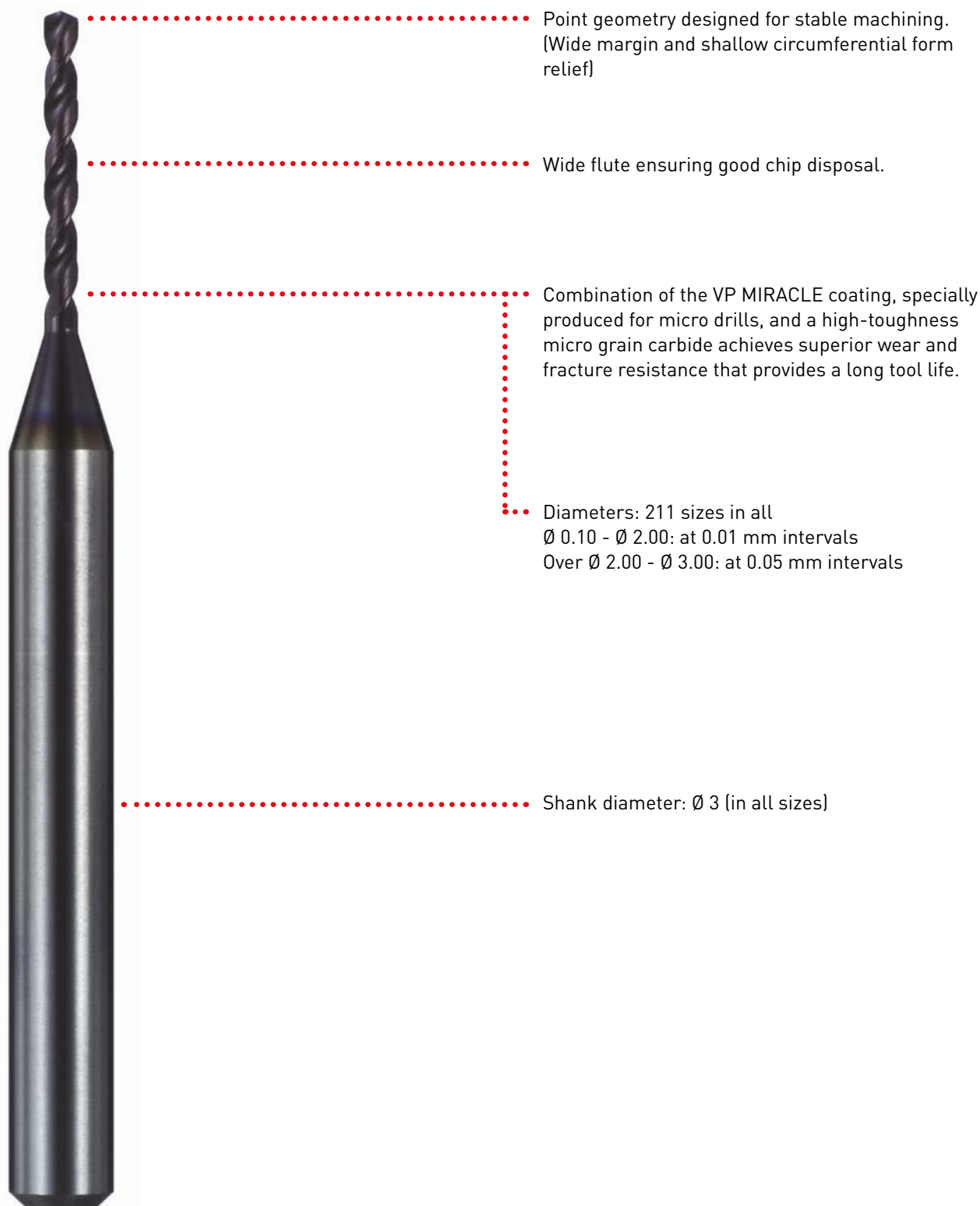

MSE

LONG TOOL LIFE AND HIGHLY EFFICIENT MICRO DRILLING
ENABLED BY ULTRA-HIGH PRECISION MANUFACTURING



MSE MINI STAR

LONG TOOL LIFE AND HIGHLY EFFICIENT MICRO DRILLING
ENABLED BY ULTRA-HIGH PRECISION MANUFACTURING

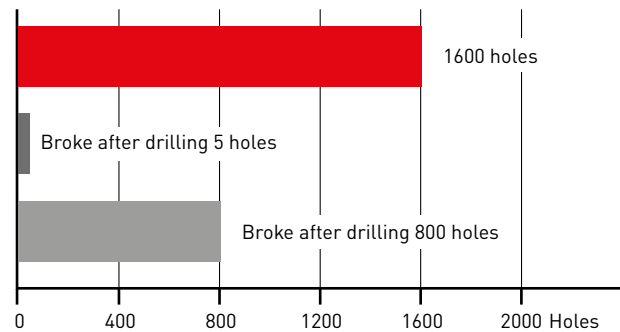


CUTTING PERFORMANCE

TOOL LIFE EVALUATION (DRILLING STAINLESS STEEL)

