

Micro Solid Carbide Drills

**MIRACLE MINI STAR** Drill

**Long tool life and highly efficient micro drilling through high-precision and stable machining.**

Cutting edge diameter of  $\varnothing 0.1 - \varnothing 3$   
211 standardized drills



For cutting a guide hole

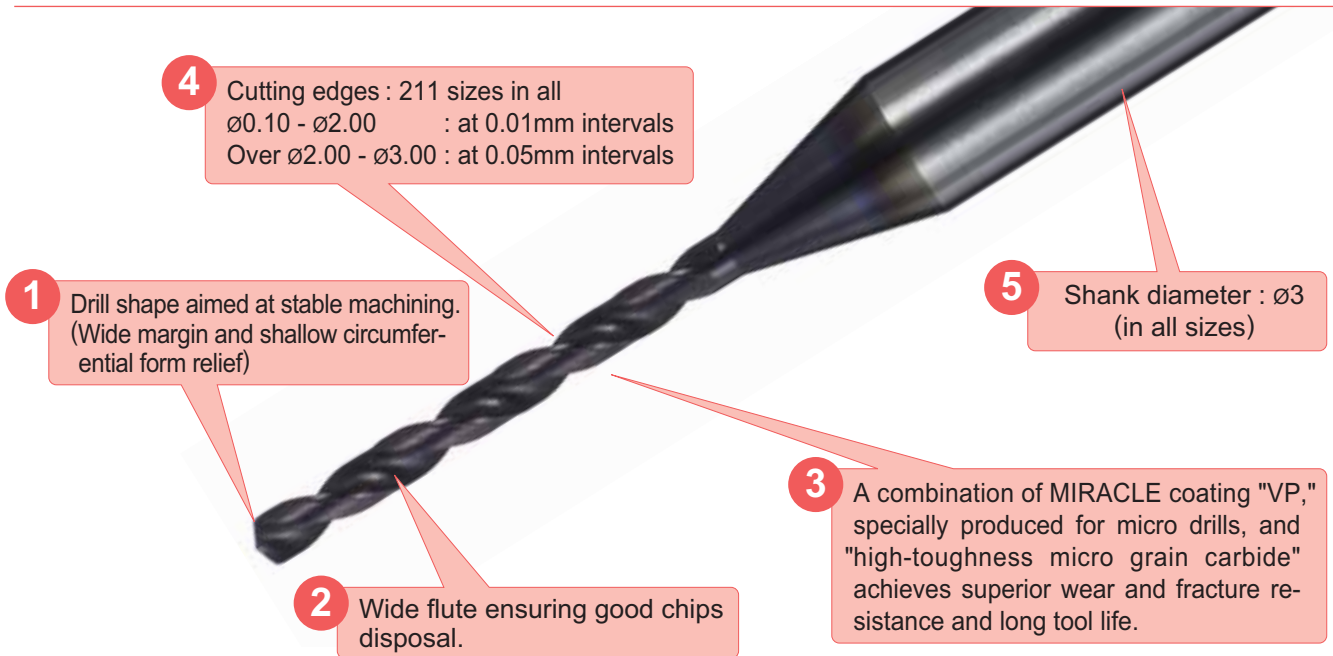
***STARTING Drill***

Triangular pyramid shape helps drill a high precision guide hole.

# Micro Solid Carbide Drills

# MIRACLE MINI STAR Drill

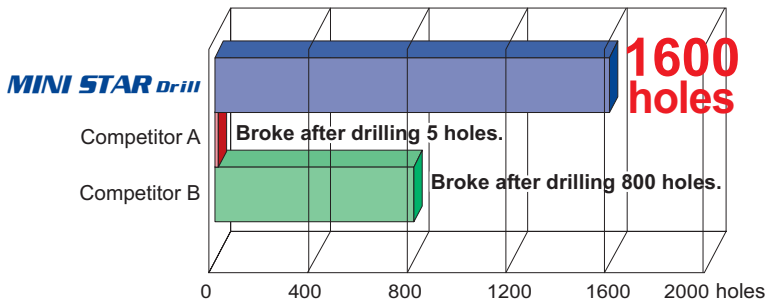
## Features



## Cutting performance

### ● Tool life evaluation (in drilling of stainless steel)

Superior resistance to welding, wear and fracture. Long tool life.

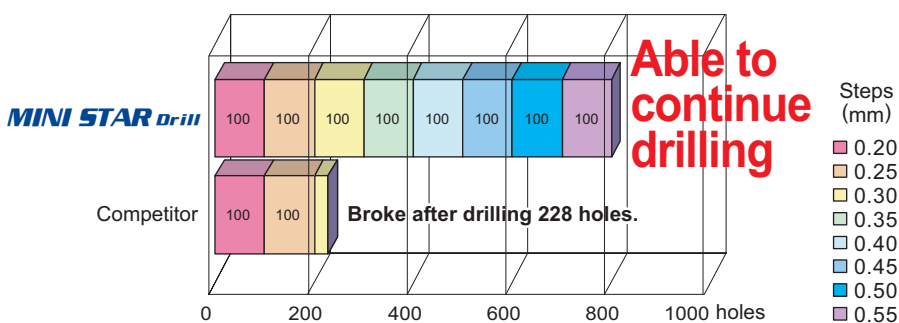


<Cutting conditions>  
 Tool : MSE0050SB  
 Workpiece : SUS304  
 Cutting speed : 9.4m/min (6,000min<sup>-1</sup>)  
 Feed : 0.015mm/rev (90mm/min)  
 Hole depth : 5.0mm Blind hole  
 Steps : 0.15mm  
 Coolant : Water soluble emulsion  
 Machine : Machining center

### ● Chips disposal (in drilling aluminum alloy)

Wide flute prevents chips jamming.

