

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

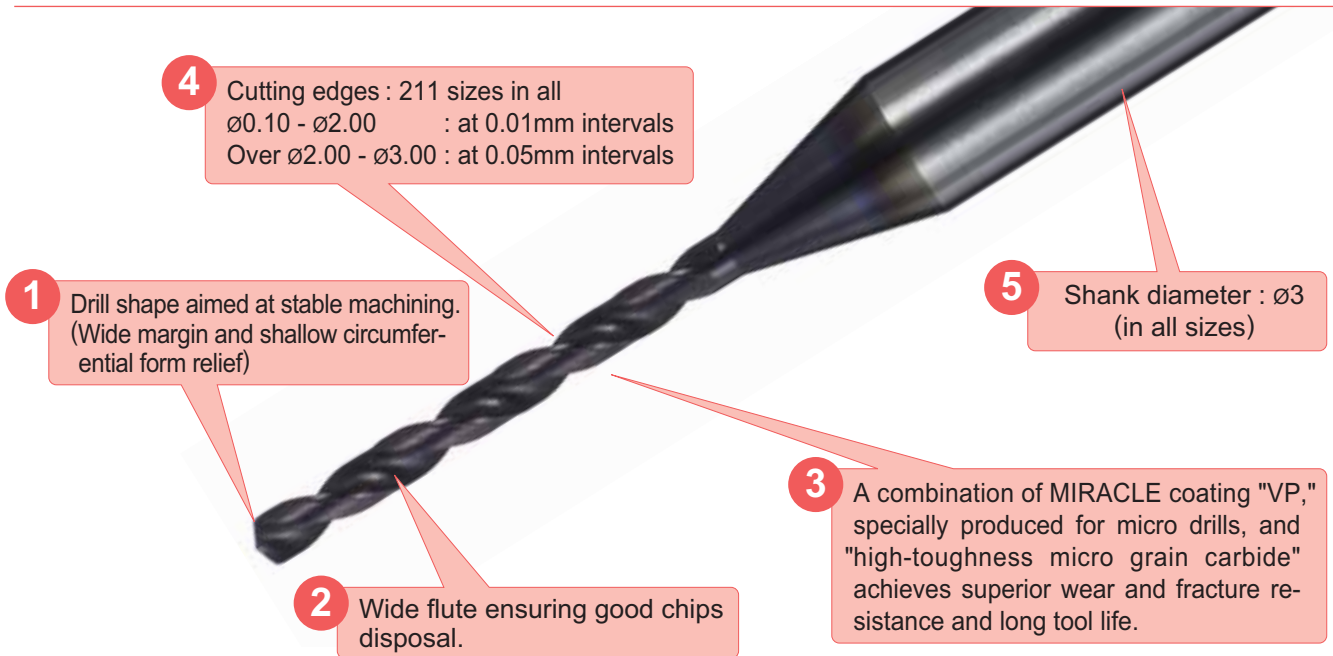
STARTING Drill

Triangular pyramid shape helps drill a high precision guide hole.

Micro Solid Carbide Drills

MIRACLE MINI STAR Drill

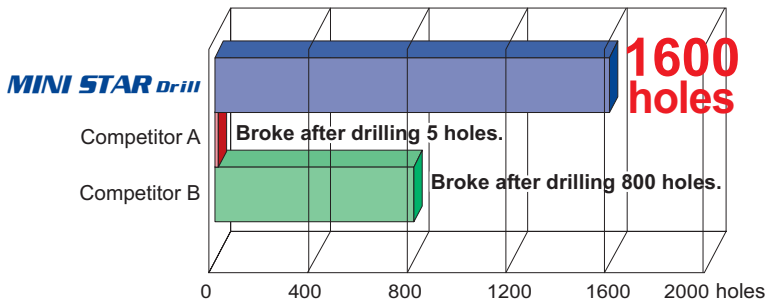
Features



Cutting performance

● Tool life evaluation (in drilling of stainless steel)

