

## Diamond Coated Drill Series

For Hard Brittle Materials **DC-BSS** (produced to order only)

For Non-ferrous Materials **DC-SSS DC-SSM**

# Innovative drills for non-ferrous and hard brittle materials!



# Diamond Coated Drill Series

## For Hard Brittle Materials **DC-B55** (produced to order only)

## For Non-ferrous Materials **DC-555 DC-55M**

Mitsubishi Materials unique diamond coated drill series suitable for machining non-ferrous and hard brittle materials.

### ■ Features

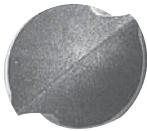
#### 1. Drills for machining non-ferrous and hard brittle materials available

##### **DC-B55**

Produced to order only

##### Drill for hard brittle materials

- Suitable for drilling of non-ferrous hard brittle materials that cannot be machined with conventional drills.
- Employs a point geometry optimized for high tool rigidity for machining hard brittle materials. (Patented)

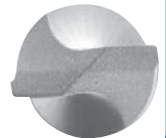


##### **DC-555, DC-55M**

Inventory maintained

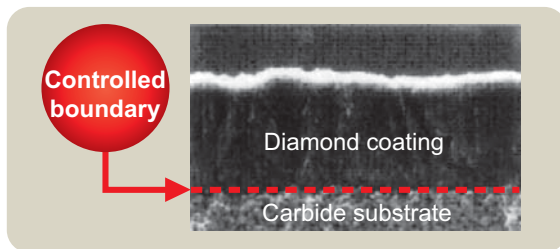
##### Drill for non-ferrous materials

- Suitable for drilling of high silicon aluminium alloys, graphite and machinable ceramics.
- Long tool life and high precision drilling.



#### 2. Use of Mitsubishi Materials unique diamond coating

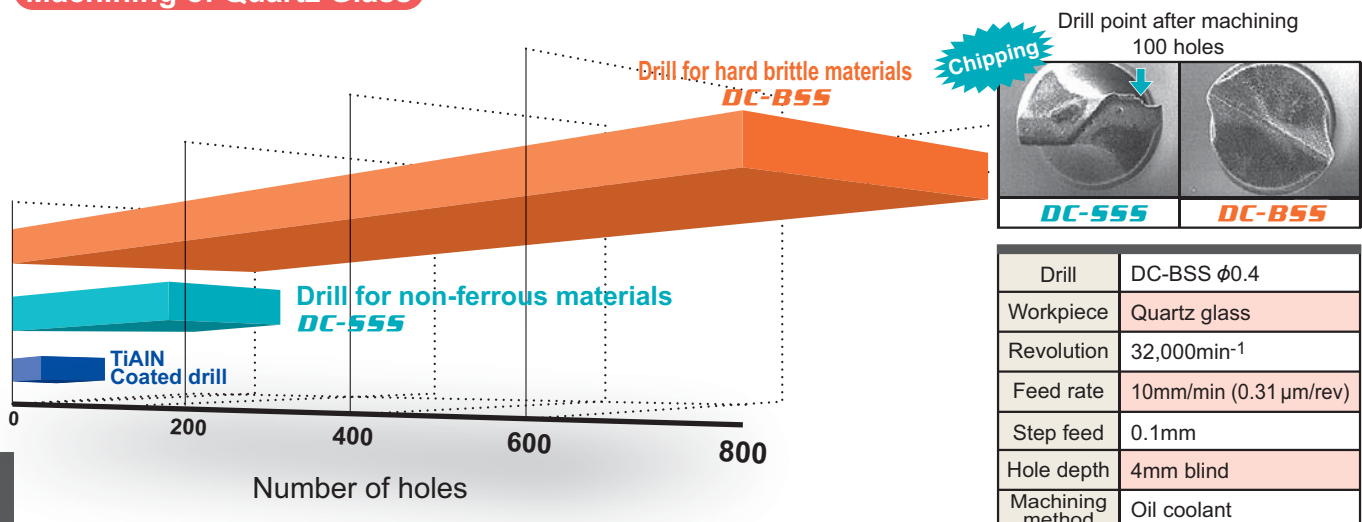
Unique plasma CVD coating technology is employed to obtain high adhesion to the carbide substrate and excellent wear resistance.



