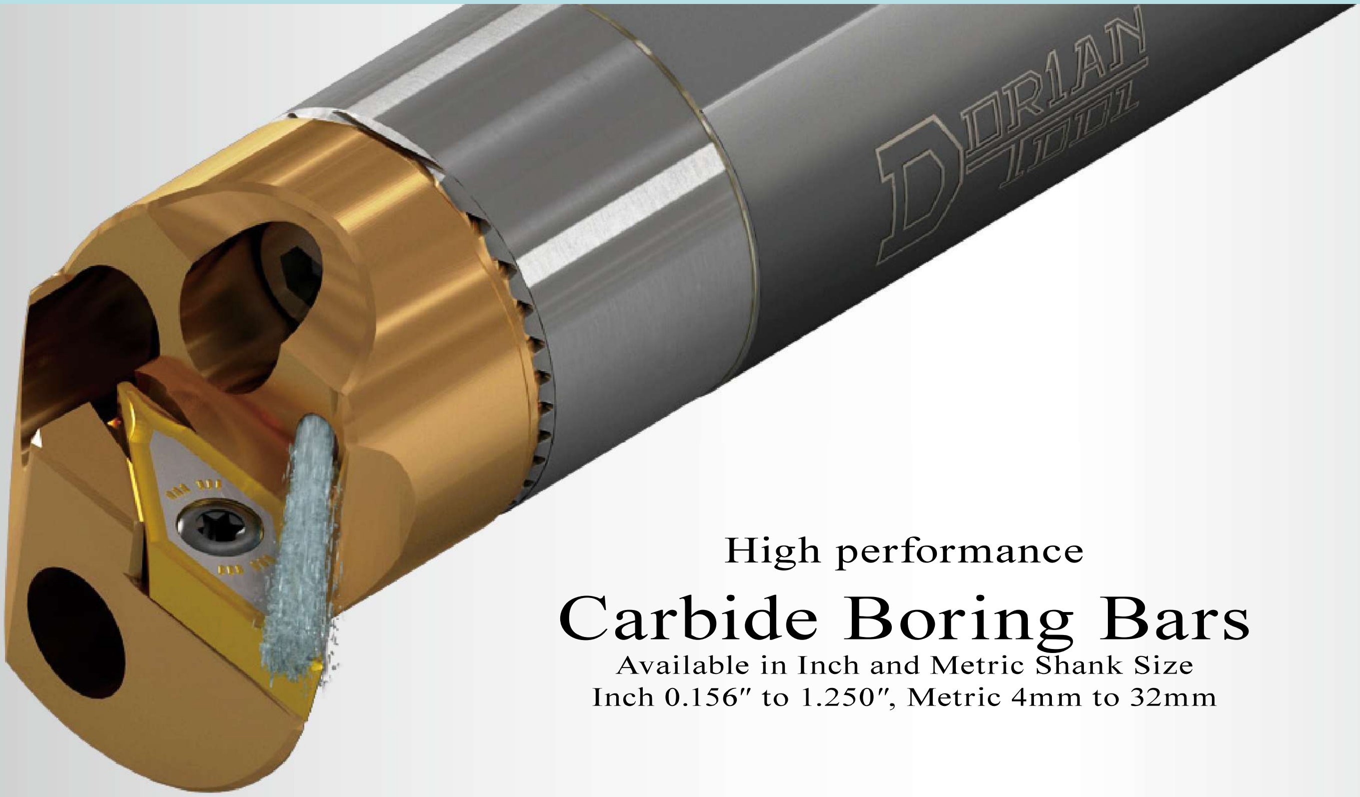
DORIAN INTERNATIONAL TOOL

The First Choice TECHNOLOGY

Solution Tool! ™

歡迎來電/來信索取型錄及諮詢相關業務。

Please feel free to contact us for product details.



High performance

Carbide Boring Bars

Available in Inch and Metric Shank Size
Inch 0.156″ to 1.250″, Metric 4mm to 32mm

Thru Coolant Integral Carbide Boring System
Shank Size 0.156″ to 1.250″ & (4mm to 32mm)

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Thru Coolant Integral Jet-Stream™ Carbide Boring System
Shank Size 1.000″ to 1.250″ & (25mm to 32mm)

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Quick Change Modular Carbide Boring System
Shank Size 0.750″ to 1.250″ & (20mm to 32mm)

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Thru Coolant Integral Carbide Threading System
Shank Size 0.218 to 0.750″ & (6mm to 20mm)

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Thru Coolant Integral Jet-Stream™ Carbide Threading System
Shank Size 0.750″ to 1.250″ & (20mm to 32mm)

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Quick Change Modular Carbide Threading System
Shank Size 0.750″ to 1.250″ & (20mm to 32mm)

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Solution Tool!™

The NO! Vibration Tunable Boring Bars

Available in Inch and Metric Shank Size
Inch 0.25" to 4.00″, Metric 6mm to 100mm

Solution Tool!™ Integral
The NO! Vibration Tunable Boring System
Shank Size 0.25 to 0.625″
& (6mm to 16mm)

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Solution Tool!™ Quick Change Modular
The NO! Vibration Tunable Boring System
Shank Size 0.750″ to 1.250″
& (20mm to 32mm)

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Solution Tool!™ Modular Jet-Stream™
The NO! Vibration Tunable Boring System
Shank Size 1.500″ to 4.00″
& (40mm to 100mm)

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Solution Tool!™ Quick Change Modular
The NO! Vibration Tunable Threading System
Shank Size 0.750″ to 1.250″
& (20mm to 32mm)

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Solution Tool!™ Modular Jet-Stream™
The NO! Vibration Tunable Threading System
Shank Size 1.500″ to 4.00″
& (32mm to 100mm)

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Solution Tool!™ The NO! Vibration Tunable Bars & High Performance Carbide Bars

For Multi Boring & Threading Operations

Technical Support

Carbide Boring & Threading Bar Technology

Solution Tool!™ The NO! Vibration Tunable Boring & Threading Bars

High Pressure Coolant System Spare Parts

Deep Hole Boring Application Form for Carbide & Solution Tool! ™ Boring Bars

When selecting a cutting tool & insert you must check the appropriate boxes below and fax to 979-282-2951 or e-mail: sales@doriantool.com

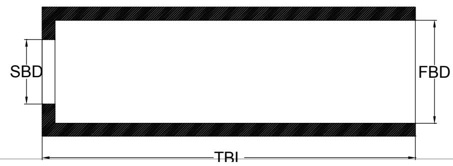
Select Your Deep Hole Boring Operation:					
1. Boring			4. Back Face		
2. Under-Cut			5. Grooving		
3. Profiling			6. Threading		

Select Your Material:		
P	Carbon & Alloy Steel	
M	Stainless Steel	
K	Cast Iron	
N	Al. and non Ferrous Materials	
S	High Temp Super Alloy	
H	Hardened Material	

Company Name:	**Contact Name:**
Phone No: ( )	**E-mail:**

1. Straight

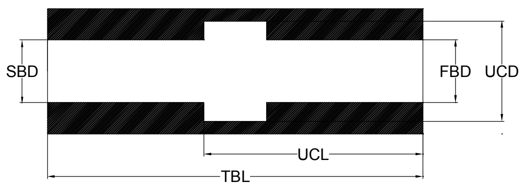
Boring Specification



	Boring Description	Inch	Metric
SBD	Starting Bore Diameter		
FBD	Finished Bore Diameter		
TBL	Total Bore Length		
Recommended Boring Bars and Tools		**Description**	**UPC 733101-**
	Boring Bar		
	Boring Bar Head		
	Insert		

2. Under-Cut

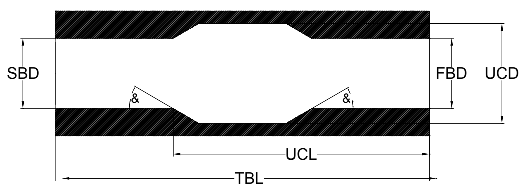
Boring Specification



	Boring Description	Inch	Metric
SBD	Starting Bore Diameter		
FBD	Finished Bore Diameter		
TBL	Total Bore Length		
UCD	Under-Cut Diameter		
UCL	Under-Cut Distance		
Recommended Boring Bars and Tools		**Description**	**UPC 733101-**
	Boring Bar		
	Boring Bar Head		
	Insert		