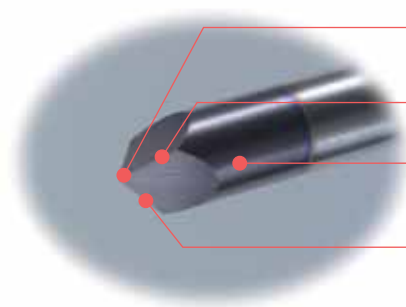
Stepped drilling test : We increased a "step"-distance of a drill being reversed-by 0.05mm every 100 holes drilling.



<Cutting conditions>  
 Tool : MSE0050SB  
 Workpiece : A7075P  
 Cutting speed : 25m/min (16,000min<sup>-1</sup>)  
 Feed : 0.075mm/rev  
 (1,200mm/min)  
 Hole depth : 5.0mm Blind hole  
 Coolant : Water soluble emulsion  
 Machine : Machining center

# For cutting a guide hole **STARTING Drill**

## Features



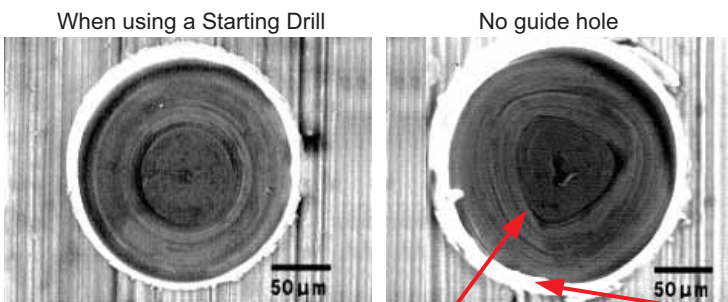
Triangular pyramid shape helps drill a high precision guide hole.

The same Starting Drill can be used to drill a center hole of  $\varnothing 0.1 - \varnothing 3.0$ . Really cost-effective.

MIRACLE coating "VP" ensures long tool life.

The same Starting Drill can be used for dual purposes. Drilling a center hole and drilling 90° cutting angle.

## Cutting performance



Cuts a high-precision hole.

The bottom of a hole is drilled polygonally because a drill moves unsteadily.

<Cutting conditions> Workpiece : SUS304	
(Cutting a guide hole)	(Drilling)
Tool : MSP0300SB	Tool : MSE0020SB
Guide hole dia. : 0.15mm	Cutting speed : 6.3m/min
Revolution : 10,000min <sup>-1</sup>	Revolution : 10,000min <sup>-1</sup>
Table feed : 5.0mm/min	Feed : 0.002mm/rev
Coolant : Water soluble emulsion	Table feed : 20mm/min
	Hole depth : 0.3mm Blind hole
	Steps : 0.02mm
	Coolant : Water soluble emulsion

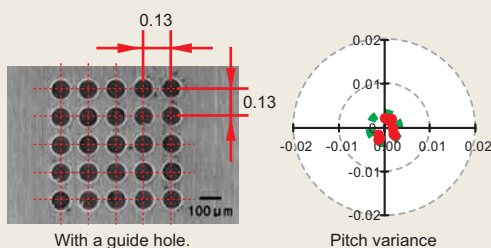
Large burr

### How to use the Starting Drill

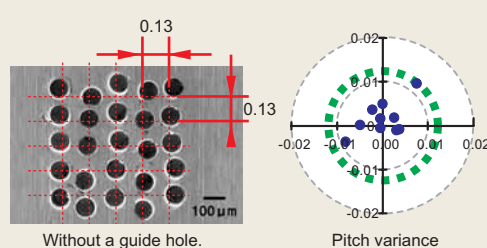
The combined use of the Mini Star Drill and the STARTING Drill enhances drilling precision and drilling stability.

## 1. Comparison of hole positioning accuracy

Maximum variance of 0.003mm. Good pitch accuracy.



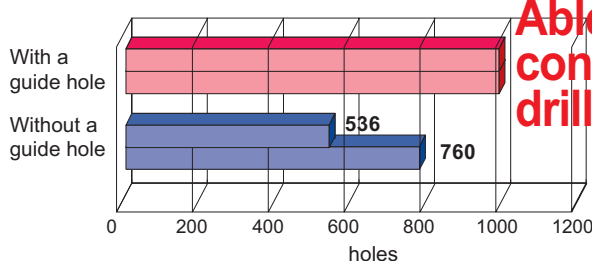
Creation of maximum variance of 0.012mm will cause short tool life.