	Natural Diamond	CVD Diamond	DLC
Hardness (HV)	10,000	7,000–10,000	1,000–7,000
Crystal Structure	Cubic	Cubic	Amorphous

### ■ Machining example 1

#### Machining of Quartz Glass





# Drill Selection Guideline

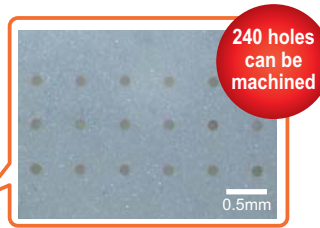
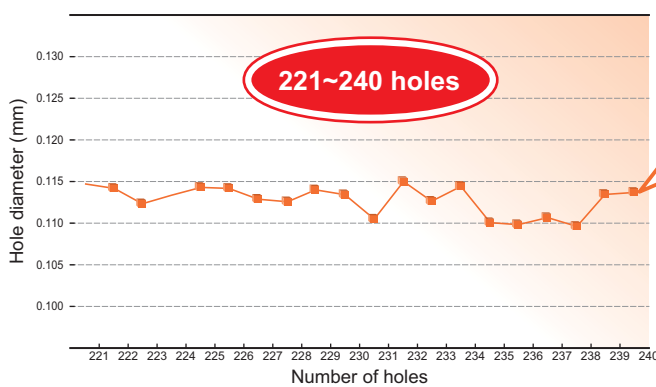
	Hard Brittle Materials									Non-ferrous Materials		
	Fine ceramics					PZT Barium Titanate Ruby Sapphire	Quartz glass SiO <sub>2</sub>	Cemented carbide	Green ceramics Machinable ceramics Graphite	MMC FRP	Aluminium alloy	Magnesium Alloy Copper alloy Copper, Brass
	Aluminium Nitride AlN	Alumina Al <sub>2</sub> O <sub>3</sub>	Zirconia ZrO <sub>2</sub>	Silicon Carbide SiC	Silicon Nitride Si <sub>3</sub> N <sub>4</sub>							
Drill for hard brittle materials <b>DC-BSS</b>	◎	◎	◎	○	△	○	◎	○	×	×	×	×
Drill for non-ferrous materials <b>DC-SSS DC-SSM</b>	○	○	△	△	×	×	○	○	◎	◎	◎	◎

◎ : First recommendation, ○ : Machinable, △ : Some can be machined, × : Not machinable

## Machining Example 2

### Machining of Alumina

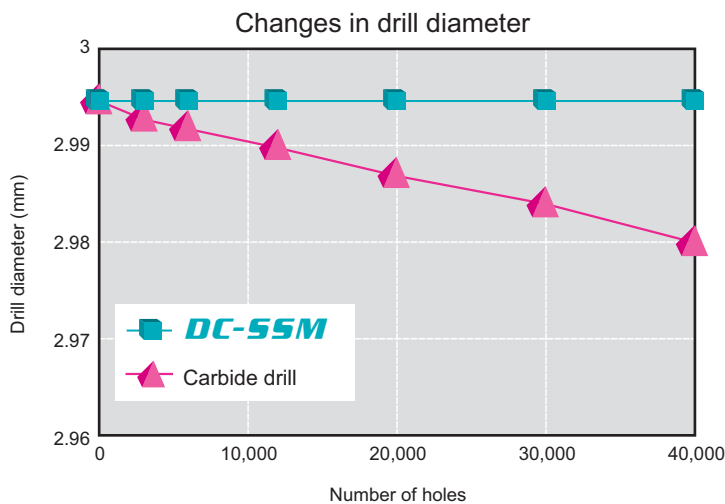
Close tolerance of the hole diameter maintained!



