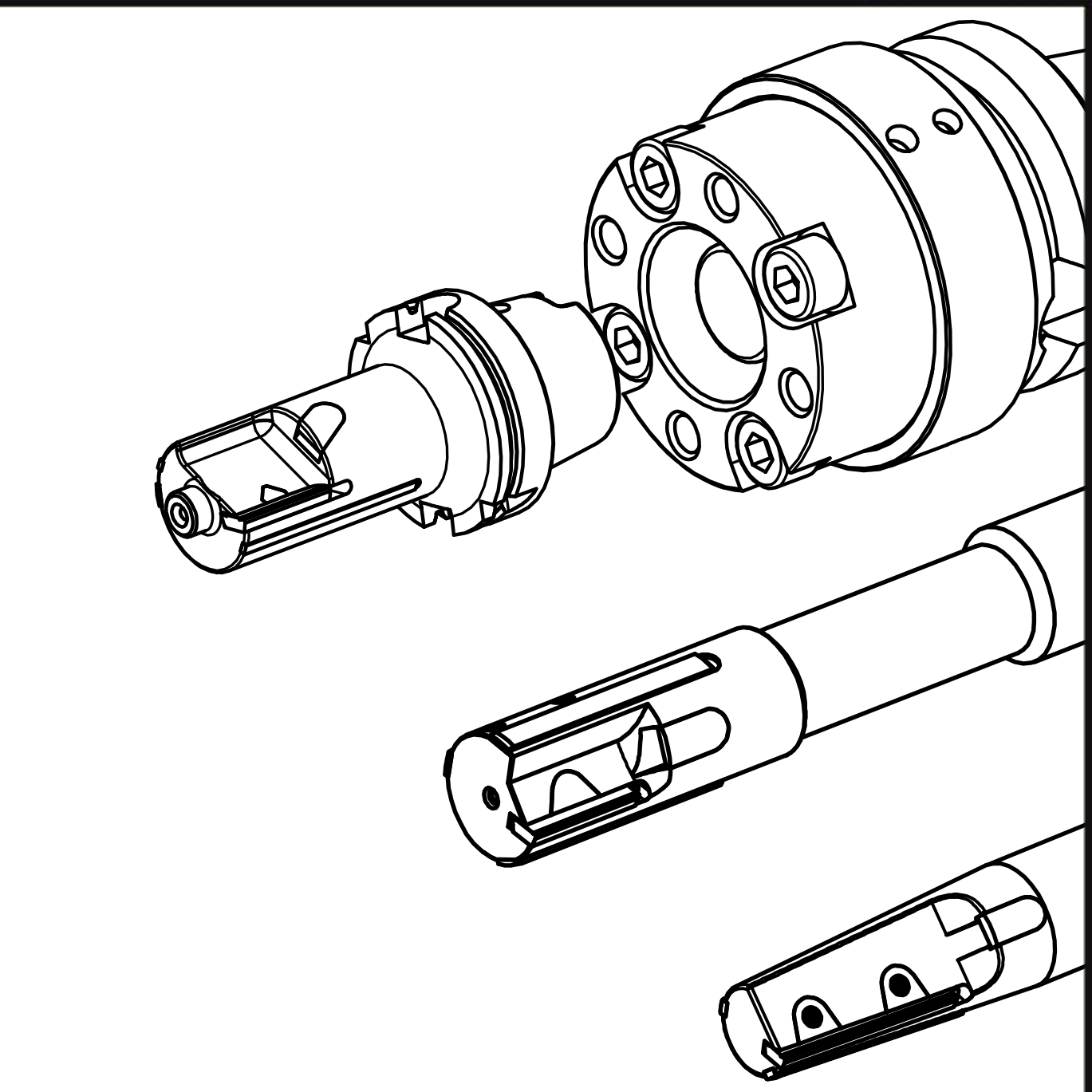
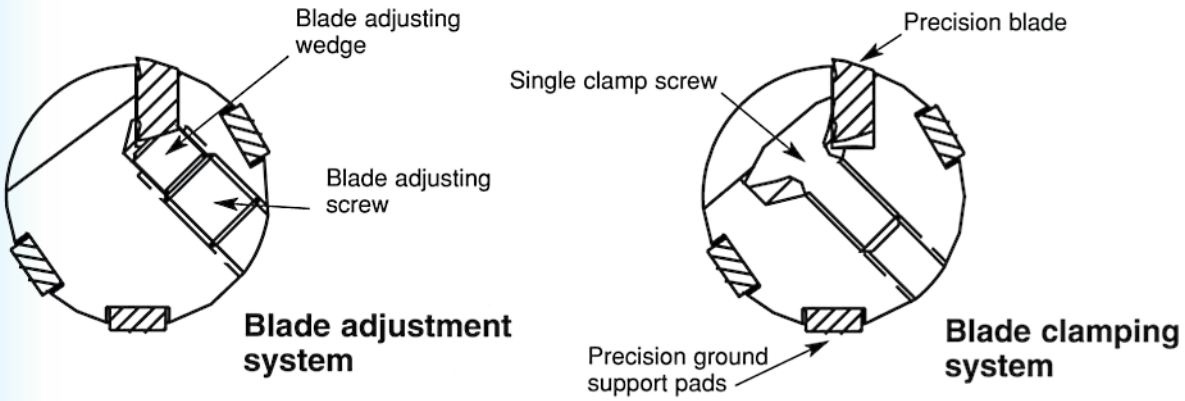
Tooltech

Precision Tooling Ltd.



