

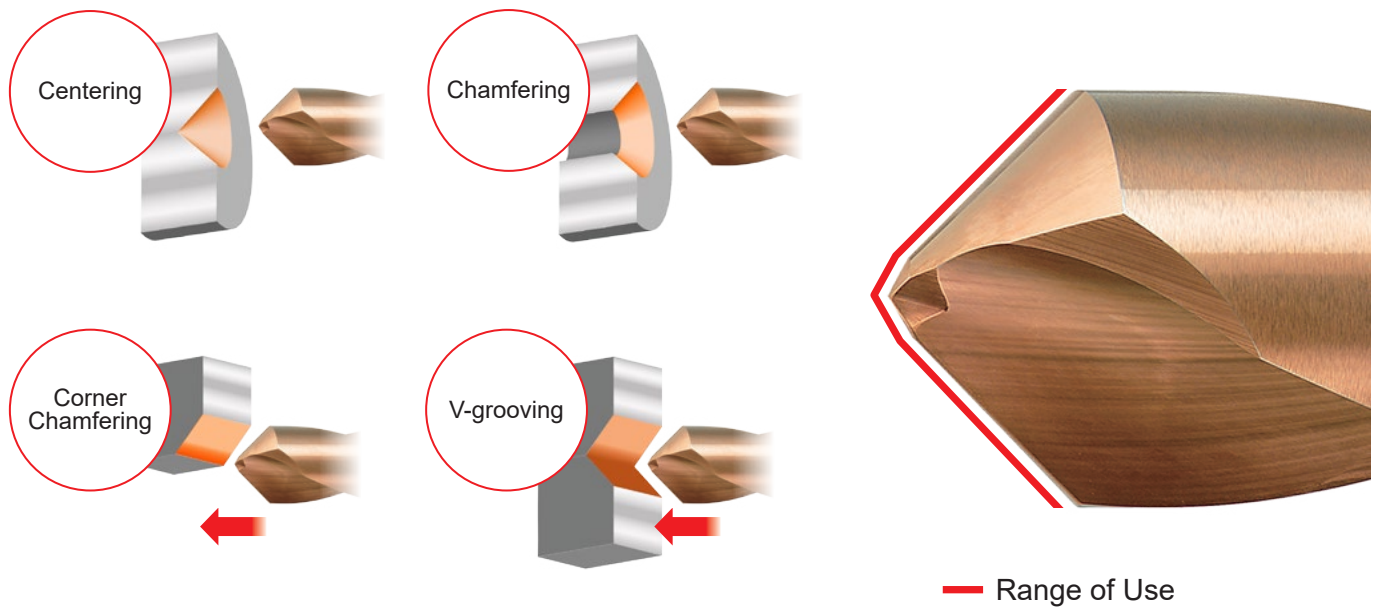
Solid Carbide Drills for Centering and Chamfering

Leading Drill Series **DLE**Series
Expansion**Sharpness and Excellent Fracture
Resistance can Achieve Stable
Processing for Stainless Steels**

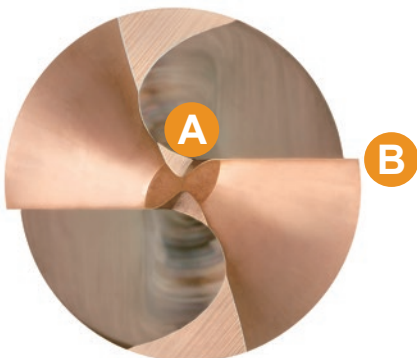
Solid Carbide Drills for Centering and Chamfering

Leading Drill Series **DLE**

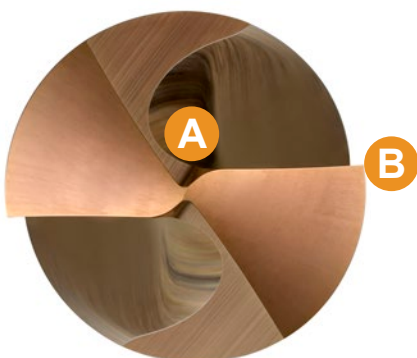
Completes strict standards for centering and chamfering.



Features



Point Angles SIG 60° 90°



Point Angles SIG 120° 145°

A 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.

B 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 60°, 90°

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

*The central area will not have a 60°, 90° hole bottom.

