Integral Carbide Boring Bar Instructions Manual

Metric: 6mm, 8mm, 10mm, 12mm and 16mm Diameter.
Boring Ratio: 8 x Dia., 10 x Dia., 12 x Dia., 14 x Dia.

1 Work holding
Use the proper chuck and jaws to hold the work-piece, to assure that the part is held with maximum rigidity and stability under cutting force.

2 Steady Rest Support
When boring a long part, it is necessary to have extra support from the steady rest to eliminate any deflection of the part under the cutting force that causes vibration and poor surface finish.

3 Boring Bar Holding
For best results, hold the bar 4 x Dia. & choose a split collar boring bar holder. The 360° locking system offers the largest surface contact between the boring bar and the holder, maximizing bar rigidity and minimizing vibration.

4 Boring Bar Size
Choose a boring bar with the largest diameter to clear the bore, maximizing rigidity. Make sure to provide enough clearance between the bore and the bar for chip evacuation so damaging does not occur on the bore wall. Also choose the shortest overhang to reduce vibration.

5 Insert
To avoid and reduce vibration of the bar, that causes chattering. Use the insert with the as small of an angle geometry possible, small nose radius, high positive rake angle and sharp cutting edge.

6 Cutting Parameter
Use the recommended cutting data and parameter specified from the insert manufacturer, and use the cutting formula to maximize performance, quality, and tool life.
For a Roughing operation with a large depth of cut and a high feed rate, low RPM is recommended.
For a Finishing operation with a small depth of cut and a low feed rate, high RPM is recommended. Minimum depth of cut is 1/2 of the insert radius. Maximum feed rate is 1/2 of the insert radius.

To Achieve Optimum Results for Deep Hole Boring
It is extremely important to follow steps 1-6.
Maximum Boring Bar Performance

Steel Bar
- 4 x Dia. Boring Ratio
- 2 x Dia. Threading Ratio
- 2 x Dia. Grooving Ratio
- General boring bar applications
- Roughing to finishing
- Stable for high material removal
- For small bores

Carbide Bar
- 6 x Dia. Boring Ratio
- 3 x Dia. Threading Ratio
- 3 x Dia. Grooving Ratio
- Best for boring small holes
- Rigid for close tolerance and furnace finish
- Rigid for heavy material removal at high ap and fn

Steel Body Solution Tool™
- 8 x Dia., 10 x Dia., 12 x Dia. Boring Ratio
- 4 x Dia. Threading Ratio
- 4 x Dia. Grooving Ratio
- For deep hole boring applications

Carbide Body Solution Tool™
- 8 x Dia., 10 x Dia., 12 x Dia., 14 x Dia. Boring Ratio
- 5 x Dia. Threading Ratio
- 5 x Dia. Grooving Ratio
- For high performance deep hole boring applications

✓ The diameter size of the boring bar is limited from the size of the hole diameter to be bored.
✓ The boring bar should have the largest diameter possible for maximum cutting rigidity, but small enough to clear the hole for chip evacuation.
✓ The Boring Bar has to be held with the maximum rigidity (4x Dia. of the Bar) and the shortest overhang possible to maximize cutting stability.
✓ The selection and use of the right insert grade, geometry, nose radius and rake angle will be critical for a good surface finish and close working tolerance.
✓ The cutting parameter is to be correct for the material machined in accordance of the insert manufacturing cutting data.
✓ The bore, while machined has to be kept clear from chips to avoid insert breakage, boring bar vibration, and undamaged the workpiece surface.

Boring Bar Cutting Ratio:
The material of the boring bar determines the cutting ratio of the boring depth.

Steel Bar; for Short Depth 4xDia.
Carbide Bar; Medium Depth for 6xDia.
Solution Tool!; Long Depth up to 14xDia.

Boring Bar Cutting Ratio: Maximum cutting length of the boring bar in relation to its own body diameter Ex.: 1” (25mm) Boring Bar with 10 x Dia. Ratio, Maximum cutting length is 10” (250mm).

Boring Bar Holding System:
When boring bar is not held properly and rigidly in the boring bar holder, vibration will develop when cutting. A split Boring Bar Holder must be used.

When holding the boring bar, the boring bar holder must:
1. Have a Precise and smooth bore
2. Use the most rigid holding system of the boring bar
3. Have a holding length of the boring bar at 4 x boring bar diameter.

BEST
Split Collar Holding System
Boring Bar Holding System
Locks the boring bar at 360° on the diameter, assuring the most rigidity and precise boring bar positioning Without scribing or damaging the bar surface.

