In the year 2000, Ingersoll Cutting Tool Company came to realize that in order to better serve our customers in the demanding world of metal removal, it was time to expand our horizons and become a full line supplier to the metal working industry. To that end Ingersoll introduced a line of innovative, technologically superior drills and rolled out its first ever comprehensive “Hole Making” catalog.

Now five years later, due in a large part to the popularity of both the Qwik-Twist and Quad-Drill+ lines of drilling products, the “BOREline” is the fastest growing division at Ingersoll Cutting Tools.

In this new “BOREline” catalog we’ve expanded both the Qwik-Twist and Quad-Drill+ lines and added exciting new products such as Ingersoll Gun Drills and a complete line of Rotary Tool Holders.

Our network of distribution partners supported by our sales engineering staff is an invaluable resource of technical tooling application expertise and customer support. These highly trained, skilled individuals are available to you on-site in your facility until our products are performing the way you expect.

We are more than just a tooling supplier. We want you to view us as partners . . . as a specialized extension of your own process engineering capabilities. We have the resources and experience you need to make informed and effective tooling decisions.

Our goal is to help you remain competitive in a rapidly changing manufacturing environment, with the latest and most productive hole making tools in the industry. Sincerely,

The Ingersoll “BOREline” Team

P.S. For all of your finish precision boring needs, please refer to Ingersoll’s “D’Andrea” Modular Boring catalog.
<table>
<thead>
<tr>
<th>Diameter Range</th>
<th>Cutting Depth</th>
<th>Description</th>
<th>Series</th>
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<td>.87-.2.08</td>
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<td>.44-.200</td>
<td>Indexable Counter Bore Tools</td>
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<td>Gun Drills</td>
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**INDEXABLE SPOTTING DRILL - SERIES “FAK”**

**Spot Drilling**

**Nominal Included Angles**
- 82°, 90°, 118°, 135°, 144°

**Insert Corner**
- 118°, 135°, 144°: .010" R
- 92°, 90°: .031", .010" R

**Diameters**
- 0.685" to 0.842"

**Nominal Included Angles**
- 82°, 90°, 118°, 135°, 144°

**Included Angle**
- 82°
- 90°
- 118°
- 135°
- 144°

**D1 Max Dia. of Spot**
- 0.782
- 0.842
- 0.685
- 0.738
- 0.737

**Nominal Included Angles**
- 82°
- 90°
- 118°
- 135°
- 144°

**D1 Max Dia. of Spot**
- 19.86
- 21.39
- 17.40
- 18.75
- 18.72

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<th>Included Angle</th>
<th>Seat Drill Number</th>
<th>L1 Maximum Depth of Cut</th>
<th>D2 Overall Diameter</th>
<th>L3 Extension from Holder</th>
<th>L4 Overall Length</th>
<th>D3 Shank Size/Style</th>
<th>Number of Inserts</th>
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<td>82°</td>
<td>FAK-0708284R01</td>
<td>.42</td>
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<td>3.50</td>
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</tbody>
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**DRILLPAK INDEXABLE SPOTTING DRILL PACKAGES - SERIES “FAK”**

**Save up to 15% when purchasing tooling packages**

**Included Angle**
- 82°
- 90°
- 118°
- 135°
- 144°

**Package Number**
- FAK-0708284K01
- FAK-0809084K01
- FAK-0611884K01
- FAK-0713584K01
- FAK-0714484K01

**Spotting drills with indexable strength and convenience**

**Tooling Package Includes:**
- One indexable spotting drill
- Ten inserts
- One Torx® screw driver
- Three additional insert screws
- Durable polypropylene case
**INSERTS**

- Engrave part numbers, serial numbers, lot numbers, company logos, etc. all in the same machine set-up.
- Utilize the CNC control capability to program the engraving.
- High speed engraving capability up to 100 inches/minute.

*Item No.— 5110040
Insert Part No.— TFLT15T303N
Grade— IN1530 (Tough wear resistant grade, well suited for engraving)*

---

### HARDWARE

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<tr>
<th>Insert Series</th>
<th>Insert Screw</th>
<th>Part No.</th>
<th>Torque</th>
<th>Driver Part No.</th>
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<tbody>
<tr>
<td>TFLT15</td>
<td>SM30-065-00</td>
<td>13-18 in. lbs.</td>
<td>DS-T09W (Tx-09)</td>
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<td>SELW10</td>
<td>SM40-093-20</td>
<td>30-35 in. lbs.</td>
<td>DS-T15T (Tx-15)</td>
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*For technical information, see pages 91 and 92.
**SpotDrill+**

**REPLACEABLE POINT SPOTTING DRILLS - SERIES “Y”**

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<thead>
<tr>
<th>Nominal Included Angles</th>
<th>Diameters</th>
<th>Max. Dia. of Spot:</th>
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<tr>
<td>.472” and .630”</td>
<td>90° and 140°</td>
<td>1/2” Drill Body: .472”</td>
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<td></td>
<td></td>
<td>3/4” Drill Body: .630”</td>
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<table>
<thead>
<tr>
<th>D1 Dia. of Spot</th>
<th>D2 Drill Body</th>
<th>L2 Max DOC</th>
<th>L2 Maximum Extension</th>
<th>L3 Overall Length</th>
<th>L4 Shank Length</th>
<th>D2 Shank Diameter</th>
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**Diagram:**

- Spot Drilling
- Chamfering
### Inserts

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For technical information, see pages 91, 92 and 93.

#### Drill Points

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<th>Included Angle</th>
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<th>Drill Point Number</th>
<th>Application</th>
<th>Grade*</th>
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<td>YCB1600R01</td>
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*For insert grade descriptions, see page 86.