- Superior resistance to welding, wear and fracturing
- Long tool life

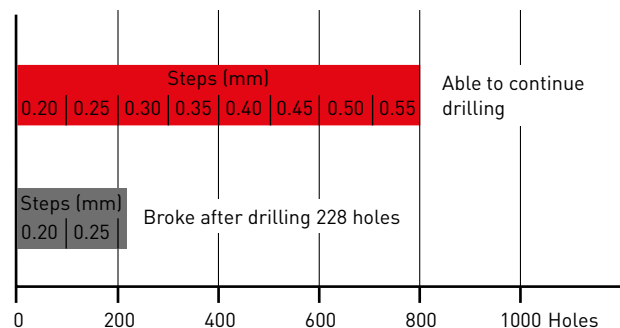
Tool	MSE0050SB
Workpiece	DIN X5CrNi189
Vc (m/min)	9.4
n (min ⁻¹)	6.000
f (mm/rev)	0.015 (90 mm/min)
Hole depth (mm) blind hole	5.0
Steps (mm)	0.16
Coolant	Water soluble emulsion
Machine	Machining centre



CHIPS DISPOSAL (DRILLING ALUMINIUM ALLOY)

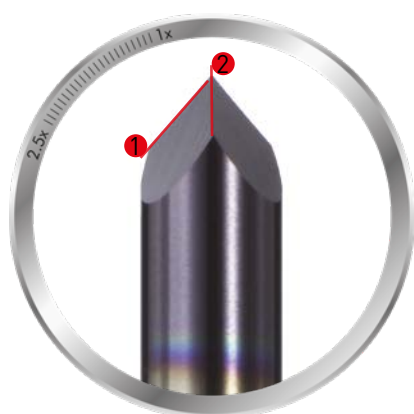
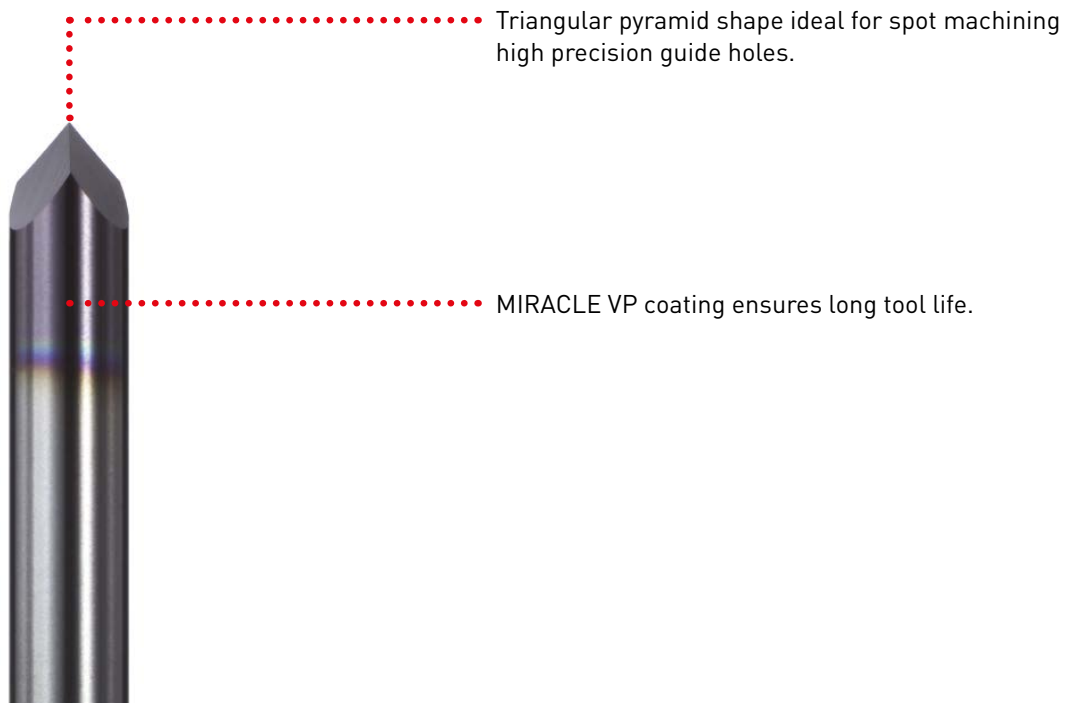
- Wide flute prevents chips jamming
- Step drilling test : Increased step distance by 0.05 mm every 100 holes