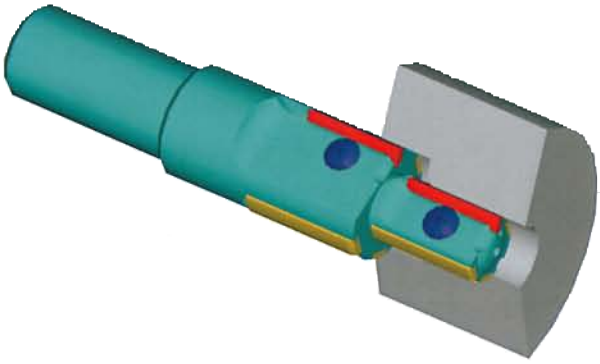
BLADED REAMERS

Tooltech Precision Reamers are designed to meet hole geometry requirements in the complex and demanding machining environment of today's manufacturing industry.
The innovative design of the Tooltech reamer system now allows machining techniques to be utilised not only on CNC but conventional, transfer, rotary and other established machines. Coupled with an easily replaceable cutting blade with a precise and positive adjusting mechanism, the Tooltech reamer becomes an efficient, operator friendly, precision reaming tool.
In most applications, the Tooltech reamer will utilise a single precision ground and lapped double-edged cutting blade. This is located and directly clamped into the reamer head by a unique clamping system patented by Tooltech Limited. The reamer head also hosts a selection of guide pads that are positioned to absorb and disperse the forces created during machining. The result, perfectly cylindrical bores with exceptional straightness and superior surface finishes combined with a bore diameter tolerance held to microns



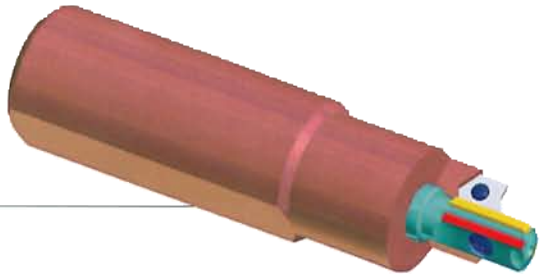
Tooltech precision reaming tools can be used on machines where the tool is stationary and allowed to follow the centre line of an existing bore. The reamer is generally run at a slightly slower surface speed than rotating tools and the result is exceptionally straight and round bores with superior surface finish. In this type of application the location of the finished bore must have been established by a previous machining operation and the precision reamer is then allowed to "float" to follow the existing bore.
Tooltech fine boring tools are used when greater positional accuracy must be established and when bore alignment is critical. These tools are usually rotating, and can be used in conjunction with 'EDR' blade geometries, which allow for greater stock removal. In many cases, excellent results can be obtained with machining directly from "as cast" conditions, especially in aluminium and cast iron components. Tools of this type can run at high speeds when equipped with through the tool coolant, but must be held accurately in the machine spindle. Precision tool holding systems are available from Tooltech.
The Tooltech reamer is a precision tool manufactured to your exact requirements. Conventional straight and morse taper shanks, along with 'BT', 'DIN', 'Modular' and 'HSK' shanks are all available. The cutting blades are manufactured from Carbide, but are available in Cermet, "PCD" (Diamond) and 'CBN' options along with a variety of surface coatings. The guide pads are available in Carbide, Cermet, Ceramic and 'PCD' to suit the application requirements. Tooltech can also utilize other techniques to produce a reamer to meet your specific needs.

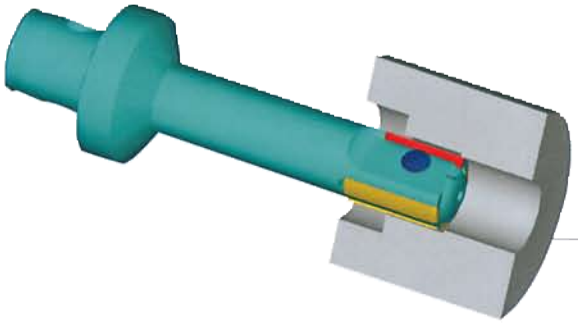
Reamer Applications - examples of how the 'R-MAX' reamer can be utilized



Multi - Diameter reamers to ensure concentricity between bores.

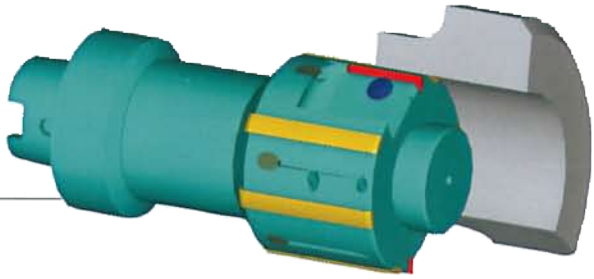
Single & Multi - Diameter reamers with fixed insert pockets or cartridge units to combine reaming and boring operations and reduce cycle times.