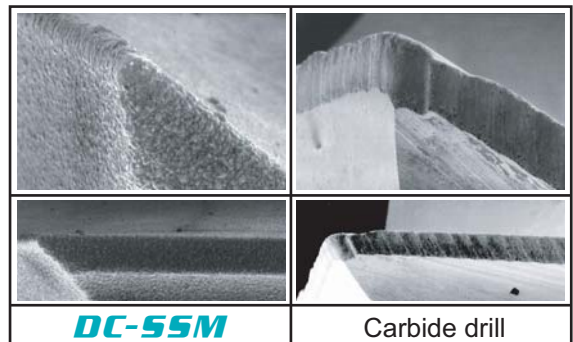
Drill	DC-BSS φ0.11
Workpiece	alumina
Revolution	12,000min <sup>-1</sup>
Feed rate	2mm/min (0.167μm/rev)
Step feed	0.005mm
Hole depth	1mm blind
Machining method	Emulsion

## Machining Example 3

### Machining of High Silicon Aluminium Alloys



Drill side after machining 40,000 holes



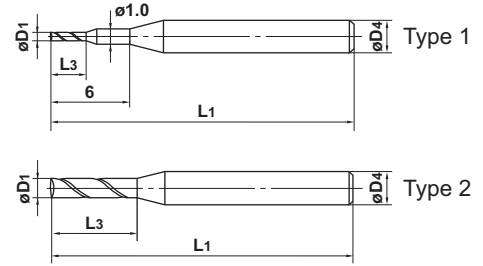
Drill	DC-SSM φ3.0
Workpiece	High silicon aluminium alloy (AC4B)
Revolution	6,000min <sup>-1</sup>
Feed rate	600mm/min (0.10mm/rev)
Hole depth	3mm blind
Coolant	Emulsion

# Diamond Coated Drill

**DC-BSS** (produced to order only)  
For hard brittle materials



0.05 ≤ D1 < 0.2 0 - -0.009  
0.2 ≤ D1 0 - -0.014



- Drill for machining hard brittle materials such as sintered ceramics and quartz glass that cannot be machined with conventional drills.

Unit : mm

Order Number	Dia. D1	Flute Length L3	Overall Length L1	Shank Dia. D4	Stock	Type	Short Delivery
—	0.05	0.5	38	3	□		
—	0.06	0.6	38	3	□		
—	0.07	0.7	38	3	□		
—	0.08	0.8	38	3	□		
—	0.09	0.9	38	3	□		
—	0.1	1	38	3	□	1	◎
—	0.11	1.2	38	3	□	1	◎
—	0.12	1.4	38	3	□	1	
—	0.13	1.5	38	3	□	1	◎
—	0.14	1.5	38	3	□	1	◎
—	0.15	1.5	38	3	□	1	◎
—	0.16	1.5	38	3	□	1	
—	0.17	1.5	38	3	□	1	◎
—	0.18	1.5	38	3	□	1	◎
—	0.19	1.5	38	3	□	1	
—	0.2	2	38	3	□	2	◎
—	0.25	2.5	38	3	□	2	◎
—	0.3	3	38	3	□	2	◎
—	0.35	3.5	38	3	□	2	◎
—	0.4	4	38	3	□	2	◎
—	0.5	4	38	3	□	2	◎
—	0.6	5	38	3	□	2	◎
—	0.7	5	38	3	□	2	◎
—	0.8	6	38	3	□	2	◎
—	0.9	6	38	3	□	2	◎
—	1	8	38	3	□	2	◎

