KENNAMETAL®

Tooling Systems

The Kennametal Tunable Boring Bars

…reduce vibration in internal turning operations.

- Optimal rigidity delivers improved surface quality and closer tolerances.
- Larger depths of cut and better chip removal yield higher productivity.
- Machine without chatter and vibration for less noise.
- Bar can be tuned on the machine to account for different vibration behavior.

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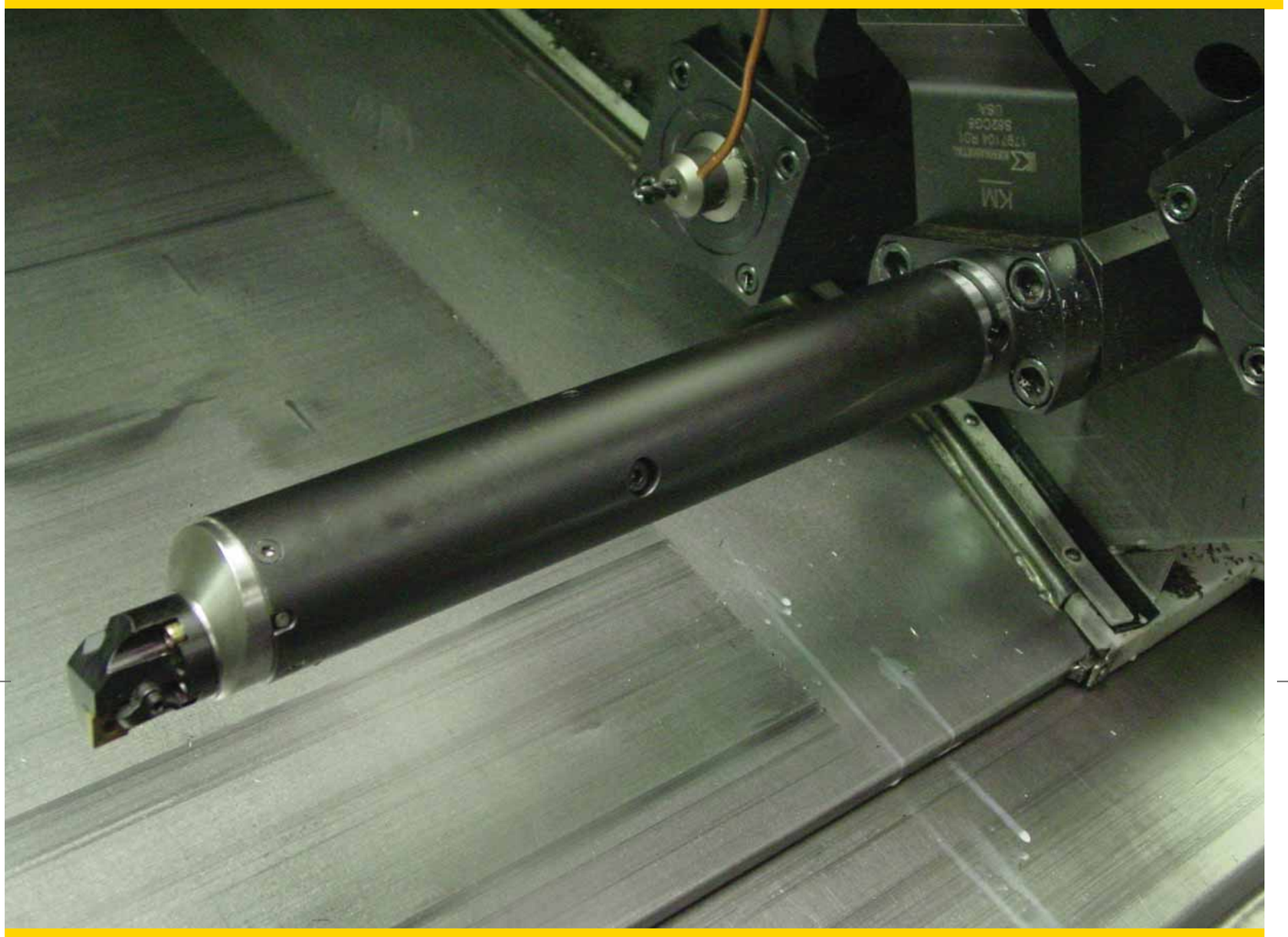

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Common Challenges in Internal Machining

Internal machining operations are very sensitive to chatter and vibrations.
Common challenges include:

- Unfavorable geometric circumstances.
- Machining at extended length-to-diameter ratios.