Tool	MSE0050SB
Workpiece	Aluminium Alloy A7075P
Vc (m/min)	25
n (min ⁻¹)	16.000
f (mm/rev)	0.075 (1.200 mm/min)
Hole depth (mm) blind hole	5.0
Coolant	Water soluble emulsion
Machine	Machining centre



MSE SPOT DRILL

FOR SPOT MACHINING A GUIDE HOLE



- 1 Dual purpose, for drilling centre holes and machining a 90° chamfer.
- 2 Versatile tool, suitable for drilling a large range of holes from \varnothing 0.1 to \varnothing 3.0.

CUTTING PERFORMANCE

COMPARISON OF HOLE POSITIONING ACCURACY

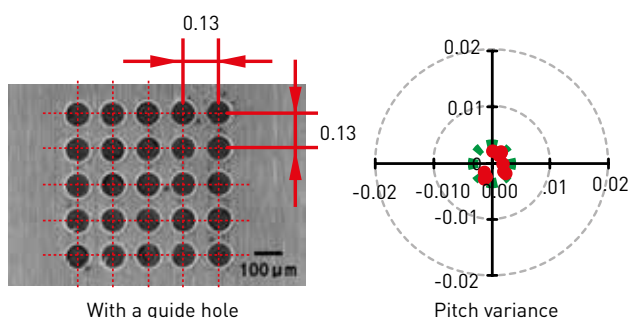
Cutting a guide hole

Tool	MSP0300SB
Workpiece	DIN X5CrNi189
n (min^{-1})	10.000
V_f (mm/min)	5.0
Guide hole dia. (mm)	0.09
Coolant	Water soluble emulsion

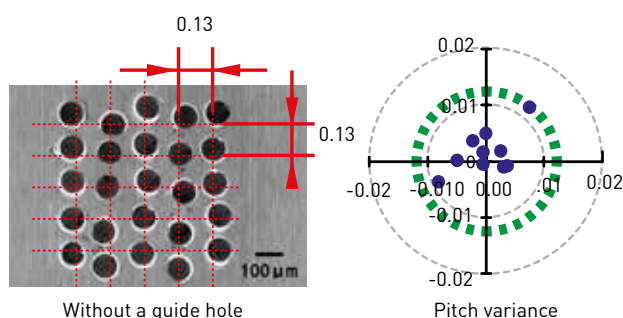
Drilling

Tool	MSE0010SB
V_c (m/min)	3.1
n (min^{-1})	10.000
f (mm/rev)	0.002
V_f (mm/min)	20
Hole depth (mm) blind hole	0.8
Steps (mm)	0.01
Coolant	Water soluble emulsion

Maximum variance of 0.003 mm.
Good pitch accuracy.



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



DRILLING STABILITY

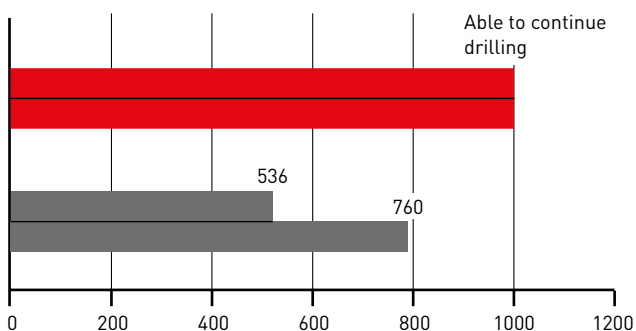
- Consistent number of drilled holes, providing stable production.

Drilling

Tool	MSE0020SB
Workpiece	DIN X5CrNi189
V_c (m/min)	6.3
n (min^{-1})	10.000
f (mm/rev)	0.002
V_f (mm/min)	20
Hole depth (mm) blind hole	1.6
Steps (mm)	0.02
Coolant	Water soluble emulsion

Cutting a guide hole

Tool	MSP0300SB
Workpiece	DIN X5CrNi189
n (min^{-1})	10.000
V_f (mm/min)	5.0
Guide hole dia. (mm)	0.15
Coolant	Water soluble emulsion

