

Tools for Small Part Machining

Series
Expansion

Series Continues to Evolve



- For Carbon Steels **MS6015** Negative Inserts **FS** Breaker
Positive Inserts **LS-P** Breaker
- Solid Carbide Drills for Centering and Chamfering Leading Drill Series **DLE**
- Solid Carbide Flat Bottom Drills **MFE** Series

PVD Coated Cemented Carbide Grade for Carbon Steels

MS6015

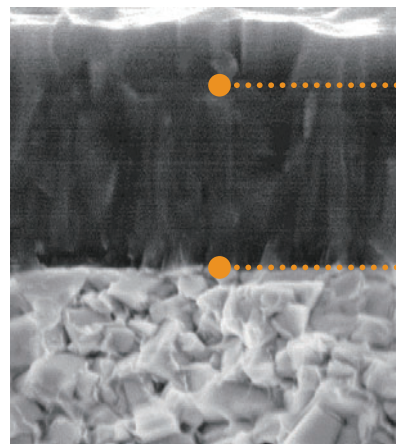
Skilled at pure irons, carbon steels and free cutting steels turning and achieving implemented stable finished surfaces and excellent dimensional accuracy.

Features 1

A fine compatible collaboration of a special carbide substrate and a new PVD coating that greatly improves wear resistance.

	MS6015	Conventional
Coating	TiCN Multi-layer	TiAlN
Hardness (HV)	3000	2800
Wear Coefficient (Carbon Steels)	Low	High
Base Material Hardness (HRA)	92.0	92.0
T.R.S (GPa)	2.0	2.0

Ti-C-N Multi-layer Coating



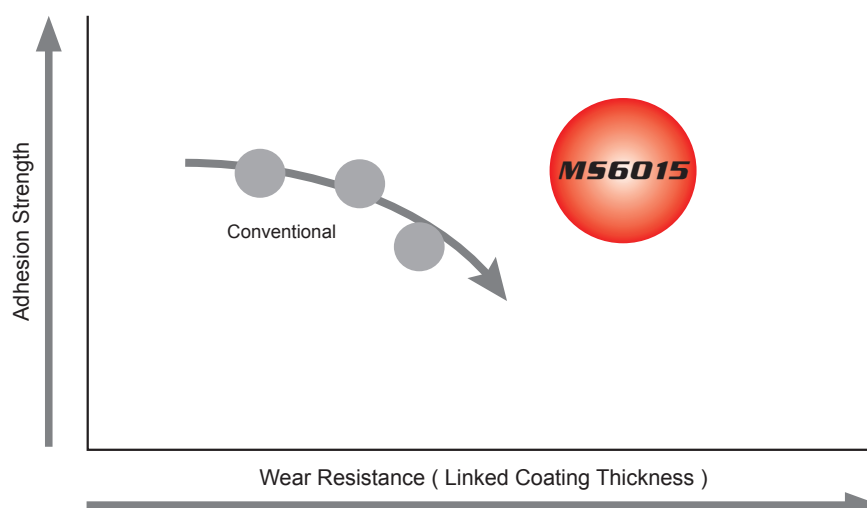
Superior wear and welding resistance and demonstrating the best possible results for carbon steels.

Minute multi-layers remarkably improve welding.

Excellent chip discharge with a reduced coefficient of friction creates a stabilized turning surface.

Optimizing the Laminated Structure

Optimizing the laminated structure enables the thickening of coating which leads to significant wear resistance.

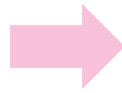


Features 2

Set the corner radius to a minus tolerance.

Order
Number

DCGT11T302 M R-SN
DCGT11T304 M -SMG



02M R0.18mm (R0.15 – R0.20mm)
04M R0.38mm (R0.35 – R0.40mm)

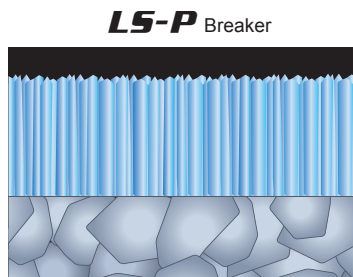
Light Cutting **LS-P** Breaker

Polished (mirror-surface) finish
of insert surfaces drastically
improves welding resistance
extending tool life.



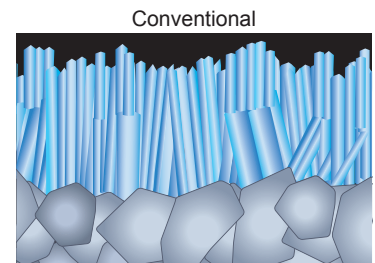
By flattening the substrate surface,
the coating particles crystals form
straightly, leading to stable cutting and
welding prevention.

*Graphical Representation.



Flat Substrate Surface

Coating layer forms straightly.
Coating surface is smooth and prevents
welding.



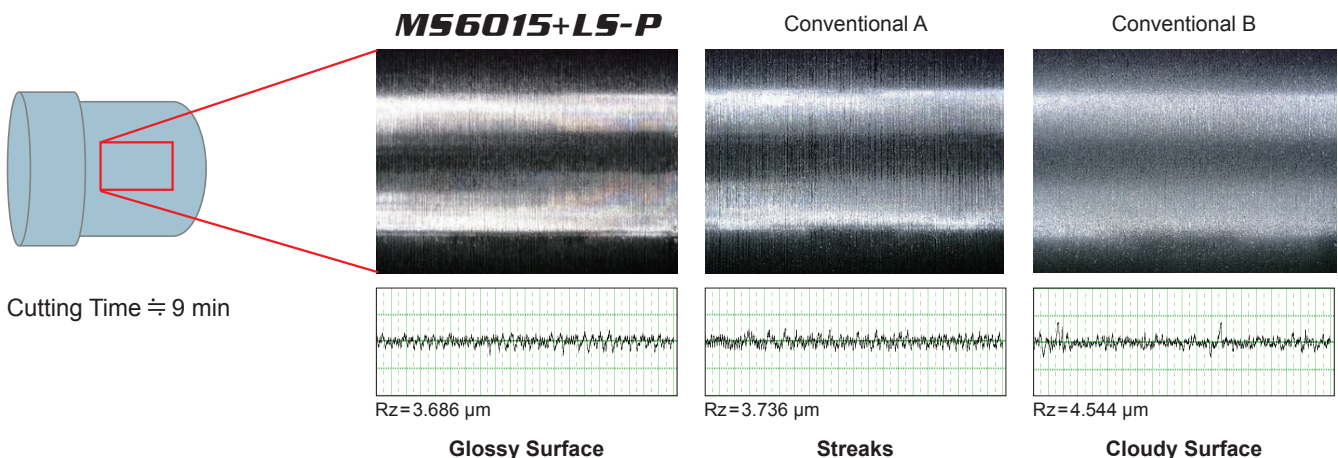
Uneven Substrate Surface

Coating layer forms irregularly.
Low cutting performance due to voids
and defects.

Cutting Performance

Surface Roughness in Soft Magnetic Iron Cutting

High quality worked surface preventing cloudiness.

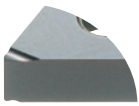


<Cutting Conditions>
Work Material : ELCH2
Insert : DCGT11T302M-LS-P
Grade : MS6015
Cutting Speed : vc=100m/min

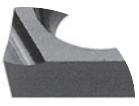
Feed per Rev. : f=0.03mm/rev
Depth of Cut : ap=0.5mm
Cutting Mode : Wet Cutting (Water-insoluble)
Machine : CNC Automatic Lathes

Breaker System

Negative Inserts

Application	Tolerance	Breaker Name and Picture	Features	Cross Section Geometry
Finish Cutting	G	R/L-FS 	Precise Finishing Double-sided chip breaker. A narrow lead chip breaker for good chip control. Sharp cutting edge gives a good surface finish.	Carbon Steel • Alloy Steel ap (mm) vs f (mm/rev) graph showing a narrow lead chip breaker. Cross section geometry showing a 14° flank angle.