<Cutting conditions> Workpiece : SUS304	
(Cutting a guide hole)	(Drilling)
Tool : MSP0300SB	Tool : MSE0010SB
Revolution : 10,000min <sup>-1</sup>	Cutting speed : 3.1m/min
Table feed : 5.0mm/min	Revolution : 10,000min <sup>-1</sup>
Guide hole dia. : 0.09mm	Feed : 0.002mm/rev
Coolant : Water soluble emulsion	Table feed : 20mm/min
	Hole depth : 0.8mm Blind hole
	Steps : 0.01mm

## 2. Drilling stability

Without variance in the number of drilled holes, stable drilling is possible.

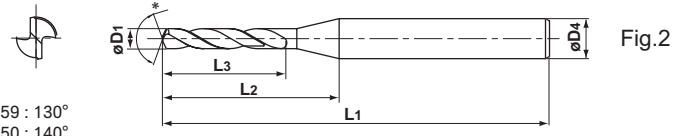
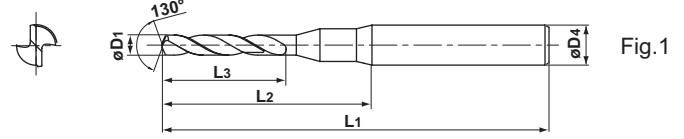


**Able to continue drilling**

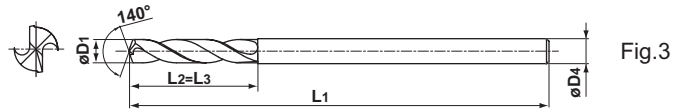
<Cutting conditions> Workpiece : SUS304	
(Cutting a guide hole)	(Drilling)
Tool : MSP0300SB	Tool : MSE0020SB
Revolution : 10,000min <sup>-1</sup>	Cutting speed : 6.3m/min
Table feed : 5.0mm/min	Revolution : 10,000min <sup>-1</sup>
Guide hole dia. : 0.15mm	Feed : 0.002mm/rev
Coolant : Water soluble emulsion	Table feed : 20mm/min
	Hole depth : 1.6mm Blind hole
	Steps : 0.02mm
	Coolant : Water soluble emulsion

# MIRACLE MINI STAR Drill

D1	0.10 ≤ D1 ≤ 3.00
Tolerance	0 -0.009



\* Drill diameter  $\phi$  0.30~1.59 : 130°  
 $\phi$  1.60~2.50 : 140°



Drill dia. D1 (mm)	Coolant	Stock		Order Number	Dimensions (mm)				Type
		VP20MF	VP15TF		D4	L1	L2	L3	
0.10	Ext.	●		MSE0010SB	3	38	9.7	1.2	Fig.1
0.11	Ext.	●		0011SB	3	38	9.7	1.2	Fig.1
0.12	Ext.	●		0012SB	3	38	9.7	1.4	Fig.1
0.13	Ext.	●		0013SB	3	38	9.7	1.4	Fig.1
0.14	Ext.	●		0014SB	3	38	9.7	2	Fig.1
0.15	Ext.	●		0015SB	3	38	9.7	2	Fig.1
0.16	Ext.	●		0016SB	3	38	9.7	2	Fig.1
0.17	Ext.	●		0017SB	3	38	9.7	2	Fig.1
0.18	Ext.	●		0018SB	3	38	9.7	2	Fig.1
0.19	Ext.	●		0019SB	3	38	9.7	2	Fig.1
0.20	Ext.	●		0020SB	3	38	9.7	2.5	Fig.1
0.21	Ext.	●		0021SB	3	38	9.7	2.5	Fig.1
0.22	Ext.	●		0022SB	3	38	9.7	2.5	Fig.1
0.23	Ext.	●		0023SB	3	38	9.7	2.5	Fig.1
0.24	Ext.	●		0024SB	3	38	9.7	3	Fig.1
0.25	Ext.	●		0025SB	3	38	9.7	3	Fig.1
0.26	Ext.	●		0026SB	3	38	9.7	3	Fig.1
0.27	Ext.	●		0027SB	3	38	9.7	3	Fig.1
0.28	Ext.	●		0028SB	3	38	9.7	3	Fig.1
0.29	Ext.	●		0029SB	3	38	9.7	3	Fig.1
0.30	Ext.		●	0030SB	3	38	10.2	5	Fig.2
0.31	Ext.		●	0031SB	3	38	10.2	5	Fig.2
0.32	Ext.		●	0032SB	3	38	10.2	5	Fig.2
0.33	Ext.		●	0033SB	3	38	10.2	5	Fig.2
0.34	Ext.		●	0034SB	3	38	11.2	6	Fig.2
0.35	Ext.		●	0035SB	3	38	11.1	6	Fig.2
0.36	Ext.		●	0036SB	3	38	11.1	6	Fig.2
0.37	Ext.		●	0037SB	3	38	11.1	6	Fig.2
0.38	Ext.		●	0038SB	3	38	11.1	6	Fig.2
0.39	Ext.		●	0039SB	3	38	11.1	6	Fig.2
0.40	Ext.		●	0040SB	3	38	12.1	7	Fig.2
0.41	Ext.		●	0041SB	3	38	12.0	7	Fig.2
0.42	Ext.		●	0042SB	3	38	12.0	7	Fig.2
0.43	Ext.		●	0043SB	3	38	12.0	7	Fig.2