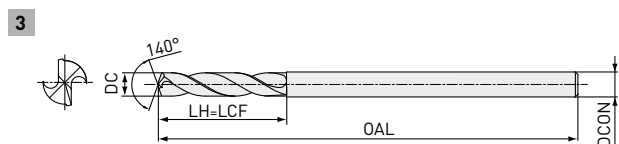
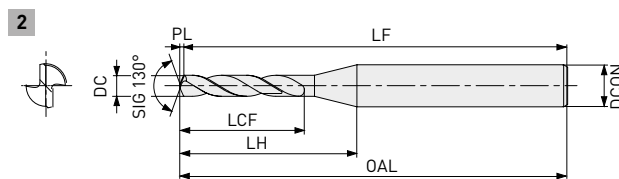
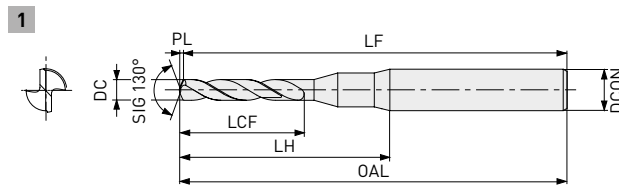


■ : With a guide hole ■ : Without a guide hole

MSE MINI STAR



MICRO SOLID CARBIDE DRILLS



$$0.1 \leq DC \leq 0.99$$



0
-0.009



0
-0.006

- MSE drills are suitable for use shrink fit holders.

Order number	VP20MF	VP15TF	∅	LCF	LH	OAL	LF	PL	DCON	Type
MSE0010SB	●		0.10	1.22	9.72	38.02	38	0.02	3	1
MSE0011SB	★		0.11	1.23	9.73	38.03	38	0.03	3	1
MSE0012SB	★		0.12	1.43	9.73	38.03	38	0.03	3	1
MSE0013SB	★		0.13	1.43	9.73	38.03	38	0.03	3	1
MSE0014SB	★		0.14	2.03	9.73	38.03	38	0.03	3	1
MSE0015SB	●		0.15	2.03	9.73	38.03	38	0.03	3	1
MSE0016SB	★		0.16	2.04	9.74	38.04	38	0.04	3	1
MSE0017SB	★		0.17	2.04	9.74	38.04	38	0.04	3	1
MSE0018SB	★		0.18	2.04	9.74	38.04	38	0.04	3	1
MSE0019SB	★		0.19	2.04	9.74	38.04	38	0.04	3	1
MSE0020SB	●		0.20	2.55	9.75	38.05	38	0.05	3	1
MSE0021SB	★		0.21	2.55	9.75	38.05	38	0.05	3	1
MSE0022SB	★		0.22	2.55	9.75	38.05	38	0.05	3	1
MSE0023SB	★		0.23	2.55	9.75	38.05	38	0.05	3	1
MSE0024SB	★		0.24	3.06	9.76	38.06	38	0.06	3	1
MSE0025SB	●		0.25	3.06	9.76	38.06	38	0.06	3	1
MSE0026SB	★		0.26	3.06	9.76	38.06	38	0.06	3	1
MSE0027SB	★		0.27	3.06	9.76	38.06	38	0.06	3	1
MSE0028SB	★		0.28	3.07	9.77	38.07	38	0.07	3	1
MSE0029SB	★		0.29	3.07	9.77	38.07	38	0.07	3	1