Additionally, internal machining provides little space for a stable tool and has restrictions for coolant supply and chip removal. These factors can lead to chattering, poor surface finish, noisy vibrations, and workpieces that are out of tolerance. Kennametal solves these problems with our complete portfolio of Tunable Boring Bars.

Kennametal Tunable Tooling

The Kennametal Tunable Boring Bars are manufactured with an internal dampening package designed to eliminate chatter in deep-hole boring applications. We manufacture standard tunable bars and have extensive capabilities to design and produce almost any style of tunable product, including boring bars, extensions, holders, rotating adapters, and modular sections.

Advantages of Kennametal Tunable Tooling

The proprietary features of the Kennametal Tunable Boring Bar system provide significant advantages:

- **Optimal rigidity**
  Improved surface quality and close tolerances due to vibration-free machining.
- **Increased productivity**
  Larger depth of cut and better chip removal by up to 10:1 (steel) and 15:1 (carbide) length-to-diameter ratio.
- **Machining without chatter or vibration**
  Less noise exposure and improved machining results.
- **Tunable damping mechanism**
  Bar can be tuned on the machine and tool can be adjusted to account for different vibration behavior.

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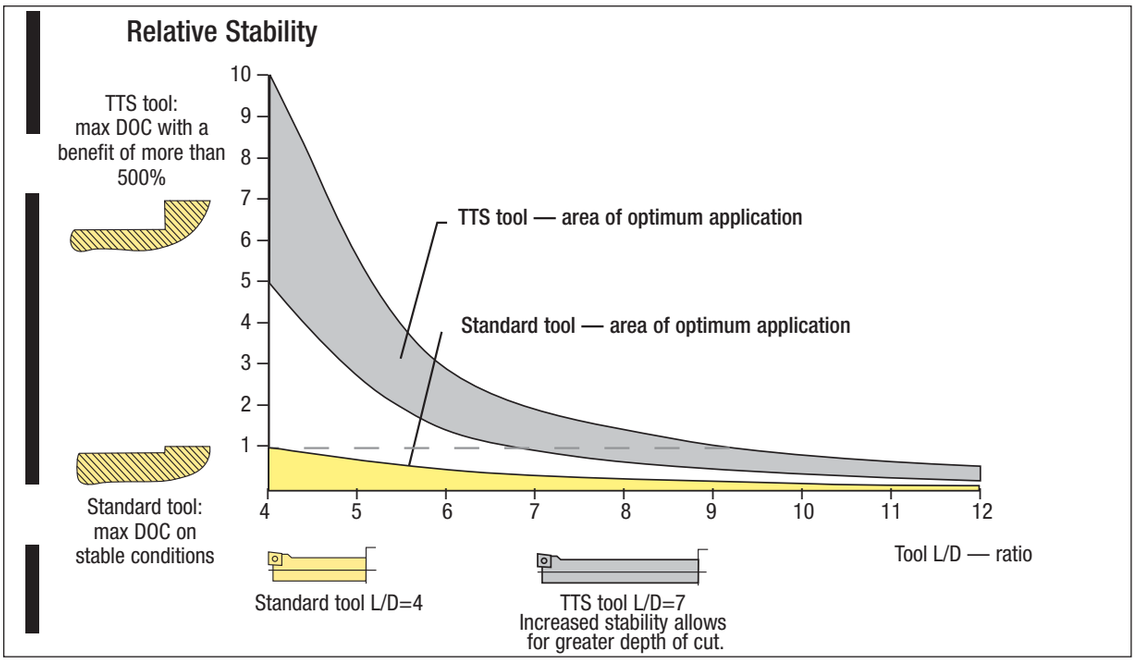
General Guidelines for Internal Machining

When selecting a tunable boring bar, you can improve your internal machining operations by reviewing the following guidelines:

1. Select the largest diameter boring bar possible. Larger diameter bars are stiffer and more stable. Remember to leave enough space for chip evacuation.
2. While larger diameters will be more stable, the diameter may also be too large, preventing proper chip evacuation and affecting surface finish or damaging the bar. Ensure the bar diameter is not so large that it will interfere with chip evacuation.
3. Keep the overhang length of the tunable boring bar as short as possible:
   a) For KM™ Tunable Boring Bars, select the shortest bar possible.
   b) For straight shank tunable boring bars, mount the bar on the machine with the shortest overhang length possible.
4. Balance machining parameters to prevent the occurrence of uncontrolled vibrations and resonance.
5. Design the tool setting angle as close to 90° as possible.
6. Make sure the insert is in the correct center position.
7. By choosing a small corner radius, you can reduce the forces on the workpiece.
8. Use boring bars with a negative back-rake angle that is as small as possible.
9. Inserts with a positive chip former are preferred.
10. Change inserts when small flank wear is detected because the radial back forces will increase in proportion to wear.