#### Hardware

**90° and 140° Angle**

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<td>KDCM-12-A</td>
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<td>YCB1600 &amp; YAB1600</td>
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</table>

For technical information, see pages 91, 92 and 93.
**SOLID CARBIDE DRILLS - SERIES “DR”**

**Diameters**
3.00mm to 12.00mm

**L:D Ratio**
5:1

**Geometry**
140° included point angle
30° axial rake angle

---

**Metric Standard-(dimensions in mm unless noted)**

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**Drilling Coolant**

**Drill Line**

**Boreline**
<table>
<thead>
<tr>
<th>D2 Diameter mm</th>
<th>Drill Number</th>
<th>D2 Shank Diameter</th>
<th>L1 Maximum Depth of Cut</th>
<th>L2 Flute Length</th>
<th>L3 Overall Length</th>
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For technical information, see page 93.
**Qwik-Twist™ Replaceable Point Drills - Series “Y”**

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Do not mount a smaller drill point than the D1 range listed for each drill body.

* Drill bodies for coolant through the point.

Metric shanks available as non-stock standards.

See pages 25-29 for replaceable drill points.

For technical information, see pages 95-99.

**Drilling Coolant**

- I

**Length to Diameter Ratio**

3:1

**.2953" to .7047" Range**

**.7087" to 1.0197" Range**

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**Notes:**
- Metric shanks available as non-stock standards.
- See pages 25-29 for replaceable drill points.
- For technical information, see pages 95-99.
**Diameters**

.2953” to 1.0197”

**Length to Diameter Ratio**

5:1

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**Drilling Coolant**

- **D1**: .2953” to .7047” Range
- **L1**: .7087” to 1.0197” Range

---

**Do not mount a smaller drill point than the D1 range listed for each drill body.**

* Drill bodies for coolant through the point.

Metric shanks available as non-stock standards.

See pages 25-29 for replaceable drill points.

For technical information, see pages 95-99.
### Diameters

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* Drill bodies for coolant through the point.

Metric shanks available as non-stock standards.  
See pages 25-29 for replaceable drill points.  
For technical information, see pages 95-99.
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Do not mount a smaller drill point than the D1 range listed for each drill body.
See pages 25-29 for replaceable drill points.
For technical information, see page 102.
TORQUE KEY

The number of drill point indexes is dependent on machine rigidity, workpiece stability and clamping, machining parameters, workpiece configuration, material coolant, coolant pressure and proper drill application.

It is recommended to use the torque key for inspection purposes only, not as a substitute for the standard key provided with each drill body.

Torque keys are available for checking minimal clamping torque. If a “click” is not heard or felt while slowly unclamping with the torque key, the drill must be replaced.
### SLIP FIT CHAMFER SHANKS - SERIES “MHK”

**Hole Diameters**

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<th>Lock Screw Key</th>
<th>Insert Screw Torque (in-lbs)</th>
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1. Minimum adjustment is with the smallest drill point diameter in the range.
2. Minimum adjustment is with the largest drill point diameter in the range.

**For chamfer inserts see page 23.**
**For replaceable points see page 25-29.**
**For technical information, see page 102.**

**Drilling Coolant**
**Tap Drills**

M6-M24

**UNC/UNF 3/8’’-7/8’’**

Combine tap drilling and chamfering in one operation.

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**Metric**

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<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>D2</th>
<th>L3 Ext</th>
<th>OAL</th>
<th>Shank Dia</th>
<th>Shank Dia</th>
<th>Chamfer Dia</th>
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**Inch**

Reduce recommended feed for M8 drill by 10%.

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For chamfer inserts see page 23. For replaceable points see page 25-29. For technical information, see page 102.

---

**HARDWARE**

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<tr>
<th>Chamfering Insert Screw</th>
<th>Chamfering Insert Screw Key</th>
<th>Torque (in-lbs)</th>
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**Drilling Coolant**

**Chamfering**

**Coolant**
**CHAMFER SHANK INSERTS**

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<td>GOMT060245R</td>
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<td>GOMT060360R</td>
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* For insert grade descriptions, see page 86.

**TAP DRILL/CHAMFER COMBO DRILL INSERTS**

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</table>

* For insert grade descriptions, see page 86.
## Chamfer RINGS - SERIES “CB”

**Chamfer Hole Diameters**
- .394” to .787”

**Chamfer Rings**
Combine drilling and chamfering in one operation.

### Chamfer Rings

<table>
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<th>H</th>
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**CHAMFER RINGS - SERIES “CB”**

Chamfer rings for use only with 3:1 and 5:1 Qwik Twist drills.

### INSERTS & HARDWARE

**ZOMW090700R**

- **Application**: Multi-Purpose
- **Grade**: IN 1530

For technical information, see pages 100-101.
## DRILL POINTS - .2677" TO .4291"

### General Purpose

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<th>General Purpose</th>
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** For insert grade descriptions, see page 86.  
** Cast iron point also effective in reducing burrs and breakout in steel applications.
## DRILL POINTS - .4331" TO .5866"

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* For insert grade descriptions, see page 86.
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* For insert grade descriptions, see page 86.
** Cast iron point also effective in reducing burrs and breakout in steel applications.
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** Cast iron point also effective in reducing burrs and breakout in steel applications.
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* For insert grade descriptions, see page 86.
** Cast iron point also effective in reducing burrs and breakout in steel applications.
### SQUARE INSERT INDEXABLE DRILLS-2:1

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#### L:D Ratio

- 2:1

#### Geometry

- Positive

#### For insert information, see page 34.
**SQUARE INSERT INDEXABLE DRILLS-3:1**

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For insert information, see page 34.
### Diameters

- **2.125” to 3.250”**

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<th>Nom. Dia.</th>
<th>Drill Number</th>
<th>L1 Drilling Length</th>
<th>L2 Ext. Trm Holder L3 Overall Length</th>
<th>D2 Shank Style/Size</th>
<th>Num. of Inserts</th>
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For insert information, see page 34.
### Inserts

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<th>Grades*</th>
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<td>.015R</td>
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<td>.625-.813</td>
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<td>.016R</td>
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<td>SPLIT07T308N-PH</td>
<td>.030R</td>
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<td>SHLT090408N-PH1</td>
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* For insert grade descriptions, see page 86.