MSE - MICRO SOLID CARBIDE DRILLS

Order number	VP20MF	VP15TF	Ø	LCF	LH	OAL	LF	PL	DCON	Type
MSE0030SB		●	0.30	5.07	10.27	38.07	38	0.07	3	2
MSE0031SB		★	0.31	5.07	10.27	38.07	38	0.07	3	2
MSE0032SB		★	0.32	5.07	10.27	38.07	38	0.07	3	2
MSE0033SB		★	0.33	5.08	10.28	38.08	38	0.08	3	2
MSE0034SB		★	0.34	6.08	11.28	38.08	38	0.08	3	2
MSE0035SB		●	0.35	6.08	11.18	38.08	38	0.08	3	2
MSE0036SB		★	0.36	6.08	11.18	38.08	38	0.08	3	2
MSE0037SB		★	0.37	6.09	11.19	38.09	38	0.09	3	2
MSE0038SB		★	0.38	6.09	11.19	38.09	38	0.09	3	2
MSE0039SB		★	0.39	6.09	11.19	38.09	38	0.09	3	2
MSE0040SB		●	0.40	7.09	12.19	38.09	38	0.09	3	2
MSE0041SB		★	0.41	7.10	12.10	38.10	38	0.10	3	2
MSE0042SB		★	0.42	7.10	12.10	38.10	38	0.10	3	2
MSE0043SB		★	0.43	7.10	12.10	38.10	38	0.10	3	2
MSE0044SB		★	0.44	7.10	12.10	38.10	38	0.10	3	2
MSE0045SB		●	0.45	7.10	12.10	38.10	38	0.10	3	2
MSE0046SB		★	0.46	7.11	12.01	38.11	38	0.11	3	2
MSE0047SB		★	0.47	7.11	12.01	38.11	38	0.11	3	2
MSE0048SB		★	0.48	7.11	12.01	38.11	38	0.11	3	2
MSE0049SB		★	0.49	7.11	12.01	38.11	38	0.11	3	2
MSE0050SB		●	0.50	7.12	12.02	38.12	38	0.12	3	2
MSE0051SB		★	0.51	7.12	11.92	38.12	38	0.12	3	2
MSE0052SB		★	0.52	7.12	11.92	38.12	38	0.12	3	2
MSE0053SB		★	0.53	7.12	11.92	38.12	38	0.12	3	2
MSE0054SB		★	0.54	7.13	11.93	38.13	38	0.13	3	2
MSE0055SB		●	0.55	7.13	11.93	38.13	38	0.13	3	2
MSE0056SB		★	0.56	7.13	11.93	38.13	38	0.13	3	2
MSE0057SB		★	0.57	7.13	11.83	38.13	38	0.13	3	2
MSE0058SB		★	0.58	7.14	11.84	38.14	38	0.14	3	2
MSE0059SB		★	0.59	7.14	11.84	38.14	38	0.14	3	2
MSE0060SB		●	0.60	7.14	11.84	38.14	38	0.14	3	2
MSE0061SB		★	0.61	7.14	11.84	38.14	38	0.14	3	2
MSE0062SB		★	0.62	7.14	11.74	38.14	38	0.14	3	2
MSE0063SB		★	0.63	7.15	11.75	38.15	38	0.15	3	2
MSE0064SB		★	0.64	7.15	11.75	38.15	38	0.15	3	2
MSE0065SB		●	0.65	7.15	11.75	38.15	38	0.15	3	2
MSE0066SB		★	0.66	7.15	11.75	38.15	38	0.15	3	2
MSE0067SB		★	0.67	7.16	11.66	38.16	38	0.16	3	2
MSE0068SB		★	0.68	7.16	11.66	38.16	38	0.16	3	2
MSE0069SB		★	0.69	7.16	11.66	38.16	38	0.16	3	2
MSE0070SB		●	0.70	8.16	12.66	38.16	38	0.16	3	2
MSE0071SB		★	0.71	8.17	12.67	38.17	38	0.17	3	2
MSE0072SB		★	0.72	8.17	12.67	38.17	38	0.17	3	2
MSE0073SB		★	0.73	8.17	12.57	38.17	38	0.17	3	2
MSE0074SB		★	0.74	8.17	12.57	38.17	38	0.17	3	2
MSE0075SB		●	0.75	8.17	12.57	38.17	38	0.17	3	2
MSE0076SB		★	0.76	8.18	12.58	38.18	38	0.18	3	2
MSE0077SB		★	0.77	8.18	12.58	38.18	38	0.18	3	2
MSE0078SB		★	0.78	8.18	12.48	38.18	38	0.18	3	2
MSE0079SB		★	0.79	8.18	12.48	38.18	38	0.18	3	2

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MSE - MICRO SOLID CARBIDE DRILLS

Order number	VP20MF	VP15TF	∅	LCF	LH	OAL	LF	PL	DCON	Type
MSE0080SB		●	0.80	10.19	14.49	38.19	38	0.19	3	2
MSE0081SB		★	0.81	10.19	14.49	38.19	38	0.19	3	2
MSE0082SB		★	0.82	10.19	14.49	38.19	38	0.19	3	2
MSE0083SB		★	0.83	10.19	14.49	38.19	38	0.19	3	2
MSE0084SB		★	0.84	10.20	14.40	38.20	38	0.20	3	2
MSE0085SB		●	0.85	10.20	14.40	38.20	38	0.20	3	2
MSE0086SB		★	0.86	10.20	14.40	38.20	38	0.20	3	2
MSE0087SB		★	0.87	10.20	14.40	38.20	38	0.20	3	2
MSE0088SB		★	0.88	10.21	14.41	38.21	38	0.21	3	2
MSE0089SB		★	0.89	10.21	14.31	38.21	38	0.21	3	2
MSE0090SB		●	0.90	10.21	14.31	38.21	38	0.21	3	2
MSE0091SB		★	0.91	10.21	14.31	38.21	38	0.21	3	2
MSE0092SB		★	0.92	10.21	14.31	38.21	38	0.21	3	2
MSE0093SB		★	0.93	10.22	14.32	38.22	38	0.22	3	2
MSE0094SB		★	0.94	10.22	14.22	38.22	38	0.22	3	2
MSE0095SB		●	0.95	10.22	14.22	38.22	38	0.22	3	2
MSE0096SB		★	0.96	10.22	14.22	38.22	38	0.22	3	2
MSE0097SB		★	0.97	10.23	14.23	38.23	38	0.23	3	2
MSE0098SB		★	0.98	10.23	14.23	38.23	38	0.23	3	2
MSE0099SB		●	0.99	10.23	14.23	38.23	38	0.23	3	2

