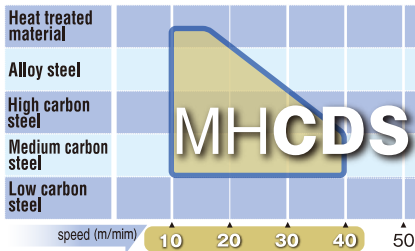


**Misalignment**

**1** Highly accurate center holes can be machined with a single-ended shape and a special cutting edge design with high centrality.



### Machining area



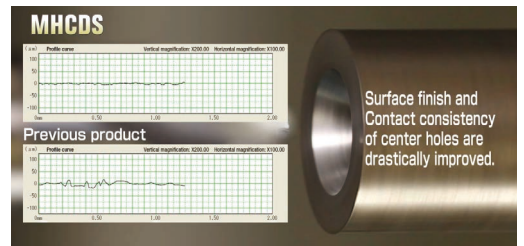
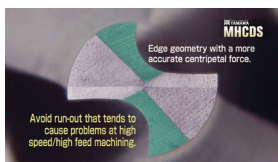
HSS-Co

Coating

Recommended machining speed is 20 to 30 m/min for medium hardness carbon steel and alloy steel, feed rate is 0.1 to 0.2 mm/rev.

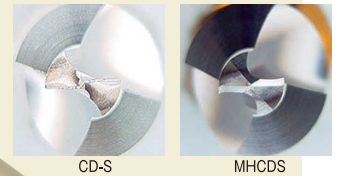
**Longer tool life, improved surface finish and roundness**

**2** Ideal shape for high speed and feeds



Surface finish and Contact consistency of center holes are drastically improved.

Right pictures show difference of the damage on cutting edge between CD-S and MHCDS after 480 hole cuttings under same cutting condition (stated in right) MHCDS has smaller wear and edge damage. This tells us we can continue to use MHCDS further.



Machining condition	[3x60°x8]
Workpiece material	S55C
Machining speed	30m/min(1,200min <sup>-1</sup> )
Feed	0.15mm/rev
Machine	NC lathe
Machining fluid	Water-soluble

**Produces reliable center hole machining in medium hardness carbon steel**

Machining data

MHCDS	Workpiece material	Machining condition/Machining result						(Remarks)
		Size	Material symbol (Hardness)	Center hole length (mm)	Machine	Revolution speed/RPM (min <sup>-1</sup> )	Feed (mm/rev)	
1 × 60° × 4	S48C	1	NC lathe	2,000	0.03	Oil	900	The cone was broken at 200 holes. * <b>Workpiece name: Automotive parts</b>
2 × 60° × 6	S55C	3.6	NC lathe	2,100	0.04	Water soluble	5,400	Very worn at 2,400 holes. * <b>Workpiece name: Oil pump shaft</b>
2 × 60° × 6	S45C (35HRC)	4	MC	2,000	0.1	Water soluble	700	Broken at the early stage of cutting.
3 × 60° × 8	Inconels	5	MC	500	0.03	Water soluble	400	Poor surface finish.
3 × 60° × 8	SUS310	6	NC lathe	500	0.03	Water soluble	500	High speed cutting was not possible.
3 × 60° × 8	SNCM420 (43HRC)	9	NC lathe	600	0.08	Water soluble	10 (continued possible)	Breaks at one hole * <b>Workpiece name: Camshaft</b>