### Hardware

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<th>Driver</th>
<th>Coolant Fitting</th>
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<td>5-9 in. lbs.</td>
<td>DS-TP06S</td>
<td>PF-0012</td>
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<td>SM22-052-00</td>
<td>7-11 in. lbs.</td>
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<td>PF-0012</td>
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<td>PF-0013</td>
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<td>DS-T10T (Tx-10)</td>
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For technical information, see page 108.
### CENTER-CUTTING COUNTER BORE TOOLS - SERIES “15S”

#### Hardware

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For technical information, see pages 109 and 110.

---

**Insert Loading-15S**: Insert Series R.

- **Right**: Series R inserts have only two cutting edges and must be loaded into the pockets properly or damage to the tool may result.
- **Wrong**: For insert information see page 38.
**INDEXABLE COUNTER BORING TOOLS—SERIES “15C”**

**Diameters**

-.438" to 2.000"

**L:D Ratio**

1:1

**Geometry**

Positive

---

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<th><strong>L&lt;sub&gt;3&lt;/sub&gt;</strong></th>
<th><strong>L&lt;sub&gt;4&lt;/sub&gt;</strong></th>
<th><strong>D&lt;sub&gt;2&lt;/sub&gt;</strong></th>
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<th><strong>Min. Cored Hole Dia.</strong></th>
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**Min. Cored Hole Dia.**

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<th>Socket Head Cap Screw</th>
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*Modified Weldon shank for more extension.

---

**HARDWARE**

**Insert Screw**

**Drill Diameter** | **Part No.** | **Torque** | **Driver** | **New Part No.**
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<td>1.750</td>
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**Torque**

For technical information, see pages 109 and 110.

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**Insert Loading—15C: Insert Series R.**

- **Right**
- **Wrong**

Series R inserts have only two cutting edges and must be loaded into the pockets properly or damage to the tool may result.

For technical information, see pages 109 and 110.
INDEXABLE COUNTER BORING INSERTS

**INSERTS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Image</th>
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*For Insert Descriptions, see page 86.

**DM04 Series:** Designed with 4 cutting edges and is suitable for use in all materials.

**R Series:** Designed with 2 cutting edges for use in materials such as steels, cast irons, stainless, carbon and alloyed steels.

**FS Series:** Designed with 4 cutting edges for use in materials that tend to drill easily but are too malleable to break.

**FS Series:** Designed with 4 cutting edges for use in materials such as steels, cast irons, stainless, carbon and alloyed steels.

**PH Series:** Designed with 4 cutting edges for use in materials such as steels, cast irons, stainless, carbon, alloyed steels, aluminum and high temp alloys.

**HR Series:** Designed with 4 cutting edges for use in materials such as steels, cast irons, stainless, carbon, alloyed steels, aluminum and high temp alloys.
### 15C Counterbore Diameter

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*For insert grade descriptions, see page 86.

### 15S Center Cutting

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<td>SHLT140508TN-HR</td>
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<td></td>
</tr>
</tbody>
</table>

*For insert grade descriptions, see page 86.

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**Optional Inserts**


Series 15C1G, 15C1J, 15S1G and 15S1TJ can use optional insert Series SHLT110408TN-HR & SHLT140508TN-HR. These inserts include a chipbreaker designed to enhance chip formation when end milling. Do not use Series SHLT110408TN-HR or SHLT140508TN-HR inserts for counterboring applications.
SINGLE FLUTE BRAZED GUN DRILLS

Diameter Range (inch): Ø0.100” to Ø1.575”
Length Range (inch): 5.9” to 118.0”

Advantages:
• Hole tolerance of IT7 to IT9 attainable
• Excellent straightness and concentricity
• Reduced true position deviation
• Surface finish Ra 0.4 to 1.6 easily achieved
• Often eliminates secondary reaming operation

The Carbide Cutting Tip
Available with 4 different standard cutting geometries, 8 different standard pad forms and 4 coating options for a multitude of possibilities.

The Extension Tube
Designed with a crimped “V” flute and large coolant ports. The hardened steel extension tube provides the optimal conditions for twist resistance, coolant flow and ship evacuation.

The Driver
The steel driver provides the means to clamp the gundrill into the machine tool.
**SOLID CARBIDE GUNDRILLS**

Diameter Range (inch): Ø.055” to Ø.630”
Length Range (inch): 40 x Drill Diameter up to 7.874” flute length

Made with an integral cutting tip and extension tube with either a steel or carbide driver. The solid carbide gun drill is designed for use in conventional machining centers and lathes. These drills provide superior rigidity with optimum coolant flow. As a result, speeds and feeds up to 100% faster may be obtained.
STANDARD GUN DRILL SHARPENING ANGLES

Depending on the required tolerance, cutting performance and desired chip shape, the following standard sharpening angles are recommended:

### Standard Sharpening

- **Diameters less than .157”**
  - Standard sharpening:
    - 30˚
    - 15˚
    - 30˚
    - 0.25xD

- **Diameters greater than .157”**
  - Standard sharpening for diameters greater than .157”:
    - 30˚
    - 12˚
    - 20˚
    - 30˚
    - 25˚
    - 30˚
    - 38˚
    - 40˚
    - 30˚
    - 0.25xD

### Optional Sharpening

Optional sharpening for materials where it is difficult to break a chip.

### Standard Gundrill Carbide Length

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<th>Diameter Range</th>
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<td>.150” - .159”</td>
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<td>.160” - .199”</td>
<td>.094”</td>
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<td>.200” - .258”</td>
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<tr>
<td>.259” - .435”</td>
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<td>.436” - .722”</td>
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<tr>
<td>.723” - .841”</td>
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<td>.842” - .919”</td>
<td>1.970”</td>
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<tr>
<td>.920” - 1.037”</td>
<td>2.165”</td>
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<tr>
<td>1.038” - 1.260”</td>
<td>2.560”</td>
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</table>

Regrindable Length = Length - Dia.
STANDARD GUN DRILL PAD FORMS

Drilling capacity and hole finish are dependent on the geometrical shape of the drill head. Both the pad form and the sharpening must be matched to the workpiece material. The pad form is determined when the tool is manufactured. Regrinding may change the cutting geometry, but the pad form will remain the same.