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

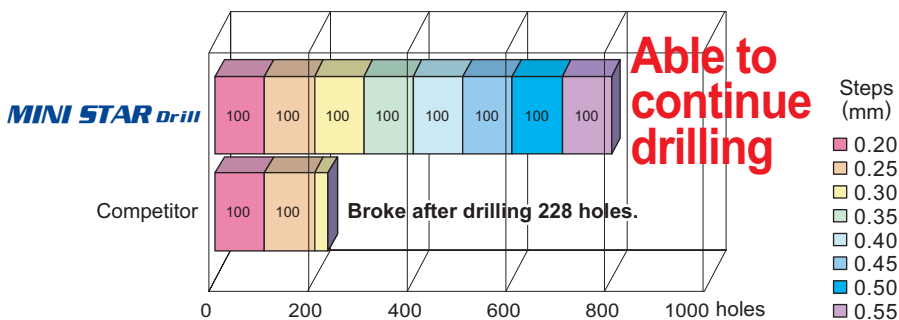


<Cutting conditions>
 Tool : MSE0050SB
 Workpiece : SUS304
 Cutting speed : 9.4m/min ($6,000\text{min}^{-1}$)
 Feed : 0.015mm/rev (90mm/min)
 Hole depth : 5.0mm Blind hole
 Steps : 0.15mm
 Coolant : Water soluble emulsion
 Machine : Machining center

● Chips disposal (in drilling aluminum alloy)

Wide flute prevents chips jamming.

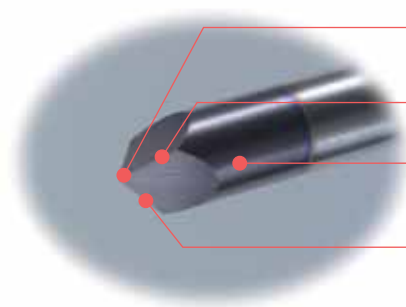
Stepped drilling test : We increased a "step"-distance of a drill being reversed-by 0.05mm every 100 holes drilling.



<Cutting conditions>
 Tool : MSE0050SB
 Workpiece : A7075P
 Cutting speed : 25m/min ($16,000\text{min}^{-1}$)
 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



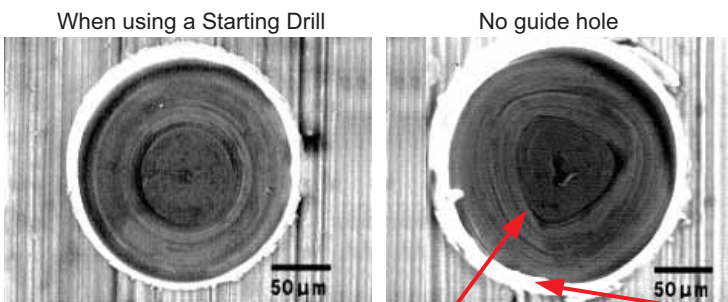
Triangular pyramid shape helps drill a high precision guide hole.

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.

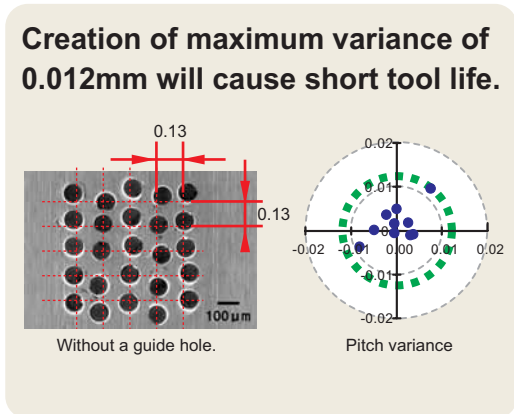
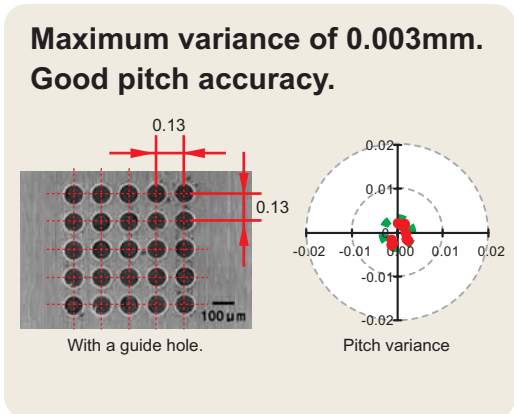
<Cutting conditions> Workpiece : SUS304	
(Cutting a guide hole)	(Drilling)
Tool : MSP0300SB	Tool : MSE0020SB
Guide hole dia. : 0.15mm	Cutting speed : 6.3m/min
Revolution : 10,000min ⁻¹	Revolution : 10,000min ⁻¹
Table feed : 5.0mm/min	Feed : 0.002mm/rev
Coolant : Water soluble emulsion	Table feed : 20mm/min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