NOTE: This chart illustrates how KM Tunable Boring Bars provide greater stability than standard toolholders, even in larger tool length-to-diameter ratios. Increased stability allows for greater depth of cut.

Selecting the Correct Bar

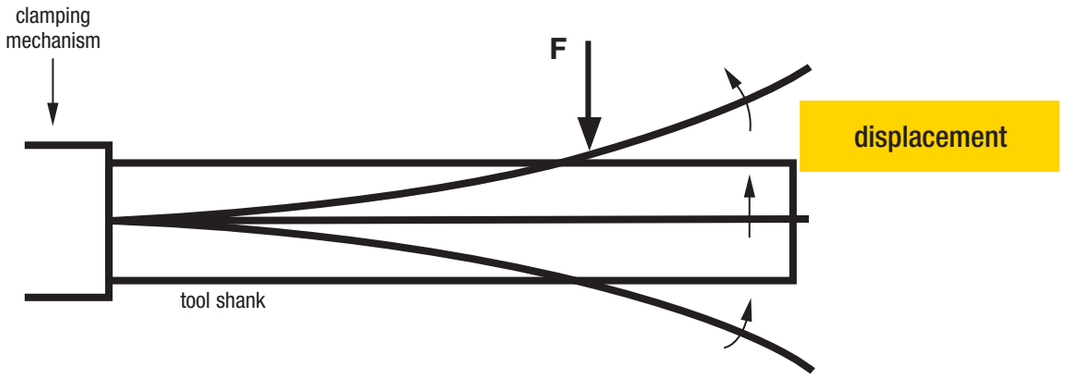
Kennametal offers TTS Boring bars with KM back-end or straight shank, KM front-end or bolt-on-head connection for the cutting unit. Boring bars are available in steel or carbide. Please compare product pages for more details.

In deep-hole boring applications, chatter can be a common problem. As a starting point, the length-to-diameter ratio (L:D) should always be kept as small as possible. The smaller the L:D ratio, the greater the stiffness and stability of the bar.

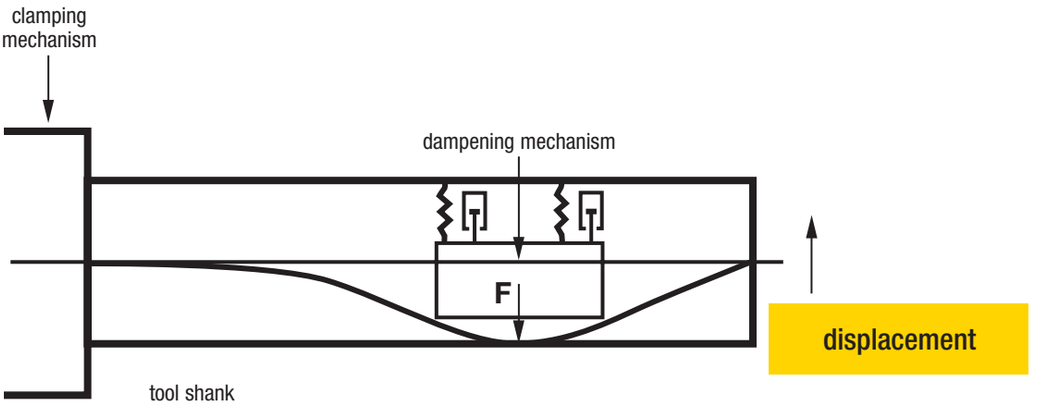
The L:D ratios of KM™ Tunable Boring Bars are fixed, where straight shank tunable bar L:D ratios are not. When using straight shank bars, the overhang length should be kept as small as possible.

Please note that only standard pre-tuned straight shank tunable bars are pre-tuned at the factory for 10:1 L:D. If the straight shank bar is mounted with less than 10:1 L:D, it may be necessary to retune the bar. This is discussed in more detail in the “Tuning the Bar” section on page 8.