All cross section profile parameters such as: P, La and α must be precisely matched to the workpiece material properties.

**Universal G Form**
- Applications:
  - For all material groups
  - Works well in materials that tend to shrink
  - Maintains precision bore tolerance and straightness

**Standard A Form**
- Applications:
  - For cast iron & aluminum alloys (coated)
  - Drilling through cross holes and angled entry and exits
  - Large gap between pads ensures good lubrication

**Standard B Form**
- Applications:
  - For cast iron & aluminum alloys
  - Maintains high precision hole tolerances
  - Excellent surface finish

**Standard C Form**
- Applications:
  - With larger back taper for use in materials that tend to shrink.
  - (Some alloys and stainless)
  - Drilling through cross holes and angled entry and exit
  - Not recommended for precise straightness control

**Standard D Form**
- Applications:
  - For cast iron only (with coating)
  - Works very well in grey cast iron

**Standard E Form**
- Applications:
  - General purpose for all materials
  - Commonly used in crankshaft and other forged materials
  - Precise straightness control

**Standard H Form**
- Applications:
  - For all non-ferrous materials
  - For cast iron greater than .200” hole diameter
  - Can be used in wood & plastic with a larger back taper

**Standard I Form**
- Applications:
  - For aluminum and brass when best surface finish is required
  - Can be used in cross hole and interrupted cut applications
# Standard Gun Drill Drivers for Machining Centers, Lathes, etc.

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<th>Driver Type</th>
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*Recommended style*
# STANDARD GUN DRILL DRIVERS FOR GUN DRILL MACHINES

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- Recommended style
All Ingersoll brazed gun drills are made to order. Standard gun drill components, carbide tips, extension tubes and drivers are kept in stock.

**STANDARD DESIGN**
- Standard diameters:
  - 0.098” to .787” available in .004” increments
  - 0.788” to 1.260” available in .039” (1mm) increments
- Standard sub-micron carbide Grade (K15)
- Standard inch sizes in stock: 1/4, 7/16, 3/8, 1/2, 9/16, 5/8, 3/4
- Standard pad form = G form (Standard inch sizes = E form)
- Standard back taper (0.07%)
- Standard sharpening
- Uncoated
- Standard driver

**SEMI-STANDARD DESIGN**
- Out of standard diameter range
- Any other pad form from the catalog other than G or E
- Special surface finish
- Any coating

**SPECIAL DESIGN**
- Any non-catalog specification

All Ingersoll solid carbide gun drills are made to order. Standard solid carbide gun drills and drivers are kept in stock.

**STANDARD DESIGN**
- Standard sub-micron carbide Grade (K15)
- Standard pad form (G)
- Standard back taper (0.07%)
- Standard sharpening
- Uncoated
- Standard driver

**SEMI-STANDARD DESIGN**
- Any other pad form from the catalog
- Special surface finish
- Coating

**SPECIAL DESIGN**
- Any non-catalog specification
## Gun Drill Request for Quotation Form

### Customer
- **Customer Number**
- **Company Name**
- **Address**
- **Contact Person**

### The Piece Part
- **Name**
- **Part Number**
- **Hole Diameter**
  - **Tolerance**
  - **Surface Finish (Ra, Rz,...)**
  - **Concentricity (.001"/1.0")**
  - **Straightness (.001"/1.0")**
- **Hole Depth**
- **Hole Type** (Check all that apply)
  - Blind Hole
  - Through Hole
  - Angled entry
  - Angled exit
  - Drilling from solid
  - Core drill
  - Cross holes
  - Other (text)
- **Material** (Din material, spec etc.)
  - Steel
  - Iron
  - Aluminum
  - Stainless steel
  - Nickel
  - Other
- **Hardness**
  - Long chips
  - Short chips
- **Application**
  - Workpiece Stationary
  - Rotating
  - Tool Stationary
  - Rotating

### The Tool
- **Tool Type**
  - Carbide Tipped
  - Unknown
  - Single Lipped
  - Double Lipped
- **Tool Diameter**
  - [in/mm]
- **Tolerance**
  - h5
  - Other
- **Coating of the Carbide Tip**
  - Uncoated
  - TiAIN
  - TiN
  - TiCN
  - Other
  - Unknown
  - TiN + TiCN
- **Carbide Tip Length**
  - Other
  - Standard
- **Overall Length**
  - [in/mm]
- **Flute Length**
  - [in/mm]
- **Driver**
  - List Std catalog number
  - Other
  - Length x Diameter
  - Driver Extension L x Dia
- **Pad Forms**
- **Grind Geometry**
- **Coolant**
  - Pressure "P" (psi)
  - Flow Rate (gal/min)
  - Neat Oil
  - Soluble
  - %
- **Additional Information**

### Inquiry
- **Inquiry Number**
- **Inquiry Date**

### Quantities Requested

### The Machine
- **Machine Type/Model**
  - [hp/Kw]
- **Rigidity**
  - Good
  - Average
  - Poor
- **Cutting Data**
  - Max Possible
  - Current
  - Cutting speed "Vc" (SFM)
  - Revolutions per minute
  - Feed "f" (in/rev)
  - Feed "F" (in/min)
- **Drill Guide Method**
  - Internal Dia.
  - Tolerance
  - Pre-Drilled pilot hole
  - Bushing
- **Std Grind for Diameters from .055" thru .157"**
  - d=D/4
  - b=0
- **Std Grind for Diameters from .158" thru 1.260"**
  - d=D/4
  - b=0,03/0,5
DEEP DRILLING APPLICATIONS

Gun drilling operation in blind hole when chips and coolant are evacuated back through the flute.

Gundrill boring operation in through hole when chips and coolant are evacuated ahead of the drill tip.

Gun drill boring operation in blind hole when chips and coolant are evacuated back through the flute.