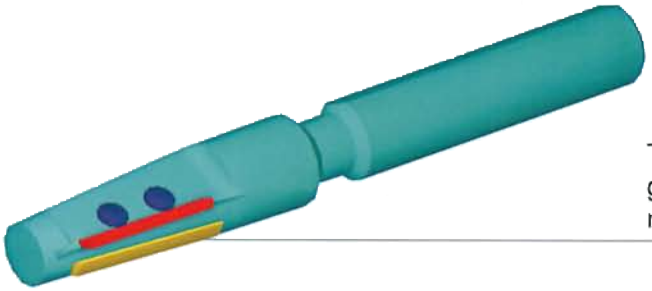




High speed machining of precision bores in volume manufacturing ensures repeatability of bore sizes even after tool changes.

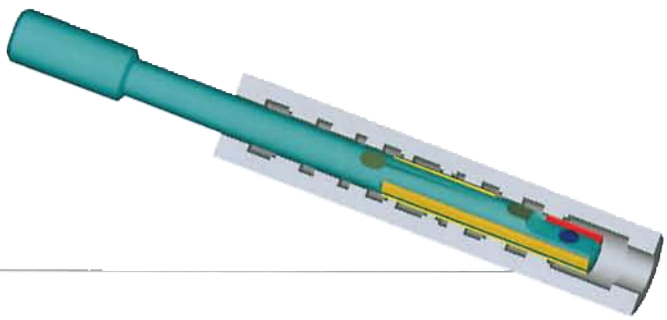
Fine boring of holes to achieve positional & geometric bore accuracy. Twin blades for higher production rates.





Taper reaming of bores produces superior hole geometry compared to conventional taper reamers.

Line reaming of multi-cavity bores from pre-machined or pre-cast bores producing bore geometry of 0,005mm. Eliminates further honing and grinding operations.



Reamer Selection

Reamer cut length CL, shank style and cut diameter are manufactured to suit your specific requirements. Our Automated Design Facility allows you to select exactly what you require.

Modular

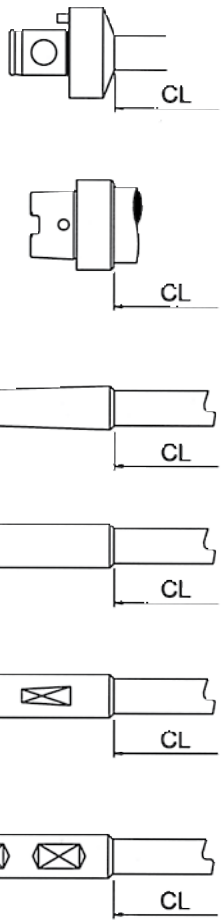
HSK

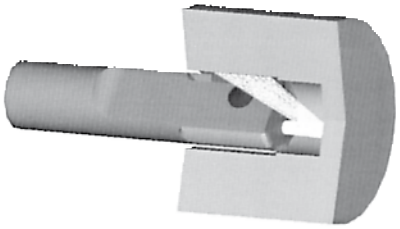
Morse Taper

Straight Shank
DIN 1835-A

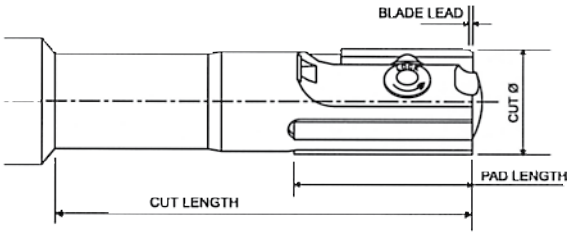
Whistle Notch
DIN 1835-E

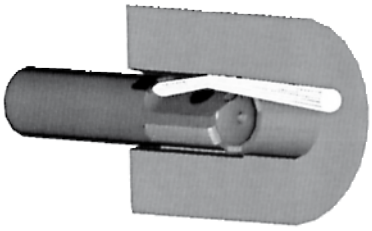
Weldon
DIN 1835-B





Coolant: Blind hole application





Coolant: Through hole application

Other shank styles also available.

Range Cut Ø		Blade Size	Standard Pad Length	Clamp Screw	Torx Key	Allen Key
Metric	Imperial					
Ø 6 - Ø 7,49	Ø .236" - .295"	0	16mm	RSCS0	P8773B	P8369AA
Ø 7,50 - Ø 7,99	Ø .296" - .314"	0	16mm	RSCS0	P8773B	P8369CC
Ø 8 - Ø 8,99	Ø .315" - .354"	1	16mm	RSCS1	P8773D	P8369CC
Ø 9 - Ø 10,99	Ø .355" - .432"	1	22mm	RSCS1	P8773D	P8369BB
Ø 11 - Ø 13,99	Ø .433" - .550"	2	27mm	RSCS2	P8773D	P8369BB
Ø 14 - Ø 17,99	Ø .551" - .708"	3	27mm	RSCS3	P8773D	P8369V
Ø 18 - Ø 21,99	Ø .709" - .865"	4	30mm	RSCS4	P8773G	P8369W
Ø 22 upwards	Ø .866" +	4	32mm	RSCS4	P8773G	P8369W

Reamer Application Sheet

Quote ref .....