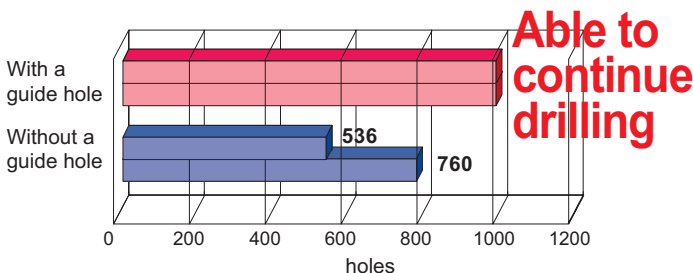
1. Comparison of hole positioning accuracy



<Cutting conditions> Workpiece : SUS304	
(Cutting a guide hole)	(Drilling)
Tool : MSP0300SB	Tool : MSE0010SB
Revolution : 10,000min ⁻¹	Cutting speed : 3.1m/min
Table feed : 5.0mm/min	Revolution : 10,000min ⁻¹
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

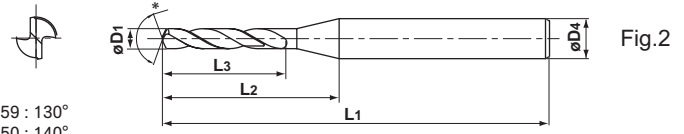
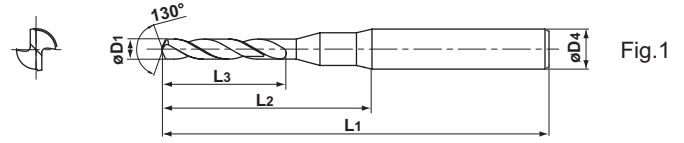
Without variance in the number of drilled holes, stable drilling is possible.



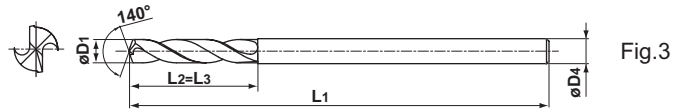
<Cutting conditions> Workpiece : SUS304	
(Cutting a guide hole)	(Drilling)
Tool : MSP0300SB	Tool : MSE0020SB
Revolution : 10,000min ⁻¹	Cutting speed : 6.3m/min
Table feed : 5.0mm/min	Revolution : 10,000min ⁻¹
Guide hole dia. : 0.15mm	Feed : 0.002mm/rev
Coolant : Water soluble emulsion	Table feed : 20mm/min
	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 ϕ 0.30~1.59 : 130°
 ϕ 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.

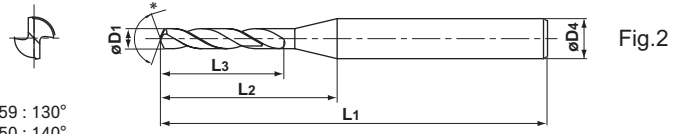
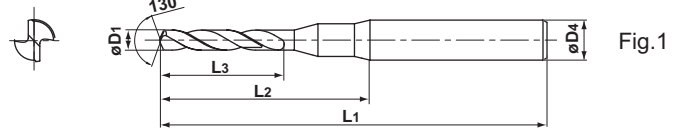
● : Inventory maintained. No mark : Products not manufactured.

Drill dia. D ₁ (mm)	Coolant	Stock		Order Number	Dimensions (mm)				Type
		VP20MF	VP15TF		D ₄	L ₁	L ₂	L ₃	
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

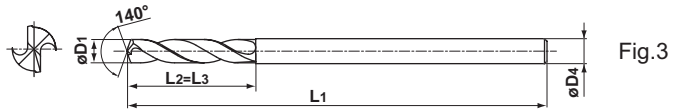
Drill dia. D ₁ (mm)	Coolant	Stock		Order Number	Dimensions (mm)				Type
		VP20MF	VP15TF		D ₄	L ₁	L ₂	L ₃	
1.28	Ext.		●	MSE0128SB	3	38	13.4	10	Fig.2
1.29	Ext.		●	0129SB	3	38	13.4	10	Fig.2
1.30	Ext.		●	0130SB	3	38	13.4	10	Fig.2
1.31	Ext.		●	0131SB	3	38	13.4	10	Fig.2
1.32	Ext.		●	0132SB	3	38	13.3	10	Fig.2
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