Drill dia. D1 (mm)	Coolant	Stock		Order Number	Dimensions (mm)				Type
		VP20MF	VP15TF		D4	L1	L2	L3	
0.44	Ext.		●	MSE0044SB	3	38	12.0	7	Fig.2
0.45	Ext.		●	0045SB	3	38	12.0	7	Fig.2
0.46	Ext.		●	0046SB	3	38	11.9	7	Fig.2
0.47	Ext.		●	0047SB	3	38	11.9	7	Fig.2
0.48	Ext.		●	0048SB	3	38	11.9	7	Fig.2
0.49	Ext.		●	0049SB	3	38	11.9	7	Fig.2
0.50	Ext.		●	0050SB	3	38	11.9	7	Fig.2
0.51	Ext.		●	0051SB	3	38	11.8	7	Fig.2
0.52	Ext.		●	0052SB	3	38	11.8	7	Fig.2
0.53	Ext.		●	0053SB	3	38	11.8	7	Fig.2
0.54	Ext.		●	0054SB	3	38	11.8	7	Fig.2
0.55	Ext.		●	0055SB	3	38	11.8	7	Fig.2
0.56	Ext.		●	0056SB	3	38	11.8	7	Fig.2
0.57	Ext.		●	0057SB	3	38	11.7	7	Fig.2
0.58	Ext.		●	0058SB	3	38	11.7	7	Fig.2
0.59	Ext.		●	0059SB	3	38	11.7	7	Fig.2
0.60	Ext.		●	0060SB	3	38	11.7	7	Fig.2
0.61	Ext.		●	0061SB	3	38	11.7	7	Fig.2
0.62	Ext.		●	0062SB	3	38	11.6	7	Fig.2
0.63	Ext.		●	0063SB	3	38	11.6	7	Fig.2
0.64	Ext.		●	0064SB	3	38	11.6	7	Fig.2
0.65	Ext.		●	0065SB	3	38	11.6	7	Fig.2
0.66	Ext.		●	0066SB	3	38	11.6	7	Fig.2
0.67	Ext.		●	0067SB	3	38	11.5	7	Fig.2
0.68	Ext.		●	0068SB	3	38	11.5	7	Fig.2
0.69	Ext.		●	0069SB	3	38	11.5	7	Fig.2
0.70	Ext.		●	0070SB	3	38	12.5	8	Fig.2
0.71	Ext.		●	0071SB	3	38	12.5	8	Fig.2
0.72	Ext.		●	0072SB	3	38	12.5	8	Fig.2
0.73	Ext.		●	0073SB	3	38	12.4	8	Fig.2
0.74	Ext.		●	0074SB	3	38	12.4	8	Fig.2
0.75	Ext.		●	0075SB	3	38	12.4	8	Fig.2
0.76	Ext.		●	0076SB	3	38	12.4	8	Fig.2
0.77	Ext.		●	0077SB	3	38	12.4	8	Fig.2

Note : Please contact Mitsubishi Materials for grades and special shapes other than our standardized products-such as different diameter/length from standard size, drill with chamfered cutting edges.

● : Inventory maintained. No mark : Products not manufactured.

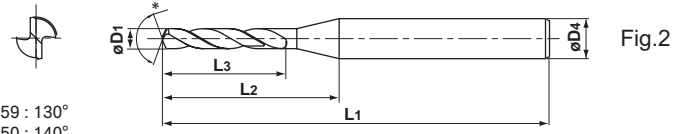
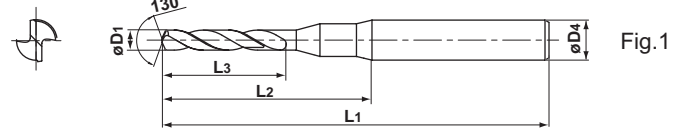