Order Number	Dia. D1	Flute Length L3	Overall Length L1	Shank Dia. D4	Stock	Type	Short Delivery
—	1.1	8	38	3	□	2	◎
—	1.2	8	38	3	□	2	◎
—	1.3	8	38	3	□	2	◎
—	1.4	8	38	3	□	2	
—	1.5	10	38	3	□	2	◎
—	1.6	10	38	3	□	2	◎
—	1.7	10	38	3	□	2	◎
—	1.8	10	38	3	□	2	◎
—	1.9	10	38	3	□	2	
—	2	12	38	3	□	2	◎
—	2.1	12	38	3	□	2	
—	2.2	12	38	3	□	2	
—	2.3	12	38	3	□	2	
—	2.4	12	38	3	□	2	◎
—	2.5	12	38	3	□	2	◎
—	2.6	12	38	3	□	2	
—	2.7	12	38	3	□	2	
—	2.8	12	38	3	□	2	
—	2.9	12	38	3	□	2	
—	3	12	38	3	□	2	◎

- \* The dimensions shown in the above table are basic sizes. Contact Mitsubishi Materials if different diameters and flute lengths are required.
- \* Drills with ◎ mark can be delivered in shorter time (1~2 weeks). For the delivery of other drills, contact Mitsubishi Materials.
- \* Drills with D1 0.05~0.09mm are designed with a special geometry.

## Cutting Conditions

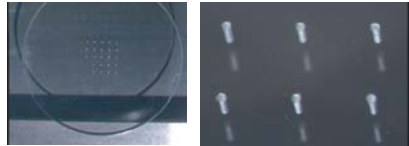

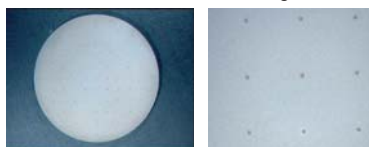


### DC-BSS

Work Material	Aluminium nitride		Alumina		Zirconia		Silicon carbide Silicon nitride		Quartz glass	
Step feed	0.01mm		0.005mm		0.003mm		0.002mm		0.05mm	
Dia. (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)
<b>0.1</b>	20,000	0.0002	20,000	0.0001	20,000	0.0001	20,000	0.00005	20,000	0.0002
<b>0.2</b>	15,000	0.0002	15,000	0.0001	15,000	0.0001	15,000	0.00005	15,000	0.0002
<b>0.5</b>	12,000	0.0002	12,000	0.0001	12,000	0.0001	12,000	0.00005	12,000	0.0003
<b>1.0</b>	10,000	0.0002	10,000	0.0001	10,000	0.0001	10,000	0.00005	10,000	0.0003
<b>1.5</b>	7,500	0.0003	7,500	0.0002	7,500	0.0002	7,500	0.0001	7,500	0.0004
<b>2.0</b>	6,000	0.0003	6,000	0.0002	6,000	0.0002	6,000	0.0001	6,000	0.0004
<b>2.5</b>	5,000	0.0003	5,000	0.0003	5,000	0.0002	5,000	0.0001	5,000	0.0005
<b>3.0</b>	5,000	0.0003	5,000	0.0003	5,000	0.0002	5,000	0.0001	5,000	0.0005

1) Depending on the type of machine, it is possible to apply cutting speeds over 20,000min<sup>-1</sup>.

2) Please use the water soluble coolant or grinding fluid.

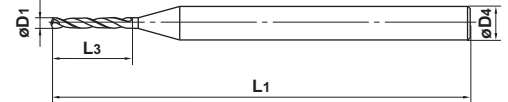
## Application examples

Work Material	Size	Cutting Conditions				Machining Method	Results
		Revolution	Feed Rate	Hole Depth			
Sapphire	DC-BSS φ0.1 x 1	24,000min <sup>-1</sup>	2mm/min	0.85mm (Blind)	Step feed drilling Water soluble coolant	23 holes can be machined. Cannot be machined with an electroplated diamond tool. 	
Zirconia ZrO <sub>2</sub>	DC-BSS φ0.2 x 2	20,000min <sup>-1</sup>	1mm/min	1mm (Blind)	Step feed drilling Water soluble coolant	100 holes can be machined. 	
Aluminium Nitride AlN	DC-BSS φ0.13 x 1.5	12,000min <sup>-1</sup>	2mm/min	1mm (Blind)	Step feed drilling Water soluble coolant	No tool wear even after machining 82 holes. 	
Silicon Carbide SiC	DC-BSS φ0.2 x 2	15,000min <sup>-1</sup>	1mm/min	1mm (Blind)	Step feed drilling Water soluble coolant	16 holes can be machined. With an electroplated diamond tool, tool life is reached within 0-2 holes. 	
Quartz Glass SiO <sub>2</sub>	DC-BSS φ0.5 x 7 Neck Length 12mm (Customised products)	24,000min <sup>-1</sup>	10mm/min	11mm (Through)	Step feed drilling Water soluble coolant	800 holes can be machined. 	