3. Profiling

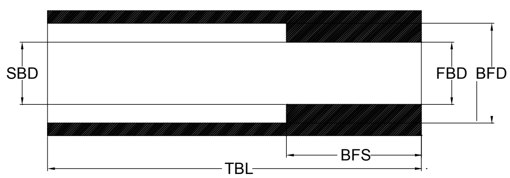
Boring Specification



	Boring Description	Inch	Metric
SBD	Starting Bore Diameter		
FBD	Finished Bore Diameter		
TBL	Total Bore Length		
UCD	Under-Cut Diameter		
UCL	Under-Cut Distance		
&°	Angle Profile		
Recommended Boring Bars and Tools		**Description**	**UPC 733101-**
	Boring Bar		
	Boring Bar Head		
	Insert		

4. Back Face

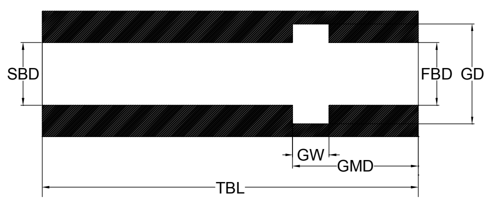
Boring Specification



	Boring Description	Inch	Metric
SBD	Starting Bore Diameter		
FBD	Finished Bore Diameter		
TBL	Total Bore Length		
BFD	Back Face Diameter		
BFS	Back Face Shoulder		
Recommended Boring Bars and Tools		**Description**	**UPC 733101-**
	Boring Bar		
	Boring Bar Head		
	Insert		

5. Grooving

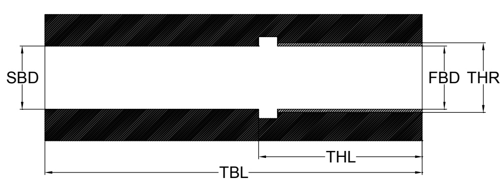
Boring Specification



	Boring Description	Inch	Metric
SBD	Starting Bore Diameter		
FBD	Finished Bore Diameter		
TBL	Total Bore Length		
GD	Groove Diameter		
GW	Groove Width		
GMD	Groove Max. distance		
Recommended Boring Bars and Tools		**Description**	**UPC 733101-**
	Boring Bar		
	Boring Bar Head		
	Insert		

6. Threading

Boring Specification



	Boring Description	Inch	Metric
SBD	Starting Bore Diameter		
FBD	Finished Bore Diameter		
TBL	Total Bore Length		
THR	Thread Dimension		
THL	Thread Length		
Recommended Boring Bars and Tools		**Description**	**UPC 733101-**
	Boring Bar		
	Boring Bar Head		
	Insert		

Deep Hole Boring Operation

1. Workholding

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

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 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.

4. Boring Bar Holding

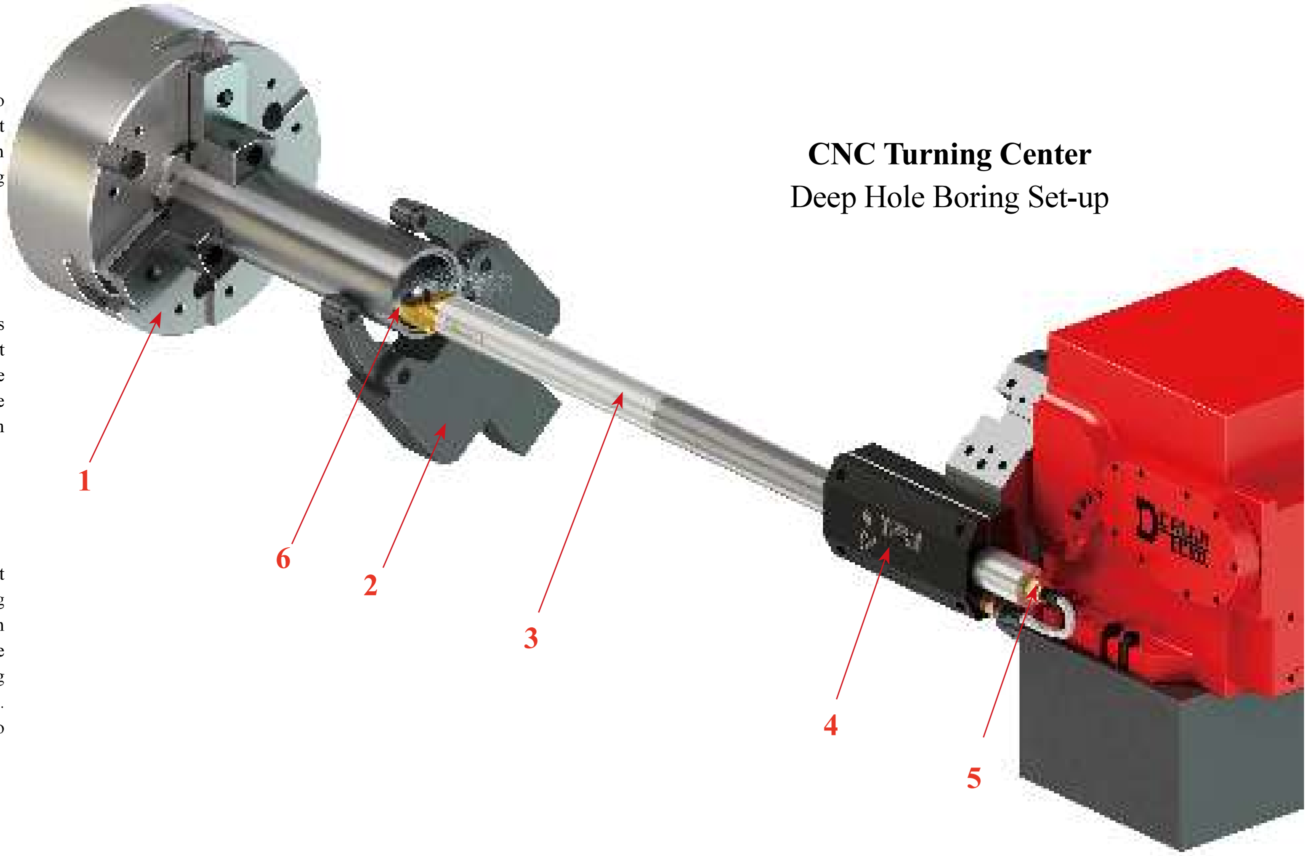
For best results, hold the bar 4 x Dia. & choose a split collar boring bar holder. The 360° locking system offers the largest surface contact between the boring bar and the holder, maximizing bar rigidity and minimizing vibration.

5. Coolant System

It is very important that the bore is kept clean and free of chips while cutting to avoid surface damage and insert to breakage. Use high pressure coolant with the boring bar to flush the chips out while cutting.