Positive Inserts

Application	Tolerance	Breaker Name and Picture	Features	Cross Section Geometry
Finish Cutting	G	R/L-F 	Finish Cutting of Automatic Lathe Machining Lead chip breaker controls chip flow. Sharp cutting edge gives a good surface finish.	Carbon Steel • Alloy Steel ap (mm) vs f (mm/rev) graph showing a lead chip breaker. Cross section geometry showing a 17° flank angle.
Light Cutting	G	LS-P 	Light Cutting of Automatic Lathe Machining Designed with parallel cutting edges. Achieves stable chip control over a wide range from low to medium depths of cut. Polished (mirror-surface) finish of insert surface drastically improves welding resistance extending tool life.	Carbon Steel • Alloy Steel ap (mm) vs f (mm/rev) graph showing a parallel cutting edge. Cross section geometry showing a 12° nose angle and a 6° flank angle.
	G	R/L-SS 	Light Cutting of Automatic Lathe Machining A parallel chip breaker. Excellent chip control at low feed rates.	Carbon Steel • Alloy Steel ap (mm) vs f (mm/rev) graph showing a parallel chip breaker. Cross section geometry showing a 14° flank angle.
Medium Cutting	G	R/L-SN 	Medium Cutting of Automatic Lathe Machining A parallel chip breaker. Excellent chip control at low to medium feed rates.	Carbon Steel • Alloy Steel ap (mm) vs f (mm/rev) graph showing a parallel chip breaker. Cross section geometry showing a 20° flank angle.
	G	SMG 	Medium Cutting of Automatic Lathe Machining 3D molded chip breaker provides good chip control. G class insert gives sharp cutting action, allowing high precision machining. Breaker geometry appropriate for copying and back turning.	Carbon Steel • Alloy Steel ap (mm) vs f (mm/rev) graph showing a 3D molded chip breaker. Cross section geometry showing a 14° nose angle and a 9° flank angle.

Recommended Cutting Conditions

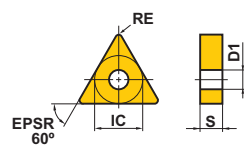
	Work Material	Grade	vc (m/min)	f (mm/rev)
P	Carbon Steels • Alloy Steels	MS6015	100 (50—150)	0.08 (0.01—0.15)
	Pure Irons • Free Cutting Steels		150 (50—250)	0.08 (0.01—0.15)
M	Stainless Steels	MS6015	80 (50—120)	0.06 (0.02—0.1)

MS6015

Negative Inserts (With Hole)

G Class

TNGG



RE : Set the corner radius to a minus tolerance.

(mm)

Order Number	Cutting Area	Stock		IC	S	RE	D1
		MS6015					
NEW TNGG160402R-FS	F	●		9.525	4.76	0.2	3.81
NEW TNGG160402L-FS	F	●		9.525	4.76	0.2	3.81
NEW TNGG160404R-FS	F	●		9.525	4.76	0.4	3.81
NEW TNGG160404L-FS	F	●		9.525	4.76	0.4	3.81
NEW TNGG160408R-FS	F	●		9.525	4.76	0.8	3.81
NEW TNGG160408L-FS	F	●		9.525	4.76	0.8	3.81

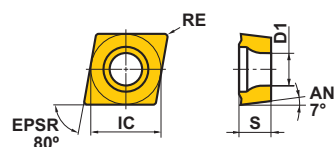
Finish		
R/L-FS		
		

MS6015

7° Positive Inserts (With Hole)

G Class

CCGH
CCGT



RE : Set the corner radius to a minus tolerance.

Order Number	Cutting Area	Stock		IC	S	RE	D1
		MS6015					
NEW CCGH060202MR-F	F	●		6.35	2.38	0.2	2.8
NEW CCGH060202ML-F	F	●		6.35	2.38	0.2	2.8
NEW CCGH060204MR-F	F	●		6.35	2.38	0.4	2.8
NEW CCGH060204ML-F	F	●		6.35	2.38	0.4	2.8
NEW CCGT03S101MR-F	F	●		3.57	1.39	0.1	2
NEW CCGT03S101ML-F	F	●		3.57	1.39	0.1	2
NEW CCGT03S102MR-F	F	●		3.57	1.39	0.2	2
NEW CCGT03S102ML-F	F	●		3.57	1.39	0.2	2
NEW CCGT03S104MR-F	F	●		3.57	1.39	0.4	2
NEW CCGT03S104ML-F	F	●		3.57	1.39	0.4	2
NEW CCGT04T001MR-F	F	●		4.37	1.79	0.1	2.4
NEW CCGT04T001ML-F	F	●		4.37	1.79	0.1	2.4
NEW CCGT04T002MR-F	F	●		4.37	1.79	0.2	2.4
NEW CCGT04T002ML-F	F	●		4.37	1.79	0.2	2.4
NEW CCGT04T004MR-F	F	●		4.37	1.79	0.4	2.4
NEW CCGT04T004ML-F	F	●		4.37	1.79	0.4	2.4
NEW CCGT060201M-LS-P	L	●		6.35	2.38	0.1	2.8
NEW CCGT060202M-LS-P	L	●		6.35	2.38	0.2	2.8
NEW CCGT09T301M-LS-P	L	●		9.525	3.97	0.1	4.4
NEW CCGT09T302M-LS-P	L	●		9.525	3.97	0.2	4.4
NEW CCGT09T304M-LS-P	L	●		9.525	3.97	0.4	4.4
CCGT060201MR-SS	L	●		6.35	2.38	0.1	2.8
NEW CCGT060201ML-SS	L	●		6.35	2.38	0.1	2.8
CCGT060202MR-SS	L	●		6.35	2.38	0.2	2.8
NEW CCGT060202ML-SS	L	●		6.35	2.38	0.2	2.8
CCGT09T301MR-SS	L	●		9.525	3.97	0.1	4.4
NEW CCGT09T301ML-SS	L	●		9.525	3.97	0.1	4.4
CCGT09T302MR-SS	L	●		9.525	3.97	0.2	4.4
NEW CCGT09T302ML-SS	L	●		9.525	3.97	0.2	4.4
CCGT09T304MR-SS	L	●		9.525	3.97	0.4	4.4
NEW CCGT09T304ML-SS	L	●		9.525	3.97	0.4	4.4

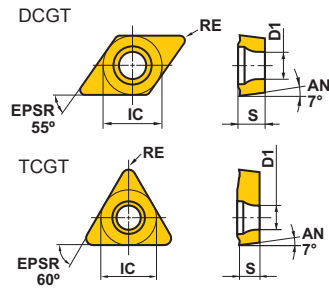
Finish	Light	Light
R/L-F	LS-P	R/L-SS
Medium	Medium	
R/L-SN	SMG	

(mm)

Order Number	Cutting Area	Stock		IC	S	RE	D1
		MS6015					
CCGT060201MR-SN	M	●		6.35	2.38	0.1	2.8
NEW CCGT060201ML-SN	M	●		6.35	2.38	0.1	2.8
CCGT060202MR-SN	M	●		6.35	2.38	0.2	2.8
NEW CCGT060202ML-SN	M	●		6.35	2.38	0.2	2.8
CCGT09T301MR-SN	M	●		9.525	3.97	0.1	4.4
NEW CCGT09T301ML-SN	M	●		9.525	3.97	0.1	4.4
CCGT09T302MR-SN	M	●		9.525	3.97	0.2	4.4
NEW CCGT09T302ML-SN	M	●		9.525	3.97	0.2	4.4
CCGT09T304MR-SN	M	●		9.525	3.97	0.4	4.4
NEW CCGT09T304ML-SN	M	●		9.525	3.97	0.4	4.4
CCGT060201M-SMG	M	●		6.35	2.38	0.1	2.8
CCGT060202M-SMG	M	●		6.35	2.38	0.2	2.8
CCGT060204M-SMG	M	●		6.35	2.38	0.4	2.8
CCGT09T301M-SMG	M	●		9.525	3.97	0.1	4.4
CCGT09T302M-SMG	M	●		9.525	3.97	0.2	4.4
CCGT09T304M-SMG	M	●		9.525	3.97	0.4	4.4

7° Positive Inserts (With Hole)

G Class



RE : Set the corner radius to a minus tolerance.