DLE



High Strength of Centre

Conventional



Fractures of Centre

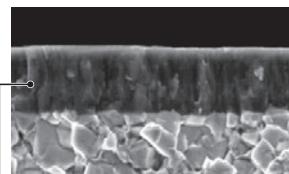
One-step Point Angles 120°, 145°

Using SIG145° leading drills will improve hole accuracy in the next process.

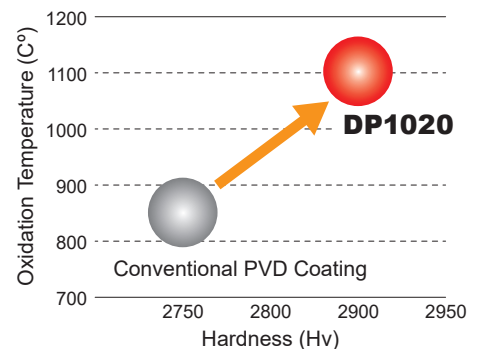


Coated Grade **DP1020**

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

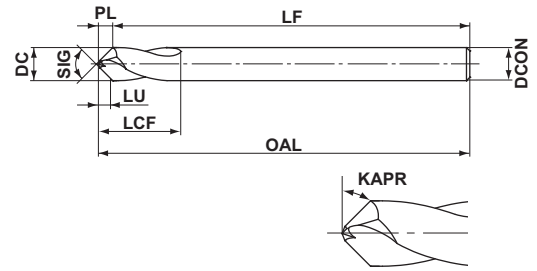
Solid Carbide Drills for Centering and Chamfering

DLE

Leading Drill Series



External Coolant



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

(mm)

DC	SIG	DP1020	Order Number	LU	LCF	OAL	LF	PL	KAPR	DCON
3	60°	●	DLE0300S030P060	2.0	9	45	42.9	2.1	60°	3
4	60°	●	DLE0400S040P060	2.7	12	50	47.2	2.8	60°	4
5	60°	●	DLE0500S050P060	3.4	14	60	56.5	3.5	60°	5
6	60°	●	DLE0600S060P060	4.0	15	66	61.8	4.2	60°	6
7	60°	●	DLE0700S070P060	4.7	18	74	69.1	4.9	60°	7
8	60°	●	DLE0800S080P060	5.4	20	74	68.4	5.6	60°	8
10	60°	●	DLE1000S100P060	6.8	24	84	77.0	7.0	60°	10
12	60°	●	DLE1200S120P060	8.1	28	95	86.6	8.4	60°	12
3	90°	●	DLE0300S030P090	1.2	9	45	43.7	1.3	45°	3
4	90°	●	DLE0400S040P090	1.6	12	50	48.3	1.7	45°	4
5	90°	●	DLE0500S050P090	2.0	14	60	57.9	2.1	45°	5
6	90°	●	DLE0600S060P090	2.4	15	66	63.4	2.6	45°	6
7	90°	●	DLE0700S070P090	2.8	18	74	71.0	3.0	45°	7
8	90°	●	DLE0800S080P090	3.2	20	74	70.6	3.4	45°	8
10	90°	●	DLE1000S100P090	4.1	24	84	79.7	4.3	45°	10
12	90°	●	DLE1200S120P090	4.9	28	95	89.9	5.1	45°	12
16	90°	●	DLE1600S160P090	6.6	35	113	106.2	6.8	45°	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 60°, 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.

● : Inventory maintained in Japan.

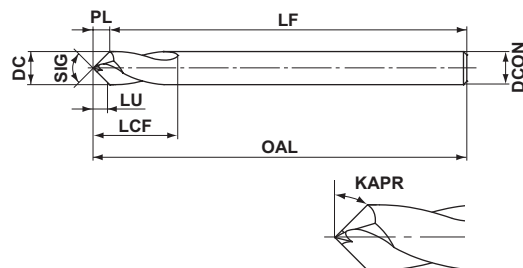
DLE

Leading Drill Series



P M K N S H

External Coolant



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

(mm)