Standard Boring Bar



Kennametal Tunable Boring Bar



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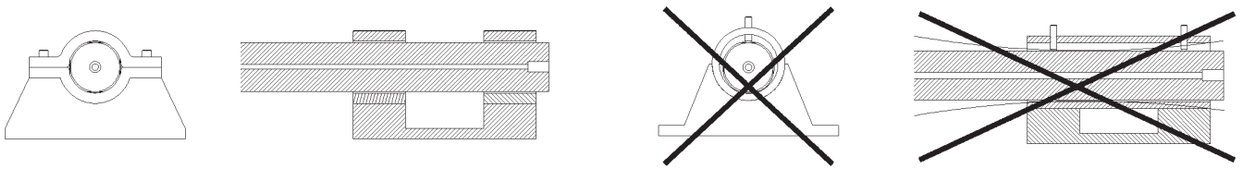
Holding the Bar

How the tunable boring bar is held is just as critical to performance as selecting and tuning the bar. The connection between the boring bar and the machine should be as rigid as possible. Rigid connections enable the tuner mass to function more effectively. The minimum holding length of the bar should be 2.5 times the diameter of the bar. Various connection methods are shown below and listed from most stable to least stable:



Most Stable

Least Stable

Face and taper contact with interference fit

Example: KM™ Tunable Boring Bar clamped with short overhang KM clamping unit on turret.

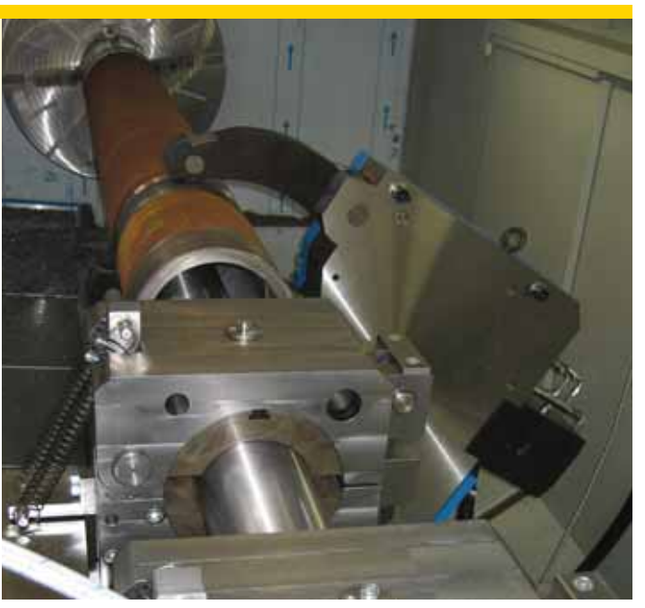
Split sleeve/full cylindrical contact

Example: Straight shank tunable boring bar with split sleeve.

Screw clamping

Example: Straight shank tunable boring bar with screw clamping on bar flat.

It is important to note that KM tunable boring bars are 180° reversible, enabling the bar to be used for boring and for OD turning. When clamping tunable boring bars, it is important to minimize the overhang length. Clamping should be selected to keep the overhang as short as possible and keep the number of clamping connections as short as possible. For example, avoid excessive use of adapters or extensions, as this decreases rigidity of the system and the performance of the tunable boring bar.



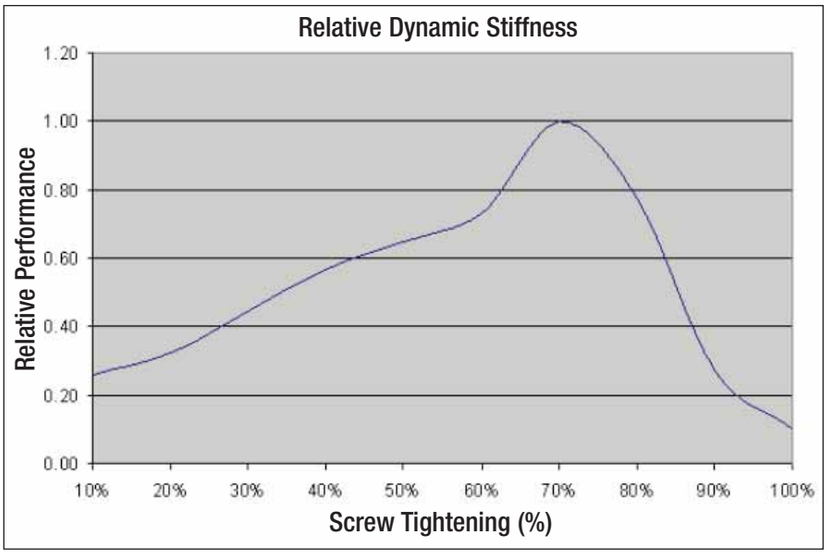
Kennametal Tunable Boring Bar

Dynamic Stiffness

The chart to the right shows the relative dynamic stiffness of a tunable boring bar as a function of the adjusting screw tightness. 100% is completely tight, or snug, in the positive direction, and 10% is just before the screw is completely loose.