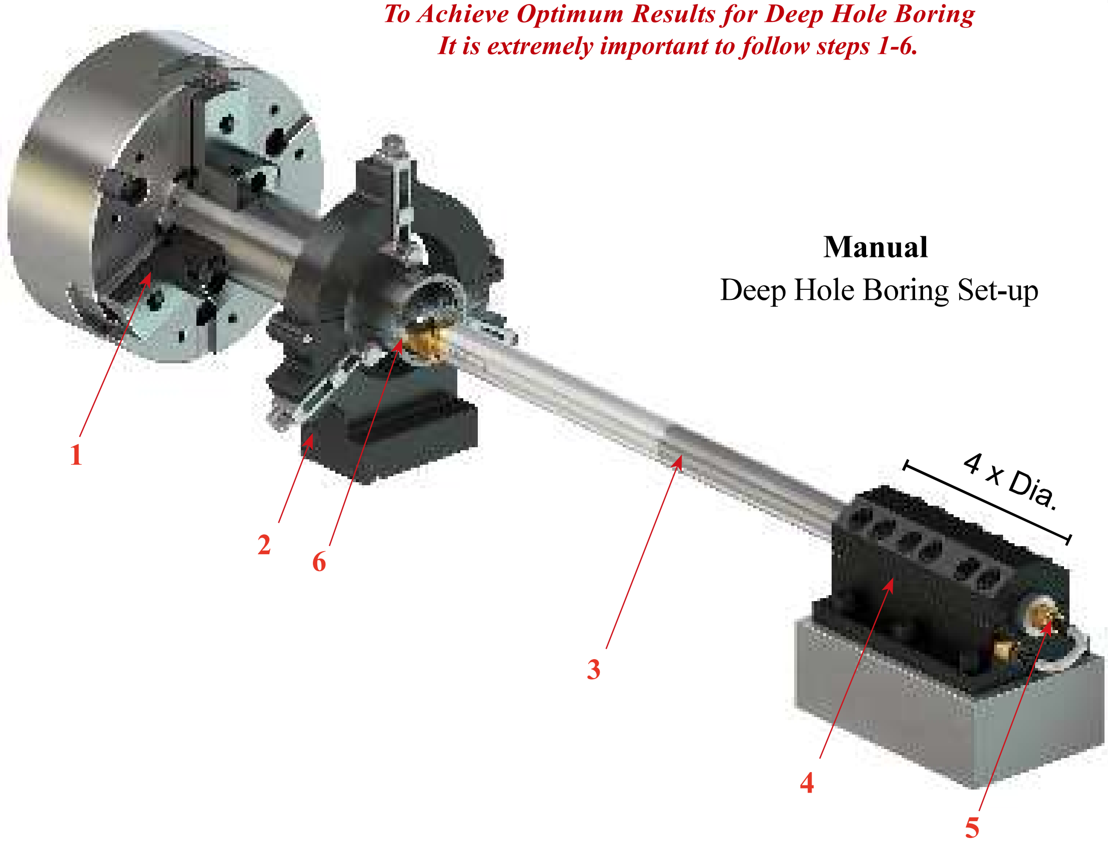
6. Insert

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.



CNC Turning Center
Deep Hole Boring Set-up

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



Manual
Deep Hole Boring Set-up

Deep Hole Boring Operation

IN A DEEP HOLE BORING OPERATION:

- 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 and the shortest overhang possible to maximize cutting stability and minimize vibration.
- 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 hole, while machined has to be kept clear from chips to avoid tool breakage, boring bar vibration and the walls of the work piece undamaged.

THE COMMON DEEP HOLE BORING OPERATION PROBLEMS:
Poor Surface Finish, Poor Machining Tolerance & Poor Insert Life

THE COMMON CAUSE:

1) Boring Bar Cutting Ratio:
If the incorrect boring bar cutting ratio is used, the boring bar will not perform.

2) Boring Bar Holding System:
When boring bar is not held properly and rigid on to the boring bar holder, vibration will develop when cutting.

3) Boring Bar Diameter:
To small boring bar diameter will deflect under pressure and vibrate, to large boring bar diameter, will obstruct the evacuation of the chips.

4) Boring Overhang:
The boring bar is over extended (Steel 4 x Dia., Carbide 6 x Dia.,Solution Tool!™ (The NO! Vibration Tunable Boring Bar) 8 x Dia., and over).

5) Incorrect Insert:
Incorrect insert grade geometry for the boring operation with incorrect nose radius, rake angle, chip break, and clearance angle.

6) Cutting Parameter:
Wrong cutting parameters are used for the specific work piece material to be cut, and for the operation to be executed.

7) Chip Clogging:
Chips are clogged in to the work piece bore jamming the insert, wrapping around the boring bar, and thrown against the wall.

Technical Support for Deep Hole Boring

1) Bar Cutting Ratio Deep Hole Boring Solution:

Problem

Boring Bar Cutting Ratio: If the incorrect boring bar cutting ratio is used, the boring bar will not perform.

Solution: Choose the correct boring bar cutting Ratio for optimum performance

Boring Depth: The depth of the machining bore determines on the style and the type material of the boring bar.
The general rule for boring bar depth is steel bar boring have a short depth, carbide bars have a medium depth, and anti vibration tunable boring bars have a long depth.

The Max. Boring Bar Overhangs: The maximum extended length of the boring bar before loss of rigidity and the start of vibration with poor cutting performance.

Boring Bar Overhangs: Is the distance measured from the face of the Boring Bar Holder to the Insert Cutting Edge,

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

Threading Bar Cutting Ratio: When threading the radial force is higher then boring, the threading Ratio is reduced considerably over boring.

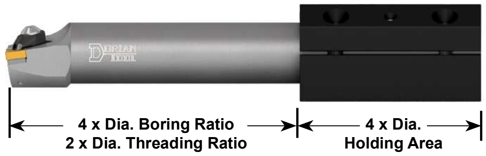
If the incorrect boring bar cutting ratio is used, the boring bar will not perform.

Maximum Boring & Threading Ratio According to Steel or Carbide Bar Material

Steel Bar

4 x Dia. Boring Ratio
2 x Dia. Threading Ratio

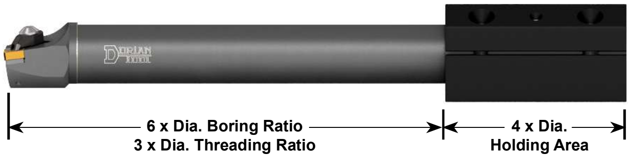
- General boring bar applications
- Roughing to finishing
- Stable for high material removal
- Poor for small bores



Carbide Bar

6 x Dia. Boring Ratio
3 x Dia. Threading Ratio

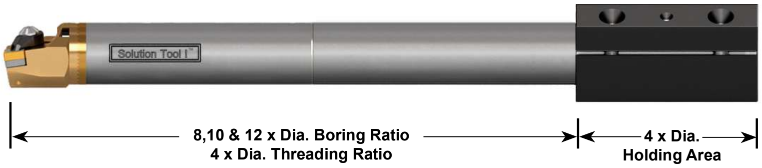
- Best for boring small holes
- Rigid for close tolerance and furnace finish
- Rigid for heavy material removal at high ap and fn



Steel Body (Solution Tool!™)

8 x Dia., 10 x Dia., 12 x Dia. Boring Ratio
4 x Dia. Threading Ratio

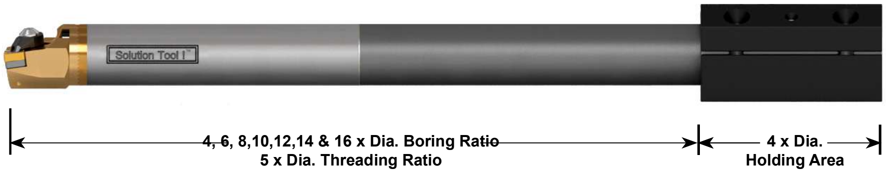
- For deep hole boring applications



Carbide Body (Solution Tool!™)

8 x Dia., 10 x Dia., 12 x Dia., 14 x Dia. Boring Ratio
5 x Dia. Threading Ratio

- For high performance deep hole boring applications



2) Bar Holding System Deep Hole Boring Solution:

Problem

Boring Bar Holding System: When boring bar is not held properly and rigid on to the boring bar holder, vibration will develop when cutting with poor surface finish, tolerance, and insert life.

Solution: When holding the boring bar, the boring bar holder must:

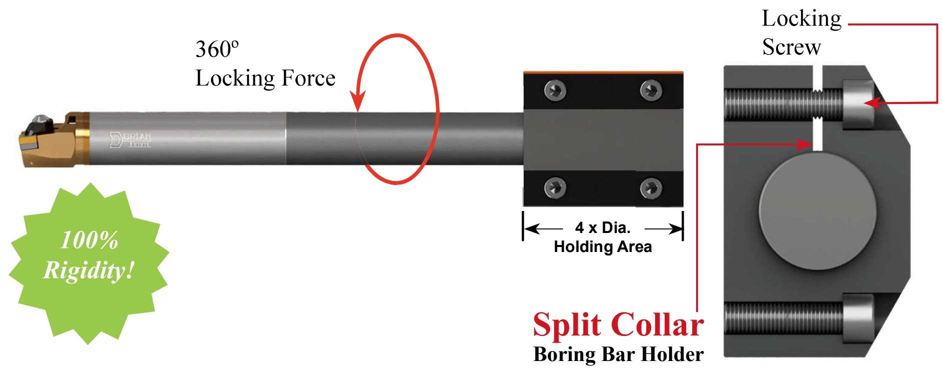
1. Have a Precise and smooth bore
2. Use the most rigid holding system of the boring bar
3. Have a holding length of the boring bar at 4 x boring bar diameter

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 scarring or damaging the bar surface.***