Order Number	Cutting Area	Stock		IC	S	RE	D1
		MS6015					
NEW DCGT070201M-LS-P	L	●		6.35	2.38	0.1	2.8
NEW DCGT070202M-LS-P	L	●		6.35	2.38	0.2	2.8
NEW DCGT070204M-LS-P	L	●		6.35	2.38	0.4	2.8
NEW DCGT11T301M-LS-P	L	●		9.525	3.97	0.1	4.4
NEW DCGT11T302M-LS-P	L	●		9.525	3.97	0.2	4.4
NEW DCGT11T304M-LS-P	L	●		9.525	3.97	0.4	4.4
DCGT070201MR-SS	L	●		6.35	2.38	0.1	2.8
NEW DCGT070201ML-SS	L	●		6.35	2.38	0.1	2.8
DCGT070202MR-SS	L	●		6.35	2.38	0.2	2.8
NEW DCGT070202ML-SS	L	●		6.35	2.38	0.2	2.8
DCGT11T301MR-SS	L	●		9.525	3.97	0.1	4.4
NEW DCGT11T301ML-SS	L	●		9.525	3.97	0.1	4.4
DCGT11T302MR-SS	L	●		9.525	3.97	0.2	4.4
NEW DCGT11T302ML-SS	L	●		9.525	3.97	0.2	4.4
DCGT11T304MR-SS	L	●		9.525	3.97	0.4	4.4
NEW DCGT11T304ML-SS	L	●		9.525	3.97	0.4	4.4
DCGT070201MR-SN	M	●		6.35	2.38	0.1	2.8
NEW DCGT070201ML-SN	M	●		6.35	2.38	0.1	2.8
DCGT070202MR-SN	M	●		6.35	2.38	0.2	2.8
NEW DCGT070202ML-SN	M	●		6.35	2.38	0.2	2.8
DCGT11T301MR-SN	M	●		9.525	3.97	0.1	4.4
NEW DCGT11T301ML-SN	M	●		9.525	3.97	0.1	4.4
DCGT11T302MR-SN	M	●		9.525	3.97	0.2	4.4
NEW DCGT11T302ML-SN	M	●		9.525	3.97	0.2	4.4
DCGT11T304MR-SN	M	●		9.525	3.97	0.4	4.4
NEW DCGT11T304ML-SN	M	●		9.525	3.97	0.4	4.4
DCGT070201M-SMG	M	●		6.35	2.38	0.1	2.8
DCGT070202M-SMG	M	●		6.35	2.38	0.2	2.8
DCGT070204M-SMG	M	●		6.35	2.38	0.4	2.8
DCGT11T301M-SMG	M	●		9.525	3.97	0.1	4.4
DCGT11T302M-SMG	M	●		9.525	3.97	0.2	4.4
DCGT11T304M-SMG	M	●		9.525	3.97	0.4	4.4

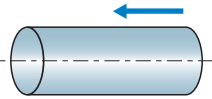
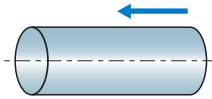
Light	Light	Medium	Medium
LS-P	R/L-SS	R/L-SN	SMG
Finish			
R/L-F			

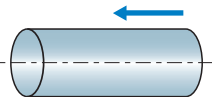
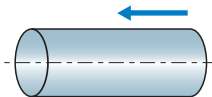
(mm)

Order Number	Cutting Area	Stock		IC	S	RE	D1
		MS6015					
NEW TCGT060101MR-F	F	●		3.97	1.59	0.1	2.3
NEW TCGT060101ML-F	F	●		3.97	1.59	0.1	2.3
NEW TCGT060102MR-F	F	●		3.97	1.59	0.2	2.3
NEW TCGT060102ML-F	F	●		3.97	1.59	0.2	2.3
NEW TCGT060104MR-F	F	●		3.97	1.59	0.4	2.3
NEW TCGT060104ML-F	F	●		3.97	1.59	0.4	2.3

PVD Coated Cemented Carbide Grade for Carbon Steels

Application Example

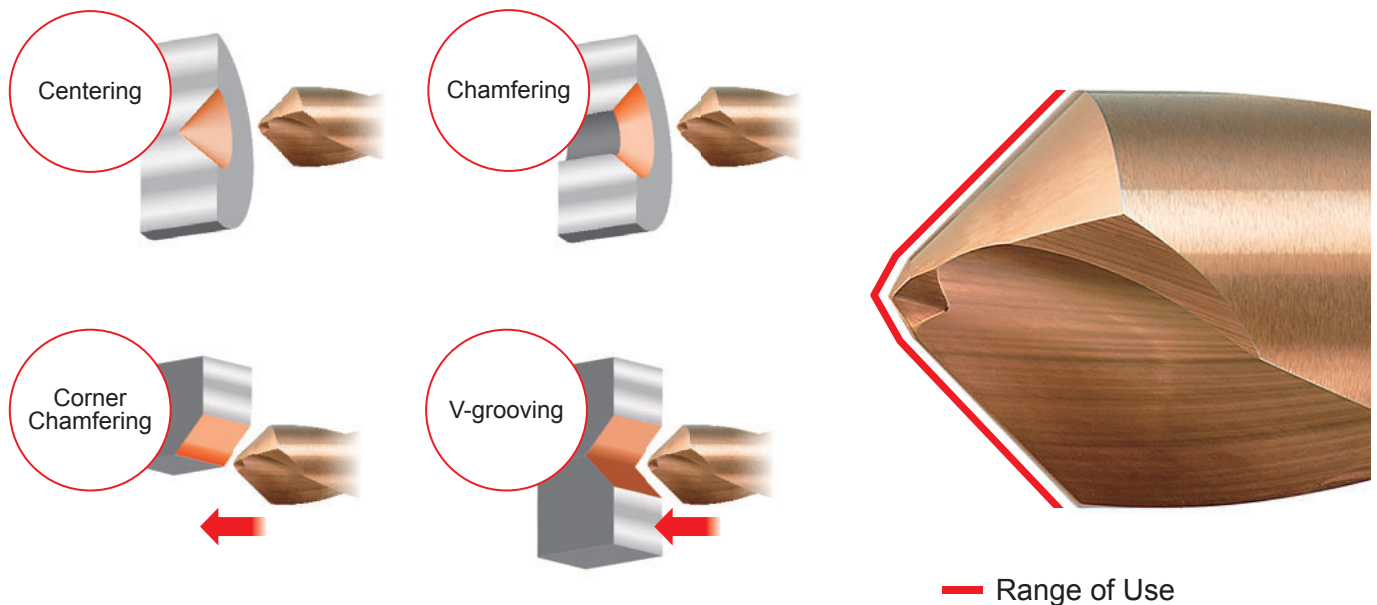
Insert (Grade)		DCGT11T302M-SMG (MS6015)	DCGT11T301MR-SN (MS6015)
Workpiece		Iron-based Soft Magnetic Material (ELCH2) 	Free Cutting Steel (JIS SUM24L) 
Cutting Conditions	Cutting Speed vc (m/min)	197 (4500min ⁻¹)	125 (5000min ⁻¹)
	Feed per Rev. f (mm/rev)	0.1	0.05
	Depth of Cut ap (mm)	0.1	0.3
Cutting Mode		Wet Cutting (Water-insoluble)	Wet Cutting (Water-insoluble)
Machine		CNC Automatic Lathes	CNC Automatic Lathes
Results		Number of Workpieces (pcs. /corner) 250 500 MS6015  Conventional  An excellent finished surface and 1.4 times longer life compared with conventional products. Stable SMG breaker and chip discharge management.	Number of Workpieces (pcs. /corner) 1000 2000 3000 MS6015  Conventional  MS6015 has minimal welding and maintains secure dimensional accuracy.

Insert (Grade)		DCGT11T302MR-SN (MS6015)	DCGT11T302M-SMG (MS6015)
Workpiece		Carbon Steel (AISI 1045) 	Mild Steel (AISI 1015) 
Cutting Conditions	Cutting Speed vc (m/min)	113 (3000min ⁻¹)	100 (1300min ⁻¹)
	Feed per Rev. f (mm/rev)	0.03	0.12
	Depth of Cut ap (mm)	1.0	1.3
Cutting Mode		Wet Cutting (Water-insoluble)	Wet Cutting (Water-insoluble)
Machine		CNC Automatic Lathes	CNC Automatic Lathes
Results		Number of Workpieces (pcs. /corner) 500 1000 1500 MS6015  Conventional  MS6015 has superior wear resistance and achieves double longer life compared with conventional products.	Number of Workpieces (pcs. /corner) 250 500 MS6015  Conventional  MS6015 has superior welding resistance and achieves 1.3 times longer life compared with conventional products.

Solid Carbide Drills for Centering and Chamfering

Leading Drill Series ***DLE***

Completes strict standards for centering and chamfering.



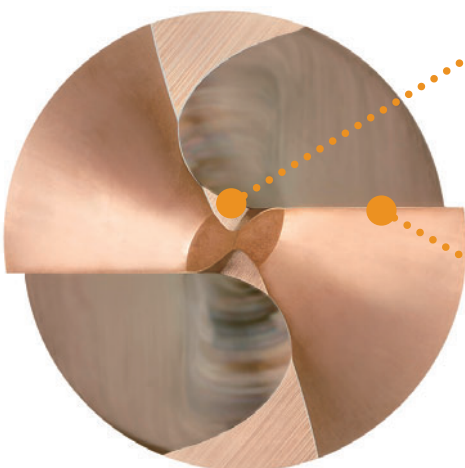
Features

Thinning Geometry

The thinning pocket promotes smooth chip discharge and brings excellent hole position accuracy. Additionally, the negative cutting edge of the drill point offers high cutting edge strength.