Customer: .....
Address: .....
.....
.....Post Code: .....

Date: .....
Contact: .....
Job Title: .....
Tel Nº: .....Ext .....
Fax Nº: .....

Comp't Part Nº: .....
Part Name: .....
Material Spec: .....
Material Hardness: .....
Prime objective for using R-MAX:

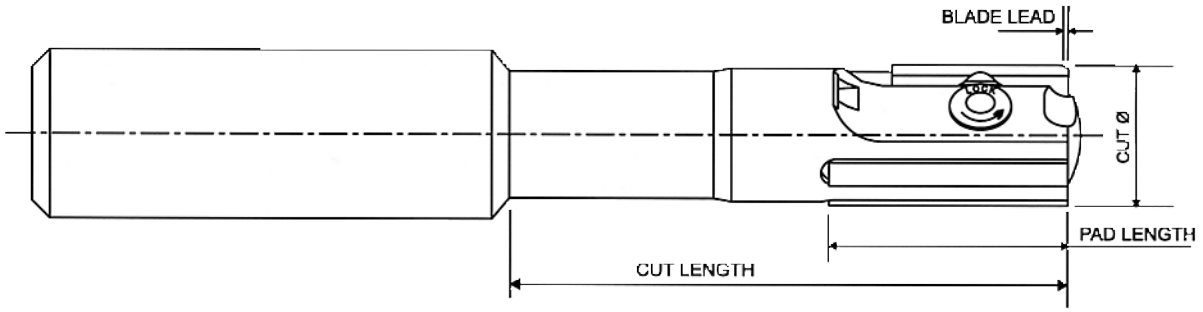
- ❑ Size
- ❑ Surface Finish
- ❑ Bore Position

Bore Size(s) & Tolerance: .....
.....
Roundness Tolerance .....
Straightness Tolerance .....
* Always try and supply a component drawing, to ensure we interpret your requirements correctly.
Bore Depth: .....
Surface Finish Req'd: .....
When reaming is the bore: .....
Thro .....Blind .....
Are there interruptions in the bore: .....
If YES, supply a component drawing.

Machine to be used: .....
Is the spindle:
Vertical .....Horizontal .....
Is the tool:
Rotating .....Stationary .....
What is the shank in the machine spindle:
.....
What is the coolant type: .....
Coolant pressure/volume: .....
Coolant concentration: .....
Is coolant supply: External Flood .....
Internal thro' the spindle/tool .....
Other. Please explain .....
.....
Spindle speed available / req'd: .....
Feed rate available / req'd: .....
Are there any tool restrictions to consider i.e. length / weight / diameter: .....
.....
.....

What shank is req'd: .....
What cut length is req'd: .....
How many support pads are needed: .....
What blade lead is req'd: .....
What blade rake angle is req'd: .....

What is stock removal for reamer: .....
Is tool held rigid for boring: .....
Is tool to be used in floating holder: .....
Is tool to be used in a 'steerable' style of holder (type ?): .....



Additional Information or Instructions: .....
.....
.....
.....

Reamer Blade Geometry, Radial Rake and Coatings

The Tooltech Reamer Blade part number is made up of 10 numbers selected from 5 categories. The first two digits are the manufacturer product code, the next two digits are determined by reamer size and the balance of the numbers allow specific blade configurations and coatings.

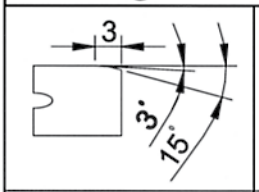
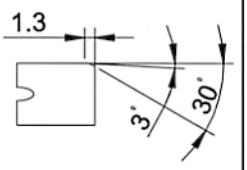
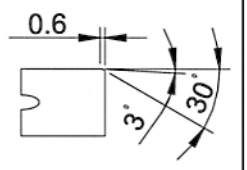
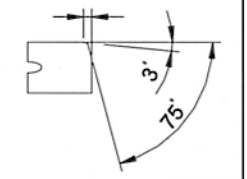
R_	00	000	00	0
Code	Size	Lead	Rake	Coating

Manufacturer Product Identification Code

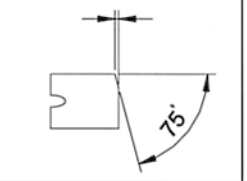
Blade Size

Cut Ø	X	
6.0-7.99	X = 10.5	00
8.0-10.99	X = 15	01
11.0-13.99	X = 18	02
14.0-17.99	X = 20	03
18.0+	X = 27	04

Cutting Lead

	E30
	E13
	E06
	EDS

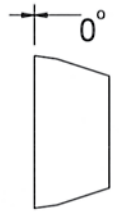
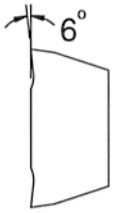
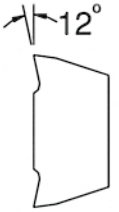
BLADE SIZE	0	1	2	3	4
LEAD LENGTH	.75	.85	1.0	1.1	1.2

	EGS

BLADE SIZE	0	1	2	3	4
LEAD LENGTH	.25	.35	.50	.60	.70

Radius Blade	R--
Special Blade	S--

Rake Angle

	00
	06
	12

Coating

Uncoated	U
TiN Coated	T
TiCN Coated	C
AlTin Coated	F
CrN Coated	H
P.C.D.	P
C.B.N.	B

Blade Options and Cutting Geometry

The data chart below is only a guide to allow starting values to be selected. The final data for a particular application is best determined by trial or during the machining process.