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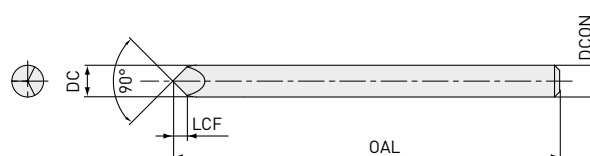
1. Please contact Mitsubishi Materials for grades and special geometries other than our standard products, such as a different diameters or lengths from the standard sizes.



MSE SPOT DRILL



FOR MACHINING GUIDE HOLES



Order number	VP15TF	LCF	DC	OAL	DCON	Range of Diameter (mm)
MSP0300SB	●	1.5	3	38	3	0.1-3.0

1. Please contact Mitsubishi Materials for grades and special geometries other than our standard products, such as a different diameters or lengths.



MSE

RECOMMENDED CUTTING CONDITIONS

Material	DC	Vc	n	f	Vf	Step
Mild steel (≤180HB)	0.1	6	20000	0.002 [0.001—0.003]	40	0.02
	0.12	8	20000	0.002 [0.001—0.003]	40	0.02
	0.16	10	20000	0.002 [0.001—0.003]	40	0.02
	0.2	13	20000	0.003 [0.002—0.004]	60	0.04
	0.25	16	20000	0.003 [0.002—0.004]	60	0.04
	0.32	20	20000	0.004 [0.003—0.005]	80	0.05
	0.4	25	20000	0.004 [0.003—0.005]	80	0.05
	0.5	31	20000	0.006 [0.005—0.007]	120	0.1
	0.63	40	20000	0.008 [0.006—0.01]	160	0.1
	0.8	50	20000	0.02 [0.015—0.025]	400	0.3
Carbon steel, Alloy steel (180—280HB)	0.1	6	20000	0.002 [0.001—0.003]	40	0.02
	0.12	8	20000	0.002 [0.001—0.003]	40	0.02
	0.16	10	20000	0.002 [0.001—0.003]	40	0.02
	0.2	13	20000	0.003 [0.002—0.004]	60	0.04
	0.25	16	20000	0.003 [0.002—0.004]	60	0.04
	0.32	20	20000	0.004 [0.003—0.005]	80	0.05
	0.4	25	20000	0.004 [0.003—0.005]	80	0.05
	0.5	31	20000	0.006 [0.005—0.007]	120	0.1
	0.63	40	20000	0.008 [0.006—0.01]	160	0.1
	0.8	50	20000	0.015 [0.012—0.018]	300	0.3
Carbon steel, Alloy steel (280—350HB)	0.1	6	20000	0.002 [0.001—0.003]	40	0.02
	0.12	8	20000	0.002 [0.001—0.003]	40	0.02
	0.16	10	20000	0.002 [0.001—0.003]	40	0.02
	0.2	13	20000	0.003 [0.002—0.004]	60	0.04
	0.25	16	20000	0.003 [0.002—0.004]	60	0.04
	0.32	20	20000	0.004 [0.003—0.005]	80	0.05
	0.4	25	20000	0.004 [0.003—0.005]	80	0.05
	0.5	31	20000	0.006 [0.005—0.007]	120	0.1
	0.63	40	20000	0.008 [0.006—0.01]	160	0.1
	0.8	50	20000	0.015 [0.012—0.018]	300	0.3
Pre-Hardened steel (35—45HRC)	0.1	6	20000	0.002 [0.001—0.003]	40	0.02
	0.12	8	20000	0.002 [0.001—0.003]	40	0.02
	0.16	10	20000	0.002 [0.001—0.003]	40	0.02
	0.2	13	20000	0.003 [0.002—0.004]	60	0.04
	0.25	16	20000	0.003 [0.002—0.004]	60	0.04
	0.32	20	20000	0.004 [0.003—0.005]	80	0.05
	0.4	25	20000	0.004 [0.003—0.005]	80	0.05
	0.5	31	20000	0.006 [0.005—0.007]	120	0.1
	0.63	40	20000	0.008 [0.006—0.01]	160	0.1
	0.8	50	20000	0.015 [0.012—0.018]	300	0.3
	0.99	62	20000	0.02 [0.015—0.025]	400	0.3