Drill dia. D <sub>1</sub> (mm)	Coolant	Stock		Order Number	Dimensions (mm)				Type
		VP20MF	VP15TF		D4	L1	L2	L3	
0.78	Ext.		●	MSE0078SB	3	38	12.3	8	Fig.2
0.79	Ext.		●	0079SB	3	38	12.3	8	Fig.2
0.80	Ext.		●	0080SB	3	38	14.3	10	Fig.2
0.81	Ext.		●	0081SB	3	38	14.3	10	Fig.2
0.82	Ext.		●	0082SB	3	38	14.3	10	Fig.2
0.83	Ext.		●	0083SB	3	38	14.3	10	Fig.2
0.84	Ext.		●	0084SB	3	38	14.2	10	Fig.2
0.85	Ext.		●	0085SB	3	38	14.2	10	Fig.2
0.86	Ext.		●	0086SB	3	38	14.2	10	Fig.2
0.87	Ext.		●	0087SB	3	38	14.2	10	Fig.2
0.88	Ext.		●	0088SB	3	38	14.2	10	Fig.2
0.89	Ext.		●	0089SB	3	38	14.1	10	Fig.2
0.90	Ext.		●	0090SB	3	38	14.1	10	Fig.2
0.91	Ext.		●	0091SB	3	38	14.1	10	Fig.2
0.92	Ext.		●	0092SB	3	38	14.1	10	Fig.2
0.93	Ext.		●	0093SB	3	38	14.1	10	Fig.2
0.94	Ext.		●	0094SB	3	38	14.0	10	Fig.2
0.95	Ext.		●	0095SB	3	38	14.0	10	Fig.2
0.96	Ext.		●	0096SB	3	38	14.0	10	Fig.2
0.97	Ext.		●	0097SB	3	38	14.0	10	Fig.2
0.98	Ext.		●	0098SB	3	38	14.0	10	Fig.2
0.99	Ext.		●	0099SB	3	38	14.0	10	Fig.2
1.00	Ext.		●	0100SB	3	38	13.9	10	Fig.2
1.01	Ext.		●	0101SB	3	38	13.9	10	Fig.2
1.02	Ext.		●	0102SB	3	38	13.9	10	Fig.2
1.03	Ext.		●	0103SB	3	38	13.9	10	Fig.2
1.04	Ext.		●	0104SB	3	38	13.9	10	Fig.2
1.05	Ext.		●	0105SB	3	38	13.8	10	Fig.2
1.06	Ext.		●	0106SB	3	38	13.8	10	Fig.2
1.07	Ext.		●	0107SB	3	38	13.8	10	Fig.2
1.08	Ext.		●	0108SB	3	38	13.8	10	Fig.2
1.09	Ext.		●	0109SB	3	38	13.8	10	Fig.2
1.10	Ext.		●	0110SB	3	38	13.7	10	Fig.2
1.11	Ext.		●	0111SB	3	38	13.7	10	Fig.2
1.12	Ext.		●	0112SB	3	38	13.7	10	Fig.2
1.13	Ext.		●	0113SB	3	38	13.7	10	Fig.2
1.14	Ext.		●	0114SB	3	38	13.7	10	Fig.2
1.15	Ext.		●	0115SB	3	38	13.7	10	Fig.2
1.16	Ext.		●	0116SB	3	38	13.6	10	Fig.2
1.17	Ext.		●	0117SB	3	38	13.6	10	Fig.2
1.18	Ext.		●	0118SB	3	38	13.6	10	Fig.2
1.19	Ext.		●	0119SB	3	38	13.6	10	Fig.2
1.20	Ext.		●	0120SB	3	38	13.6	10	Fig.2
1.21	Ext.		●	0121SB	3	38	13.5	10	Fig.2
1.22	Ext.		●	0122SB	3	38	13.5	10	Fig.2
1.23	Ext.		●	0123SB	3	38	13.5	10	Fig.2
1.24	Ext.		●	0124SB	3	38	13.5	10	Fig.2
1.25	Ext.		●	0125SB	3	38	13.5	10	Fig.2
1.26	Ext.		●	0126SB	3	38	13.4	10	Fig.2
1.27	Ext.		●	0127SB	3	38	13.4	10	Fig.2

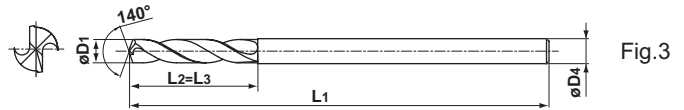
Drill dia. D <sub>1</sub> (mm)	Coolant	Stock		Order Number	Dimensions (mm)				Type
		VP20MF	VP15TF		D4	L1	L2	L3	
1.28	Ext.		●	MSE0128SB	3	38	13.4	10	Fig.2
1.29	Ext.		●	0129SB	3	38	13.4	10	Fig.2
1.30	Ext.		●	0130SB	3	38	13.4	10	Fig.2
1.31	Ext.		●	0131SB	3	38	13.4	10	Fig.2
1.32	Ext.		●	0132SB	3	38	13.3	10	Fig.2
1.33	Ext.		●	0133SB	3	38	13.3	10	Fig.2
1.34	Ext.		●	0134SB	3	38	13.3	10	Fig.2
1.35	Ext.		●	0135SB	3	38	13.3	10	Fig.2
1.36	Ext.		●	0136SB	3	38	13.3	10	Fig.2
1.37	Ext.		●	0137SB	3	38	13.2	10	Fig.2
1.38	Ext.		●	0138SB	3	38	13.2	10	Fig.2
1.39	Ext.		●	0139SB	3	38	13.2	10	Fig.2
1.40	Ext.		●	0140SB	3	38	13.2	10	Fig.2
1.41	Ext.		●	0141SB	3	38	13.2	10	Fig.2
1.42	Ext.		●	0142SB	3	38	13.1	10	Fig.2
1.43	Ext.		●	0143SB	3	38	13.1	10	Fig.2
1.44	Ext.		●	0144SB	3	38	13.1	10	Fig.2
1.45	Ext.		●	0145SB	3	38	13.1	10	Fig.2
1.46	Ext.		●	0146SB	3	38	13.1	10	Fig.2
1.47	Ext.		●	0147SB	3	38	13.1	10	Fig.2
1.48	Ext.		●	0148SB	3	38	13.0	10	Fig.2
1.49	Ext.		●	0149SB	3	38	13.0	10	Fig.2
1.50	Ext.		●	0150SB	3	38	13.0	10	Fig.2
1.51	Ext.		●	0151SB	3	38	13.0	10	Fig.2
1.52	Ext.		●	0152SB	3	38	13.0	10	Fig.2
1.53	Ext.		●	0153SB	3	38	12.9	10	Fig.2
1.54	Ext.		●	0154SB	3	38	12.9	10	Fig.2
1.55	Ext.		●	0155SB	3	38	12.9	10	Fig.2
1.56	Ext.		●	0156SB	3	38	12.9	10	Fig.2
1.57	Ext.		●	0157SB	3	38	12.9	10	Fig.2
1.58	Ext.		●	0158SB	3	38	12.8	10	Fig.2
1.59	Ext.		●	0159SB	3	38	12.8	10	Fig.2
1.60	Ext.		●	0160SB	3	45	14.6	12	Fig.2
1.61	Ext.		●	0161SB	3	45	14.6	12	Fig.2
1.62	Ext.		●	0162SB	3	45	14.6	12	Fig.2
1.63	Ext.		●	0163SB	3	45	14.6	12	Fig.2
1.64	Ext.		●	0164SB	3	45	14.5	12	Fig.2
1.65	Ext.		●	0165SB	3	45	14.5	12	Fig.2
1.66	Ext.		●	0166SB	3	45	14.5	12	Fig.2
1.67	Ext.		●	0167SB	3	45	14.5	12	Fig.2
1.68	Ext.		●	0168SB	3	45	14.5	12	Fig.2
1.69	Ext.		●	0169SB	3	45	14.4	12	Fig.2
1.70	Ext.		●	0170SB	3	45	14.4	12	Fig.2
1.71	Ext.		●	0171SB	3	45	14.4	12	Fig.2
1.72	Ext.		●	0172SB	3	45	14.4	12	Fig.2
1.73	Ext.		●	0173SB	3	45	14.4	12	Fig.2
1.74	Ext.		●	0174SB	3	45	14.4	12	Fig.2
1.75	Ext.		●	0175SB	3	45	14.3	12	Fig.2
1.76	Ext.		●	0176SB	3	45	14.3	12	Fig.2
1.77	Ext.		●	0177SB	3	45	14.3	12	Fig.2