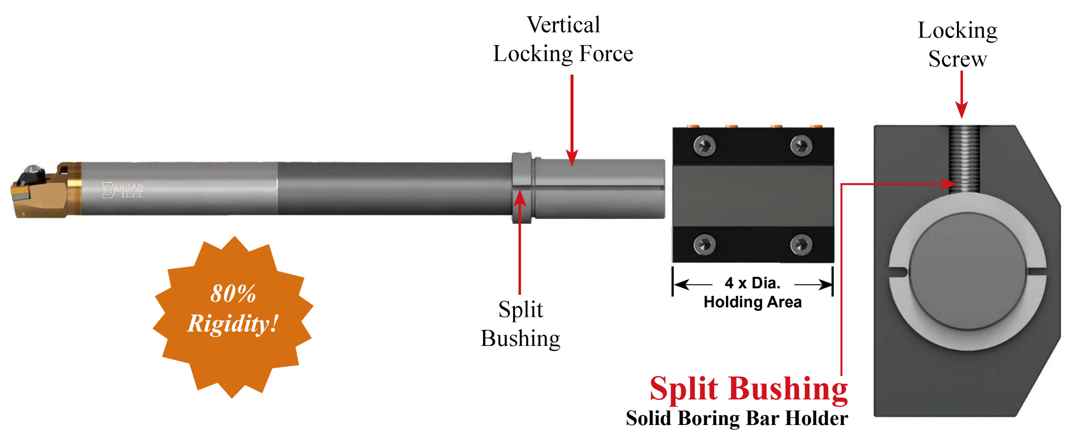


GOOD

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 scarring or damaging the bar surface with precise positioning.***



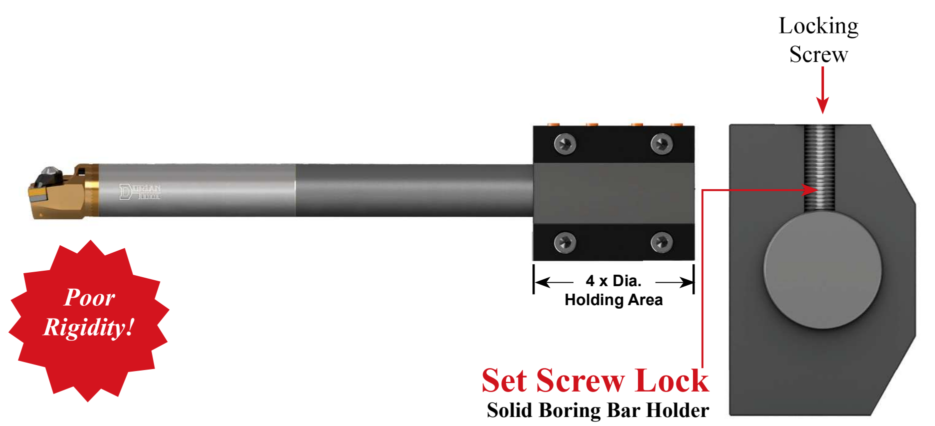
STOP Do Not Use It

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.***



3) Bar Diameter Deep Hole Boring Solution:

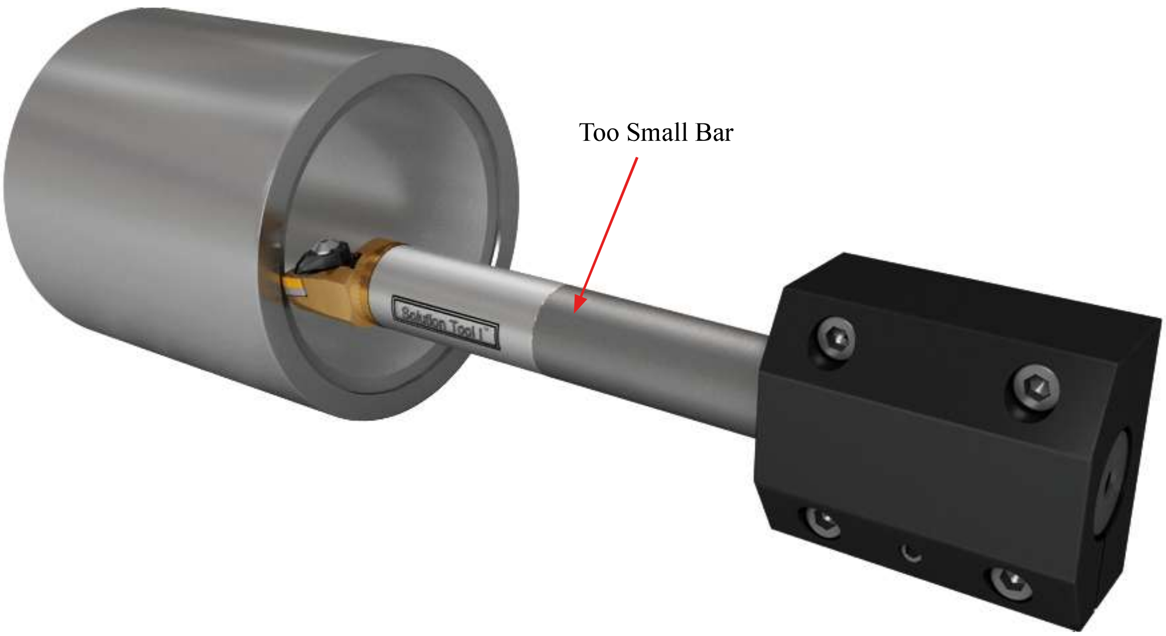
Problem

Boring Bar Diameter: To small boring bar diameter will deflect under pressure and vibrate, Too large boring bar diameter, will obstruct the evacuation of the chips

Solution: Use the largest boring bar for rigidity and performance, but small enough for the chips to evacuate

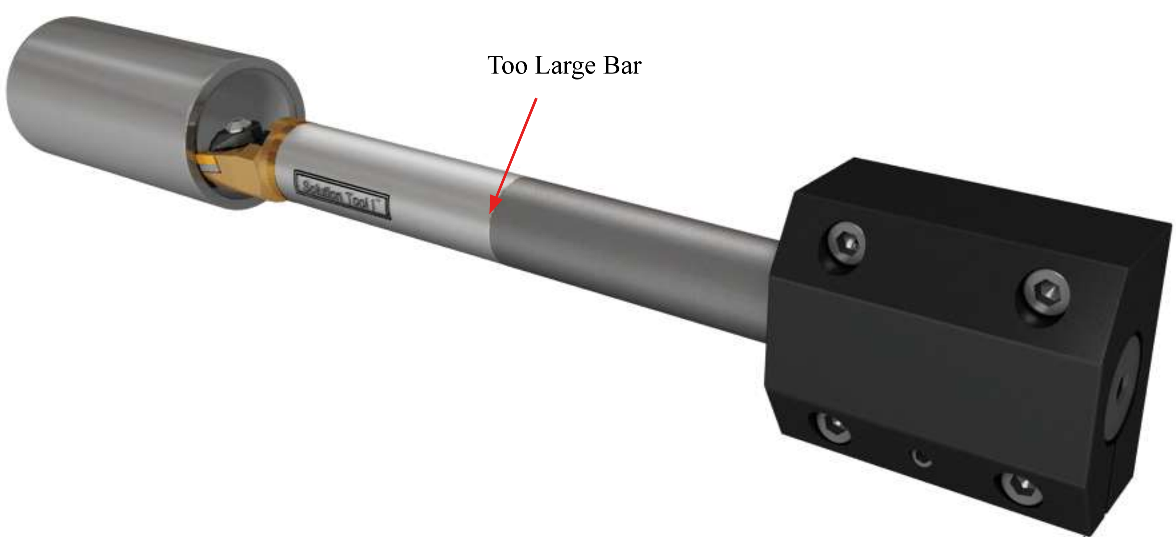
Small Boring Bar Diameter: If the diameter of the boring is to small, it has no rigidity to Withstand the tangential and radial forces that generate under the cutting pressure. The bar will be easily pushed down below the center line, and deflect away from the cutting wall. When this occurs, the boring bar is not any more in control of the boring operation to a point that the boring bar will vibrate with poor surface finish, poor machining tolerance, and short insert life.

