Micro Solid Carbide Drills (under 1mm) for Machining Small Diameter Precision Metal Parts.

Available in sizes from Ø0.1 - Ø0.99
90 standard drills

For cutting a guide hole
STARTER Drill

Triangular, pyramid point shape for high precision guide hole.
Micro Solid Carbide Drills

Features

1. Point geometry for stable machining. (Wide margin and shallow circumferential relief form)
2. Wide flute ensuring good chip disposal.
3. A combination of MIRACLE VP coating specially produced for micro drills, and a high-toughness micro grain carbide substrate for superior wear and fracture resistance and long tool life.
4. Cutting edges: 90 sizes in all 0.10-0.99 at 0.01mm intervals.
5. Ø3 Shank for all sizes.

Cutting performance

- Tool life evaluation (Stainless steel drilling)
  Long tool life and superior resistance to welding, wear and fracture.

  <Cutting conditions>
  Tool: MSE0050SB
  Workpiece: Stainless Steel
  Cutting speed: 30 SFM (6,000min⁻¹)
  Feed: .0006 IPR
  Hole depth: .200 inch Blind hole
  Steps: .006 inch
  Coolant: Water soluble emulsion
  Machine: Machining center

  MINI STAR drill

  Competitor A: Broke after drilling 5 holes.
  Competitor B: Broke after drilling 800 holes.
  1600 holes

- Chip disposal (Aluminum alloy drilling)
  Wide flute prevents chips jamming.

  Step drilling test: The step distance was increased by .002 inch after every 100 holes drilled.

  <Cutting conditions>
  Tool: MSE0050SB
  Workpiece: 7075 Aluminum Alloy
  Cutting speed: 82 SFM (16,000min⁻¹)
  Feed: .003 IPR
  Hole depth: .200 inch Blind hole
  Coolant: Water soluble emulsion
  Machine: Machining center

  MINI STAR drill

  Competitor: Broke after drilling 228 holes.
STARTER Drill

Features

- Triangular pyramid shape helps high precision drilling.
- Optimize cost effectiveness by creating center holes of 0.118 inch to 0.039 inch.
- Long tool life ensured by MIRACLE VP15TF coating.
- The same Starting / Guide drill can be used for dual purposes. Center hole drilling and a 90° chamfer angle.

Cutting performance

<table>
<thead>
<tr>
<th>When using a Starter Drill</th>
<th>No guide hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Cutting conditions&gt;</td>
<td></td>
</tr>
<tr>
<td>Workpiece: 304 stainless steel</td>
<td>Tool: MSP0300SB</td>
</tr>
<tr>
<td>(Cutting a guide hole)</td>
<td>(Drilling)</td>
</tr>
<tr>
<td>Tool: MSP0300SB</td>
<td>Tool: MSE0020SB</td>
</tr>
<tr>
<td>Guide hole dia: .006 inch</td>
<td>Cutting speed: 20 SFM</td>
</tr>
<tr>
<td>Revolution: 10,000min⁻¹</td>
<td>Revolution: 10,000min⁻¹</td>
</tr>
<tr>
<td>Cutting speed: 310 SFM</td>
<td>Feed: .00002 IPR</td>
</tr>
<tr>
<td>Feed: .00002 IPR</td>
<td>Hole depth: .011 inch Blind hole</td>
</tr>
<tr>
<td>Coolant: Water soluble emulsion</td>
<td>Coolant: Water soluble emulsion</td>
</tr>
</tbody>
</table>

Cuts a high-precision hole. The bottom of the hole is drilled polygonally because the drill wanders.

How to use the Spot Drill

Combined use of the Mini Star Drill and the Spot Drill enhances drilling precision and stability.

1. Comparison of hole positioning accuracy

<table>
<thead>
<tr>
<th>Maximum positional variance of 0.00012inch. Good pitch accuracy.</th>
<th>Maximum positional variance of 0.0005inch will cause short tool life.</th>
</tr>
</thead>
<tbody>
<tr>
<td>With a guide hole. Pitch variance</td>
<td>Without a guide hole. Pitch variance</td>
</tr>
<tr>
<td>0.00012</td>
<td>0.00012</td>
</tr>
<tr>
<td>(Unit : inch)</td>
<td>(Unit : inch)</td>
</tr>
</tbody>
</table>

2. Drilling stability

Stable drilling performance when using a spot drill.