Sharp Cutting Edge and High Fracture Resistance

A cutting edge shape with sharp and high fracture resistance, stable cutting and burr prevention are possible.



DLE



Conventional

Two-step Point Angles

Two-step point angles ensure strength at the center and prevent sudden fracturing.

*The central area will not have a 90° hole bottom.

DLE



High Strength of Center

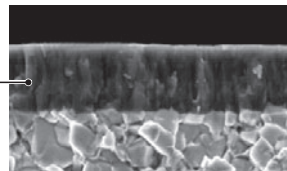
Conventional



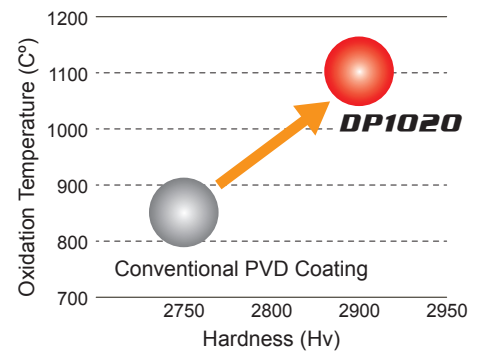
Fractures of Center

Coated Grade **DP1020**

DP1020 grade offers excellent wear resistance and reduced friction for longer tool life and a versatile range of applications.



With Accumulated Al-Ti-Cr-N Based PVD Coating



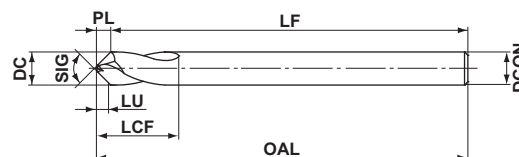
Extensive Support for CNC Automatic Lathes

Diverse lineup of shanks compatible with ER collets.

DCON(Connection Diameter) 5mm=ER8

DCON 7mm=ER11

P M K N S H



	DCON=3	3 < DCON ≤ 6	6 < DCON ≤ 10	10 < DCON ≤ 16
h7	$\begin{matrix} 0 \\ -0.010 \end{matrix}$	$\begin{matrix} 0 \\ -0.012 \end{matrix}$	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	$\begin{matrix} 0 \\ -0.018 \end{matrix}$

External Coolant

(mm)

DC	SIG	DP1020	Order Number	LU	LCF	OAL	LF	PL	DCON
3	90°	●	DLE0300S030P090	1.2	9	45	43.7	1.3	3
4	90°	●	DLE0400S040P090	1.6	12	50	48.3	1.7	4
5	90°	●	DLE0500S050P090	2.0	14	60	57.9	2.1	5
6	90°	●	DLE0600S060P090	2.4	15	66	63.4	2.6	6
7	90°	●	DLE0700S070P090	2.8	18	74	71.0	3.0	7
8	90°	●	DLE0800S080P090	3.2	20	74	70.6	3.4	8
10	90°	●	DLE1000S100P090	4.1	24	84	79.7	4.3	10
12	90°	●	DLE1200S120P090	4.9	28	95	89.9	5.1	12
16	90°	●	DLE1600S160P090	6.6	35	113	106.2	6.8	16

(Note 1) In the region of roughly $DC/4$, which is the region of the two-step point angles, the central area will not have a 90° hole bottom. Chamfering will also not be possible in this region.

(Note 2) The centering diameter should be less than the drill diameter (processing diameter) **DC** and the usable length **LU** should be referred to as a guideline.

DC = Cutting Diameter
LU = Usable Length
LCF = Length Chip Flute

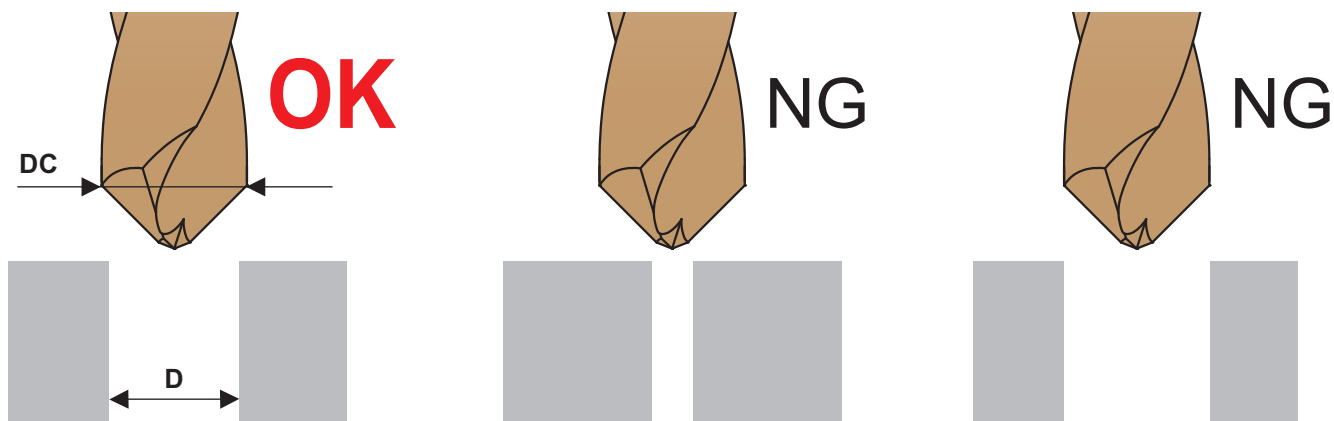
OAL = Overall Length
LF = Functional Length
PL = Point Length

DCON = Connection Diameter
SIG = Point Angle

Drill Diameter Selection

When Chamfering

With respect to guide hole diameter **D**, select the drill diameter (cutting diameter) **DC** to be within the range of $D < DC < 2D$.



If **DC** is equal to or greater than $2D$:

If drill diameter **DC** is too large compared to guide hole diameter **D** (equal to or greater than $2D$), chamfering cannot be performed.

If **DC** is a drill diameter equal to **D**:

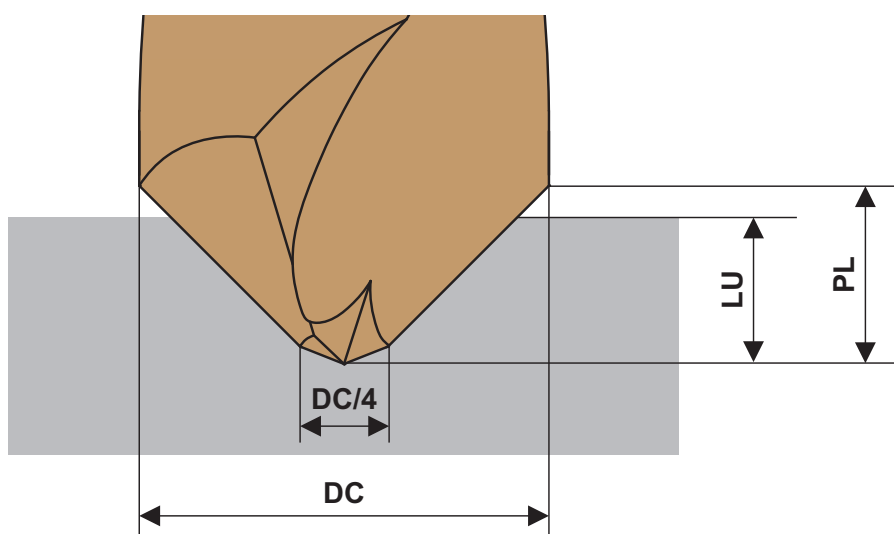
Chamfering cannot be performed if drill diameter **DC** is the same as guide hole diameter **D**.

Example) If guide hole diameter **D** is 5 mm: Drill diameter **DC** should be greater than 6 mm but less than 10 mm. Select a **DC** of 6 mm, 7 mm, or 8 mm.

When Centering

The tool cannot be used for processing if the centering diameter has the same guide hole diameter as drill diameter **DC**. Refer to the usable length **LU** (page 3) as a guideline.

In the region of roughly $DC/4$, which is the region of the two-step point angles, the central area will not have a 90° hole bottom.