DC	SIG	DP1020	Order Number	LU	LCF	OAL	LF	PL	KAPR	DCON
3	120°	●	DLE0300S030P120	0.8	9	45	44.1	0.9	30°	3
4	120°	●	DLE0400S040P120	1.1	12	50	48.8	1.2	30°	4
5	120°	●	DLE0500S050P120	1.3	14	60	58.6	1.4	30°	5
6	120°	●	DLE0600S060P120	1.6	15	66	64.3	1.7	30°	6
7	120°	●	DLE0700S070P120	1.9	18	74	72.0	2.0	30°	7
8	120°	●	DLE0800S080P120	2.2	20	74	71.7	2.3	30°	8
10	120°	●	DLE1000S100P120	2.8	24	84	81.1	2.9	30°	10
12	120°	●	DLE1200S120P120	3.3	28	95	91.5	3.5	30°	12
3	145°	●	DLE0300S030P145	0.4	9	45	44.5	0.5	17.5°	3
4	145°	●	DLE0400S040P145	0.5	12	50	49.4	0.6	17.5°	4
5	145°	●	DLE0500S050P145	0.7	14	60	59.2	0.8	17.5°	5
6	145°	●	DLE0600S060P145	0.8	15	66	65.1	0.9	17.5°	6
7	145°	●	DLE0700S070P145	1.0	18	74	72.9	1.1	17.5°	7
8	145°	●	DLE0800S080P145	1.1	20	74	72.7	1.3	17.5°	8

(Note 1) 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

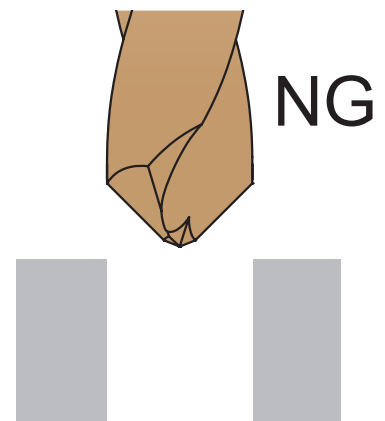
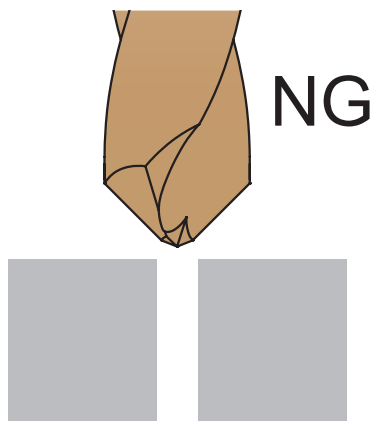
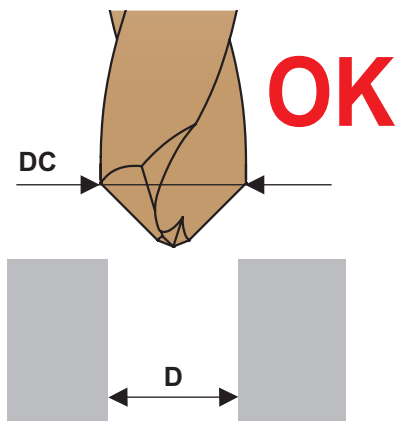
OAL = Overall Length
LF = Functional Length
PL = Point Length

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**.

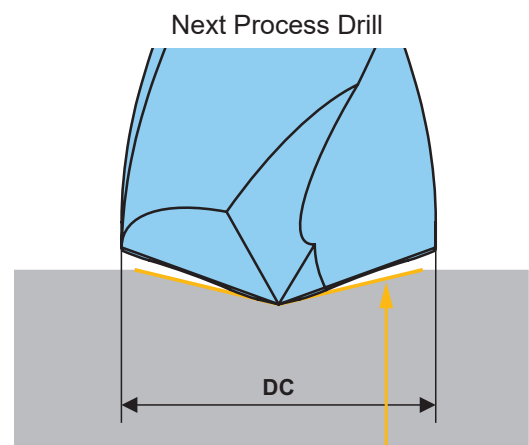
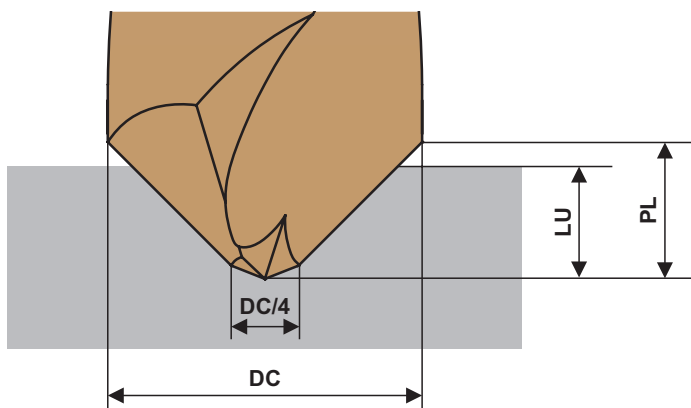
Example) If guide hole diameter **D** is 5 mm: Drill diameter **DC** should be greater than 6 mm but less than 10 mm. Select a **DC** of 6 mm, 7 mm, or 8 mm.