# Diamond Coated Drill

## DC-SSS

Short, For non-ferrous material



$D_1 < 1.5$

$1.5 \leq D_1$

$1.5 \leq D_1$

- Our original diamond coating technology ensures excellent film adherence, for stable drilling without flaking or chipping.

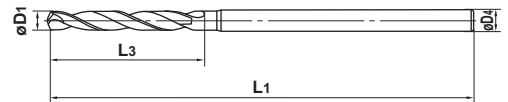
Unit : mm

Order Number	Dia. D1	Flute Length L3	Overall Length L1	Shank Dia. D4	Stock
DCSSSD0020	0.2	2	38	3	■
D0030	0.3	3	38	3	■
D0040	0.4	4	38	3	■
D0050	0.5	4	38	3	■
D0060	0.6	5	38	3	■
D0070	0.7	5	38	3	■
D0080	0.8	6	38	3	■
D0090	0.9	6	38	3	■
D0100	1.0	8	38	3	■
D0110	1.1	8	38	3	■

Order Number	Dia. D1	Flute Length L3	Overall Length L1	Shank Dia. D4	Stock
DCSSSD0120	1.2	8	38	3	■
D0130	1.3	8	38	3	■
D0140	1.4	8	38	3	■
D0150	1.5	10	45	3	■
D0160	1.6	10	45	3	■
D0170	1.7	10	45	3	■
D0180	1.8	10	45	3	■
D0190	1.9	10	45	3	■
D0200	2.0	12	45	3	■

## DC-SSM

Medium, For non-ferrous material



- Our original diamond coating technology ensures excellent film adherence, for stable drilling without flaking or chipping.

Unit : mm

Order Number	Dia. D1	Flute Length L3	Overall Length L1	Shank Dia. D4	Stock
DCSSMD0210	2.1	17	60	3	■
D0220	2.2	17	60	3	■
D0230	2.3	17	60	3	■
D0240	2.4	17	60	3	■
D0250	2.5	21	60	3	■
D0260	2.6	21	60	3	■

Order Number	Dia. D1	Flute Length L3	Overall Length L1	Shank Dia. D4	Stock
DCSSMD0270	2.7	21	60	3	■
D0280	2.8	21	60	3	■
D0290	2.9	21	60	3	■
D0300	3.0	21	60	3	■

# DC-SSS DC-SSM

For non-ferrous material

## Cutting Conditions

### DC-SSS, DC-SSM

Work Material	Aluminium Alloy Extensive Materials JIS A6061 JIS A7075 etc.		Aluminium Alloy Casting JIS AC4B JIS ADC10 etc.		Copper Copper Alloy Brass Magnesium Alloy		Graphite Machinable Ceramics Green Ceramics		MMC FRP	
	Dia. (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Revolution (min <sup>-1</sup> )
<b>0.2</b>	20,000	0.006	10,000	0.003	20,000	0.003	20,000	0.01	10,000	0.003
<b>0.5</b>	20,000	0.02	10,000	0.01	20,000	0.01	20,000	0.03	10,000	0.01
<b>1.0</b>	20,000	0.04	10,000	0.02	20,000	0.02	20,000	0.05	10,000	0.02
<b>1.5</b>	20,000	0.05	10,000	0.02	16,000	0.02	16,000	0.08	10,000	0.02
<b>2.0</b>	20,000	0.06	9,000	0.03	11,000	0.03	11,000	0.10	9,000	0.03
<b>2.5</b>	18,500	0.08	7,500	0.04	10,000	0.04	10,000	0.12	7,500	0.04
<b>3.0</b>	17,000	0.10	6,000	0.05	8,500	0.05	8,500	0.15	6,000	0.05

- 1) When machining high hardness workpiece materials, reduce the feed rate.
- 2) When machining deep holes, lower the cutting conditions.
- 3) Cutting speeds can be increased using higher spindle speeds.