Recommended Cutting Conditions

(mm)

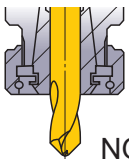
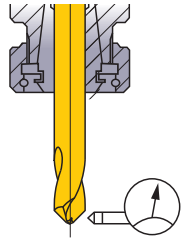
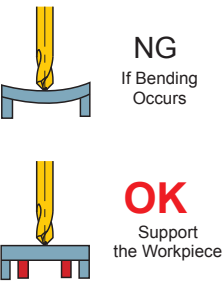
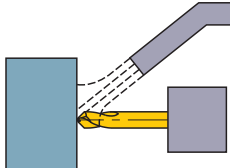
Work Material	Mild Steels ($\leq 180\text{HB}$)		Carbon Steels, Alloy Steels (180—280HB)		Carbon Steels, Alloy Steels (280—350HB)	
	AISI 1010 etc.		AISI 1045, 4140 etc.		AISI 4340 etc.	
DC	n (min^{-1})	fr (Min.—Max.) (mm/rev)	n (min^{-1})	fr (Min.—Max.) (mm/rev)	n (min^{-1})	fr (Min.—Max.) (mm/rev)
3	7900	0.06 (0.04—0.08)	6800	0.06 (0.04—0.08)	6300	0.05 (0.03—0.07)
4	5900	0.06 (0.04—0.08)	5100	0.06 (0.04—0.08)	4700	0.05 (0.03—0.07)
5	5000	0.07 (0.05—0.09)	4400	0.07 (0.05—0.09)	4100	0.06 (0.04—0.08)
6	4200	0.07 (0.05—0.09)	3700	0.07 (0.05—0.09)	3400	0.06 (0.04—0.08)
7	3600	0.08 (0.05—0.10)	3100	0.08 (0.05—0.10)	2900	0.06 (0.04—0.08)
8	3100	0.08 (0.05—0.10)	2700	0.08 (0.05—0.10)	2500	0.06 (0.04—0.08)
10	2700	0.09 (0.05—0.11)	2300	0.09 (0.05—0.11)	2200	0.07 (0.04—0.09)
12	2200	0.09 (0.05—0.11)	1900	0.09 (0.05—0.11)	1800	0.07 (0.04—0.09)
16	1700	0.12 (0.10—0.14)	1500	0.12 (0.10—0.14)	1400	0.08 (0.06—0.10)

Work Material	Austenitic Stainless Steels ($\leq 200\text{HB}$)		Gray Cast Irons ($\leq 350\text{MPa}$)		Ductile Cast Irons ($\leq 450\text{MPa}$)	
	AISI 304, 316 etc.		AISI No45B etc.		AISI 60-40-18 etc.	
DC	n (min^{-1})	fr (Min.—Max.) (mm/rev)	n (min^{-1})	fr (Min.—Max.) (mm/rev)	n (min^{-1})	fr (Min.—Max.) (mm/rev)
3	1500	0.04 (0.02—0.06)	7900	0.06 (0.04—0.08)	5800	0.06 (0.04—0.08)
4	1100	0.04 (0.02—0.06)	5900	0.06 (0.04—0.08)	4300	0.06 (0.04—0.08)
5	1200	0.06 (0.04—0.08)	5000	0.07 (0.05—0.09)	3800	0.07 (0.05—0.09)
6	1000	0.06 (0.04—0.08)	4200	0.07 (0.05—0.09)	3100	0.07 (0.05—0.09)
7	900	0.06 (0.04—0.08)	3600	0.08 (0.05—0.10)	2700	0.07 (0.05—0.09)
8	790	0.06 (0.04—0.08)	3100	0.08 (0.05—0.10)	2300	0.07 (0.05—0.09)
10	630	0.06 (0.04—0.08)	2700	0.09 (0.05—0.11)	1900	0.08 (0.05—0.10)
12	530	0.06 (0.04—0.08)	2200	0.09 (0.05—0.11)	1500	0.08 (0.05—0.10)
16	390	0.08 (0.06—0.10)	1700	0.12 (0.10—0.14)	1100	0.11 (0.09—0.13)

(Note 1) When chamfering a circumference of a guide hole, make sure that the tool diameter(DC) is $D < DC < 2D$.

(Note 2) When V-grooving and chamfering, please reduce cutting conditions.

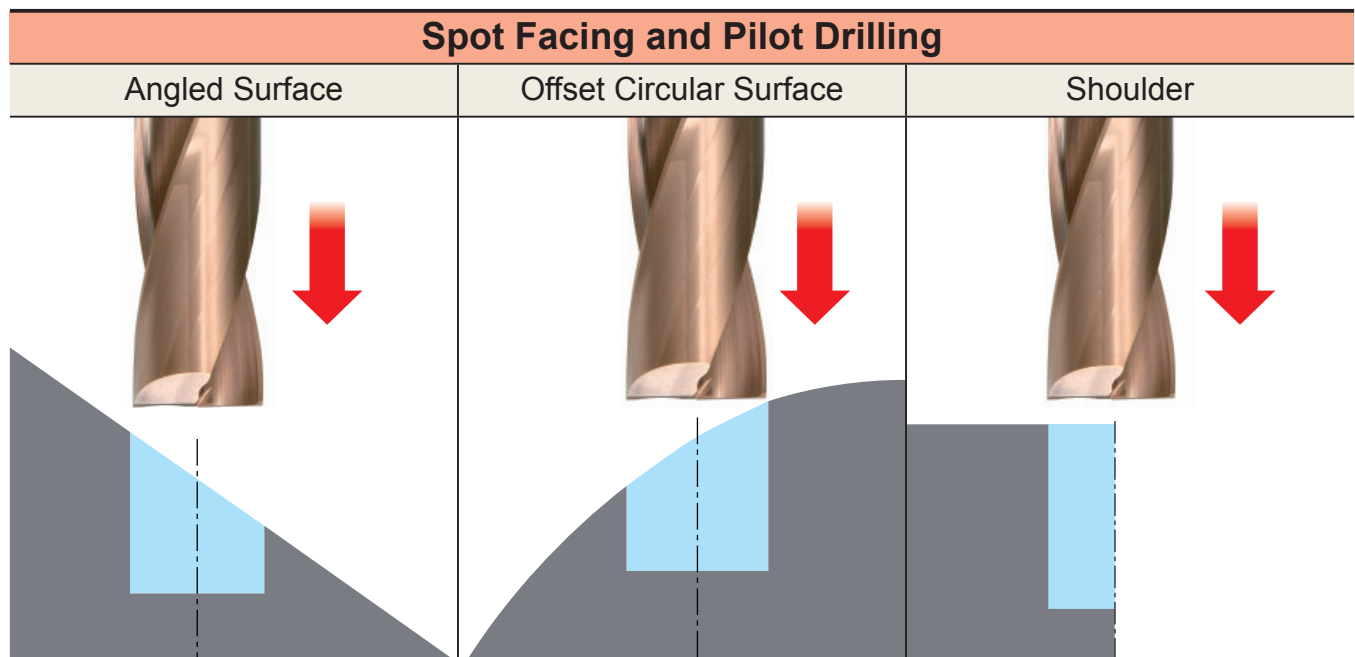
Operational Guidance

Drill Holding	Drill Installation	Installation Tolerance	Thin Workpiece	Coolant Method
 Collet chuck holds the drill securely.	 Do not clamp on the flutes.	 Run-out $\leq 0.03\text{mm}$	 NG If Bending Occurs OK Support the Workpiece	 Coolant positions, at the end at the center are ideal.