GOOD
Split Bushing Holding System
With a solid boring bar holder
The split bushing embraces the boring bar at 360° on the diameter. The screw will squeeze the bushing around the boring bar Without scribing or damaging the bar surface with precise positioning.

DO NOT USE IT
Set Screw Lock Holding System
Solid boring bar holder without bushing
Never lock the screw over the boring bar. Locking a screw over the boring bar will create only one point of contact causing very poor rigidity. Additionally, the screw will damage the boring bar surface and make positioning difficult.
Boring Bar Overhang:
Do not over stand the boring bar limitation.
Steel bar 4 x Dia.,
Carbide bar 6 x Dia.,
Solution Tool™ 8 - 14 x Dia.

Boring Bar Deflection: The bar under the Cutting Pressure will deflect. Use and set the boring bar to the correct overhang that is built for.

Incorrect Insert:
Vibration are caused when incorrect insert geometry edge prep. (honing), nose radius, rake angle, chip breaker (too small), and clearance angle is used.

Use the correct insert grade, geometry and characteristics for the material to be machined and the operation to be executed.

For a Finishing operation and small depth of cut, use a wear resistant grade insert with a positive rake angle, small nose radius, sharp cutting edge, large chip break, and clearance angle. If the insert is too hard, it will chip and break under the cutting pressure, and vibration will develop. Switch to a softer grade.

For a Roughing operation and large depth of cut, use an impact resistant insert with a positive rake angle, medium to large nose radius, honed cutting edge, large chip break, and clearance angle. If the insert is too soft it will wear prematurely, and friction will develop losing tolerance and good surface finish, switch to a harder grade. Minimum depth of cut is 1/2 of the insert radius. Maximum feed rate is 1/2 of the insert radius.

Best insert application:
“V” for profiling and finishing
“D” for general application
“T” For light roughing and finishing
“C” For heavy roughing

Cutting Parameter:
Use the recommended cutting data and parameter specified from the insert manufacturer, and use the cutting formula to maximize performance, quality, and tool life.

For a Roughing operation with a large depth of cut and a high feed rate, low RPM is recommended.

For a Finishing operation with a small depth of cut and a low feed rate, high RPM is recommended.

Minimum depth of cut is 1/2 of the insert radius. Maximum feed rate is 1/2 of the insert radius.

When wrong cutting parameters are used for the specific material to be bored, and for the operation to be executed, the boring bar will not perform properly, generating poor surface finish and/or vibration.
HIGH PRECISION FINISHING
1. Hard and Abrasive Resistant Insert
2. Ground, Polished and Coated
3. Sharp Cutting Edge
4. High Positive Chip Breaker
5. PVD Microplus® Plasma Coating
6. Low Cutting Force
7. High Cutting Speeds ($V_c$)
8. High Surface Finish

FINISHING
1. Hard and Abrasive Resistant Insert
2. Precision Ground and Coated
3. Positive Cutting Edge
4. Positive Chip Breaker
5. PVD Coated
6. Low Cutting Force
7. High Cutting Speeds ($V_c$)
8. High Surface Finish

MEDIUM / ROUGHING
1. Tough and Impact Resistant
2. Ground Periphery
3. High Positive Molded Chip Breaker
4. CVD Coated
5. Heavy Material Removal
6. Low Cutting Force
7. Medium Cutting Speed ($V_c$)
8. Good Surface Finish

Material Application
P10 Carbon Steel & Alloy Steel Annealed
M10 Stainless Steel
K10 Cast Iron
N10 Aluminum
S10 High Temp Super Alloys

<table>
<thead>
<tr>
<th>Insert</th>
<th>ISO</th>
<th>Grade</th>
<th>UPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCGT-060202-NFU</td>
<td>DNX10UT</td>
<td>80221</td>
<td></td>
</tr>
<tr>
<td>CCGT-060204-NFU</td>
<td>DNX10UT</td>
<td>80225</td>
<td></td>
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<tr>
<td>CCGT-09T302-NFU</td>
<td>DNX10UT</td>
<td>80299</td>
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</tr>
<tr>
<td>CCGT-09T304-NFU</td>
<td>DNX10UT</td>
<td>80333</td>
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</tr>
<tr>
<td>CCGT-09T308-NFU</td>
<td>DNX10UT</td>
<td>80377</td>
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</tr>
<tr>
<td>DCGT-070202-NFU</td>
<td>DNX10UT</td>
<td>80249</td>
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<tr>
<td>DCGT-070204-NFU</td>
<td>DNX10UT</td>
<td>80553</td>
<td></td>
</tr>
<tr>
<td>TCGT-110204-NFU</td>
<td>DNX10UT</td>
<td>80990</td>
<td></td>
</tr>
<tr>
<td>VCGT-110302-NFU</td>
<td>DNX10UT</td>
<td>80999</td>
<td></td>
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<tr>
<td>VCGT-110304-NFU</td>
<td>DNX10UT</td>
<td>80104</td>
<td></td>
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</tbody>
</table>

Note: The choice of the correct insert, cutting parameters, are critical for the performance of the Solution Tool™. For Deep Boring, the use of a small cutting radius, sharp cutting edge and a positive rake angle is recommended.