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 3,4) 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.

Using SIG 145° leading drills will improve hole accuracy by preventing shoulder contact when applying drills under SIG 143° in the next process.



Centering of Point Angle SIG145°

Point Angle SIG 60°

Recommended Cutting Conditions

(mm)

Work Material	Mild Steels ($\leq 180\text{HB}$) JIS SS400, S10C etc.		Carbon Steels, Alloy Steels (180—280HB) JIS S45C, SCM440 etc.		Carbon Steels, Alloy Steels (280—350HB) JIS SNCM439 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	0.05(0.03—0.07)	6800	0.05(0.03—0.07)	6300	0.04(0.02—0.06)
4	5900	0.05(0.03—0.07)	5100	0.05(0.03—0.07)	4700	0.04(0.02—0.06)
5	5000	0.06(0.04—0.08)	4400	0.06(0.04—0.08)	4100	0.05(0.03—0.07)
6	4200	0.06(0.04—0.08)	3700	0.06(0.04—0.08)	3400	0.05(0.03—0.07)
7	3600	0.07(0.04—0.09)	3100	0.07(0.04—0.09)	2900	0.05(0.03—0.07)
8	3100	0.07(0.04—0.09)	2700	0.07(0.04—0.09)	2500	0.05(0.03—0.07)
10	2700	0.08(0.04—0.10)	2300	0.08(0.04—0.10)	2200	0.06(0.03—0.08)
12	2200	0.08(0.04—0.10)	1900	0.08(0.04—0.10)	1800	0.06(0.03—0.08)

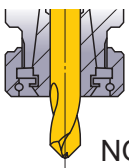
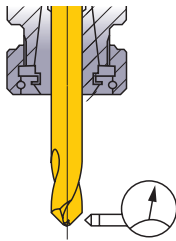
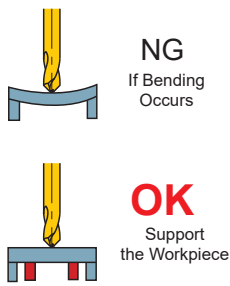
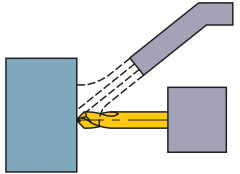
Work Material	Austenitic Stainless Steels ($\leq 200\text{HB}$) JIS SUS304, SUS316 etc.		Gray Cast Irons ($\leq 350\text{MPa}$) JIS FC300 etc.		Ductile Cast Irons ($\leq 450\text{MPa}$) JIS FCD450 etc.	
DC	n (min ⁻¹)	fr (Min.—Max.) (mm/rev)	n (min ⁻¹)	fr (Min.—Max.) (mm/rev)	n (min ⁻¹)	fr (Min.—Max.) (mm/rev)
3	1500	0.03(0.01—0.05)	7900	0.05(0.03—0.07)	5800	0.05(0.03—0.07)
4	1100	0.03(0.01—0.05)	5900	0.05(0.03—0.07)	4300	0.05(0.03—0.07)
5	1200	0.04(0.02—0.06)	5000	0.06(0.04—0.08)	3800	0.06(0.04—0.08)
6	1000	0.04(0.02—0.06)	4200	0.06(0.04—0.08)	3100	0.06(0.04—0.08)
7	900	0.04(0.02—0.06)	3600	0.07(0.04—0.09)	2700	0.06(0.04—0.08)
8	790	0.04(0.02—0.06)	3100	0.07(0.04—0.09)	2300	0.06(0.04—0.08)
10	630	0.04(0.02—0.06)	2700	0.08(0.04—0.10)	1900	0.07(0.04—0.09)
12	530	0.04(0.02—0.06)	2200	0.08(0.04—0.10)	1500	0.07(0.04—0.09)

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

(Note 2) When centering into curved or inclined surfaces, please reduce the feed rate.

(Note 3) When V-grooving and chamfering, please reduce cutting conditions.

Operational Guidance

Drill Holding	Drill Length	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 centre are ideal.