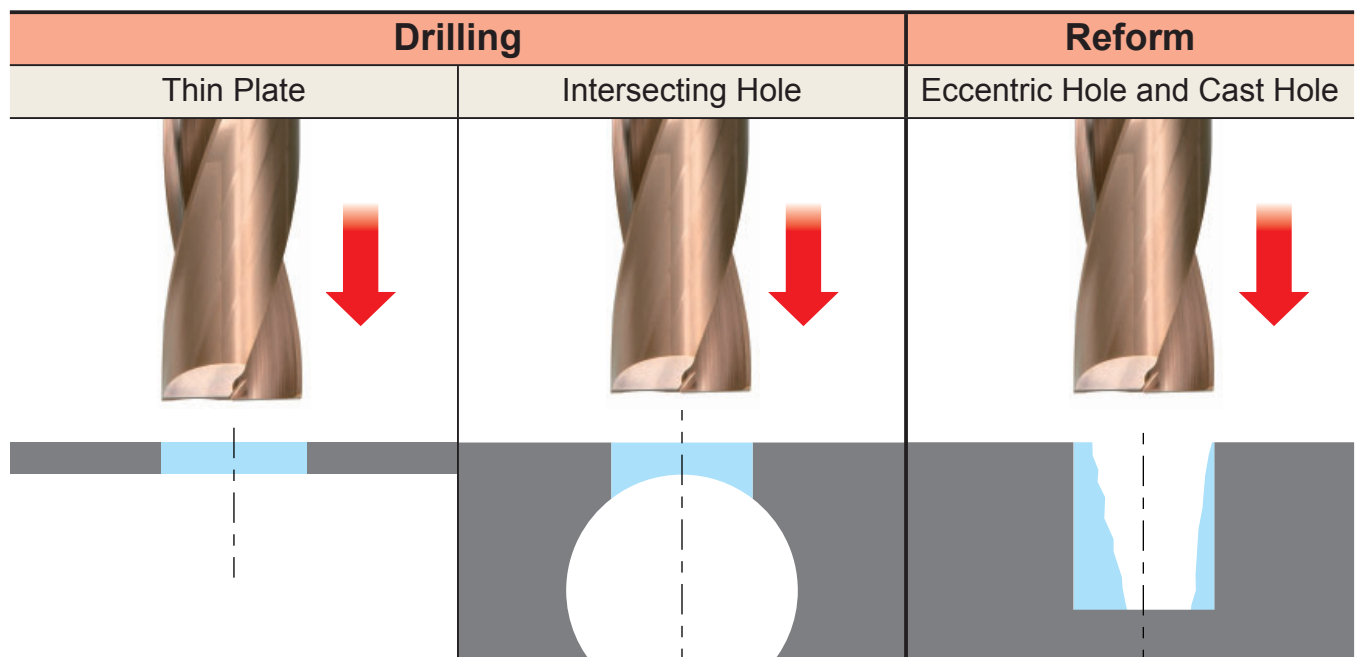
Solid Carbide Flat Bottom Drills

MFE Series

High Efficiency Drilling in Various Types of Machining



High efficiency counter boring in various types of machining with excellent chipping resistance.



Low cutting force provides less burr.

Excellent performance in correction of eccentric hole and cast hole due to high position accuracy.

NEW

Features Small Dia. DC<3mm

Excellent Chip Control

Combination of different radius sizes provides strong cutting edge and excellent chip control.

Thinning with Lower Thrust Force

Ideal chip shape formed by the radius form, securing the chip pocket on the center part, thereby dramatically reducing the cutting resistance.



MFE



Conventional

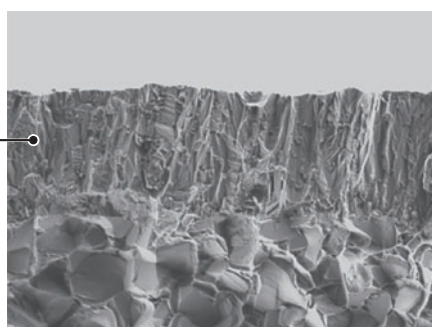
Unique Sharp Cutting Edges

The flat lands on the cutting edge corners provide greater strength and sharpness, which can substantially reduce the formation of burrs.

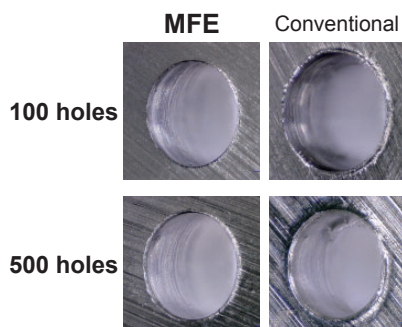
Sharp Cutting Edges with Long Tool Life

Coated Grade **DP102A**

DP102A is a PVD coated cemented carbide grade specialized for small diameter drills, with greatly improved wear resistance when drilling small-diameter holes at low speeds and low feed conditions. This provides high adhesion and stability even with sharp cutting edges.



Al-Cr-N Based PVD Coating



<Cutting Conditions>

Drill : MFE0100X02S030
Work Material : AISI 304
Hole Depth : 2mm
Cutting Speed : **vc**=25m/min
Feed per Rev. : **fr**=0.007mm/rev
Machine : Vertical MC (BT40)

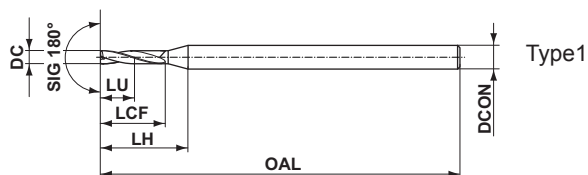
Solid Carbide Flat Bottom Drills

MFE **NEW**

for Small Diameter



P M K N S H



$0.75 \leq DC \leq 2.95$			
0 -0.014			
DCON=3	DCON=4		
0 -0.006	0 -0.008		

External Coolant

(mm)

DC	Hole Depth (L/D)	Stock DP102A	Order Number	LU	LCF	LH	OAL	DCON	Type
0.75	2	●	MFE0075X02S030	1.5	3	7.7	45	3	1
0.8	2	●	MFE0080X02S030	1.6	3.2	7.8	45	3	1
0.85	2	●	MFE0085X02S030	1.7	3.4	7.9	45	3	1
0.9	2	●	MFE0090X02S030	1.8	3.6	8	45	3	1
0.95	2	●	MFE0095X02S030	1.9	3.8	8.1	45	3	1
1	2	●	MFE0100X02S030	2	4	8.2	45	3	1
1.05	2	●	MFE0105X02S030	2.1	4.2	8.3	45	3	1
1.1	2	●	MFE0110X02S030	2.2	4.4	8.4	45	3	1
1.15	2	●	MFE0115X02S030	2.3	4.6	8.6	45	3	1
1.2	2	●	MFE0120X02S030	2.4	4.8	8.7	45	3	1
1.25	2	●	MFE0125X02S030	2.5	5	8.8	45	3	1
1.3	2	●	MFE0130X02S030	2.6	5.2	8.9	45	3	1
1.35	2	●	MFE0135X02S030	2.7	5.4	9	45	3	1
1.4	2	●	MFE0140X02S030	2.8	5.6	9.1	45	3	1
1.45	2	●	MFE0145X02S030	2.9	5.8	9.2	45	3	1
1.5	2	●	MFE0150X02S030	3	6	9.3	45	3	1
1.55	2	●	MFE0155X02S030	3.1	6.2	9.4	45	3	1
1.6	2	●	MFE0160X02S030	3.2	6.4	9.5	45	3	1
1.65	2	●	MFE0165X02S030	3.3	6.6	9.6	45	3	1
1.7	2	●	MFE0170X02S030	3.4	6.8	9.7	45	3	1
1.75	2	●	MFE0175X02S030	3.5	7	9.8	45	3	1
1.8	2	●	MFE0180X02S030	3.6	7.2	9.9	45	3	1
1.85	2	●	MFE0185X02S030	3.7	7.4	10	45	3	1
1.9	2	●	MFE0190X02S030	3.8	7.6	10.2	45	3	1
1.95	2	●	MFE0195X02S030	3.9	7.8	10.3	45	3	1
2	2	●	MFE0200X02S040	4	8	12.2	50	4	1
2.05	2	●	MFE0205X02S040	4.1	8.2	12.3	50	4	1
2.1	2	●	MFE0210X02S040	4.2	8.4	12.4	50	4	1
2.15	2	●	MFE0215X02S040	4.3	8.6	12.6	50	4	1
2.2	2	●	MFE0220X02S040	4.4	8.8	12.7	50	4	1
2.25	2	●	MFE0225X02S040	4.5	9	12.8	50	4	1
2.3	2	●	MFE0230X02S040	4.6	9.2	12.9	50	4	1
2.35	2	●	MFE0235X02S040	4.7	9.4	13	50	4	1
2.4	2	●	MFE0240X02S040	4.8	9.6	13.1	50	4	1
2.45	2	●	MFE0245X02S040	4.9	9.8	13.2	50	4	1
2.5	2	●	MFE0250X02S040	5	10	13.3	50	4	1
2.55	2	●	MFE0255X02S040	5.1	10.2	13.4	50	4	1
2.6	2	●	MFE0260X02S040	5.2	10.4	13.5	50	4	1
2.65	2	●	MFE0265X02S040	5.3	10.6	13.6	50	4	1
2.7	2	●	MFE0270X02S040	5.4	10.8	13.7	50	4	1
2.75	2	●	MFE0275X02S040	5.5	11	13.8	50	4	1
2.8	2	●	MFE0280X02S040	5.6	11.2	13.9	50	4	1
2.85	2	●	MFE0285X02S040	5.7	11.4	14	50	4	1
2.9	2	●	MFE0290X02S040	5.8	11.6	14.2	50	4	1
2.95	2	●	MFE0295X02S040	5.9	11.8	14.3	50	4	1

● : Inventory maintained in Japan.