Re-Turning The Solution Tool™

The Solution Tool™ is dynamically tuned, tested and certified to meet Dorian Tool Quality control standards and performance and ready to be used.

Optimizing Performance
Can be retuned on the machine to optimize the boring bar performance when:
• Extreme and exotic materials change from very soft to very hard.
• Changing the boring depth. Ex: a boring bar with a 12 x Dia. boring Ratio will be used for a shorter boring Ratio like 6 x Dia.
• Improving performance for specific machining operations such as finishing, roughing boring, threading, and grooving.

1 Unlock dampener position locking screw.
2 Insert Re-Tuning Key.
3 While machining, turn the Re-Tuning Key very slow.
   3-1 Clockwise for roughing operations at low SFM.
   3-2 Counter-clockwise for finish operations at high SFM.
3-3 Until the optimized boring performance is reached
4 Re-lock dampener position locking screw.
5 Remove Turning Key
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration</td>
<td>Boring Bar over extended</td>
<td>Do not overextend the Boring Bar above the described cutting ratio:</td>
</tr>
<tr>
<td></td>
<td>Incorrect Cutting Ratio</td>
<td><strong>Steel Boring Bar:</strong> (6 \times \text{Dia.})</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Solution Tool(^\text{TM}):</strong> (8 \times \text{Dia.}, 10 \times \text{Dia.}, 12 \times \text{Dia.}, )</td>
</tr>
<tr>
<td>Chattering</td>
<td>Boring Bar not rigid for the cutting pressure</td>
<td>- Use a larger Bar Diameter</td>
</tr>
<tr>
<td></td>
<td>Insert angle geometry too large</td>
<td>- Reduce the Insert Angle Geometry:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(80^\circ) Geometry for roughing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(60^\circ) Geometry for general application</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(55^\circ) Geometry for finishing application</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(35^\circ) Geometry for profiling application</td>
</tr>
<tr>
<td></td>
<td>Insert Cutting Radius too large</td>
<td>Change the insert with a small cutting radius and or increase cutting feed</td>
</tr>
<tr>
<td></td>
<td>Insert Cutting Rake angle too small</td>
<td>Change the insert with a larger cutting rake angle</td>
</tr>
<tr>
<td></td>
<td>Insert relief angle to small</td>
<td>Change the insert with a larger relief angle and or place the insert cutting edge above the center line</td>
</tr>
<tr>
<td>Poor Surface Finish</td>
<td>Revolution RPM too low: At a low RPM, the cutting edge of the insert moves very slow over the cutting surface, no friction, no heat and little cutting force is developed resulting a poor and dull surface finish.</td>
<td>Increase the RPM.</td>
</tr>
<tr>
<td></td>
<td>Revolution RPM too high: At a high RPM, the cutting edge of the insert moves very fast over the cutting surface generating friction, head and premature wear of the insert cutting edge, resulting a shine and uneven surface finish.</td>
<td>Decrease the RPM.</td>
</tr>
<tr>
<td>Not holding dimensions &amp; tolerances</td>
<td>Boring bar deflection: Under the cutting force, the boring bar will deflect radially and axially, dimensions and tolerances are difficult to be held.</td>
<td>Use a larger diameter boring bar to the maximum rigidity and minimize deflection Check the deflection of the Boring Bar to calculate the finish size.</td>
</tr>
<tr>
<td></td>
<td>Too large depth of cut: With a large depth of cut, lot of cutting force is placed over the boring bar deflecting radially and axially, and the dimensions and tolerances are difficult to be held.</td>
<td>1) Reduce the depth of cut to control and maintain dimensions and tolerances.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) For roughing operation, by trial and error calculate the bar deflection to establish the relation of the finish dimension, boring bar deflection and the depth of cut.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) For finishing operation, reduce the depth of cut, use an insert with a small angle geometry, and or a small cutting radius and sharp cutting edge.</td>
</tr>
<tr>
<td></td>
<td>Insert wear: if the insert cutting edge is wearing prematurely, dimensions and tolerances are lost, the RPM is too high and or the insert grade is soft.</td>
<td>Increase the depth of cut, minimum depth of cut, should be not less than 1/2 the size of the insert radius, i.e., (0.16) ((4.4 \text{mm})) depth of cut, (0.008) ((0.2 mm)).</td>
</tr>
<tr>
<td>Whistling Cutting Sound</td>
<td>Insert cutting edge dull: The insert is not cutting, is rubbing and creating friction.</td>
<td>Increase the depth of cut, and or change to a small insert cutting radius.</td>
</tr>
<tr>
<td></td>
<td>Insert Cutting Radius Too Large: Too much contact of cutting edge and work piece.</td>
<td>Replace the insert with a smaller cutting radius.</td>
</tr>
<tr>
<td></td>
<td>Too Small depth of Cut: Insert cutting edge not engaged to the work piece.</td>
<td>Increase the depth of cut.</td>
</tr>
<tr>
<td></td>
<td>Too High RPM: Too much RPM, creates friction and noises.</td>
<td>Change to low RPM</td>
</tr>
<tr>
<td>Insert Breaks</td>
<td>RPM too low: Insert under pressure not cutting.</td>
<td>Increase RPM.</td>
</tr>
<tr>
<td></td>
<td>Feed Rate too fast: Insert under pressure not cutting.</td>
<td>Slow feed rate.</td>
</tr>
<tr>
<td></td>
<td>Depth of Cut too large: Too much pressure to the insert.</td>
<td>Change to a small depth of cut.</td>
</tr>
<tr>
<td></td>
<td>Insert too hard: Hard inserts are very brittle, will break easily.</td>
<td>Change to a tougher and impact resistant insert.</td>
</tr>
<tr>
<td>Chattering</td>
<td>Wrong Insert: Not all the inserts will perform with the Solution Tool(^\text{TM})</td>
<td>The smallest insert angle geometry, high positive with a small cutting radius.</td>
</tr>
<tr>
<td></td>
<td>Wrong Boring Bar: Boring bar size must be selected for the boring application.</td>
<td>The largest boring bar possible with shorts overhang.</td>
</tr>
<tr>
<td></td>
<td>Wrong Cutting Parameter: Wrong cutting parameter will develop chattering.</td>
<td>The optimum cutting parameter for the specific insert and operation.</td>
</tr>
</tbody>
</table>