# MIRACLE MINI STAR Drill

D1	0.10 ≤ D1 ≤ 3.00
Tolerance	0 -0.009



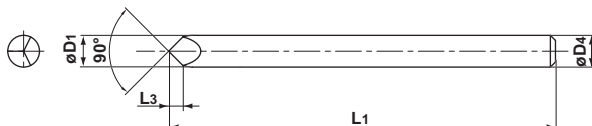
\* Drill diameter  $\phi$  0.30~1.59 : 130°  
 $\phi$  1.60~2.50 : 140°



Drill dia. D1 (mm)	Coolant	Stock		Order Number	Dimensions (mm)				Type
		VP20MF	VP15TF		D4	L1	L2	L3	
1.78	Ext.		●	MSE0178SB	3	45	14.3	12	Fig.2
1.79	Ext.		●	0179SB	3	45	14.3	12	Fig.2
1.80	Ext.		●	0180SB	3	45	14.2	12	Fig.2
1.81	Ext.		●	0181SB	3	45	14.2	12	Fig.2
1.82	Ext.		●	0182SB	3	45	14.2	12	Fig.2
1.83	Ext.		●	0183SB	3	45	14.2	12	Fig.2
1.84	Ext.		●	0184SB	3	45	14.2	12	Fig.2
1.85	Ext.		●	0185SB	3	45	14.1	12	Fig.2
1.86	Ext.		●	0186SB	3	45	14.1	12	Fig.2
1.87	Ext.		●	0187SB	3	45	14.1	12	Fig.2
1.88	Ext.		●	0188SB	3	45	14.1	12	Fig.2
1.89	Ext.		●	0189SB	3	45	14.1	12	Fig.2
1.90	Ext.		●	0190SB	3	45	14.1	12	Fig.2
1.91	Ext.		●	0191SB	3	45	14.0	12	Fig.2
1.92	Ext.		●	0192SB	3	45	14.0	12	Fig.2
1.93	Ext.		●	0193SB	3	45	14.0	12	Fig.2
1.94	Ext.		●	0194SB	3	45	14.0	12	Fig.2
1.95	Ext.		●	0195SB	3	45	14.0	12	Fig.2
1.96	Ext.		●	0196SB	3	45	13.9	12	Fig.2
1.97	Ext.		●	0197SB	3	45	13.9	12	Fig.2
1.98	Ext.		●	0198SB	3	45	13.9	12	Fig.2
1.99	Ext.		●	0199SB	3	45	13.9	12	Fig.2