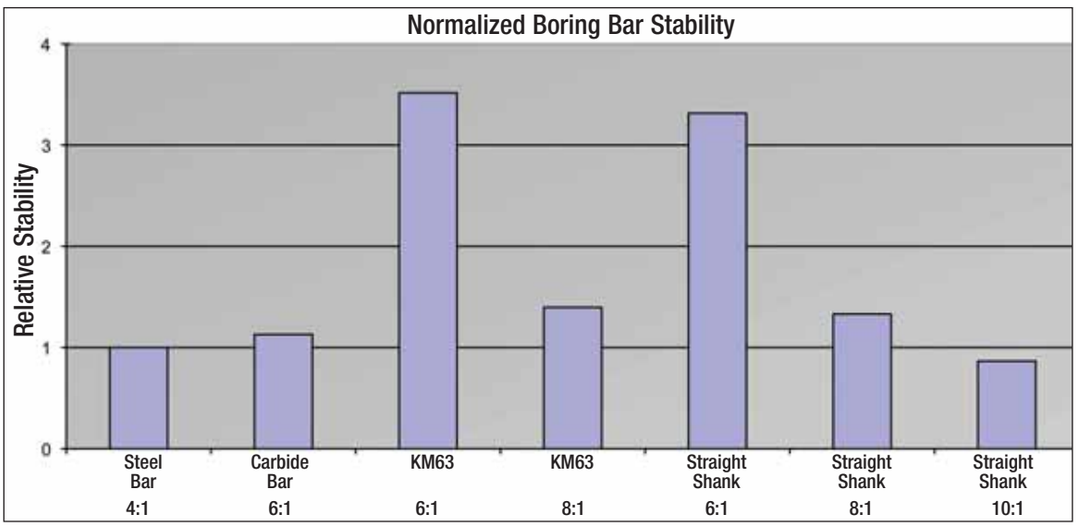
Referencing the chart, this given bar is optimally tuned at about 70%, or when the relative performance equals 1.

It is also important to recognize that the performance decreases more severely when the bar is over-tuned, compared to when it is under-tuned. This can be seen by comparing 50% tight to 90% tight. For this reason, it is best to slightly under-tune the bar.



This chart shows how adjusting a tunable bar can impact relative performance.

This procedure is valid for L:D of 6:1 and below. For 8:1 and 10:1 bars, adjustments are more sensitive. It may be necessary to make smaller adjustments of the adjusting screw in order to optimally tune the bar. As L:D ratio grows, the adjusting screw should be turned in smaller increments.



NOTE: This chart shows the relative stability for different boring bar types with different length-to-diameter ratios.

Tuning the Bar

A key benefit of the KM™ Tunable Boring Bars is that they can be optimally tuned for any given customer application. While Kennametal standard tunable boring bars come pre-tuned from the factory, it may be beneficial to further optimize the bar once it is on the machine.

Several factors influence the required adjusting screw setting on tunable boring bars, including:
- Overhang and L:D ratio.
- Depth of cut.
- Overall dynamics and rigidity of the machine.

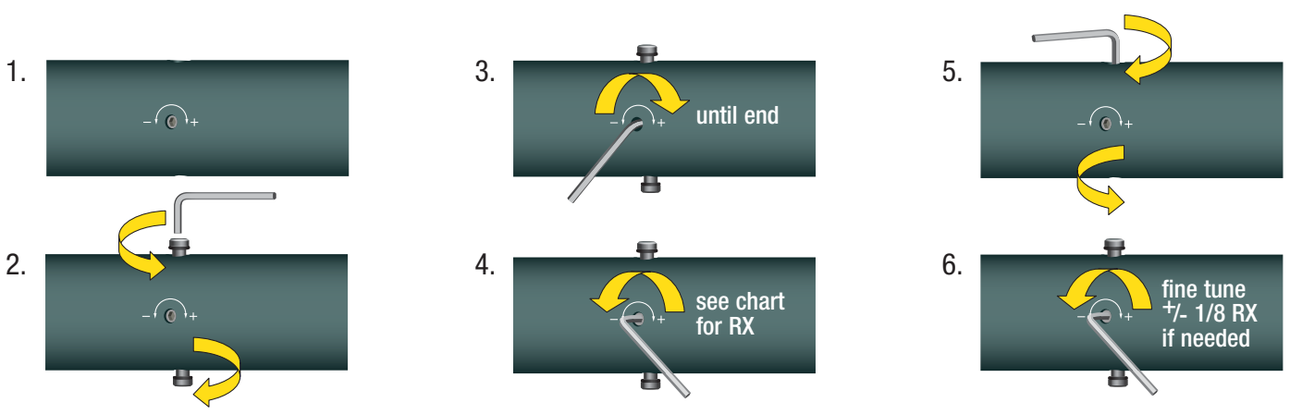
A tunable boring bar with standard tuning may work right out of the box for one machine, and it may chatter on another because of differences in dynamic response between the machines.