## Application examples

Work Material	Size	Cutting Conditions				Machining Method	Results
		Revolution	Feed Rate	Hole Depth			
High Silicon Aluminium Alloy	DC-SSM φ3.0	6,000min <sup>-1</sup>	0.03mm/rev	3mm (Blind)		Emulsion	Possible to machine up to 40,000 holes. Carbide drill: Diameter wear 0.02mm DC-SSM: No diameter wear (10 times longer tool life)
Aluminium Alloy (JIS A7075)	DC-SSS φ2.0	32,000min <sup>-1</sup>	0.094mm/rev	6mm (Through)		Emulsion Step feed drilling	HSS drill: Possible to machine up to 20,000 holes. DC-SSS: 300,000 holes. The DC-SSS left less burrs and the time on burr removal was shortened by 85%.
Copper (Copper Electrode)	DC-SSS φ0.9	18,000min <sup>-1</sup>	0.017mm/rev	4mm (Blind)		Emulsion Step feed drilling	Carbide drill: Possible to machine up to 1,000 holes DC-SSS: 6,000 holes Hole size accuracy can be maintained with less diameter wear.
Graphite	DC-SSS φ0.5	10,000min <sup>-1</sup>	0.08mm/rev	3mm (Blind)		Dry Step feed drilling	Carbide drill: Possible to machine up to 7,000 holes DC-SSS: Over 50,000 holes. Wandering can be reduced to 0.015mm. Hole size accuracy can be maintained with less diameter wear.
Hard Brittle Materials	Machinable Ceramics	DC-SSS φ1.0	5,000min <sup>-1</sup>	0.02mm/rev	5mm (Through)	Emulsion Step feed drilling	The DC-SSS can machine 50 times larger number of holes than the carbide drill. * Care should be taken to prevent the cutting edge from chipping when entering and exiting the workpiece.
	Quartz Glass	DC-SSS φ0.6	10,000min <sup>-1</sup>	0.5μm/rev	3mm (Through)	Emulsion Step feed drilling	DC-SSS: 300 holes can be machined (no damage) * Care should be taken to prevent the cutting edge from chipping when entering and exiting the workpiece. (When simultaneously machining cover plates)
	Alumina Nitride Ceramics	DC-SSS φ0.2	8,000min <sup>-1</sup>	0.1μm/rev	1.5mm (Through)	Emulsion Step feed drilling	Carbide drill: 30 holes can be machined. DC-SSS: Over 250 holes. Hole size accuracy can be maintained without distortion.



## B063G

### Diamond Coated End Mills

A wide range of Mitsubishi Materials original diamond coated end mills are available.

#### Wide Selection

#### For graphite

##### **DC-2XLB**

Ball Nose, Long Neck,  
2 flute, For Graphite

##### **DC-XB**

Ball Nose, Taper Neck,  
2 flute, For Graphite

##### **DC-2MB**

Ball Nose, Medium, 2 flute, For Graphite

##### **DC-2LB**

Ball Nose, Long, 2 flute, For Graphite

#### For non-ferrous materials (high silicon aluminium alloy, ceramics, graphite)

##### **DC-2MS-3**

Medium, 2 flute,  
For Non-ferrous material  
(3mm shank series)

##### **DC-2MB-NF**

Ball Nose, Medium, 2 flute,  
For Non-ferrous material

#### 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 using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc. ●Grinding or heating of cutting tools produces dust and mist. Inhaling large amount of dust or contacting with eyes and skins may harm your body.

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