Lead	Suggested Application	Finish Attainable Micro inch	Recommended Machining Allowance					
			Reamer Dia		Machining Allowance (Dia.)			
					Recommended		Max	
			MM	Inches	MM	Inches		
E30	Float Reaming Good surface finish Use at slower cutting speeds <80 M/min NOTE: lead is 3.0mm long	0.15 - 0.6 µm 6 - 24 micro	8.0 – 10.99 11.0 – 13.99 14.0 – 17.99 18.0 +	(.315-.432") (.433-.550") (.551 -.708") (.709" +)	0.10 - 0.25 0.15 - 0.30 0.15 - 0.35 0.15 - 0.40	(.004-.010") (.006-.012") (.006-.014") (.006-.016")	0.3 (.012") 0.4 (.016") 0.5 (.020")* 0.7 (.028")*	
E13	Good general purpose lead Higher cutting speeds upto 200 M/min Good for Aluminium with 12 deg rake and thin wall applications.	0.2 - 0.9 µm 8 - 36 micro (0.1 µm in Alum)	6.0 – 7.99 8.0 – 10.99 11.0 – 13.99 14.0 – 17.99 18.0 +	(.236-.314") (.315-.432") (.433-.550") (.551 -.708") (.709" +)	0.05 - 0.20 0.10 - 0.25 0.15 - 0.30 0.15 - 0.35 0.15 - 0.40	(.002-.008") (.004-.010") (.006-.012") (.006-.014") (.006-.016")	0.3 (.012") 0.4 (.016") 0.5 (.020") 0.5 (.020")* 0.7 (.028")*	
E06	Blind bores when reaming/boring close to a shoulder. Only to be used when short lead is required.	0.4 - 1.2 µm 16 - 48 micro (0.15 µm in Alum)	6.0 – 7.99 8.0 – 10.99 11.0 – 13.99 14.0 – 17.99 18.0 +	(.236-.314") (.315-.432") (.433-.550") (.551 -.708") (.709" +)	0.05 - 0.15 0.10 - 0.20 0.15 - 0.25 0.15 - 0.30 0.15 - 0.35	(.002-.006") (.004-.008") (.006-.010") (.006-.012") (.006-.014")	0.3 (.012") 0.4 (.016") 0.5 (.020") 0.5 (.020")* 0.5 (.020")*	
EGS	For gun reaming - Particularly good for aluminium at high cutting speeds >150 M/min. Allows larger depths of cut. If machining from as cast, the reamer must have internal coolant feed and may require an external bushing support.	0.3 - 1.5 µm 12 - 80 micro (0.15 µm in Alum)	6.0 – 7.99 8.0 – 10.99 11.0 – 13.99 14.0 – 17.99 18.0 +	(.236-.314") (.315-.432") (.433-.550") (.551-.708") (.709" +)	0.25 - 1.00 0.40 - 1.30 0.50 - 1.80 0.50 - 2.50 0.50 - 2.80	(.010-.039") (.016-.051") (.020-.071") (.020-.098") (.020-.110")	1.5 (.080") 2.1 (.083") 2.4 (.094") 3.3 (.130") 4.0 (.157")	
EDR	For gun reaming - Similar to EGS lead but will produce higher quality surface finish. See notes on EGS above.	0.3 - 1.0 µm 12 - 40 micro (0.1 µm in Alum)	6.0 – 7.99 8.0 – 10.99 11.0 – 13.99 14.0 – 17.99 18.0 +	(.236-.314") (.315-.432") (.433-.550") (.551 -.708") (.709" +)	0.25 - 1.00 0.40 - 1.30 0.50 - 1.80 0.50 - 2.50 0.50 - 2.80	(.010-.039") (.016-.051") (.020-.071") (.020-.098") (.020-.110")	1.5 (.059") 1.8 (.071") 2.4 (.094") 3.3 (.130") 4.0 (.157")	

*Best results are achieved with reduced depths of cut in most materials.

Blade Geometry, Radial Rake and Coatings should be selected for the machining operation being performed. In most cases the lead form E13 is a good general purpose lead geometry. For greater stock removal or higher cutting speed the EDS lead is recommended in specific materials.

All blades are supplied in 0, 6, or 12 degree radial rakes. These rakes are applied in the same relationship as conventional types of machining operations. The radial rake is important for proper formation of the chip. When machining cast iron a 0 degree top rake is recommended, while in aluminium a 12 degree rake would be preferred.