<Cutting conditions> Workpiece: 304 Stainless Steel
(Cutting a guide hole)
Tool: MSP0300SB
Cutting speed: 310 SFM
Revolution: 10,000min⁻¹
Feed: .00002 IPR
Guide hole dia: .006 inch
Coolant: Water soluble emulsion

(Drilling)
Tool: MSE0020SB
Cutting speed: 20 SFM
Revolution: 10,000min⁻¹
Feed: .00008 IPR
Guide hole dia: .006 inch
Coolant: Water soluble emulsion

Continued drilling is possible

<table>
<thead>
<tr>
<th>With a guide hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>536 holes</td>
</tr>
<tr>
<td>760 holes</td>
</tr>
<tr>
<td>Without a guide hole</td>
</tr>
<tr>
<td>0 200 400 600 800 1000 1200 holes</td>
</tr>
</tbody>
</table>
# Micro Solid Carbide Drills

## MIRACLE MINI STAR Drill

### METRIC STANDARD

<table>
<thead>
<tr>
<th>Drill dia. (D1)</th>
<th>Coolant</th>
<th>Stock</th>
<th>Order Number</th>
<th>Dimensions (mm)</th>
<th>Type</th>
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<tbody>
<tr>
<td>0.10</td>
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<td>MSE0010SB</td>
<td>1.2 9.7 38 3 A</td>
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<tr>
<td>0.11</td>
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<tr>
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<tr>
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<td>0.36</td>
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<td>0.39</td>
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<td>0.41</td>
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<td>7 12.1 38 3 B</td>
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</tbody>
</table>

Note: Please contact Mitsubishi Materials for special grades and geometries other than our standard products.

*: Inventory maintained in Japan.
### RECOMMENDED CUTTING CONDITIONS

<table>
<thead>
<tr>
<th>Work Material</th>
<th>Drill Diameter Conditions</th>
<th>ø0.10 – 0.19mm</th>
<th>ø0.20 – 0.29mm</th>
<th>ø0.30 – 0.49mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Revolution (min⁻¹)</td>
<td>Feed (IPR)</td>
<td>Peck (inch)</td>
</tr>
<tr>
<td>P General Steel Carbon Steel</td>
<td>≤180HB</td>
<td>20,000</td>
<td>.00008</td>
<td>.0008</td>
</tr>
<tr>
<td>M Stainless Steel</td>
<td>≤200HB</td>
<td>20,000</td>
<td>.00008</td>
<td>.0008</td>
</tr>
<tr>
<td>K Cast Iron</td>
<td>Tensile Strength ≤350MPa</td>
<td>20,000</td>
<td>.00008</td>
<td>.0008</td>
</tr>
<tr>
<td>N Aluminum Alloy</td>
<td>–</td>
<td>20,000</td>
<td>.00016</td>
<td>.0020</td>
</tr>
<tr>
<td>S Heat Resistant Alloy</td>
<td>–</td>
<td>7,000</td>
<td>.00004</td>
<td>.0008</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Material</th>
<th>Drill Diameter Conditions</th>
<th>ø0.50 – 0.79mm</th>
<th>ø0.80 – 0.99mm</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Revolution (min⁻¹)</td>
<td>Feed (IPR)</td>
</tr>
<tr>
<td>P General Steel Carbon Steel</td>
<td>≤180HB</td>
<td>20,000</td>
<td>.00040</td>
</tr>
<tr>
<td>M Stainless Steel</td>
<td>≤200HB</td>
<td>10,000</td>
<td>.00040</td>
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<tr>
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<td>Tensile Strength ≤350MPa</td>
<td>20,000</td>
<td>.00040</td>
</tr>
<tr>
<td>N Aluminum Alloy</td>
<td>–</td>
<td>20,000</td>
<td>.00200</td>
</tr>
<tr>
<td>S Heat Resistant Alloy</td>
<td>–</td>
<td>3,000</td>
<td>.00020</td>
</tr>
</tbody>
</table>

(Note)