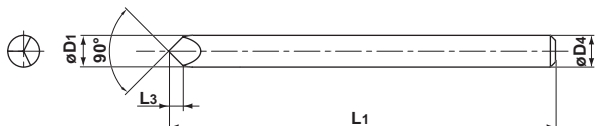
* Drill diameter ϕ 0.30~1.59 : 130°
 ϕ 1.60~2.50 : 140°



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 ⁻¹)	Feed (mm/rev)	Steps (mm)	Revolution (min ⁻¹)	Feed (mm/rev)	Steps (mm)	Revolution (min ⁻¹)	Feed (mm/rev)	Steps (mm)
P 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
M Stainless steel	$\leq 200\text{HB}$	20,000	0.002	0.02	18,000	0.003	0.04	15,000	0.004	0.05
K 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
N Aluminum alloy	-	20,000	0.004	0.05	20,000	0.006	0.1	20,000	0.02	0.3
S 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 ⁻¹)	Feed (mm/rev)	Steps (mm)	Revolution (min ⁻¹)	Feed (mm/rev)	Steps (mm)	Revolution (min ⁻¹)	Feed (mm/rev)	Steps (mm)
P 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
M Stainless steel	$\leq 200\text{HB}$	10,000	0.01	0.1	6,000	0.02	0.2	5,000	0.03	0.3
K 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
N Aluminum alloy	-	20,000	0.05	0.5	20,000	0.06	0.8	20,000	0.08	1.0
S 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 ⁻¹)	Feed (mm/rev)	Steps (mm)	Revolution (min ⁻¹)	Feed (mm/rev)	Steps (mm)	Revolution (min ⁻¹)	Feed (mm/rev)	Steps (mm)
P 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
M Stainless steel	$\leq 200\text{HB}$	4,000	0.03	0.4	3,000	0.04	0.5	3,000	0.05	0.6
K 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
N Aluminum alloy	-	18,000	0.10	1.2	15,000	0.10	1.5	12,000	0.12	2.0
S Heat resistant alloy	-	-	-	-	-	-	-	-	-	-

Workpiece	Hardness	Drill diameter $\phi 2.50 - 2.95$			Drill diameter $\phi 3.00$		
		Revolution (min ⁻¹)	Feed (mm/rev)	Steps (mm)	Revolution (min ⁻¹)	Feed (mm/rev)	Steps (mm)
P 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
M Stainless steel	$\leq 200\text{HB}$	2,500	0.08	0.7	2,000	0.10	0.8
K Cast iron	Tensile strength $\leq 350\text{N/mm}^2$	7,600	0.12	0.9	6,300	0.12	1.0
N Aluminum alloy	-	9,000	0.12	2.5	7,500	0.15	3.0
S Heat resistant alloy	-	-	-	-	-	-	-

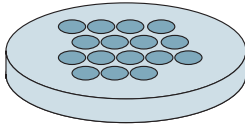
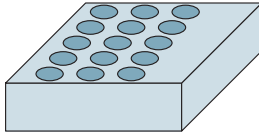
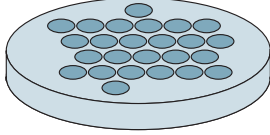
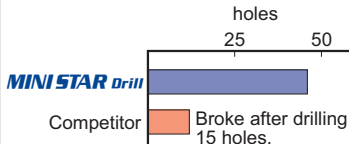
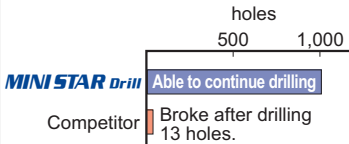
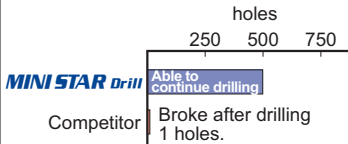
(Note)

- * 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 ⁻¹)	Table Feed (mm/min)
MSP0300SB	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 ⁻¹)	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 MINI STAR Drill could drill 47 holes stably. 	A competitor's product broke after 13 holes. The MINI STAR Drill 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 MINI STAR Drill 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.

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(Tools specifications subject to change without notice.)