Solid Carbide Drills for Centering and Chamfering

Point Angle SIG 90°, 120° and 145°

Recommended Cutting Conditions

(mm)

Work Material	Mild Steels ($\leq 180\text{HB}$) JIS SS400, S10C etc.		Carbon Steels, Alloy Steels (180—280HB) JIS S45C, SCM440 etc.		Carbon Steels, Alloy Steels (280—350HB) JIS SNCM439 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 ($\leq 200\text{HB}$) JIS SUS304, SUS316 etc.		Gray Cast Irons ($\leq 350\text{MPa}$) JIS FC300 etc.		Ductile Cast Irons ($\leq 450\text{MPa}$) JIS FCD450 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 $D < DC < 2D$.

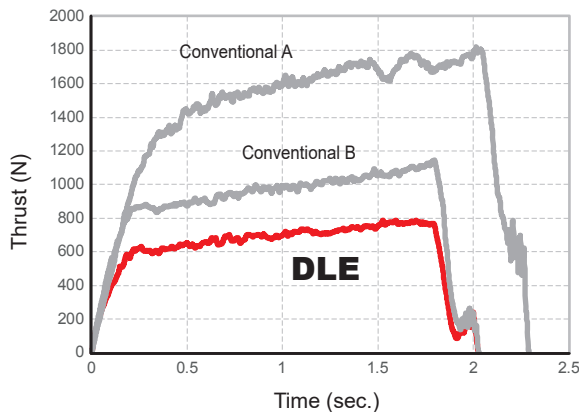
(Note 2) When centering into curved or inclined surfaces, please reduce the feed rate.

(Note 3) When V-grooving and chamfering, please reduce cutting conditions.

Cutting Performance

Comparison of Cutting Performance during Centering

Ideal for processing at low power, when compared to conventional products.



<Cutting Conditions>

Work Material : JIS S45C

Drill : DLE1200S120P090 ø12

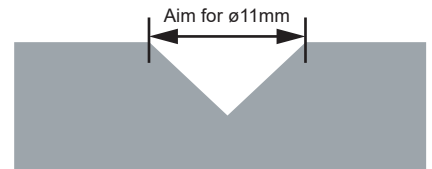
Cutting Speed : $v_c = 60 \text{ m/min}$

Feed per Rev. : $f_r = 0.06 \text{ mm/rev}$

Cutting Mode : Wet Cutting

External Coolant
(Chlorine Free Emulsion)

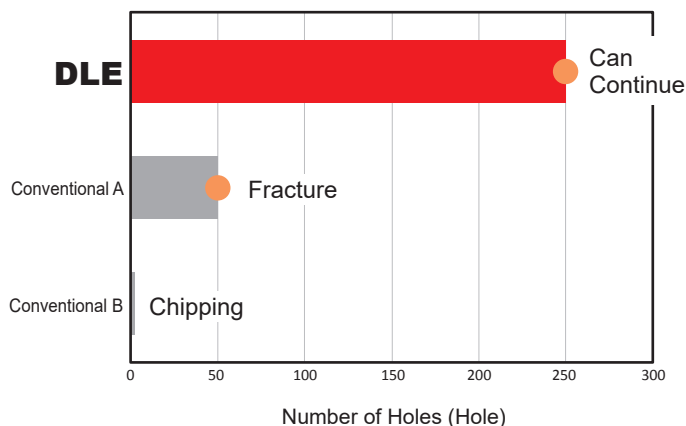
Machine : Vertical MC



*Differences along the time axis are a result of differences in processing depth.

Comparison of Centering Life when Processing JIS SUS304

The two-step point angles, together with the negative cutting edge shape and cutting edge treatment of the thinning pocket, provide outstanding durability with no abnormal damage.



<Cutting Conditions>

Work Material : JIS SUS304

Drill : DLE0600S060P090

Cutting Speed : $v_c = 25 \text{ m/min}$

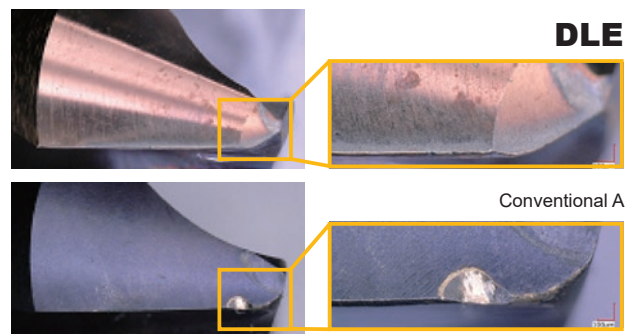
Feed per Rev. : $f_r = 0.06 \text{ mm/rev}$