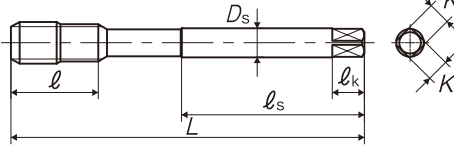


Spiral fluted Taps for Blind Hole in Medium Hardness Carbon Steel

# MHSP



TYPE: 1



Segment : 1D

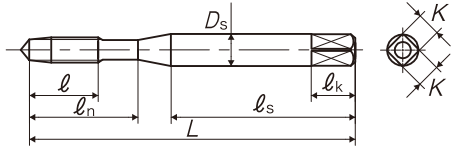
Size	Class	Code	Chamfer	L (mm)	l (mm)	l <sub>n</sub> (mm)	l <sub>s</sub> (mm)	D <sub>s</sub> (mm)	K (mm)	l <sub>k</sub> (mm)	No. of flutes	TYPE	MSRP
<b>For Metric Threads</b>													
<b>M8 × 1.25</b>	P4	SY8.0NSOCLJ	2.5P	90	19	-	46	6.2	5	8	3	1	¥ 4,720
<b>M10 × 1.5</b>	P4	SY0100SOCLJ	2.5P	100	23	-	51	7	5.5	8	3	1	¥ 5,460
<b>M10 × 1.25</b>	P4	SY010NSOCLJ	2.5P	100	23	-	51	7	5.5	8	3	1	¥ 5,460
<b>M10 × 1</b>	P4	SY010MSOCLJ	2.5P	100	23	-	51	7	5.5	8	3	1	¥ 6,490
<b>M12 × 1.75</b>	P4	SY012PSOCLJ	2.5P	110	26	-	56	8.5	6.5	9	4	1	¥ 7,830
<b>M12 × 1.5</b>	P4	SY012SOCLJ	2.5P	110	26	-	56	8.5	6.5	9	4	1	¥ 7,830
<b>M12 × 1.25</b>	P4	SY012NSOCLJ	2.5P	110	26	-	56	8.5	6.5	9	4	1	¥ 7,830
<b>M14 × 2</b>	P5	SY014QTOCLJ	2.5P	110	26	-	56	10.5	8	11	4	1	¥ 10,900
<b>M14 × 1.5</b>	P4	SY014SOCLJ	2.5P	110	26	-	56	10.5	8	11	4	1	¥ 10,900
<b>M16 × 2</b>	P5	SY016QTOCLJ	2.5P	110	26	-	56	12.5	10	13	4	1	¥ 14,100
<b>M16 × 1.5</b>	P4	SY016SOCLJ	2.5P	110	26	-	56	12.5	10	13	4	1	¥ 14,100

Spiral fluted Taps for through hole in medium hardness carbon steel

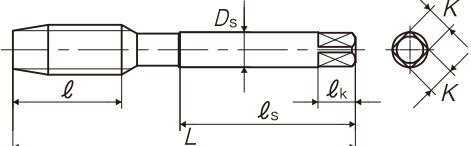
# MHSL



TYPE: 1



TYPE: 2

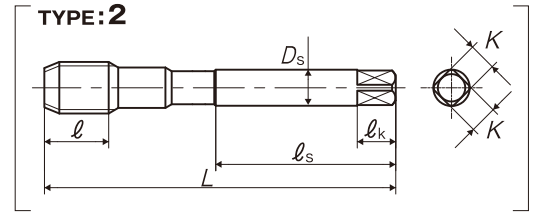
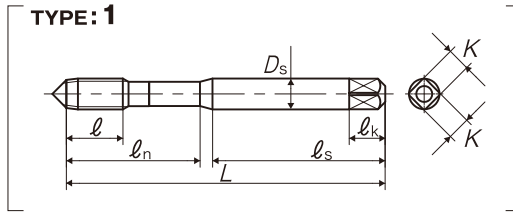


Segment : 1T

Size	Class	Code	Chamfer	L (mm)	l (mm)	l <sub>n</sub> (mm)	l <sub>s</sub> (mm)	D <sub>s</sub> (mm)	K (mm)	l <sub>k</sub> (mm)	No. of flutes	TYPE	MSRP
<b>For Metric Threads</b>													
<b>M6 × 1</b>	P3	MHSLR6.0M5	5P	62	15	26	33	6	4.5	7	3	1	¥ 3,120
<b>M8 × 1.25</b>	P4	MHSLS8.0N5	5P	70	19	-	36	6.2	5	8	3	2	¥ 4,060
<b>M10 × 1.5</b>	P4	MHSLS01005	5P	75	23	-	38	7	5.5	8	3	2	¥ 4,750
<b>M10 × 1.25</b>	P4	MHSLS010N5	5P	75	23	-	38	7	5.5	8	3	2	¥ 4,750
<b>M12 × 1.75</b>	P5	MHSLT012P5	5P	82	26	-	42	8.5	6.5	9	4	2	¥ 6,400
<b>M12 × 1.5</b>	P5	MHSLT01205	5P	82	26	-	42	8.5	6.5	9	4	2	¥ 6,400
<b>M12 × 1.25</b>	P5	MHSLT012N7	7P	82	26	-	42	8.5	6.5	9	4	2	¥ 6,400
<b>M14 × 1.5</b>	P5	MHSLT01407	7P	88	26	-	45	10.5	8	11	4	2	¥ 8,660
<b>M16 × 1.5</b>	P5	MHSLT01607	7P	95	26	-	48	12.5	10	13	4	2	¥ 11,800