Drill dia. D1 (mm)	Coolant	Stock		Order Number	Dimensions (mm)				Type
		VP20MF	VP15TF		D4	L1	L2	L3	
2.00	Ext.		●	MSE0200SB	3	50	16.9	15	Fig.2
2.05	Ext.		●	0205SB	3	50	16.8	15	Fig.2
2.10	Ext.		●	0210SB	3	50	16.7	15	Fig.2
2.15	Ext.		●	0215SB	3	50	16.6	15	Fig.2
2.20	Ext.		●	0220SB	3	50	16.5	15	Fig.2
2.25	Ext.		●	0225SB	3	50	16.4	15	Fig.2
2.30	Ext.		●	0230SB	3	50	16.3	15	Fig.2
2.35	Ext.		●	0235SB	3	50	16.2	15	Fig.2
2.40	Ext.		●	0240SB	3	50	16.1	15	Fig.2
2.45	Ext.		●	0245SB	3	50	16.0	15	Fig.2
2.50	Ext.		●	0250SB	3	50	15.9	15	Fig.2
2.55	Ext.		●	0255SB	3	50	15	15	Fig.3
2.60	Ext.		●	0260SB	3	50	15	15	Fig.3
2.65	Ext.		●	0265SB	3	50	15	15	Fig.3
2.70	Ext.		●	0270SB	3	50	15	15	Fig.3
2.75	Ext.		●	0275SB	3	50	15	15	Fig.3
2.80	Ext.		●	0280SB	3	50	15	15	Fig.3
2.85	Ext.		●	0285SB	3	50	15	15	Fig.3
2.90	Ext.		●	0290SB	3	50	15	15	Fig.3
2.95	Ext.		●	0295SB	3	50	15	15	Fig.3
3.00	Ext.		●	0300SB	3	50	15	15	Fig.3

## For cutting a guide hole **STARTING Drill**



Order Number	Grade	Stock	Dimensions (mm)				Range of Diameter (mm)
			D1	D4	L1	L3	
MSP0300SB	VP15TF	●	3	3	38	1.5	0.1~3.0

Note : Please contact Mitsubishi Materials for grades and special shapes other than our standardized products-such as different diameter/length from standard size, drill with chamfered cutting edges.

● : Inventory maintained. No mark : Products not manufactured.

## Recommended cutting conditions

Workpiece	Hardness	Drill diameter $\phi 0.10 - 0.19$			Drill diameter $\phi 0.20 - 0.29$			Drill diameter $\phi 0.30 - 0.49$		
		Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)
<b>P</b> General steel / Carbon steel	$\leq 180\text{HB}$	20,000	0.002	0.02	20,000	0.003	0.04	20,000	0.004	0.05
	Alloy steel Pre-hardened steel	$\leq 40\text{HRC}$	20,000	0.002	0.02	20,000	0.003	0.04	20,000	0.004
<b>M</b> Stainless steel	$\leq 200\text{HB}$	20,000	0.002	0.02	18,000	0.003	0.04	15,000	0.004	0.05
<b>K</b> Cast iron	Tensile strength $\leq 350\text{N/mm}^2$	20,000	0.002	0.02	20,000	0.003	0.04	20,000	0.004	0.05
<b>N</b> Aluminum alloy	–	20,000	0.004	0.05	20,000	0.006	0.1	20,000	0.02	0.3
<b>S</b> Heat resistant alloy	–	7,000	0.001	0.02	5,000	0.002	0.04	4,000	0.003	0.05

Workpiece	Hardness	Drill diameter $\phi 0.50 - 0.79$			Drill diameter $\phi 0.80 - 0.99$			Drill diameter $\phi 1.00 - 1.19$		
		Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)
<b>P</b> General steel / Carbon steel	$\leq 180\text{HB}$	20,000	0.01	0.1	20,000	0.04	0.3	16,000	0.06	0.5
	Alloy steel Pre-hardened steel	$\leq 40\text{HRC}$	20,000	0.01	0.1	20,000	0.02	0.3	16,000	0.03
<b>M</b> Stainless steel	$\leq 200\text{HB}$	10,000	0.01	0.1	6,000	0.02	0.2	5,000	0.03	0.3
<b>K</b> Cast iron	Tensile strength $\leq 350\text{N/mm}^2$	20,000	0.01	0.1	20,000	0.04	0.3	16,000	0.06	0.5
<b>N</b> Aluminum alloy	–	20,000	0.05	0.5	20,000	0.06	0.8	20,000	0.08	1.0
<b>S</b> Heat resistant alloy	–	3,000	0.005	0.1	1,800	0.01	0.2	1,000	0.015	0.3

Workpiece	Hardness	Drill diameter $\phi 1.20 - 1.49$			Drill diameter $\phi 1.50 - 1.99$			Drill diameter $\phi 2.00 - 2.45$		
		Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)
<b>P</b> General steel / Carbon steel	$\leq 180\text{HB}$	13,000	0.07	0.6	12,000	0.08	0.7	9,500	0.10	0.8
	Alloy steel Pre-hardened steel	$\leq 40\text{HRC}$	13,000	0.05	0.6	10,000	0.06	0.7	7,000	0.07
<b>M</b> Stainless steel	$\leq 200\text{HB}$	4,000	0.03	0.4	3,000	0.04	0.5	3,000	0.05	0.6
<b>K</b> Cast iron	Tensile strength $\leq 350\text{N/mm}^2$	13,000	0.07	0.6	12,000	0.08	0.7	9,500	0.10	0.8
<b>N</b> Aluminum alloy	–	18,000	0.10	1.2	15,000	0.10	1.5	12,000	0.12	2.0
<b>S</b> Heat resistant alloy	–	–	–	–	–	–	–	–	–	–