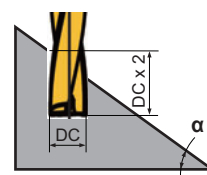
Recommended Cutting Conditions

(mm)

Work Material		Mild Steels ($\leq 180\text{HB}$)		Carbon Steels, Alloy Steels (180—280HB)		Carbon Steels, Alloy Steels (280—350HB)	
		AISI 1010 etc.		AISI 1045, 4140 etc.		AISI 4340 etc.	
DC	L/D	n (min ⁻¹)	$\alpha=0^\circ$ fr (Min.—Max.) (mm/rev)	n (min ⁻¹)	$\alpha=0^\circ$ fr (Min.—Max.) (mm/rev)	n (min ⁻¹)	$\alpha=0^\circ$ fr (Min.—Max.) (mm/rev)
0.75	≤ 2	23300	0.030 (0.010—0.050)	19000	0.030 (0.010—0.050)	16900	0.030 (0.010—0.050)
1.0	≤ 2	17500	0.030 (0.010—0.050)	14300	0.030 (0.010—0.050)	12700	0.030 (0.010—0.050)
1.5	≤ 2	12200	0.035 (0.015—0.055)	10000	0.035 (0.015—0.055)	8400	0.035 (0.015—0.050)
2.0	≤ 2	9500	0.040 (0.020—0.060)	7900	0.040 (0.020—0.060)	6700	0.040 (0.020—0.060)
2.5	≤ 2	7900	0.050 (0.030—0.070)	6600	0.050 (0.030—0.070)	5700	0.050 (0.030—0.070)
3.0	≤ 2	7900	0.060 (0.040—0.080)	7900	0.060 (0.040—0.080)	6800	0.060 (0.040—0.080)
4.0	≤ 2	5900	0.080 (0.060—0.100)	5900	0.080 (0.060—0.100)	5100	0.080 (0.060—0.100)
5.0	≤ 2	4700	0.100 (0.080—0.130)	4700	0.100 (0.080—0.130)	4100	0.100 (0.080—0.130)
6.0	≤ 2	3900	0.130 (0.100—0.150)	3900	0.130 (0.100—0.150)	3400	0.130 (0.100—0.150)
8.0	≤ 2	2900	0.150 (0.130—0.170)	2900	0.150 (0.130—0.170)	2500	0.150 (0.130—0.170)
10.0	≤ 2	2300	0.170 (0.150—0.200)	2300	0.170 (0.150—0.200)	2000	0.170 (0.150—0.200)
12.0	≤ 2	1900	0.200 (0.170—0.250)	1900	0.200 (0.170—0.250)	1700	0.200 (0.170—0.250)
16.0	≤ 2	1400	0.250 (0.200—0.300)	1400	0.250 (0.200—0.300)	1200	0.250 (0.200—0.300)
20.0	≤ 2	1100	0.300 (0.250—0.350)	1100	0.300 (0.250—0.350)	1000	0.300 (0.250—0.350)

Work Material		Austenitic Stainless Steels ($\leq 200\text{HB}$)		Gray Cast Irons ($\leq 350\text{MPa}$)		Ductile Cast Irons ($\leq 450\text{MPa}$)	
		AISI 304, 316 etc.		AISI No45B etc.		AISI 60-40-18 etc.	
DC	L/D	n (min ⁻¹)	$\alpha=0^\circ$ fr (Min.—Max.) (mm/rev)	n (min ⁻¹)	$\alpha=0^\circ$ fr (Min.—Max.) (mm/rev)	n (min ⁻¹)	$\alpha=0^\circ$ fr (Min.—Max.) (mm/rev)
0.75	≤ 2	10600	0.007 (0.003—0.011)	23300	0.030 (0.010—0.050)	16900	0.010 (0.005—0.015)
1.0	≤ 2	7900	0.007 (0.003—0.011)	17500	0.030 (0.010—0.050)	12700	0.010 (0.005—0.015)
1.5	≤ 2	5300	0.010 (0.005—0.015)	12200	0.035 (0.015—0.055)	10000	0.020 (0.010—0.030)
2.0	≤ 2	4700	0.015 (0.010—0.020)	9500	0.040 (0.020—0.060)	8700	0.030 (0.015—0.045)
2.5	≤ 2	3800	0.015 (0.010—0.020)	7900	0.050 (0.030—0.070)	7300	0.045 (0.025—0.065)
3.0	≤ 2	3100	0.020 (0.010—0.030)	7900	0.060 (0.040—0.080)	6800	0.050 (0.040—0.060)
4.0	≤ 2	2300	0.030 (0.020—0.040)	5900	0.080 (0.060—0.100)	5500	0.060 (0.050—0.080)
5.0	≤ 2	1900	0.040 (0.030—0.050)	4700	0.100 (0.080—0.120)	4400	0.080 (0.060—0.100)
6.0	≤ 2	1500	0.050 (0.040—0.060)	3900	0.120 (0.100—0.140)	3700	0.100 (0.080—0.120)
8.0	≤ 2	1100	0.060 (0.050—0.080)	2900	0.140 (0.120—0.160)	2700	0.120 (0.100—0.150)
10.0	≤ 2	950	0.080 (0.060—0.100)	2300	0.160 (0.140—0.180)	2200	0.150 (0.120—0.180)
12.0	≤ 2	790	0.100 (0.080—0.120)	1900	0.180 (0.160—0.200)	1800	0.180 (0.150—0.200)
16.0	≤ 2	590	0.120 (0.100—0.150)	1400	0.200 (0.180—0.240)	1300	0.200 (0.180—0.250)
20.0	≤ 2	470	0.150 (0.120—0.200)	1100	0.240 (0.200—0.280)	1100	0.250 (0.200—0.300)

Work Material		Aluminum Alloys (Si<5%)	
		AISI A6061, 7075 etc.	
DC	L/D	n (min ⁻¹)	$\alpha=0^\circ$ fr (Min.—Max.) (mm/rev)
0.75	≤ 2	42400	0.020 (0.010—0.030)
1.0	≤ 2	31800	0.020 (0.010—0.030)
1.5	≤ 2	21200	0.020 (0.010—0.030)
2.0	≤ 2	17500	0.050 (0.030—0.070)
2.5	≤ 2	14000	0.060 (0.040—0.090)
3.0	≤ 2	11600	0.060 (0.040—0.090)
4.0	≤ 2	8700	0.080 (0.060—0.100)
5.0	≤ 2	7000	0.100 (0.080—0.130)
6.0	≤ 2	5800	0.130 (0.100—0.160)
8.0	≤ 2	4300	0.160 (0.130—0.200)
10.0	≤ 2	3500	0.200 (0.160—0.240)
12.0	≤ 2	2900	0.240 (0.200—0.280)
16.0	≤ 2	2100	0.280 (0.240—0.320)
20.0	≤ 2	1700	0.320 (0.280—0.360)



(Note 1) The recommended hole depth is $DC \times 2$. This should be the depth from the uppermost surface of the work material when machining on an angled surface. (Refer to diagram)

(Note 2) The above cutting table assumes drilling on a flat surface.

For hole drilling on an angled surface, adjust the feed rate in accordance with the inclination angle.

When the inclination angle α is 30° or less, adjust the feed rate to 70% or lower as a guideline.

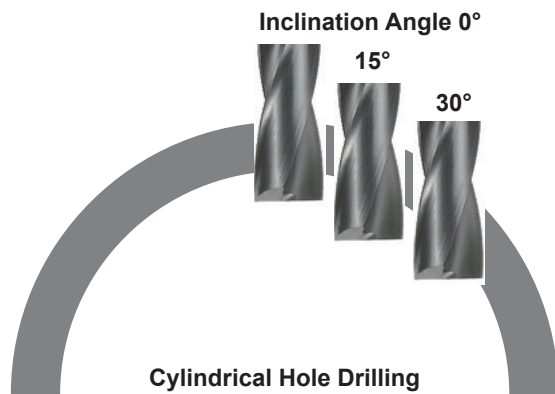
When the inclination angle α is greater than 30° , adjust the feed rate to 50% or lower as a guideline.

(Note 3) This product is a tool intended for hole drilling. It cannot be used for cross-feed machining or helical machining.

Cutting Performance

Comparison of Exit Burrs Generated in AISI 304

The unique cutting edge shape suppresses the formation of exit burrs.