Use the largest boring bar possible that clears the bore diameter and allows chips evacuation



Large Boring Bar Diameter: If the diameter of the boring is to large, there will be no clearance between the bore diameter and the boring bar body, making impossible for the chips to evacuate. The chips will be jammed against the wall of the hole and the boring bar, damaging the work piece wall destroying the insert.

Use a smaller boring bar Without losing rigidity and to allow the chips to evacuate.



4) Bar Overhang and Deflection Deep Hole Boring Solution:

Problem

Boring Overhang: The boring bar is over extended, exceeding the overhang limit built for.

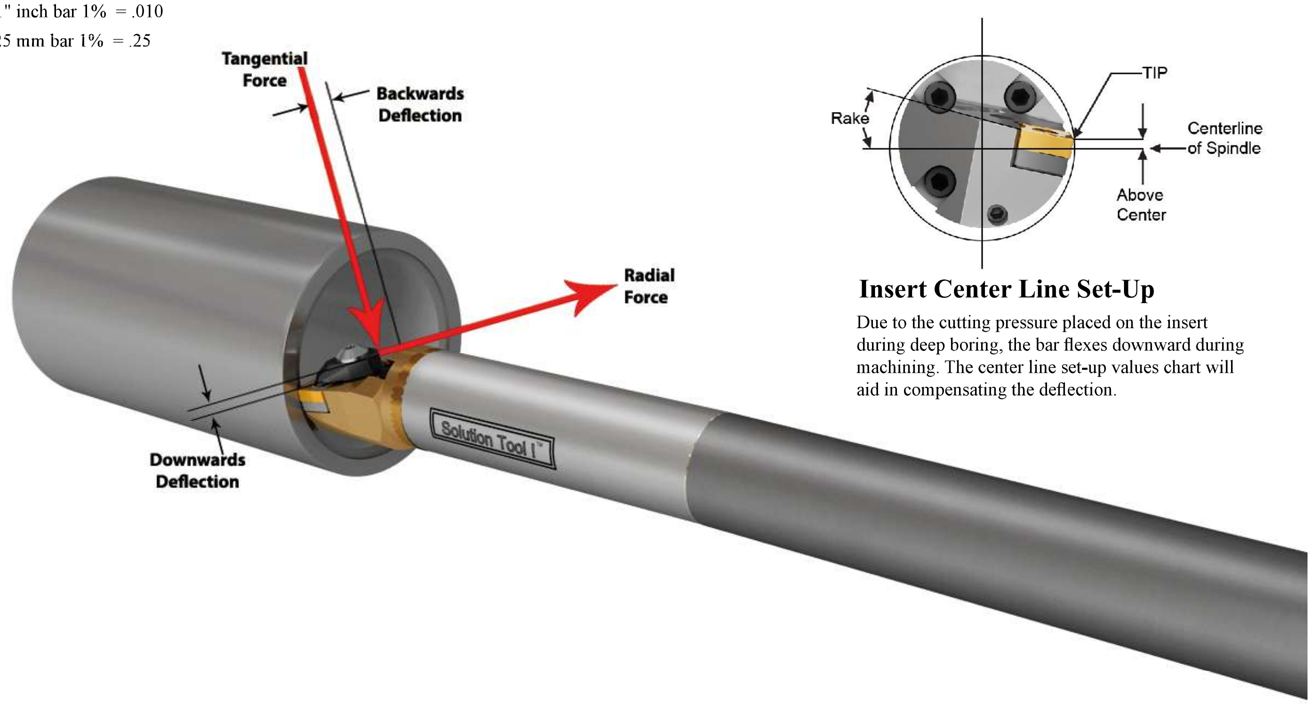
Boring Bar Deflection: The bar under the Cutting Pressure will deflect.

Overhang Solution: Use and set the boring bar to the correct overhang that is built for; Steel Boring bar 4 x Dia., Carbide 6 x Dia., Solution Tool!™ NO! Vibration Tunable Boring Bar Steel Body 8 x Dia.,10 x Dia., Carbide 12 x Dia., and 14 x Dia..

Deflection Solution: Place the insert cutting edge above the center line. 10% diameter of bar.

Example: 1" inch bar 1% = .010

25 mm bar 1% = .25



Insert Center Line Set-Up

Due to the cutting pressure placed on the insert during deep boring, the bar flexes downward during machining. The center line set-up values chart will aid in compensating the deflection.

In the Boring Operation, the Boring Bar is to Withstand all the stress derived from the cutting force. In a long depth of cut, the stress is multiplied with a long overhang of the boring bar.
The boring bar becomes unstable and very flexible under the cutting force.

When the Boring Bar is cutting, the Tangential and the Radial cutting force applied over the cutting edge of the insert will push the Boring Bar below the center line and away from the cutting wall. The Tangential Force generate under the cutting operation will increase with the depth of cut and feed rate in pushing the insert below the center line.

The insert clearance angle will be reduce, and the body of the insert will make contact with the cutting wall creating interference and friction with poor cutting results.
The Radial Force will push the insert away from the cutting surface creating an harmonic or weaving reaction.
The insert cutting edge, will be moving in and out from the cutting wall surface. The deflection of the boring bar is direct related to the overhang of the boring bar and the depth of cut and feed rate.
Use the shortest overhang boring bar possible to minimize deflection and maximize cutting performance.

Solution Tool! ™ Center line Set-up Values Chart (Inch)

Bar Size	Nominal	Insert Set-Up Above Center Line*			Depth of Cut	
Dia. (in.)	Center (in.)	Finish	Rough	Rough/Finish	Finishing	Roughing
0.500	0.250	.005	.010	.0075	.001"	.020"
0.625	0.3125	.006	.012	.009	.001"	.030"
0.750	0.3750	.007	.014	.021	.001"	.050"
1.000	0.500	.010	.020	.015	.001"	.070"
1.250	0.625	.012	.024	.018	.001"	.075"
1.500	0.750	.015	.030	.0225	.002"	.080"
1.750	0.8750	.0175	.035	.026	.002"	.085"
2.000	1.000	.020	.040	.030	.002"	.090"
2.500	1.250	.025	.050	.0375	.002"	.095"
3.000	1.500	.030	.060	.045	.003"	.100"
4.000	2.000	.040	.080	.060	.003"	.120"

Solution Tool! ™ Center line Set-up Values Chart (Metric)

Bar Size	Nominal	Insert Set-Up Above Center Line*			Depth of Cut	
Dia. (mm)	Center (mm)	Finish	Rough	Rough/Finish	Finishing	Roughing
12	6	.2	.4	.3	.025	.50
16	8	.25	.5	.375	.025	.75
20	10	.3	.6	.45	.025	1.2
25	12.5	.35	.7	.5	.025	1.7
32	16	.4	.8	.6	.025	1.8
40	20	.45	.9	.7	.050	2.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A
50	25	.5	.10	.75	.050	2.1
60	30	.6	.12	.9	.050	2.3
80	40	.8	.16	.12	.075	2.5
100	50	1.0	2.0	1.5	.075	3.0

The above values can change depending on different aspects of machining.
For example a sharper insert will deflect less. Use table as reference only, as actual values may need to be adjusted as necessary.

5) Incorrect Insert Deep Hole Boring Solution:

Problem

Use of Incorrect Insert: Incorrect insert grade and geometry for material or operation excited and/or any other insert characteristics of the insert, such as nose radius, rake angle, chip break clearance angle, and cutting leading angle, can contribute to the cutting problems.

Solution: 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 to 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 to soft it will wear prematurely, and friction will develop loosing 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.

For a **Deep Boring** operation, always use a Solution Tool!™ boring bar with a high positive and sharp cutting edge insert.

Use the smallest insert angle geometry for the operation, like;
"V" for profiling and finishing
"D" for general application
"T" For light roughing and finishing
"C" For heavy roughing

Use the correct insert grade for the material and operation. Use a small angle geometry, **like the "V","D" and "T" style** insert, small nose radius, sharp cutting edge, high positive rake angle, large chip breaker and high clearance angle.