Hole Depth : Aim for hole dia. ø5mm

Cutting Mode : Wet Cutting

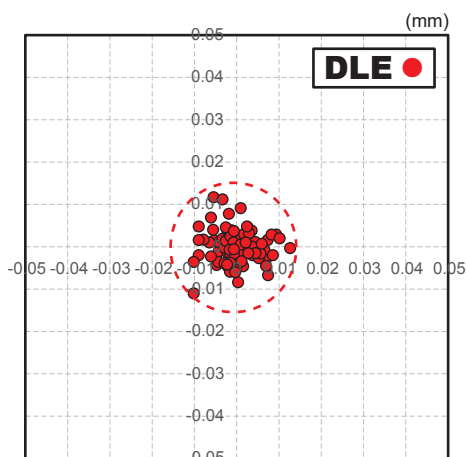
External Coolant
(Water-insoluble Coolants)

Machine : Small Automatic Lathes



Centering Hole Position Precision for JIS SUS420J2

Stainless steels are likely to experience abnormal damage from build-up edge. Compared to conventional products which often suffered early fractures, the DLE has a long tool life.



<Cutting Conditions>

Work Material : JIS SUS420J2

Drill : DLE0600S060P090

Cutting Speed : $v_c = 15 \text{ m/min}$

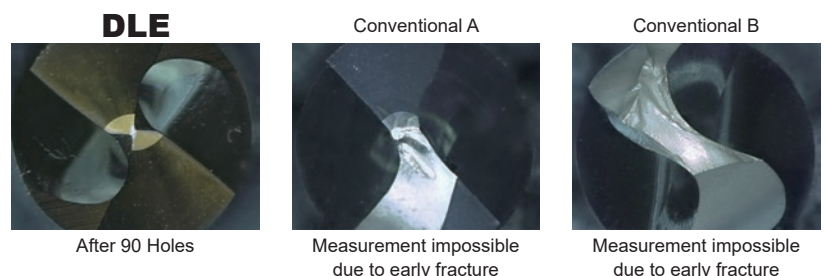
Feed per Rev. : $f_r = 0.04 \text{ mm/rev}$

Hole Depth : Aim for hole dia. ø5.5mm

Cutting Mode : Wet Cutting

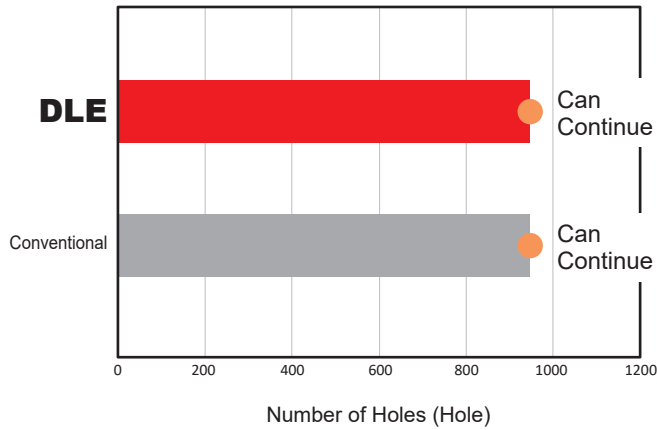
External Coolant
(Chlorine Free Emulsion)

Machine : Vertical MC



Solid Carbide Drills for Centering and Chamfering

Comparison of Centering Life when Processing JIS SUS304 : Point Angle 120°



<Cutting Conditions>

Work Material : JIS SUS304

Drill : DLE0600S060P120

Cutting Speed : $vc=20$ m/min

Feed per Rev. : $fr=0.06$ mm/rev

Hole Depth : Aim for hole dia. $\phi 5.5$ mm

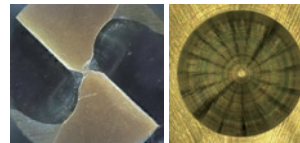
Cutting Mode : Wet Cutting

External Coolant

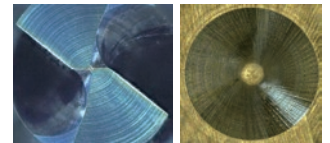
(Water-insoluble Coolants)