Roll taps for medium hardness carbon steel

# MHRZ



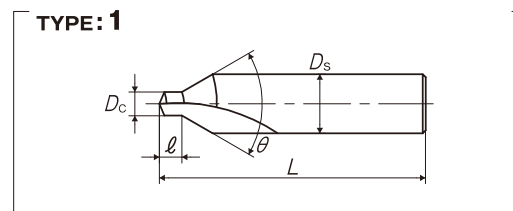
Segment : 1J

Size	Class	Code	Chamfer	L (mm)	l (mm)	ln (mm)	ls (mm)	Ds (mm)	K (mm)	lk (mm)	Lobe	TYPE	MSRP
<b>For Metric Threads</b>													
M6 × 1	G8	RY6.0M80CTP	4P	62	11	26	33	6	4.5	7	5	1	¥ 4,510
M6 × 1	G8	RY6.0M80CTB	2P	62	11	26	33	6	4.5	7	5	1	¥ 4,510
M8 × 1.25	G8	RY8.0N80CTP	4P	70	12	-	36	6.2	5	8	6	2	¥ 6,120
M8 × 1.25	G8	RY8.0N80CTB	2P	70	12	-	36	6.2	5	8	6	2	¥ 6,120
M10 × 1.5	G8	RY10.0O80CTP	4P	75	13	-	38	7	5.5	8	8	2	¥ 7,400
M10 × 1.5	G8	RY10.0O80CTB	2P	75	13	-	38	7	5.5	8	8	2	¥ 7,400
M10 × 1.25	G8	RY10.1N80CTP	4P	75	13	-	38	7	5.5	8	8	2	¥ 7,400
M10 × 1.25	G8	RY10.1N80CTB	2P	75	13	-	38	7	5.5	8	8	2	¥ 7,400
M12 × 1.75	G8	RY12.2P80CTP	4P	82	15	-	42	8.5	6.5	9	8	2	¥ 11,400
M12 × 1.75	G8	RY12.2P80CTB	2P	82	15	-	42	8.5	6.5	9	8	2	¥ 11,400
M12 × 1.5	G8	RY12.2O80CTP	4P	82	15	-	42	8.5	6.5	9	8	2	¥ 11,400
M12 × 1.5	G8	RY12.2O80CTB	2P	82	15	-	42	8.5	6.5	9	8	2	¥ 11,400
M12 × 1.25	G8	RY12.2N80CTP	4P	82	15	-	42	8.5	6.5	9	8	2	¥ 11,400
M12 × 1.25	G8	RY12.2N80CTB	2P	82	15	-	42	8.5	6.5	9	8	2	¥ 11,400
M14 × 1.5	G9	RY14.0Q90CTP	4P	88	18	-	45	10.5	8	11	8	2	¥ 15,400
M14 × 1.5	G9	RY14.0Q90CTB	2P	88	18	-	45	10.5	8	11	8	2	¥ 15,400
M16 × 1.5	G9	RY16.0R90CTP	4P	95	18	-	48	12.5	10	13	8	2	¥ 19,300
M16 × 1.5	G9	RY16.0R90CTB	2P	95	18	-	48	12.5	10	13	8	2	¥ 19,300
M18 × 1.5	G10	RY18.0O00CTP	4P	100	20	-	51	14	11	14	8	2	¥ 27,100
M18 × 1.5	G10	RY18.0O00CTB	2P	100	20	-	51	14	11	14	8	2	¥ 27,100
M20 × 1.5	G10	RY20.0O00CTP	4P	105	20	-	50	15	12	15	8	2	¥ 31,800
M20 × 1.5	G10	RY20.0O00CTB	2P	105	20	-	50	15	12	15	8	2	¥ 31,800

Number of oil grooves: M6 = 5, M8 = 6, M10 and larger = 8 For M6 and smaller, external centers of 2 thread chamfer taps are removed.

Center Drills for Carbon Steels of Medium Hardness for High Speed machining

# MHCDS



Segment : 51

Size Dc × θ × Ds	Code	Ds (mm)	Dc (mm)	L (mm)	l (mm)	TYPE	MSRP
1 × 60° × 4	VMHCD1.0S	4	1	30	1	1	¥ 2,600
1.5 × 60° × 5	VMHCD1.5S	5	1.5	30	1.5	1	¥ 2,470
2 × 60° × 6	VMHCD2.0S	6	2	30	1.9	1	¥ 2,700
2.5 × 60° × 8	VMHCD2.5S	8	2.5	40	2.4	1	¥ 3,270
3 × 60° × 8	VMHCD3.0S	8	3	40	2.8	1	¥ 3,270
4 × 60° × 10	VMHCD4.0S	10	4	45	3.8	1	¥ 4,780
5 × 60° × 12	VMHCD5.0S	12	5	55	4.6	1	¥ 6,170
6 × 60° × 16	VMHCD6.0S	16	6	65	5.5	1	¥ 14,400

### Warning

- ◆ Tools may shatter. Wear cover or eye glasses to avoid injury during tapping.
- ◆ Tools may shatter. Use tools under the proper tapping condition.
- ◆ Never wear gloves during turning operations as the gloves may get caught with the tools.
- ◆ Wear safety shoes to avoid injuring yourself by the falling tools.
- ◆ On attaching tools to the machine, fasten firmly to avoid chattering and run-out.
- ◆ Fasten the work pieces firmly so that they never move during operation. Never use worn tools or damaged tools with chipping.
- ◆ Take a special care to fire trouble. High temperature during machining may cause fire.

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