Stepped gundrill boring operation in through hole when chips and coolant are evacuated ahead of the drill tip.
GUN DRILL MACHINING CENTER APPLICATION

Deep Hole Drilling on Conventional Machine Tools

1. Operation - Pilot hole

- Workpiece

\[ L = 1.5 \times D \]

2. Operation - Deep hole drilling

- Coolant circle

- High pressure pump

- Filter

Gun Drills in Machining Centers

- Centering/Guiding hole for gundrill operation in machining center

- Bushing guide barrel for Gun drill stabilizing in machining center
## GUN DRILL TROUBLESHOOTING GUIDE

### Drill Problems

| Poor clamping | Insufficient coolant flow | Low coolant pressure | Incorrect coolant type | Feed fluctuations | Too high feed | Too low feed | Spindle speed too high | Spindle speed too low | Material structure | Material shrinking due to heat | Workpiece thin wall section | Misalignment | Undersized hole | Built up edge | Worn out edge | Interrupted chip flow | Too small flute clearance | Incorrect drill profile | Incorrect head angles | Vibrations | Oversized bushing | A gap between bushing and workpiece | Bushing undersized | Loss of coolant pressure | High coolant pressure | Overheating coolant | Insufficient coolant | Head inside angle excessive wear | Head outside angle excessive wear | Too short carbide head | Tool heel drag | Worn supporting pads | Tool whip - Reverse tool rotation |
|---------------|---------------------------|---------------------|-----------------------|-------------------|--------------|-------------|----------------------|----------------------|-----------------|-----------------------------|---------------------------|-------------|----------------|----------------|-------------|-----------------|--------------------------|--------------------------|-------------------------|-----------------|------------------|----------------------------|---------------------------|-----------------|-----------------|----------------|----------------|-------------------|---------------------|
|                            |                           |                     |                       |                   |              |             |                      |                      |                 |                             |                           |             |               |               |             |                  |                          |                          |                         |                 |                  |                             |                           |             |               |               |             |                  |                      |
|                            |                           |                     |                       |                   |              |             |                      |                      |                 |                             |                           |             |               |               |             |                  |                          |                          |                         |                 |                  |                             |                           |             |               |               |             |                  |                      |
|                            |                           |                     |                       |                   |              |             |                      |                      |                 |                             |                           |             |               |               |             |                  |                          |                          |                         |                 |                  |                             |                           |             |               |               |             |                  |                      |
|                            |                           |                     |                       |                   |              |             |                      |                      |                 |                             |                           |             |               |               |             |                  |                          |                          |                         |                 |                  |                             |                           |             |               |               |             |                  |                      |
|                            |                           |                     |                       |                   |              |             |                      |                      |                 |                             |                           |             |               |               |             |                  |                          |                          |                         |                 |                  |                             |                           |             |               |               |             |                  |                      |
|                            |                           |                     |                       |                   |              |             |                      |                      |                 |                             |                           |             |               |               |             |                  |                          |                          |                         |                 |                  |                             |                           |             |               |               |             |                  |                      |
|                            |                           |                     |                       |                   |              |             |                      |                      |                 |                             |                           |             |               |               |             |                  |                          |                          |                         |                 |                  |                             |                           |             |               |               |             |                  |                      |
|                            |                           |                     |                       |                   |              |             |                      |                      |                 |                             |                           |             |               |               |             |                  |                          |                          |                         |                 |                  |                             |                           |             |               |               |             |                  |                      |

### Hole Problems

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### Possible Cause

- **Poor clamping**
- **Insufficient coolant flow**
- **Low coolant pressure**
- **Incorrect coolant type**
- **Feed fluctuations**
- **Too high feed**
- **Too low feed**
- **Spindle speed too high**
- **Spindle speed too low**
- **Material structure**
- **Material shrinking due to heat**
- **Workpiece thin wall section**
- **Misalignment**
- **Undersized hole**
- **Built up edge**
- **Worn out edge**
- **Interrupted chip flow**
- **Too small flute clearance**
- **Incorrect drill profile**
- **Incorrect head angles**
- **Vibrations**
- **Oversized bushing**
- **A gap between bushing and workpiece**
- **Bushing undersized**
- **Loss of coolant pressure**
- **High coolant pressure**
- **Overheating coolant**
- **Insufficient coolant**
- **Head inside angle excessive wear**
- **Head outside angle excessive wear**
- **Too short carbide head**
- **Tool heel drag**
- **Worn supporting pads**
- **Tool whip - Reverse tool rotation**
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CAT - TOOLHOLDER STANDARD

CAT A.N.S.I. B5.50

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**CAT - ER COLLET CHUCK**  
**CAT-ER 16-20**

Add B suffix for coolant through flange.

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* Balanced to G6.3 12000 RPM.
CAT - ER COLLET CHUCK

Add B suffix for coolant through flange.

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Through-Flange coolant available.

* Balance to G6.3 12000 RPM.
Add B suffix for coolant through flange.

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**CAT A.N.S.I. B5.50**

**TG100(1)**

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Through-Flange coolant available.
* Left-hand thread.
CAT - ENDMILL HOLDER CAT-EM

Add B suffix for coolant through flange.

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Through-Flange coolant available.
Add B suffix for coolant through flange.

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Add B suffix for coolant through flange.

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Add B suffix for coolant through flange.

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* Balance G2.5 35.000 RPM.
** Balance G2.5 30.000 RPM.
Coolant tube not included.
Add B suffix for coolant through flange.

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* Balance to G6.3 12,000 RPM.
Coolant tube not included.
### HSK - ER COLLET CHUCK (METRIC)  
**HSK A-ER**

Add B suffix for coolant through flange.

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* Balance to G6.3 12,000 RPM.  
Coolant tube not included.
Add B suffix for coolant through flange.

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Coolant tube not included.
**HSK - ENDMILL HOLDER**  
HSK A-EM

Add B suffix for coolant through flange.

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Coolant tube not included.  
* Metric styles available. Call for delivery information.
Add B suffix for coolant through flange.

**ER Collet Type DIN 6499**

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*ER50 DIN6499*

**ER Sizes**

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**Application:**
For use with solid and coolant through tools. Ideal for high speed machining as well as conventional machining. Can be used on machining centers, lathes and other machine types.