Chatter can be eliminated by optimally tuning the boring bar for a given setup.

The following process should be used for retuning tunable boring bars. It is best to slightly under-tune the bar. Therefore, the tuning process focuses on identifying the adjusting screw setting where chatter starts, and then backing off the screw by a 1/2 turn in the negative direction.

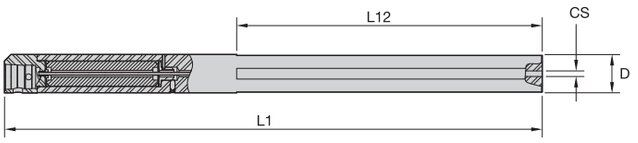
Retuning a Tunable Boring Bar

1. Loosen both clamping screws.
2. Turn the adjusting screw in the positive direction until it becomes snug. The adjusting screw becomes snug when it locks the tuner mass.
3. Turn the screw one complete turn in the negative direction and take a test cut.
4. Repeat Step 3 until chatter is eliminated.
5. Once chatter is eliminated, note that chatter starts between the current screw setting and one turn in the positive direction. Make 1/4 turn adjustments within this range, taking test cuts for each setting, until you can identify the adjusting screw setting that causes chatter to start.
6. Once the adjusting screw setting that causes chatter is determined, back the adjusting screw off a 1/2 turn in the negative direction.
7. Tighten both clamping screws and take a test cut to confirm desired results.



To tune the bar, complete Steps 1–6. If needed, repeat Steps 2 and 3, then proceed to Step 6 for fine tuning.

Steel Tunable Boring Bars with KM™ Connection



Tunable steel shank with through coolant and front end KM clamping unit

D...TTB-KM™ • Metric

catalog number	system size	D	L1	CS	L12	L1 min
D40MTTB560KM40	KM40	40	520	RP 3/8-19	305	330
D50MTTB737KM40	KM40	50	697	RP 3/8-19	470	337
D60MTTB1000KM40	KM40	60	931	RP 3/8-19	686	396
D80MTTB1120KM63	KM63	80	1060	RP 3/8	610	560
D100MTTB1330KM63	KM63	100	1384	RP 3/8	622	695

D...TTB-KM • Inch

catalog number	system size	D	L1	CS	L12	L1 min
D28TTB26KM40	KM40	**1.75**	24.44	1/4 - 18 NPT	15.75	13.50
D32TTB29KM40	KM40	2.00	27.44	1/4 - 18 NPT	18.50	13.38
D40TTB36KM40	KM40	2.50	34.45	1/4 - 18 NPT	24.75	16.00
D48TTB45KM63	KM63	3.00	42.23	1/4 - 18 NPT	24.00	21.70
D64TTB58KM63	KM63	4.00	56.24	3/8 - 18 NPT	20.00	27.62

To select the proper cutting head, refer to the current Kennametal Tooling Systems and Lathe Catalogs.

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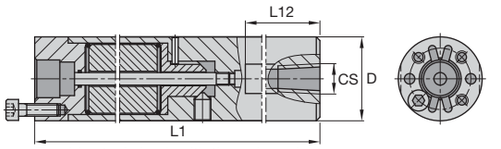
Steel Tunable Boring Bars with Bolt-on Head Connection



Tunable steel shank with through coolant

D...TTB • Metric

catalog number	D	L1	CS	L12	L1 min	screw 3 required	screw	hex
D25MTTB400	25	381	RP1/4	203	227	MS1499	MS1322	3mm
D32MTTB447	32	422	RP3/8	267	332	MS325	MS1130	4mm
D40MTTB530	40	492	RP3/8	305	300	MS326	MS330	4mm
D50MTTB700	50	670	RP3/8	470	309	MS339	MS339	5mm