MSE

Material	DC	Vc	n	f	Vf	Step
M Austenitic stainless steel (≤200HB)	0.1	6	20000	0.002 [0.001—0.003]	40	0.02
	0.12	8	20000	0.002 [0.001—0.003]	40	0.02
	0.16	10	20000	0.002 [0.001—0.003]	40	0.02
	0.2	11	18000	0.003 [0.002—0.004]	54	0.04
	0.25	14	18000	0.003 [0.002—0.004]	54	0.04
	0.32	15	15000	0.004 [0.003—0.005]	60	0.05
	0.4	19	15000	0.004 [0.003—0.005]	60	0.05
	0.5	16	10000	0.006 [0.005—0.007]	60	0.1
	0.63	20	10000	0.008 [0.006—0.01]	80	0.1
	0.8	15	6000	0.015 [0.012—0.018]	90	0.2
0.99	19	6000	0.02 [0.015—0.025]	120	0.2	
K Gray cast iron (≤350MPa)	0.1	6	20000	0.002 [0.001—0.003]	40	0.02
	0.12	8	20000	0.002 [0.001—0.003]	40	0.02
	0.16	10	20000	0.002 [0.001—0.003]	40	0.02
	0.2	13	20000	0.003 [0.002—0.004]	60	0.04
	0.25	16	20000	0.003 [0.002—0.004]	60	0.04
	0.32	20	20000	0.004 [0.003—0.005]	80	0.05
	0.4	25	20000	0.004 [0.003—0.005]	80	0.05
	0.5	31	20000	0.006 [0.005—0.007]	120	0.1
	0.63	40	20000	0.008 [0.006—0.01]	160	0.1
	0.8	50	20000	0.02 [0.015—0.025]	400	0.3
0.99	62	20000	0.04 [0.03—0.05]	800	0.3	
N Aluminium alloy (Si<5%)	0.1	6	20000	0.002 [0.001—0.003]	40	0.05
	0.12	8	20000	0.003 [0.002—0.004]	60	0.05
	0.16	10	20000	0.004 [0.003—0.005]	80	0.05
	0.2	13	20000	0.006 [0.005—0.007]	120	0.1
	0.25	16	20000	0.008 [0.006—0.01]	160	0.1
	0.32	20	20000	0.01 [0.008—0.012]	200	0.3
	0.4	25	20000	0.02 [0.015—0.025]	400	0.3
	0.5	31	20000	0.03 [0.025—0.035]	600	0.5
	0.63	40	20000	0.04 [0.035—0.045]	800	0.5
	0.8	50	20000	0.05 [0.045—0.055]	1000	0.8
0.99	62	20000	0.06 [0.055—0.065]	1200	0.8	
S Heat resistant alloy	0.1	2	7000	0.001 [0.0005—0.001]	7	0.02
	0.12	3	7000	0.001 [0.0005—0.001]	7	0.02
	0.16	4	7000	0.001 [0.0005—0.001]	7	0.02
	0.2	3	5000	0.002 [0.001—0.002]	10	0.04
	0.25	4	5000	0.002 [0.001—0.002]	10	0.04
	0.32	4	4000	0.002 [0.001—0.002]	8	0.05
	0.4	5	4000	0.002 [0.001—0.002]	8	0.05
	0.5	5	3000	0.003 [0.001—0.003]	9	0.1
	0.63	6	3000	0.004 [0.002—0.004]	12	0.1
	0.8	5	1800	0.006 [0.004—0.006]	10.8	0.2
0.99	6	1800	0.01 [0.008—0.01]	18	0.2	

2/2

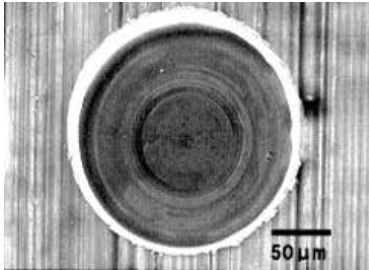
1. When drilling holes up to $\varnothing 3.0$ mm, the use of a spot drill is recommended.
2. Change the cutting conditions depending on your machine and workpiece rigidity.
3. When machining holes over 5DC, reduce the step distance stated above.
4. The use of water-soluble fluid (diluted 20 times) is recommended for drilling using the cutting conditions above.
Lower the revolutions if oil fluid or mist is used.
5. Work materials marked by "—" in the tables above are difficult to drill with external coolant.

MSE

CUTTING PERFORMANCE

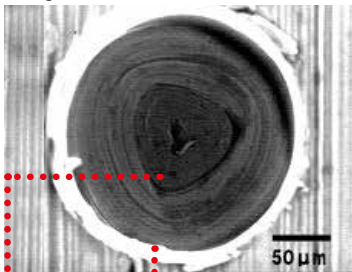
Combined use of the Mini Star and the spot drill enhances accuracy.