Workpiece	Hardness	Drill diameter $\phi 2.50 - 2.95$			Drill diameter $\phi 3.00$		
		Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)	Revolution (min <sup>-1</sup> )	Feed (mm/rev)	Steps (mm)
<b>P</b> General steel / Carbon steel	$\leq 180\text{HB}$	7,600	0.12	0.9	6,300	0.12	1.0
	Alloy steel Pre-hardened steel	$\leq 40\text{HRC}$	5,500	0.08	0.9	4,500	0.10
<b>M</b> Stainless steel	$\leq 200\text{HB}$	2,500	0.08	0.7	2,000	0.10	0.8
<b>K</b> Cast iron	Tensile strength $\leq 350\text{N/mm}^2$	7,600	0.12	0.9	6,300	0.12	1.0
<b>N</b> Aluminum alloy	–	9,000	0.12	2.5	7,500	0.15	3.0
<b>S</b> Heat resistant alloy	–	–	–	–	–	–	–

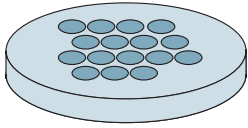
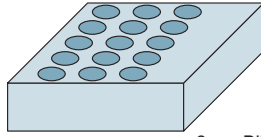
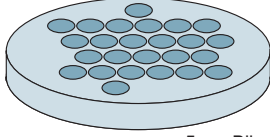
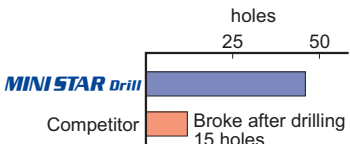
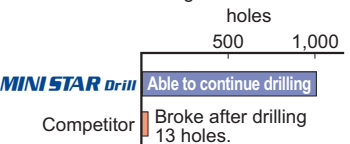
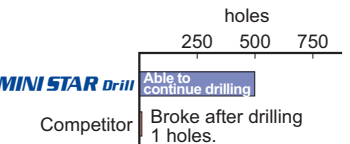
(Note)

- \* When drilling a hole of  $\phi 3.00$  or smaller, use of the Starting Drill is recommend. (Order number: MSP0300SB, Cutting conditions: See below.)
- \* Change cutting conditions, depending on your machines.
- \* When drilling depth is over 5 times the drill diameter, decrease "step" above.
- \* Use of water-soluble fluid (thinned by 20 times) is a precondition for drilling under cutting conditions above. Lower revolution if you use oil fluid or mist.
- \* Workpieces marked by "-" in the above tables are difficult to drill with external coolant. Use of internal coolant type MZS, YC-SSL-OH or VA-PDS-SUS is recommended.

Workpiece	Revolution (min <sup>-1</sup> )	Table Feed (mm/min)
<b>MSP0300SB</b>	10,000	5.0

# MIRACLE MINI STAR Drill

## Application examples

Tool		MSE0050SB	MSE0050SB	MSE0100SB
Workpiece		Heat resistant alloy (Inconel 718)  5.25mm Through hole	Pre-hardened steel (JIS 45HRC)  6mm Blind hole	Aluminum alloy (JIS A7075)  5mm Blind hole
Component		Test piece	Plate	Plate
Cutting conditions	Cutting speed (m/min)	4.7	24	80
	Feed (mm/rev)	0.005	0.01	0.08
	Revolution (min <sup>-1</sup> )	3,000	15,000	25,000
	Table feed (mm/min)	15	150	2,000
	Steps (mm)	0.1	0.1	1.0
Coolant		Water soluble oil	Mist	Water soluble oil
Machine		Machining center	Machining center	Machining center
Result		A competitor's product broke after drilling 15 holes. The <b>MINI STAR Drill</b> could drill 47 holes stably. 	A competitor's product broke after 13 holes. The <b>MINI STAR Drill</b> drilled 100 holes and was in a condition of being able to continue drilling. 	A competitor's product broke after drilling one hole due to chips jamming. The <b>MINI STAR Drill</b> were capable of stable drilling even when "steps" were 

For Your Safety

●Don't touch breakers and chips without gloves. ●Please machine within recommended application range, and exchange expired tools with new parts in advance. ●Please use safety cover and wear safety glasses. ●When using compounded cutting oils, please take fire prevention. ●When attaching chips or spare parts, please use the attached wrench or spanner. ●When using tools in revolution machining, please make a trial run to check run-out, vibration, 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.

## MITSUBISHI MATERIALS CORPORATION



### Overseas Operations Center : Cutting Tools

KFC bldg., 7F, 1-6-1, Yokoami, Sumida-ku, Tokyo 130-0015, Japan  
TEL 81-3-5819-8771 FAX 81-3-5819-8774

### MMC HARTMETALL GmbH

Comeniusstr.2, 40670, Meerbusch GERMANY  
TEL 49-2159-9189-0 FAX 49-2159-50462

### MITSUBISHI MATERIALS U.S.A. CORPORATION Headquarters

17401, Eastman Street, Irvine, California, 92614, USA  
TEL 1-949-862-5100 FAX 1-949-862-5180

### MMC METAL SINGAPORE PTE LTD.

10, Arumugam Road, #04-00 Lion Industrial Bldg.,409957, SINGAPORE  
TEL 65-6743-9370 FAX 65-6749-1469

Mitsubishi Carbides Home page : <http://www.mitsubishicarbide.com>  
(Tools specifications subject to change without notice.)