Blade coatings can greatly improve the life of the cutting edge of the blades. A number of standard coatings are available and it is always recommended to use one of these coatings when machining ferrous materials. The use of Polycrystalline Diamond (PCD) tipped blades are recommended when machining aluminium at high speeds and/or high production rates.

Operating Requirements

Tooltech offer technical support both on site and over the telephone. However, the following information gives general guidelines for using the Tooltech Reamer.

Power Feed: A constant power feed is required in all cases to ensure consistent cutting pressure on the tool. Hand feeding will result in poor performance, poor finish, and possible tool damage. If mounting the tool in a tailstock, attach the tailstock to the machine carriage and use the carriage feed.

Alignment: When applying an Tooltech Reamer it is critical that the tool be aligned correctly. Depending on the application (reaming, fine boring, gun reaming), alignment can be achieved by different means and primarily by the correct application of the tool holding devices.

Most reaming applications, where the tool does not rotate, employ the use of a floating holder to allow the reamer to align to the existing bore. Care must be used to ensure that the tension of the float suits the weight of the reamer.

When applying the reamer as a fine boring tool, it is important to ensure that the angular and radial run out of the tool is kept to a minimum. This is usually accomplished with the use of precision tool holders or employing an adjustable type of tool holder. These holders are available from Tooltech.

Machining Allowance: It is important that the hole size prior to reaming allows sufficient depth of cut for the reamer to remove all pre-machined tool marks. A general guideline would be to allow about 0.3 mm (.Ol2inch) on the diameter for the finish cut. See recommended machining allowances on page 7.

Coolant: The proper selection, concentration, filtration, and delivery of the coolant is essential to the performance of the tool. A flood of clean coolant should be directed over the blade and along the length of the guide pads to provide swarf evacuation and lubrication to the pads. For maximum blade life and superior finishes select a coolant with a high oil content. The Tooltech reamer should never be run dry without consultation with a Tooltech technician.

As a rule, it is recommended to use through-the-tool coolant delivery whenever possible. Tooltech Reamers are designed in two styles of internal coolant, blind bore and through bore. Coolant is generally supplied through the shank of the reamer. It can also be induced into the side of the reamer for non-rotating applications, or through a rotary gland when the reamer is rotating. Internal coolant feed is recommended if any of the following conditions exist:

Blind bores where the bore length is more than twice the diameter.

Deep through style bores, particularly in horizontal applications.