**How to Remove Chattering**

Slow the RPM, increase \(f_r\), and use a high positive rake insert to cut under the chartered surface until the chatter is totally removed, then resume in normal cutting condition.
Material 414026/32HRC
Cutting Speed: SFM 450/700
\( V_c: \) 136/231 m/min

### Integral Carbide Boring Bar Parameter.

<table>
<thead>
<tr>
<th>Solution Tool Boring Bar</th>
<th>Roughing Operation</th>
<th>Medium Operation</th>
<th>Finishing Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carbide Bar 5.00(^\circ)&quot;</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59400 59401 59034 59035 59036 59037 59038 59039</td>
<td>DV10X-06(_______)CB 500&quot;</td>
<td>4.000&quot;</td>
<td>0.040 0.006 CCGT-060204-UXML-DPC1525UT 0.030 0.004 CCGT-060204-UUE-DUP15VT 0.005 0.003 CCGT-060202-NFU-DNX10UT</td>
</tr>
<tr>
<td>59414 59415 59076 59077 59078 59079 59080 59081</td>
<td>DV12X-08(_______)CB 12mm</td>
<td>0.500&quot;</td>
<td>1.02 0.15 CCGT-060204-UXML-DPC2525UT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Carbide Bar 12mm</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>59404 59405 59046 59047 59048 59049 59050 59051</td>
<td>DV110X-06(_______)CB 625&quot;</td>
<td>5.00&quot;</td>
<td>0.050 0.006 CCGT-060204-UXML-DPC1525UT 0.040 0.004 CCGT-060204-UUE-DUP15VT 0.005 0.003 CCGT-060202-NFU-DNX10UT</td>
</tr>
<tr>
<td>59418 59419 59088 59089 59090 59091 59092 59093</td>
<td>DV16X-08(_______)CB 16mm</td>
<td>128mm</td>
<td>1.27 0.15 CCGT-060204-UXML-DPC2525UT 1.02 0.10 CCGT-060204-UUE-DUP15VT 0.13 0.08 CCGT-060202-NFU-DNX10UT</td>
</tr>
</tbody>
</table>

Note: Cutting parameter of the chart has been tested in Dorian Tool facilities and using Dorian Tool inserts grades. The actual parameter will change with the insert used according to the geometry and grade.

For Technical Support contact Dorian Tool:
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