**Features:**
- Front sealed design
- .040" (1mm) range
- Improved coolant delivery can increase tool life
- Two styles available: ER JET and JET2

**Advantages:**
- Can be used with high pressure coolant 1450 PSI max.
- Designed for use with Weldon shanks, cylindrical shanks and whistle notch styles.

**Notes:**
- Minimum clamping length: 2X shank diameter, to insure minimum run-out and maximum clamping.
- When using JET2 style collets, tool should be rotated to direct coolant flow to flutes for optimum chip evacuation.
ER COLLET - ER COOLIT SEALED COLLET

Two types:

Sealed Collet jet
For straight shank cutting tools with coolant through.

Sealed Collet jet 2
With angular double nozzle. Coolant flow should be directed to flutes of cutting tool.

Shank Standards

Cylindrical Shank

Weldon/DIN 1835/B

Whistle Notch
Description:
Precision ER retention nut. Two-piece design incorporating a specialized, two-piece friction mechanism which is self-centering.

Features:
- Friction/bearing design offers 50%-100% greater torque transfer than conventional ER collet chucks.
- Balanced, allowing much higher RPM, due to unique extractor teeth.
- Compact style, no longer than standard ER retention nut.
- Designed for use with sealed collets.

Operation:
Always insert collet INTO nut BEFORE threading nut onto the collet chuck.

Assembly Procedure:
1. Angle collet into nut, inserting the extract teeth into the groove on collet.
2. Place collet/nut onto a flat work surface.
3. Press collet into nut until it “snaps” into place; thread collet/nut onto collet chuck; insert tool shank and tighten to proper torque for that size collet.
**Important:** Do not insert any ER collet parallel to the extractor ring. Damage to the ring and teeth may occur. When removing the nut during disassembly, the collet will easily release from the ring.

**To Disassemble**
1. After removing the nut/collet assembly from the collet chuck, align the engraved “diamond” (D) with a key slot (E) on the nut.
2. Place the nut/collet on a flat surface as shown in figure F.
3. Insert a flat blade screwdriver between the nut and collet.
4. Using a minimum force, tilt the screwdriver outward, while applying opposite pressure by hand to remove the collet.

**Note:**
For maximum performance, the clamping nut thread and collet taper must be cleaned and oiled before use.

---

### Recommended Clamping Torque for Standard ER & ER-Top Clamping Nut

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**Important:**
Torque values have been calculated based on maximum diameter capacity. The torque spec may be reduced based on smaller diameter shank sizes.
### ER-11, 16, 20, 25-SPR

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# ER COLLET - ER SPRING COLLETS DIN 6499

## ER50-SPR

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## ER-EX* (Single-diameter spring collets)

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*Recommended for improved runout and clamping torque.
### ER11, 16, 20-SPR-AA

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## ER COLLET - ER SPRING COLLETS DIN 6499 “AA”

### Ultra Precision ‘AA’

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### TG100++-SPR

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*Expanded collapsability range (.04")

### SET-TG100++-SPR Spring Collets

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### ER16, 20, 25-SEAL

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**ER32, 40-SEAL**

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**ER COOLIT - SEALED JET2 SPRING COLLETS 1450 PSI**

**ER16, 20, 25-SEAL-JET2**

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### TG100 SEAL

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<td>61/64 (.938-.953)</td>
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## ER SPRING COLLET SETS

### SET-ER SPRING COLLETS DIN 6499

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<thead>
<tr>
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<th>Diameter Range (mm)</th>
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<td>0.022-0.278</td>
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<td>SET ER16 SPR 10</td>
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<td>0.022-0.396</td>
<td>0.5-10</td>
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<td>SET ER20 SPR 12</td>
<td>12</td>
<td>0.041-0.514</td>
<td>1-13</td>
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<td>SET ER25 SPR 15</td>
<td>15</td>
<td>0.041-0.632</td>
<td>1-16</td>
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<td>SET ER32 SPR 18</td>
<td>18</td>
<td>0.080-0.789</td>
<td>2-20</td>
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<tr>
<td>SET ER40 SPR 23</td>
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<td>0.120-1.025</td>
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<td>SET ER50 SPR 23</td>
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### SET-ER-SPR-AA SPRING COLLETS DIN 6499 “AA”

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<td>0.080-0.789</td>
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<td>SET ER40 SPR 23 AA</td>
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<td>0.120-1.025</td>
<td>3-26</td>
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## ER COOLIT - SEALED JETS COLLET SETS 1450- PSI

### SET ER-SEAL COLLETS 6499

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<td>SET ER25 SEAL 13</td>
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<td>SET ER40 SEAL 23</td>
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### SET ER-SEAL-JET2 COLLETS DIN 6499

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### ER SPRING EMI COLLET SETS DIN 6490

#### SET ER SPR-EMI (1)

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(1) EMI-Endmill cutter inch sizes

### ER COOLIT - SEALED JET EMI COLLET SETS

#### SET-ER SEAL-EMI(1)

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(1) EMI-Endmill cutter inch sizes

#### SET-ER SEAL-EMI JET2

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<th>Workpiece Materials</th>
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<td>C-1/C-2</td>
<td>K20-K30</td>
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<td>Cast iron, aluminum, non-ferrous materials, high-temp alloys</td>
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<td>M20-M40</td>
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<td>C-5/C-6</td>
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<td>MT-CVD</td>
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### Material

- Short Chipping: Malleable Iron, Non-Ferrous Metal, Hardened Iron, Chilled Iron, Cast Iron
- High-Temp Alloys, Alloy Iron, Steel Casting, Manganese
- Free Cutting Steels, Malleable Iron, Steel Casting, Steel
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Diagram keys:
- P
- M
- K
- N
- S
- H
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*Z-axis DOC is measured to theoretical sharp corner.

### Z-Axis DOC to Spot Diameter Chart (SPOT IN)

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*Z-axis DOC is measured to theoretical sharp corner.