INSERT VIBRATION

INSERT GEOMETRY

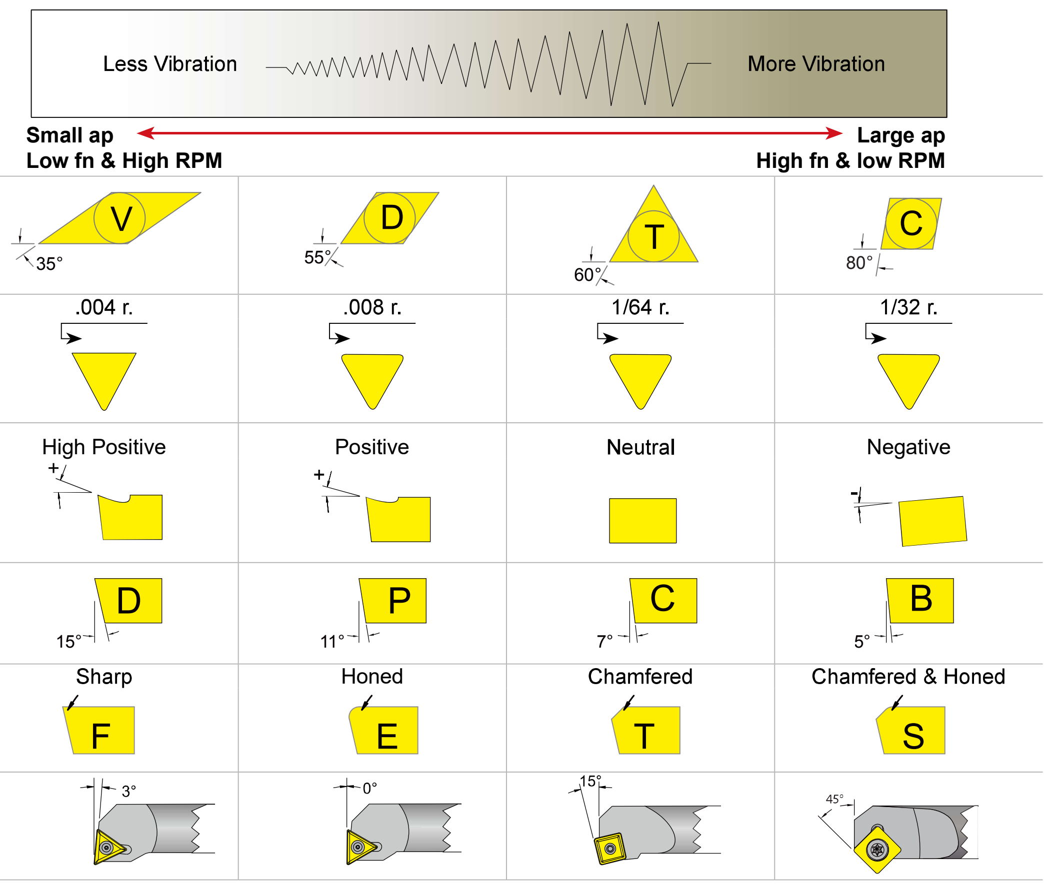
INSERT RADIUS
Use a smaller radius to limit vibration

INSERT CUTTING RAKE
Use a positive cutting rake to limit vibration.

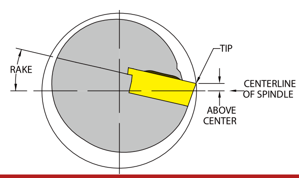
INSERT RELIEF ANGLE

INSERT EDGE PREP

INSERT CUTTING EDGE ANGLE
Use a cutting edge angle as close to 90º as possible.



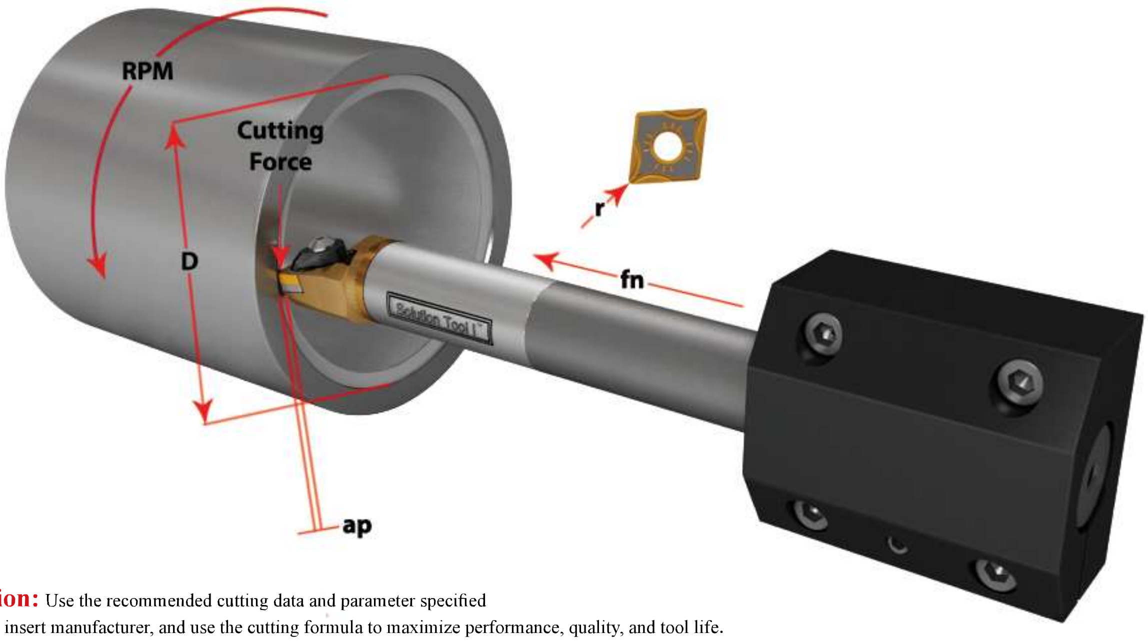
INSERT CENTER LINE
Insert Center Line, .002 to .025" [.050 to .635mm] above center line, to compensate for bar deflection and reduce vibration.



6) Cutting Parameter Deep Hole Boring Solution:

Problem

Cutting Parameter: If the cutting parameters are not correct for the specific material chattering and insert breakage will occur.



Solution: 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.

Inch Formulas for Turning and Boring

a_p= Depth of cut (DOC)	Inch	k_c= Specific cutting force	Lb/Inch^2
D_m= Diameter of part (DIA)	Inch	n= Spindle speed (RPM)	Rev/Min
f_n= Feed per revolution (FEED)	Inch/Rev	v_c= Cutting speed (SFM)	Feet/Min
l_m= Machined length (LEN)	Inch	T_c= Cutting time (TIM)	Min
Q= Metal removal rate (MMR)	Inch^3/ Min	R_{max}= Profile depth	µInch
P_c= Power requirements (POW)	Hp	r_ε= Insert nose radius	Inch

Cutting Speed Surface Feet Per Minute: $vc = \frac{\pi \times Dm \times n}{12}$	EX: Determine the cutting speed (v_c) required for turning a 2-1/2" diameter part with a spindle speed of 600 RPM. $v_c = \frac{\pi \times 2.5 \times 600}{12}$ = 392.70 Feet/Min
Spindle Speed Revolution Per Minute: $n = \frac{Vc \times 12}{\pi \times Dm}$	EX: Determine the spindle speed (n) required for turning a 2-1/2" diameter part with a cutting speed of 400 SFM. $n = \frac{400 \times 12}{\pi \times 2.5}$ = 611.15 Rev/Min
Metal Removal Rate Inch^3/Min: $Q = v_c \times a_p \times f_n \times 12$	EX: Determine the metal removal rate (Q) required for cutting with a depth of .062 with a cutting speed of 400 SFM and feed rate of .015 IPR. Q = 400 x .062 x .015 x 12 = 4.464 inch³/min
Power Requirement Horsepower: $P_c = \frac{v_c \times a_p \times f_n \times k_c}{33,000}$	EX: Determine the power requirement (P_c) for turning a material with a cutting force of 181,750, a depth of .062, a cutting speed of 400 SFM, and feed rate of .015 IPR. $P_c = \frac{400 \times .062 \times .015 \times 181,750}{33,000}$ = 2.05 HP
Cutting Time Minute: $T_c = \frac{l_m}{f_n \times n}$	EX: Determine the amount of time required to machine a 6" long part with a spindle speed of 600 RPM and feed rate of .015 IPR. $T_c = \frac{6}{.015 \times 600}$ = .67 Min (40 Sec)
Profile Depth (µInch) $R_{max} = \frac{f_n^2 \times 10^6}{8r_\varepsilon}$	EX: Determine the profile depth (R_{max}) of a surface machined using an insert with a nose radius of .032 and a feed rate of .015 IPR. $R_{max} = \frac{.015^2 \times 10^6}{8 \times .032}$ = 879 µinch