* When drilling a hole of ø0.99 mm or smaller, use of the Starter Drill is recommended. (Order number: MSP0300SB, Cutting conditions: Please see PS.)
* Adjust the cutting conditions depending on the machine rigidity and component set up.
* When drilling depth is over 5 times the drill diameter, reduce the peck distance above.
* Use of water-soluble fluid (Diluted x 20) is necessary for drilling using the cutting conditions above. Lower the cutting speed if oil or mist coolant is used.
METRIC STANDARD

**Micro Solid Carbide Drills**

**MSP STARTER Drill**

**RECOMMENDED CUTTING CONDITIONS**

<table>
<thead>
<tr>
<th>Order Number</th>
<th>Revolution (min⁻¹)</th>
<th>Table Feed (IPR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP0300SB</td>
<td>10,000</td>
<td>.00002</td>
</tr>
</tbody>
</table>

- Inventory maintained.

---

<table>
<thead>
<tr>
<th>Order Number</th>
<th>Grade</th>
<th>Stock</th>
<th>Dimensions (mm)</th>
<th>Range of Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP0300SB</td>
<td>VP15TF</td>
<td>●</td>
<td>D1 3.0, D4 3.0, L1 38, L3 1.5</td>
<td>0.1—0.99</td>
</tr>
</tbody>
</table>
## Application examples

<table>
<thead>
<tr>
<th>Tool</th>
<th>MSE0050SB</th>
<th>MSE0050SB</th>
<th>MSE0099SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workpiece</td>
<td>Heat resistant alloy (Inconel 718)</td>
<td>Pre-hardened steel (45HRC)</td>
<td>Aluminum alloy</td>
</tr>
<tr>
<td>Component</td>
<td>Test piece</td>
<td>Plate</td>
<td>Plate</td>
</tr>
<tr>
<td>Cutting speed (SFM)</td>
<td>15</td>
<td>80</td>
<td>260</td>
</tr>
<tr>
<td>Feed (IPR)</td>
<td>.0002</td>
<td>.0004</td>
<td>.0032</td>
</tr>
<tr>
<td>Revolution (min⁻¹)</td>
<td>3,000</td>
<td>15,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Steps (inch)</td>
<td>.0039</td>
<td>.0039</td>
<td>.0389</td>
</tr>
<tr>
<td>Coolant</td>
<td>Water soluble oil</td>
<td>Mist</td>
<td>Water soluble oil</td>
</tr>
<tr>
<td>Machine</td>
<td>Machining center</td>
<td>Machining center</td>
<td>Machining center</td>
</tr>
</tbody>
</table>

### Result

<table>
<thead>
<tr>
<th>Tool</th>
<th>MSE0050SB</th>
<th>MSE0050SB</th>
<th>MSE0099SB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workpiece</td>
<td>Heat resistant alloy (Inconel 718)</td>
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<td>Test piece</td>
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<tr>
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<td>260</td>
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<tr>
<td>Feed (IPR)</td>
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<td>.0032</td>
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<tr>
<td>Revolution (min⁻¹)</td>
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<td>15,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Steps (inch)</td>
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<td>.0039</td>
<td>.0389</td>
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<tr>
<td>Coolant</td>
<td>Water soluble oil</td>
<td>Mist</td>
<td>Water soluble oil</td>
</tr>
<tr>
<td>Machine</td>
<td>Machining center</td>
<td>Machining center</td>
<td>Machining center</td>
</tr>
</tbody>
</table>

A competitor’s product broke after drilling 15 holes. **MINI STAR Drill** tool life was 47 holes.

A competitor’s drill broke after 13 holes. The **MINI STAR Drill** was able to drill 100 holes and was in a suitable condition to continue drilling.

A competitor’s product broke after drilling one hole due to chip jamming. **MINI STAR Drills** were able to drill reliably even with a large peck distance.
Micro Solid Carbide Drills

For your safety
- Do not touch cutting or chips without wearing gloves.
- Use tools under recommended cutting conditions, and exchange tools before excessive wear occurs.
- Chips become extremely hot, scattered over and may be stretched. Ensure safety guards and goggles are used.
- In case of using non-water soluble oil, make sure to have a fire prevention countermeasure.
- Use the provided wrench spanner, and ensure the inserts and spare parts are clamped securely.

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