	MFE	Conventional A	Conventional B
Inclination Angle 0° Hole Depth=4mm			
Inclination Angle 15° Hole Depth≒5mm			
Inclination Angle 30° Hole Depth≒7mm			

<Cutting Conditions>

Drill : MFE0200X02S040

Work Material : AISI 304

Cutting Speed : $vc=30$ m/min

Feed per Rev. : $fr=0.01$ mm/rev

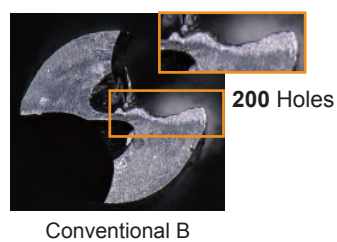
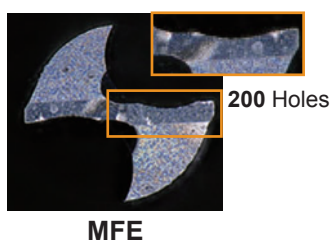
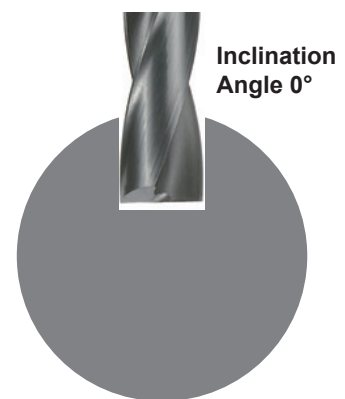
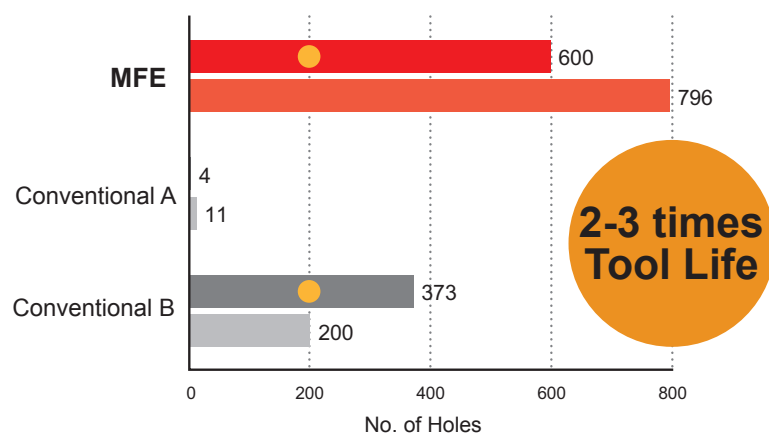
Cutting Mode : Wet Cutting

External Coolant (Water-soluble)

Machine : Vertical MC (BT40)

Comparison of Tool Life when Used on AISI 304

Excellent fracture resistance is achieved even when hole drilling cylindrical surfaces using small automatic lathes.



<Cutting Conditions>

Drill : MFE0080X02S030

Work Material : AISI 304

Cutting Speed : $vc=15$ m/min

Feed per Rev. : $fr=0.01$ mm/rev

Cutting Mode : Wet Cutting

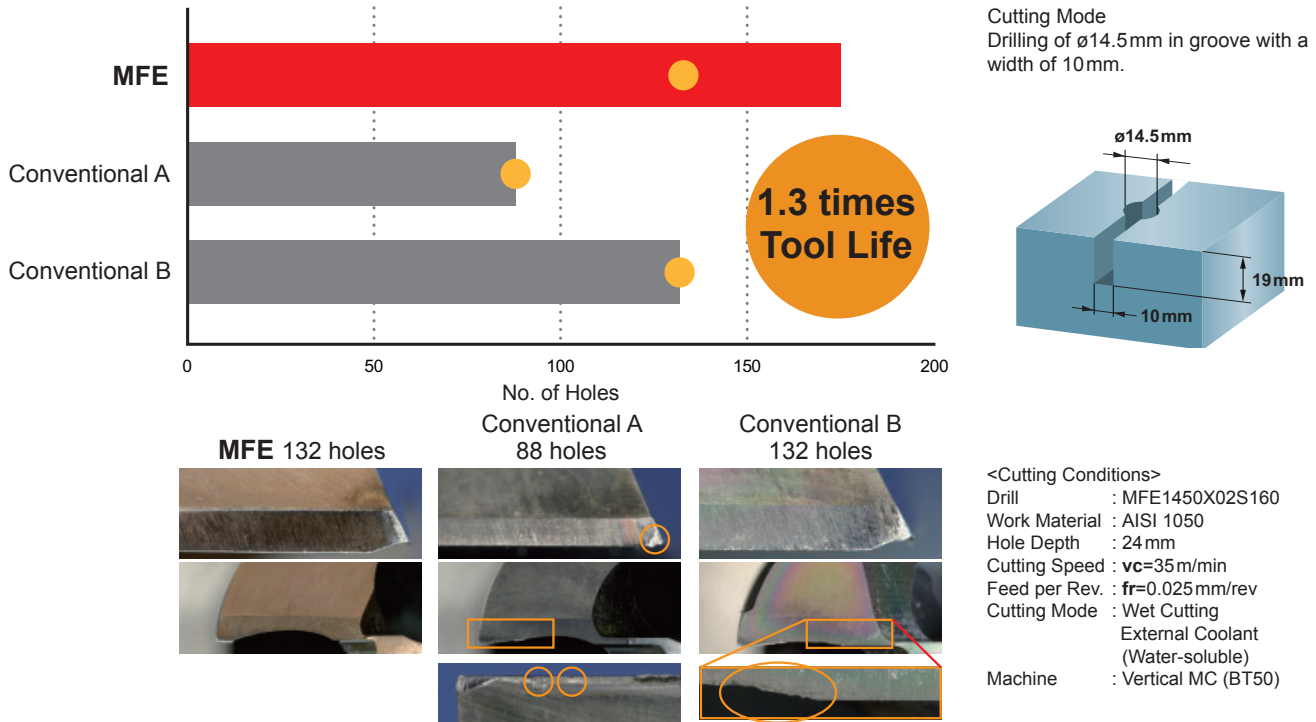
External Coolant (Water-insoluble)

Machine : Small Automatic Lathes

Cutting Performance

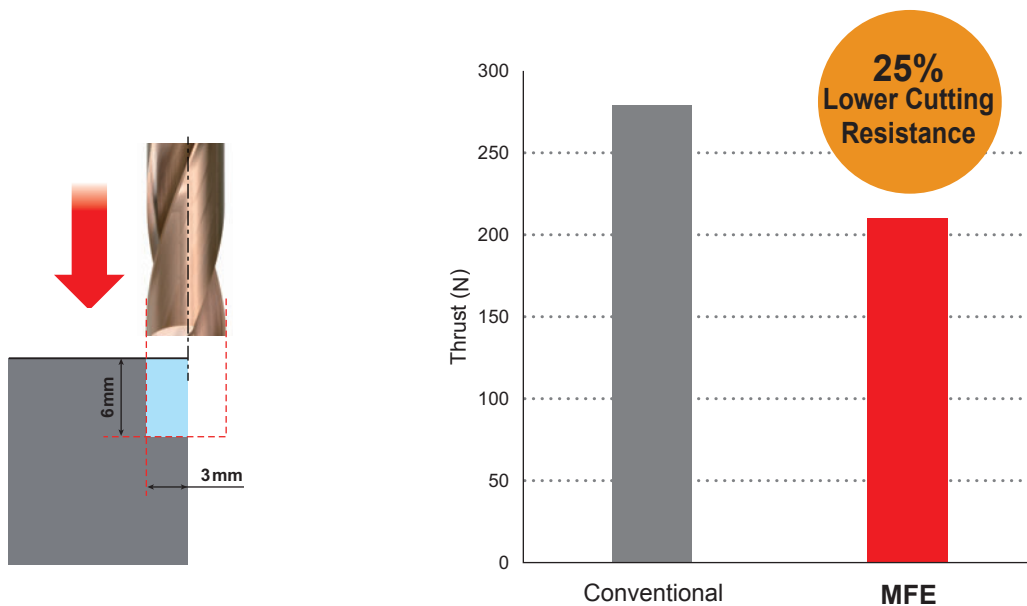
Comparison of Fracture Resistance in AISI 1050

Achieved 1.3 times longer tool life compared to conventional products because of increased stability.



Thrust Force Comparison in Shoulder Drilling

New "Z" thinning with lower thrust force.



<Cutting Conditions>
 Drill : MFE0600X02S060
 Work Material : AISI 1050
 Hole Depth : 6mm ($l=DC \times 1$)
 Cutting Speed : $vc=50\text{m/min}$
 Feed per Rev. : $fr=0.07\text{mm/rev}$

For Your Safety

●Don't handle inserts and chips without gloves. ●Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage. ●Please use safety covers and wear safety glasses. ●When using compounded cutting oils, please take fire precautions. ●When attaching inserts or spare parts, please use only the correct wrench or spanner. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

 MITSUBISHI MATERIALS CORPORATION

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Amata Nakorn Industrial Estate Phase 9
700/843 Moo 5, Tambon Nongkakha, Amphur
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EXP-13-N012
2017.8.T(-)