**Insert Loading:**

Insert loading is easy and fast. Simply insert the drill point into the special dovetail bayonet pocket. Then turn it to the locked position using the proper clamping wrench provided with each drill body.
SPOTTING DRILL RECOMMENDATIONS

SPOTTING DRILL RECOMMENDATIONS FOR SOLID CARBIDE AND QWIK TWIST DRILLS

**BEST**
Spotting drill angle is greater than the drill point angle.
- First contact is at the drill point.
- Best drill centering possibility.
- Drill loading increases with penetration.

**ACCEPTABLE**
Spotting drill angle is the same as the drill point angle.
- Tool loading problems can occur due to immediate full engagement.
- Chatter may be a problem.
- Reduced feed at entry recommended.
- Good drill centering.

**NOT RECOMMENDED WITH CARBIDE**
Spotting drill angle is less than the drill point angle.
- Point contact along cutting lips or corner - drill point should contact spotted hole first.
- Chipping likely in these areas.
## DR SOLID CARBIDE DRILLS OPERATING GUIDELINES

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</table>
1. Limit cutting edge wear to .008” to .012”. (see Fig. 1)
2. Power consumption exceeds 125% of normal. (see Fig. 2)
3. Drilled hole diameter variation. (see Fig. 3)
4. Deterioration of surface finish of the drilled hole. (see Fig. 4)
5. Significant increase in noise or vibration. (see Fig. 5)

**RECOMMENDED COOLANT PRESSURE AND FLOW RATE**

For proper chip evacuation, the coolant must flow through the tool. If the machine is not equipped with coolant through the spindle, we recommend using a coolant inducer. External coolant supply can be used if the hole depth is less than 1xD and reduced cutting parameters are applied.

**Coolant Mix**
Recommended coolant concentration is 6% to 8%. When drilling stainless and high strength steels, a 10% concentration is recommended.

**Dry Drilling**
It is possible to drill without coolant in cast iron. Oil mist through the drill is required (2xD max hole depth).
COOLANT

Through the tool Coolant
Most Recommended

No Coolant
Not Recommended

External Coolant
Acceptable up to Depth=2xDiam.

External Coolant
Wrong Coolant Direction

In stationary drill applications both through the tool and external coolant is recommended.

DRILLING LIMITATIONS

Angular or Irregular Surfaces (Maximum 6° angle)
Interrupted or Partial Holes

Wrong Coolant Direction
MOUNTING A DRILL POINT

Check Drill Point Compatibility!
Drill points should always be larger than drill body.

SET-UP: RUN-OUT TOLERANCE

Stationary drill

Rotating drill

Max. .0008"
Power/Force Requirements

Material: SAE 4340
Speed: 330 SFM
Feed: .008 ipr

Values change according to different materials and drilling conditions.

Qwik•Twist 8:1 Drills

- In case of stationary applications—on lathes—a high degree of radial and angular alignment between the chuck and the turret is required.
- The recommended cutting parameters for 8:1 drills is 20% lower than the cutting speeds used for the 3:1 and 5:1 drills.

Starter Hole Guide

<table>
<thead>
<tr>
<th>Hole Diameter Range</th>
<th>Drill Body Number 8:1</th>
<th>Starter Hole Depth</th>
<th>Starter Hole Body Number 3:1</th>
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We strongly recommend the use of a 3:1 Qwik•Twist drill of the same diameter to drill a centering starter hole. The use of a centering starter hole improves hole location, accuracy, roundness, straightness and surface finish.
Mounting Instructions:

1. Insert the Chamfer Ring on the drill body and slide to the desired position (1).
2. Rotate the ring clockwise until the stopper engages the flute edge.
3. Tighten the ring clamp screw according to the maximum tightening torque indicated in the table below.
4. Mount the chamfer insert. (Torque 35 in. lbs.).
5. Mount the Qwik•Twist Drill Point.

(1) Mount the ring on the drill body subject to the limitations shown in the drawing to the right and the position possibilities in the table “Chamfer Ring Position Range” on the next page.

<table>
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<tr>
<th>Ring Number</th>
<th>Ring Clamp Screw</th>
<th>Torque</th>
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<td>CB100-01 thru CB150-01</td>
<td>SD050-A5</td>
<td>62 in. lbs.</td>
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<tr>
<td>CB160-01 thru CB200-01</td>
<td>SD060-20</td>
<td>88 in. lbs.</td>
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</table>

Before drilling insure that:

- There exists a very small gap between the chamfer insert and the drill body, but without contact (i.e., chamfer insert should not be in contact with the drill body).
- The cutting edge point (45°) is aligned with the flute edge.
User Guide
Recommendation for better stability:
• Use 3xD drill instead of 5xD, if possible.
• Mount the ring as close as possible to the drill shank.
• In order to get better chamfer insert life, it is suggested to apply coolant to the chamfer insert in addition to the through the drill coolant and/or external coolant.
• A wider difference “X” between the drill body and the replaceable point size is preferred (i.e., for .575” replaceable point select .551” drill body rather than .571”). A slightly larger “X” dimension can dramatically increase the chamfer insert life.

Trouble Shooting
• Bad chamfer surface finish (vibrations)
  Solutions:
  • Use a shorter drill.
  • Move the ring closer to the drill shank.
  • Reduce the cutting speed while cutting th chamfer.
• Chips packed on the ring flutes:
  • Ensure that the ring is positioned as shown in the mounting instructions.
  • Adjust the cutting speed.
  • Use a pecking cycle.
**CONSTRUCTION**

**CHAMFER SHANK / SLIP FIT DRILL INITIAL SET-UP**

1. Unscrew the Chamfer Shank side lock screw, the chamfer insert screws, and remove inserts. Insert the proper Slip Fit Drill into the Chamfer Shank and position it against the rear adjusting screw. Slightly tighten the side lock screw for initial tension with the Slip Fit Drill.

2. In order to achieve symmetrical positioning of the chamfering inserts and to avoid edge damage, tighten the insert screws gradually and alternately from side to side insuring the inserts are tightly clamped against the side walls of the peripheral guiding surfaces. Tighten the side lock screw.