Metric Formulas for Turning and Boring

a_p= Depth of cut (DOC)	mm	k_c= Specific cutting force	Nm
D_m= Diameter of part (DIA)	mm	n= Spindle speed (RPM)	Rev/Min
f_n= Feed per revolution (FEED)	mm/Rev	v_c= Cutting speed (SFM)	m/Min
l_m= Machined length (LEN)	mm	T_c= Cutting time (TIM)	Min
Q= Metal removal rate (MMR)	mm^3/ Min	R_{max}= Profile depth	µm
P_c= Power requirements (POW)	kW	r_ε= Insert nose radius	mm

Cutting Speed Surface Meters Per Minute $vc = \frac{\pi \times Dm \times n}{1000}$	EX: Determine the cutting speed (v_c) required for turning a 50mm diameter part with a spindle speed of 600 RPM. $v_c = \frac{\pi \times 50 \times 600}{1000}$ = 94,25 m/Min
Spindle Speed Revolution Per Minute $n = \frac{Vc \times 1000}{\pi \times Dm}$	EX: Determine the spindle speed (n) required for turning a 32mm diameter part with a cutting speed of 100 m/Min. $n = \frac{100 \times 1000}{\pi \times 32}$ = 994,72 Rev/Min
Metal Removal Rate mm^3/Min $Q = v_c \times a_p \times f_n \times 1000$	EX: Determine the metal removal rate (Q) required for cutting with a depth of 1,5 with a cutting speed of 200 m/Min and feed rate of 0,4 mmPR. Q = 200 x 1,5 x 0,4 x 1000 = 120.000 mm³/min
Power Requirement Kilowatts $P_c = \frac{v_c \times a_p \times f_n \times k_c}{1.460.000}$	EX: Determine the power requirement (P_c) for turning a material with a specific cutting force of 20.500, a depth of 1,5, a cutting speed of 200 m/Min, and feed rate of 0,4 mmPR. $P_c = \frac{200 \times 1,5 \times 0,4 \times 20.500}{1.460.000}$ = 1,68 kW
Cutting Time Minute $T_c = \frac{l_m}{f_n \times n}$	EX: Determine the amount of time required to machine a 200mm long part with a spindle speed of 600 RPM and feed rate of 0,4 mmPR. $T_c = \frac{200}{0,4 \times 600}$ = ,83 Min (50 Sec)
Profile Depth (µm) $R_{max} = \frac{f_n^2 \times 10^6}{8r_\varepsilon}$	EX: Determine the profile depth (R_{max}) of a surface machined using an insert with a nose radius of 0,8 and a feed rate of 0,4 mmPR. $R_{max} = \frac{0,4^2 \times 10^6}{8 \times 0,8}$ = 25 µm

7) Chip Clogging Deep Hole Boring Solution:

Problem

Chip Clogging: Chips are clogged into the work piece bore jamming the insert, wrapping around the boring bar, and thrown against the wall.

Solution: Change the cutting length of the chips and use high pressure coolant or air to flush the chips out the bore.

Chip evacuation

Chip clogging during the boring operation creates a major machining problem effecting quality, performance and tooling life. Chips are to be removed from the bore as quickly as they are made to avoid and minimize the tooling insert damage, and poor surface finish. Evacuating chips from a bore is not always easy, and is more difficult when machining small diameters and deep bores. If the chips are very short and thick, a lot pressure is placed over the insert cutting edge making the boring bar vibrate. More tangential force is developed, requiring more horsepower (Kilowatts) for the boring operation.

In high speed rotation, the centrifugal force will push the chips against the wall surface making it difficult to remove out from the bore. It is more difficult when boring a small, blind, and deep hole. The chips will pack on the end of the bore.

If chips are long and stringy they are easy to machine.

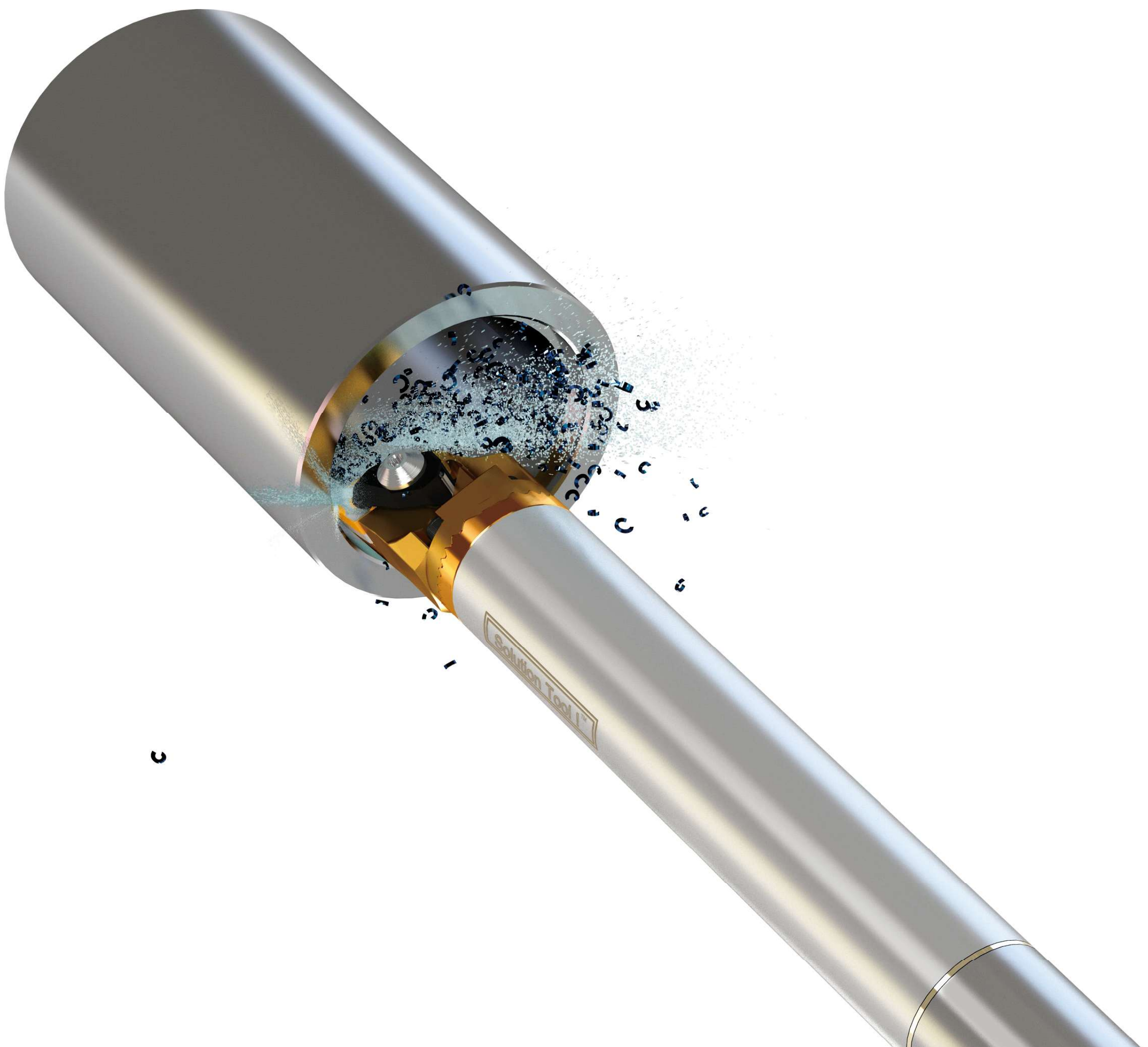
Little tangential force is developed requiring less horsepower (Kilowatts) for the boring operation, but the chips will wrap around the boring bar and jam the inside of bore, or to the end of the blind hole making it impossible to evacuate from the bore. When this occurs the operation must be stopped, and the chips have to be manually removed from the bore.

To control the chips from clogging and to evacuate them easily from the bore, the chips are to be cut the right length. Not too short to minimize insert damage and cutting force, not too long to prevent them from wrapping around the boring bar.