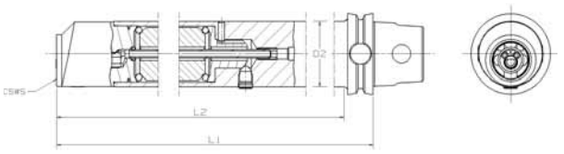
DTT-B • Inch

catalog number	D	L1	CS	L12	L1 min	screw 3 required	screw	hex
D16TTB16	1.000	15.00	1/4-18NPT	8.00	9.09	S316	S321	9/64
D20TTB18	1.250	16.13	1/4-18NPT	10.00	9.59	S325	S329	5/32
D24TTB21	1.500	19.38	1/4-18NPT	12.00	11.04	S327	S330	5/32
D28TTB25	1.750	23.38	1/4-18NPT	15.75	12.35	S337	S340	3/16
D32TTB28	2.000	26.38	1/4-18NPT	18.50	12.27	S337	S340	3/16
D40TTB35	2.500	33.38	1/4-18NPT	24.75	14.88	S350	S353	1/4
D48TTB42*	3.000	40.37	1/4-18NPT	24.00	20.00	S350	S353	1/4
D64TTB56*	4.000	54.48	3/8-18NPT	20.00	25.76	S350	S353	1/4

NOTE: see 2.5" diameter heads.

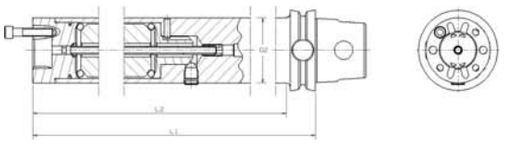
To select the proper cutting head, refer to the current Kennametal Tooling Systems and Lathe Catalogs.

KM63TS™ Tunable Boring Bars



KM63TS • KM™ Tunable Bar

catalog number	order number	system size	L1	L2	D2	L/D	CU	coolant supply
KM63TSD24TTB9KM40	**3901265**	KM63TS	9.234	8.327	1.50	6:1	KM40TS	internal
KM63TSD32TTB12KM40	**3901266**	KM63TS	12.233	11.326	2.00	6:1	KM40TS	internal
KM63TSD40TTB15KM40	**3901267**	KM63TS	15.233	15.233	2.50	6:1	KM40TS	internal
KM63TSD28TTB14KM40	**3901268**	KM63TS	14.233	13.326	1.75	8:1	KM40TS	internal
KM63TSD32TTB16KM40	**3901269**	KM63TS	16.233	15.326	2.00	8:1	KM40TS	internal
KM63TSD40TTB20KM40	**3901270**	KM63TS	20.233	20.233	2.50	8:1	KM40TS	internal



KM63TS • Bolt-On Head Tunable Bar

catalog number	order number	system size	L1	L2	D2	L/D	CU	coolant supply
KM63TSD32TTB6	**3768909**	KM63TS	5.287	4.375	2.00	3:1	BOH	internal
KM63TSD24TTB9	**3768910**	KM63TS	8.163	7.255	1.50	6:1	BOH	internal
KM63TSD32TTB12	**3768911**	KM63TS	11.162	10.255	2.00	6:1	BOH	internal
KM63TSD40TTB15	**3768912**	KM63TS	14.162	14.162	2.50	6:1	BOH	internal
KM63TSD28TTB14	**3768933**	KM63TS	13.162	12.255	1.75	8:1	BOH	internal
KM63TSD32TTB16	**3768934**	KM63TS	15.162	14.255	2.00	8:1	BOH	internal
KM63TSD40TTB20	**3768935**	KM63TS	19.162	19.162	2.50	8:1	BOH	internal

To select the proper cutting head, refer to the current Kennametal Tooling Systems and Lathe Catalogs.

KM63XMZ™ Tunable Boring Bars

KM63MXZ • KM™ Tunable Bar

catalog number	order number	system size	L1	L2	D2	L/D	CU	coolant supply
KM63XMZD24TTB9KM40	**3901271**	KM63XMZ	9.234	8.406	1.50	6:1	KM40TS	internal
KM63XMZD32TTB12KM40	**3901272**	KM63XMZ	12.233	11.404	2.00	6:1	KM40TS	internal
KM63XMZD40TTB15KM40	**3901273**	KM63XMZ	15.233	15.233	2.50	6:1	KM40TS	internal
KM63XMZD28TTB14KM40	**3901274**	KM63XMZ	14.233	13.404	1.75	8:1	KM40TS	internal
KM63XMZD32TTB16KM40	**3901275**	KM63XMZ	16.233	15.404	2.00	8:1	KM40TS	internal
KM63XMZD40TTB20KM40	**3901276**	KM63XMZ	20.233	20.233	2.50	8:1	KM40TS	internal