3. Install the proper size Qwik Twist Drill point on the Slip Fit Drill.

**DRILL DEPTH ADJUSTMENT ADJUSTMENT**

1. Remove Chamfer inserts.

2. Loosen the side lock screw and remove the Slip Fit Drill.

3. Adjust the rear adjusting screw with a flat point screw driver.

4. Insert Slip Fit Drill and slightly tighten the side lock screw.

5. Re-install Chamfer Inserts as per Initial Set-up Instructions #2. Tighten side lock screw.
QuadDrills are One-Effective. Indexable drills are one-effective cutting geometry regardless of the number of inserts in the tool. This is extremely important when establishing feeds and speeds for a given operation.

Rigidity. A high degree of rigidity of the machine and fixturing is critical for indexable drilling.

Spindle Rigidity. If the spindle is not tight or properly adjusted, the drill will cut off-center, producing oversize holes. Insert chipping or low tool life may also result and hole finish will be affected.

Fixture Rigidity. Workpiece strength is essential. Flimsy or inadequately supported workpieces will render indexable drills virtually ineffective.

Chip Control. Chip control is essential for indexable drilling. Proper chip control directly enhances chip evacuation, which extends tool life and improves hole tolerance and finish (see Fig. 2).

Large, long chips will restrict the flutes’ capacity to evacuate chips, and cause insert chipping and possible drill failure.

Operating parameters should be adjusted to fall within recommended guidelines to achieve optimum form or figure “9” chips that can successfully evacuate along the drill flutes.

Coolant. In drilling, heat and chips are generated in a confined area at the bottom of the hole. Coolant must be used as a carrier to extract heat and chips from the bottom of the hole, along the drill flutes and out of the hole.

Through the tool water base or synthetic coolant is strongly recommended.

Do not operate indexable drills over 1:1 diameter to length ratios with air, air mist or dry. Running drills under those conditions can result in drill failure.

**Fig. 2: Chip Formation**

- **Optimum form**
- **Too tight:** Increase speed within recommended limit. If unsatisfactory, decrease feed.
- **Too long:** May clog drill flutes. Reduce speed or increase feed within recommended limits.
Recommendations are starting parameters only and can be effected by cutting conditions such as spindal and fixture rigidity. Minimum 150 psi coolant through the tool is required for proper drill performance. If not possible, then cutting parameters may have to be reduced. Start at the midpoint of the range and adjust the cutting parameters according to your cutting conditions.

For drills that are 4:1 length to diameter ratio, it may be necessary to reduce your feed by 40% for the first .06” of drilling depth. Then increase to full feed rate for the remainder of the cut.
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OFFSETTING ROTATING INDEXABLE DRILLS

Offsetting indexable drills in a positive direction has proven to be beneficial in several ways. Reports indicate that it improves chip evacuation when applied to machines with inadequate coolant.

Offsetting can reduce chatter and noticeably improve surface finish when cutting materials like 316 stainless steel. It also allows drilling a full range of hole diameters with a minimum of drill sizes.

A complete list of “Maximum Offset” dimensions for each standard drill size is shown here. Remember, only 2:1 and 3:1 L/D ratio drills are recommended for this type of work because of their rigidity.

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When setting up an indexable drill, it is always a good idea to locate the drill in the turret in an attitude that puts the inserts parallel to the machine ways. Most lathes have more than one set of screws in the turret that allows this.

When using drills on the lathe, the drills must be properly aligned prior to taking the first cut. Plus, periodic alignment checks must be made to insure the continued accuracy of the setup.

**Common drilling applications with flat or convex surfaces generally require no speed or feed adjustment during the drilling cycle.**

Special situations however, may necessitate temporary adjustments. In the examples below, reductions to feed and/or speed may be required to minimize deflection or tool wear.

Material surface conditions such as case hardening or scale may require slowing penetration to some degree. Interior conditions such as porosity, sandy castings, etc., also have some effect on tool life. Operating parameters may have to be adjusted accordingly.

Feedrates on 4:1 drills may need to be reduced even more than the recommendations below indicate. Generally, this reduced feedrate is required until the first .200” DOC after full engagement is reached.

**Sloped:** If slope exceeds 5°, reduce feed by 50% during penetration.

**Concave:** Reduce feed by 60% during penetration.

**Irregular:** Reduce speed during penetration.

**Interrupted:** Reduce feed when crossing and before penetration.
ASSEMBLY, SET-UP AND ADJUSTMENT PROCEDURES

Recommend using Weldon style end mill adapter that uses two side locking screws.

1. Scribe line on front face of adapter exactly 90 degrees from locking screws.
2. Load eccentric bushing over drill shank and into adapter lining up the scribed line on adapter and bushing.
3. Before locking the set screws in adapter, line up OD insert in drill with both scribed lines on the bushing and adapter. The drill in this position will drill a nominal (drill size) hole diameter.
4. With the drill and bushing loaded into the adapter and the OD insert in line with the scribed lines, apply the rear set screw (B) in adapter locking the bushing in place. Use only hand pressure to tighten the screw. Applying the set screw to the bushing provides positive axial retention of the bushing and hand tightening allows radial adjustment.
5. Rotate the bushing either plus or minus to desired position then lock the (B) set screw using a wrench. This will lock the radial position setting in preparation for drilling.
6. Lock the front (A) set screw in the adapter using a wrench to lock the drill into the holder.

You are now ready to drill. Please check to make sure all screws are tight and assembly is rigid before drilling. Once you produce a hole with the current setting and inspect the diameter, you can repeat procedures #5 & 6 if required to achieve desired diameter.
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GUN DRILL COOLANT AND OPERATING GUIDELINES

THE RIGHT COOLANT

Neat Oil
• Oil is preferred over water soluble coolant
• Most conventional gundrilling machines use oil
• Provides superior lubricity, better tool life and surface finish
• No worry about concentration levels
• Does not evaporate

Water Soluble
• Used on most CNC machines

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CUTTING CONDITIONS

- Feed
- Diameter

1. Aluminum Alloy
2. Grey Cast Iron
3. Nodular Cast Iron
4. Structural and Free Cutting Steel
5. High Temper Alloys
6. Super Alloys
7. Ferritic and Austenitic Stainless Steel
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