The insert rake angle and chip break, depth of cut, feed rate, and RPM will control the length of the chips.
High Pressure Coolant and or Air will remove chips from the bore.

Use a Thru Coolant Boring Bar.

It is best if a Dorian Jet Stream Thru Coolant Boring Bar combined with high pressure coolant system is used. The coolant is aimed directly over the cutting edge of the insert at a high velocity blowing the chips away from the insert and flushing them out the bore.



High Performance Carbide Bars

Thru Coolant Carbide Boring Bar

Best Application for:

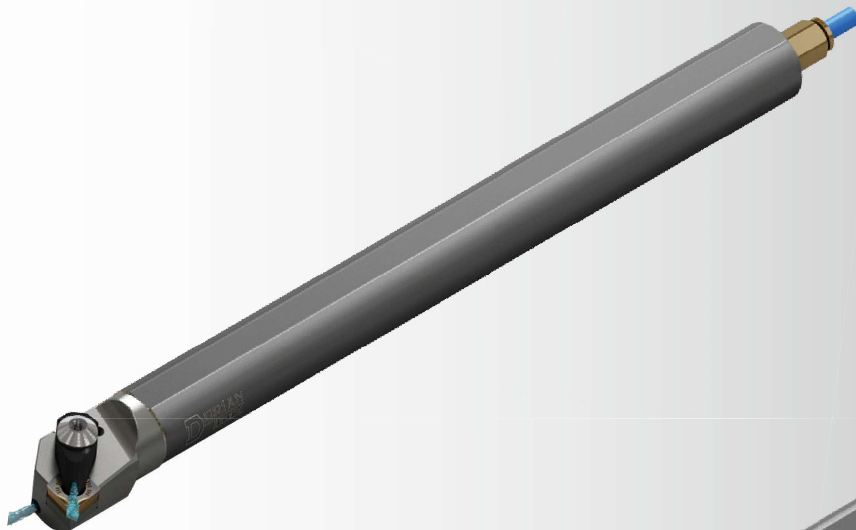
- Boring and Threading
- Heavy Roughing and Finishing Operation
- Close working tolerances
- Boring Ratio 6 x Bar Dia.
- Threading Ratio 3 x Bar Dia.

High Performance Carbide Integral Thru Coolant Bars

- For small bores
- Carbide Body
- Boring System Shank Size
  Inch 0.156″ to 1.250″
  Metric 4mm to 32mm
- Threading System Shank Size
  Inch 0.218" to 0.750″
  Metric 6mm to 20mm

High Performance Carbide Integral Jet-Stream™ Thru Coolant Bars

- For medium bores
- Carbide Body
- Boring System Shank Size
  Inch 1.000″ to 1.250″
  Metric 25mm to 32mm
- Threading System Shank Size
  Inch 0.750" to 1.250″
  Metric 20mm to 32mm



High Performance Carbide Quick Change Modular Thru Coolant Bars

- For large bores
- Carbide Body
- Boring System Shank Size
  Inch 0.750″ to 1.250″
  Metric 20mm to 32mm
- Threading System Shank Size
  Inch 0.750" to 1.250″
  Metric 20mm to 20mm

High Performance Carbide Integral Boring Bars

Thru Coolant Carbide Boring Bar System

Best Application for:

- **Boring and Threading small bore**
- **Roughing and Finishing Operation**
- **Close working tolerances**
- **Deep Boring 6 x Bar Dia.**

Better **Machining Performance**

Higher **Workmanship Quality**

Longer **Cutting Inserts Life**

The technology behind the "Carbide Boring Bar System"
The rigidity of the carbide boring bar, will make boring and threading simple and precise, from heavy roughing to precision finishing, with close tolerance and high surface finish.
- **Boring Ratio 6 x Bar Dia.**
- **Threading Ratio 3 x Bar Dia.**

Boring Bar Sizes

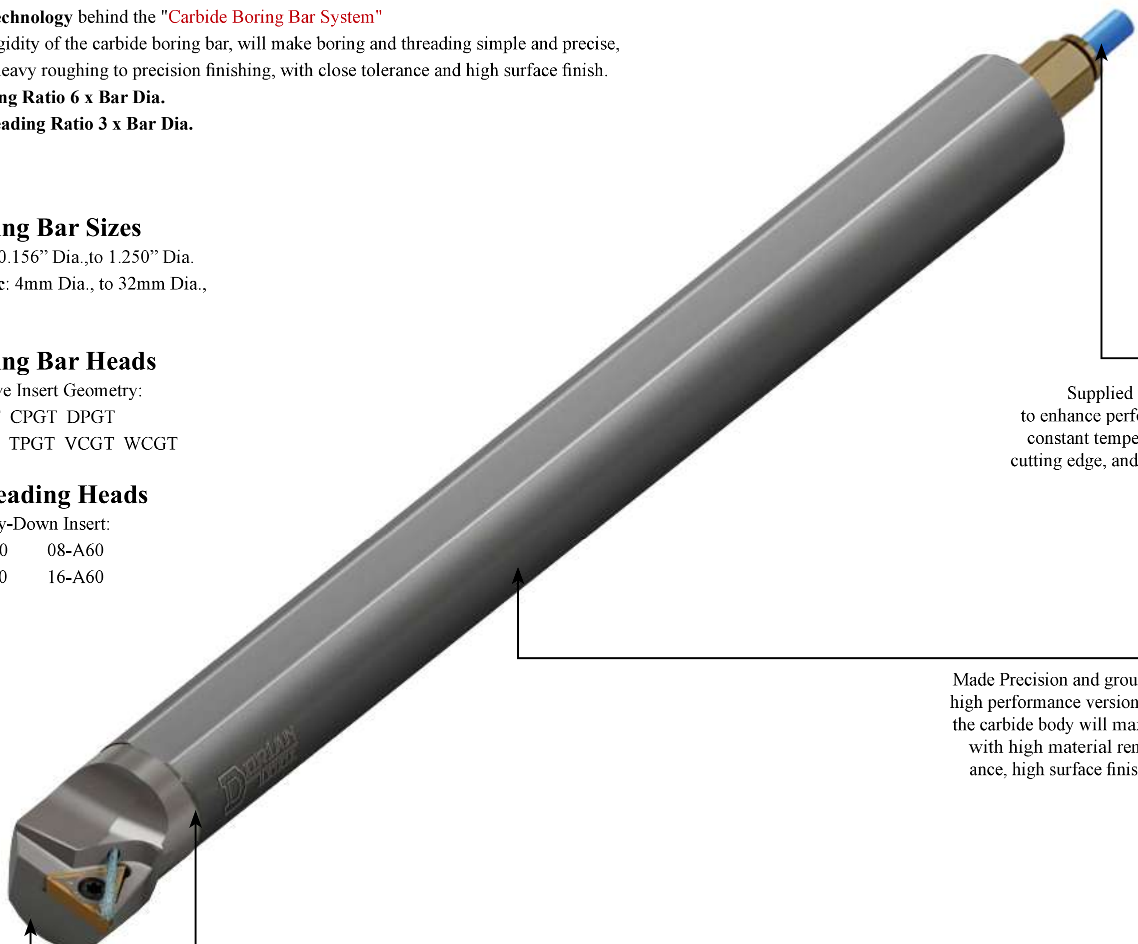
Inch: 0.156" Dia.,to 1.250" Dia.
Metric: 4mm Dia., to 32mm Dia.,

Boring Bar Heads

Positive Insert Geometry:
CCGT CPGT DPGT
TCGT TPGT VCGT WCGT

Threading Heads

for Lay-Down Insert:
06-A60 08-A60
11-A60 16-A60



Thru Coolant

Supplied with the thru coolant system to enhance performance, keep the insert at a constant temperature clean and undamaged cutting edge, and remove chips from the bore while machining.

Carbide Body

Made Precision and ground solid Alloyed Carbide for high performance version. The rigidity and stability of the carbide body will maximize boring performance with high material removal, close machining tolerance, high surface finish and deep boring (6 x Dia.)

The Insert Head Braze

Brazed on to the Carbide Bar with triple silver alloys. The combination of the correct alloy and the thickness of the braze makes brazing strong and unbreakable but flexible under cutting pressure and interrupt cuts.

The Insert Heads

Made of heat treated alloy steel, and precisely machined on the body after brazing. Thru Coolant System to improve performance, precision and insert life.