Machine : Vertical MC

DLE

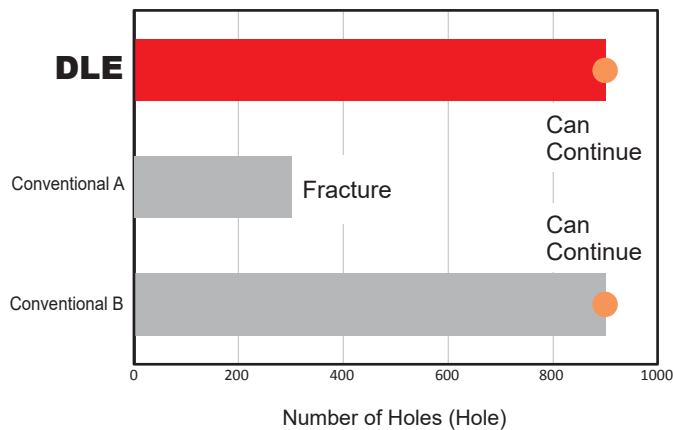


Conventional



Vibration occurred.
Poor surface quality
(Rough surface).

Comparison of Centering Life when Processing JIS SUS304 : Point Angle 60°



<Cutting Conditions>

Work Material : JIS SUS304

Drill : DLE0600S060P060

Cutting Speed : $vc=15$ m/min

Feed per Rev. : $fr=0.02$ mm/rev

Hole Depth : Aim for hole dia. $\phi 5.5$ mm

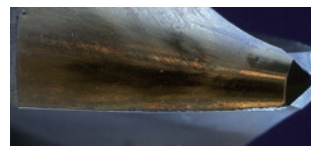
Cutting Mode : Wet Cutting

External Coolant

(Chlorine Free Emulsion)

Machine : Vertical MC

DLE



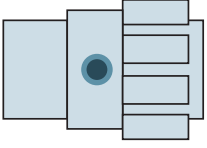
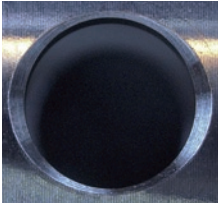
Initial Wear

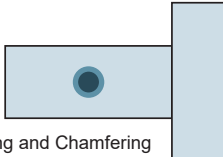
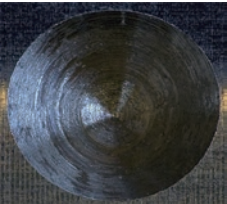
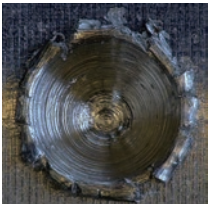
Conventional B



Fine chipping on the outer cutting edge.

Application Example

Drill		DLE0400S040P090	DLE0600S060P090
Cutting Conditions	Workpiece	JIS S10C (Equipment Parts) 	JIS SUS304 (Machine Parts) 
	Cutting Speed vc (m/min)	30	25
	Feed per Rev. fr (mm/rev)	0.045	0.05
	Guide Hole Dia. (mm)	ø3	ø5
Cutting Mode		Wet Cutting External Coolant (Chlorine Free Emulsion)	Wet Cutting External Coolant (Water-insoluble)
Machine		NC Lathe, Tool Rotation	CNC Automatic Lathe
Results			
	Burrs are suppressed Compared to conventional products, the DLE has smaller burrs and a longer expected life.		More than 200 holes Good surface finishes and no tool damage While conventional products often caused chipping to occur, the DLE is more stable and has been used to complete drilling of 200 holes with no damage on the cutting edge.

Drill		DLE0300S030P090	
Cutting Conditions	Workpiece	JIS SUS303 (Engine Parts) 	
	Cutting Speed vc (m/min)	25	
	Feed per Rev. fr (mm/rev)	0.04	
	Guide Hole Dia. (mm)	ø2.0	
Cutting Mode		Wet Cutting External Coolant (Water-insoluble) Curved Surface	
Machine		CNC Automatic Lathe	
Results			
	After 60 Holes		After 1 Hole While conventional products generated burrs during the first hole drilling, the DLE achieved 60 hole drilling without notable damage and burr generation, and provides outstanding surface quality.

The above application examples are customer's applications, so it can be different from the recommended conditions.



Solid Carbide Drills for Centering and Chamfering

Leading Drill Series **DLE**

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 driver. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

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(Tools specifications subject to change without notice.)

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