When using a spot drill



Cuts a high-precision hole

No guide hole



Large burr

The bottom of the hole is uneven because the drill wandered.

Machining a guide hole

Tool	MSP0300SB
Guide hole dia. (mm)	0.15
n (min^{-1})	10.000
V_f (mm/min)	5.0
Coolant	Water soluble emulsion

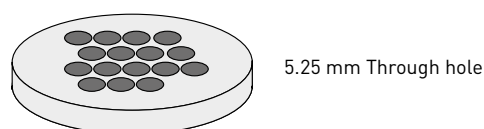
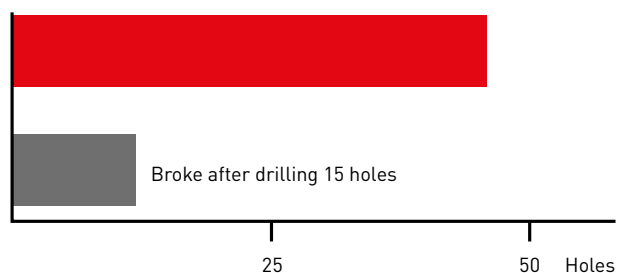
Drilling

Tool	MSE0020SB
V_c (m/min)	6.3
n (min^{-1})	10.000
f (mm/rev)	0.002
V_f (mm/min)	20
Hole depth (mm) Blind hole	0.3
Steps (mm)	0.02
Coolant	Water soluble emulsion

APPLICATION EXAMPLES

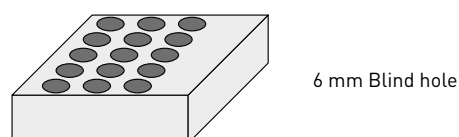
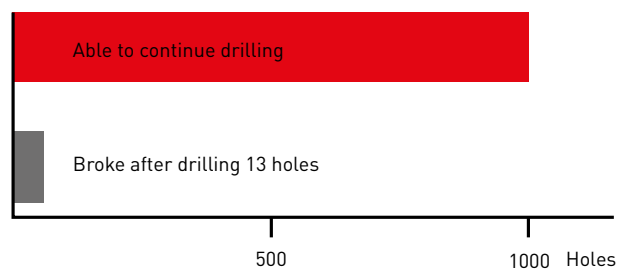
HEAT RESISTANT ALLOY (INCONEL®718)

Tool	MSE0050SB
Component	Test piece
Vc (m/min)	4.7
n (min ⁻¹)	3.000
f (mm/rev)	0.005
Vf (mm/min)	15
Steps (mm)	0.1
Coolant	Water soluble oil
Machine	Machining centre
Result	A competitor's product broke after drilling 15 holes. The MINISTAR drill could successfully machine 47 holes.



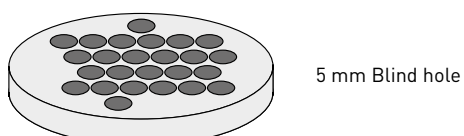
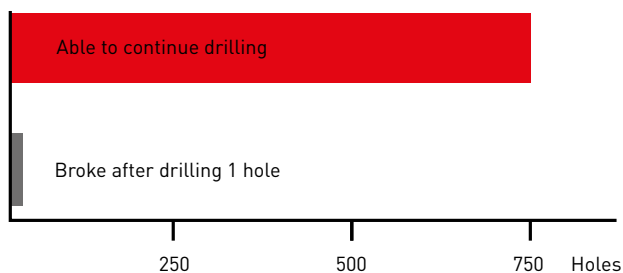
PRE-HARDENED STEEL (JIS 45HRC)

Tool	MSE0050SB
Component	Plate
Vc (m/min)	24
n (min ⁻¹)	15.000
f (mm/rev)	0.01
Vf (mm/min)	150
Steps (mm)	0.1
Coolant	Mist
Machine	Machining centre
Result	A competitor's product broke after 13 holes. The MINISTAR drill drilled 100 holes and was in able to continue drilling.



ALUMINUM ALLOY (JIS A7075)

Tool	MSE0100SB
Component	Plate
Vc (m/min)	80
n (min ⁻¹)	25.000
f (mm/rev)	0.08
Vf (mm/min)	2.000
Steps (mm)	1.0
Coolant	Water soluble oil
Machine	Machining centre
Result	A competitor's product broke after drilling one hole due to chips jamming. The MINISTAR drill was capable of stable drilling even when using long steps.



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