3. Higher cutting speeds (above 70 M/min).

4. When using Tooltech Gun Reamers.

5. When chip evacuation from the bore is likely to be a problem due to component fixtures or external bushings.

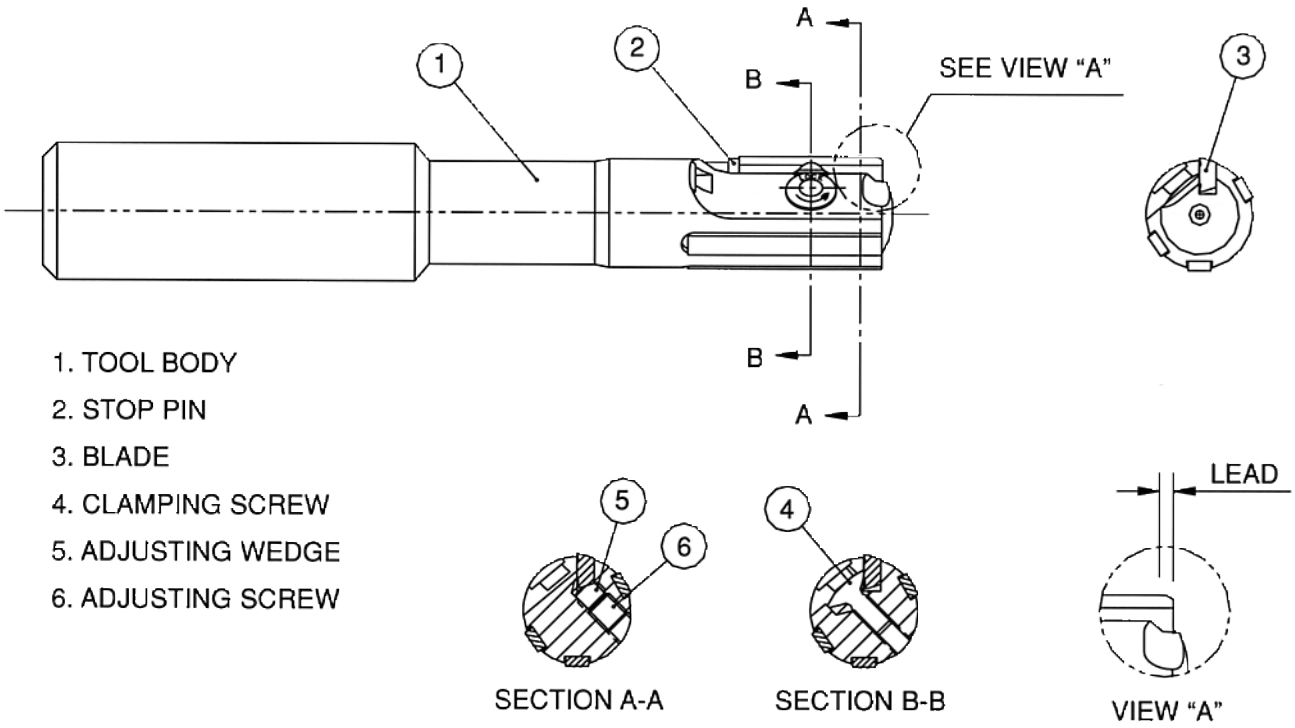
COOLANT SELECTION

Material type	Recommended	Alternative
	Mineral Oil Based Emulsions	Semi Synthetic
Steel	5%	10%
Nickel chrome steel	6%	12%
Stainless steel	6%	12%
Cast iron	4%	6%
Aluminium	6%	12%
Zinc alloys	6%	12%
Copper	6%	12%
Brass	4%	6%

PRESSURE & FLOW RATES

Cut Dia. in mm	Flow rate L/min	Pressure PSI
6 - 12mm	15 - 20	150+
12 - 16mm	20 - 40	120+
16 - 20mm	30 - 50	100+
20 - 32mm	40 - 75	75+
32 - 50mm	65 - 250	50+
50 - 100mm	175 - 350	40+

Parts Breakdown for standard R-MAX Reamer



Blade Replacement and Tool Setting:

The easiest way to set the Tooltech Reamer is with the Tooltech setting fixture. The following steps describe blade replacement and setting with either electronic or dial indicators.

1. Back out the two blade adjusting screws (6), by turning them anti-clockwise. To remove the used blade, loosen the clamping screw (4), by rotating it clockwise **(THIS IS A LEFT HAND THREADED SCREW).**
2. Remove the blade and clean any contamination from the blade pocket.
3. Insert the blade with the unused corner out, or replace it with a new blade. Holding the blade against the stop pin (2), tighten the clamp screw (4) completely by turning it **ANTI-CLOCK-WISE.**
4. Clean both centres on the tool and insert the tool into the setting fixture.
5. Position the dial indicator at the front of the blade just behind the apex of the lead geometry. If fitted, position the second indicator near the rear of the blade. Zero both indicators against one of the guide pads. Rotate the tool and ensure all the pads read zero. If not clean the centres and try again.
6. Rotate the tool between centres to find the high point of the blade as indicated on the dial indicators.
7. Adjust the front adjusting screw (6) to a final setting of + 0.01 0mm (0.0004") above the guide pad (or as indicated on the reamer drawing). Adjust the rear adjusting screw to a final setting between -0.010 to -0.015mm (0.0004" to 0.0006") below the guide pad. Note: It is recommended to gradually alternate from front to rear adjusting screw as you approach the final settings.

Using a Pressure Micrometer to Set the Tooltech Reamers

First set the Micrometer using a qualified gauge block that is thee diameter of the bore to be reamed. Follow steps 1 through 3 above, to replace worn blades. It is important to have the cutting edge of the blade locate on the fixed anvil of the micrometer and gently rock the spindle over the opposing guide pad to measure the blade setting. To prevent damage, do not allow the micrometer to pass over the cutting edge of the blade. Follow step No. 7 above for setting the reamer blade.

Blade lead	E13 lead				E30 lead				EDS lead		EGS lead	
Material to cut	External coolant supply		Internal coolant supply		External coolant supply		Internal coolant supply		Internal coolant supply		Internal coolant supply	
	M/min	mm/rev	M/min	mm/rev	M/min	mm/rev	M/min	mm/rev	M/min	mm/rev	M/min	mm/rev
Steel < 50 Tons	15-40	0.10-0.40	30-110	0.10-0.30	15-40	0.10-0.40	30-90	0.10-0.30				
Steel > 50 Tons	10-30	0.07-0.25	20-90	0.10-0.25	10-30	0.07-0.25	20-70	0.10-0.25				
Alloy steels	5-25	0.05-0.25	15-50	0.07-0.25	5-25	0.05-0.25	15-40	0.07-0.25				
Stainless steels	5-20	0.05-0.25	10-40	0.05-0.20	5-20	0.05-0.25	5-30	0.05-0.20				
Aluminium	20-100	0.10-0.40	50-250	0.10-0.30					80 +	0.05-0.25	80 +	0.05-0.25
Cast iron	20-60	0.10-0.40	50-110	0.10-0.40	20-60	0.10-0.40	50-100	0.10-0.40	60-120	0.05-0.25	40-120	0.05-0.25
Nodular (SG) iron	20-50	0.10-0.25	40-80	0.10-0.30	20-50	0.10-0.25	40-80	0.10-0.30	40-80	0.05-0.25	40-80	0.05-0.20
Brass	10-60	0.10-0.40	30-110	0.10-0.50	10-60	0.10-0.40	30-80	0.10-0.40	30-110	0.05-0.20	30-110	0.03-0.15
Hard plastics	10-100	0.10-0.05	50-200	0.10-0.40					50-200	0.05-0.40	50-200	0.05-0.30