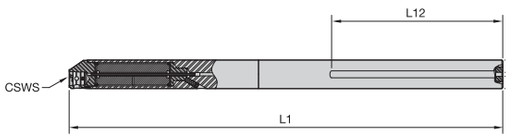
KM63MXZ • Bolt-On Head Tunable Bar

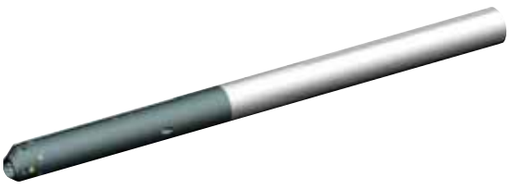
catalog number	order number	system size	L1	L2	D2	L/D	CU	coolant supply
KMXMZTSD24TTB9 3	**950859**	KM63XMZ	8.163	7.334	1.50	6:1	BOH	internal
KM63XMZD32TTB12	**3950860**	KM63XMZ	11.162	10.333	2.00	6:1	BOH	internal
KM63XMZD40TTB15	**3950861**	KM63XMZ	14.162	14.162	2.50	6:1	BOH	internal
KM63XMZD28TTB14	**3950862**	KM63XMZ	13.162	12.334	1.75	8:1	BOH	internal
KM63XMZD32TTB16	**3950873**	KM63XMZ	15.162	14.334	2.00	8:1	BOH	internal
KM63XMZD40TTB20	**3950874**	KM63XMZ	19.162	19.162	2.50	8:1	BOH	internal

To select the proper cutting head, refer to the current Kennametal Tooling Systems and Lathe Catalogs.

Carbide Tunable Boring Bars with KM™ Quick-Change Connection

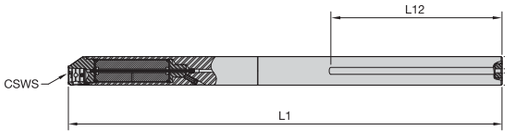
Up to 15:1 L/D

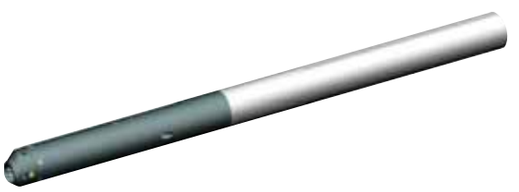




G-KM-TTB • Metric

catalog number	order number	D	L1	CS	L12	CSWS system size
G50MTTB1026KM40	**3954298**	50	986	RP 3/8-19	300	KM40
G60MTTB1226KM40	**3954299**	60	1186	RP 3/8-19	381	KM40
G80MTTB1666KM63	**3954300**	80	1606	RP 3/8-19	480	KM63
G100MTTB2066KM63	**3954301**	100	2003	RP 3/8-19	600	KM63





G-KM-TTB • Inch

catalog number	order number	D	L1	CS	L12	CSWS system size
G32TTB41KM40	**3954294**	2.00	39.44	3/8 - 18 NPT	12.00	KM40
G40TTB51KM40	**3954295**	2.50	49.44	3/8 - 18 NPT	15.00	KM40
G48TTB63KM63	**3954296**	3.00	60.24	3/8 - 18 NPT	18.00	KM63
G64TTB83KM63	**3954297**	4.00	80.13	3/8 - 18 NPT	24.00	KM63

To select the proper cutting head, refer to the current Kennametal Tooling Systems and Lathe Catalogs.

Custom Solutions

For specialized applications that require customized tooling, tap into our Custom Solutions program. From simple specials to modified standards, we can deliver the product you need — when and where you need it.

Kennametal's Custom Solutions Services help to significantly increase your productivity and competitiveness by providing products custom-configured to maximize your specific application. We can help you to shorten operating cycles and reduce the time required for both in-process production tasks and supporting processes.

Our Custom Solutions Team will quickly and efficiently handle your inquiry, providing answers to modification questions in as little as 24 hours.

To learn more, please contact your Kennametal Representative or Authorized Kennametal Distributor.

Custom Solution Example

Steel bar with OAL for machining landing gear component (steel)

Back chamfer tool for Indexable Milling steel parts.

- Circle interpolation.
- CV spindle mount with KM™ Quick-Change arbor.
- External tuner mass.

TTS Indexable Milling Tool for Machining Titanium Aircraft Components.

- Extended reach with flange mount.
- Improved metal removal rate with surface finish.

Fix-Perfect® Indexable Milling Tool for Machining Aluminum Automotive Engine Block.

- TTS extended length arbor (450mm long).
- HSK spindle mount.

Tooling Systems

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