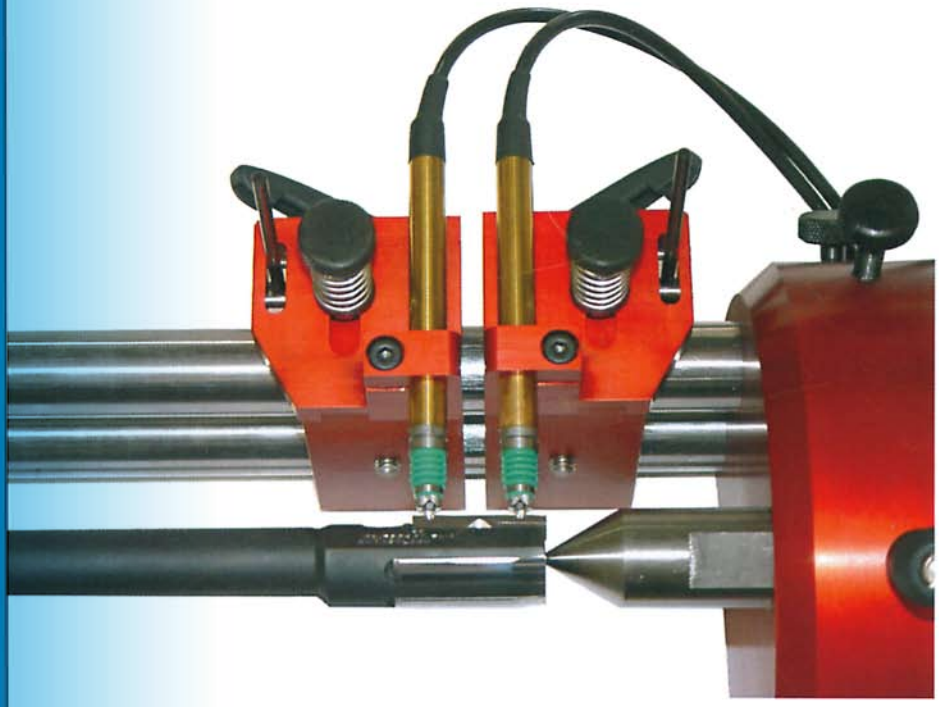
This table is intended as a guide to establish initial cutting parameters when using the Tooltech single blade reamer. Establishing the optimum cutting data for a specific application should be determined in the environment in which the tool will actually be used.
As a guide we suggest a speed is selected in the mid to higher ranges given, with the feed rate to the lower range. Factors affecting this selection will include the depth of cut, the rigidity of the machine and fixturing, the quality of the bore required and the blade and support pad material.
Wherever possible we always recommend through the tool coolant, but an external coolant supply will generally suffice for bores up to 2.5 x's the bore diameter. However, the 'EDR' and 'EGD' gun reaming leads must be used with through tool coolant supply.
When using the Tooltech reamers at high speeds it is advisable to have the tools balanced and to use a 'steerable' holder to allow the tools to be clocked true in the machine spindle. These are available with Modular, 'HSK' and Hydraulic bores or to suit your specific requirement.

The Tooltech Reamer will produce a bore that is consistent in roundness, straightness, size and surface finish. High accuracy applications require precision set-ups. We assist you within the catalogue with basic recommendations for the correct determination of tool selection and the requirements and guidelines for the reaming process.
The information given will help to address problems which may be encountered during setting up of the Tooltech reamers. For specific technical assistance please contact our engineering department.

Problem Occuring	Suggested Corrective Action
Tapered Bore	Spindle alignment to work piece must be within 0.010mm. A floating holder can correct this problem. Check blade back taper - Increase the taper. Normal setting is 0.001mm per 1mm of blade length.
Oversized Bore	Re-check tool setting. Make necessary adjustment. Spindle alignment to work-piece must be within 0.010mm. Floating tool holder can correct this problem.
Out-of-Roundness	Check blade setting. Blade is probably set too high above the guide pad. Check blade back taper - Reduce the taper. Normal setting is 0.001mm per 1mm of blade length. Make sure work holding method is not causing distortion.
Bell Mouth Entrance or Exit	Check blade back taper. If entrance is bell mouthed increase back taper. If exit, decrease back taper. Feed rate may be too high. Reduce feed rate. Check overall condition of tool especially the guide pads. Spindle alignment to work-piece must be within 0.010mm.
Poor Surface Finish	Check coolant mixture and type. 10:1 or higher mixture is best. Check speed and vary up or down to get optimum speed. Check machine feed rate. Reduce feed rate. Ensure stock removal is sufficient.
Tool Chatter in Bore	Spindle alignment to work piece must be within 0.010mm. A floating holder can correct this problem. Check blade back taper - Increase the taper. Normal setting is 0.001mm per 1mm of blade length. Make sure work holding method is rigid.

Tooltech Reamer Setting Fixture

A precise and simple method of pre-setting Tooltech reamers



Availble with single or dual indicators