



High-Speed Machining and Balancing

CV Shank

When machining at today's higher speeds, it's crucial to observe sound machining practices. As the rpm increase, unbalance forces increase (unbalance forces are proportional to the spindle speed squared). Unbalanced tools cause vibration and excessive vibration can lead to premature tool and spindle bearing wear.

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Balancing

Kennametal offers a range of 'balanced' and 'balanced-by-design' toolholders, which will extend spindle and tool life and improve process part quality at higher machining speeds.

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Kennametal's Definitions Concerning 'Balancing'

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Standard Toolholder - A toolholder that may contain uncorrected features (unbalanced drive slots, notches, locking screws, etc.). No compensating features have been added to the toolholder to correct balance. Basic low-speed applications are appropriate.

Straight Shank

The majority of Kennametal's toolholder and adapter offerings are either 'balanced-by-design' or 'balanced' as stated in the toolholder sections.

Collets/Sleeves

Accessories

Toolholding Technical Data

Toolholding Systems

Index

Balance-by-Design - Describes a toolholder with compensating features designed into the toolholder to correct any unbalance due to uneven drive slots, notches, locking screws, etc. The balanced toolholder is capable of being used in high-speed applications. Small, residual unbalance may result due to normal manufacturing tolerances within the shank standards.

Balanced - After manufacture, the toolholder has been balanced to a predetermined specification by checking the balance condition with a balancing device. This may be followed by physically removing material from the toolholder such as holes and or slots.

Balanceable - An adjustable mechanism built into the toolholder that can adjust, out/down, any unbalance inaccuracies incurred in normal manufacturing. The fully assembled tool (toolholder and cutting tool) may be balanced as a system using a balancing device.



Kennametal also offers balanceable toolholders. Please contact your Kennametal representative for further details.



Toolholder and Adapter Awareness:

The toolholder and adapter are a crucial component of the complete machining setup, where any problem in this area could ruin a workpiece. Please review the following areas of concern:

Cleanliness

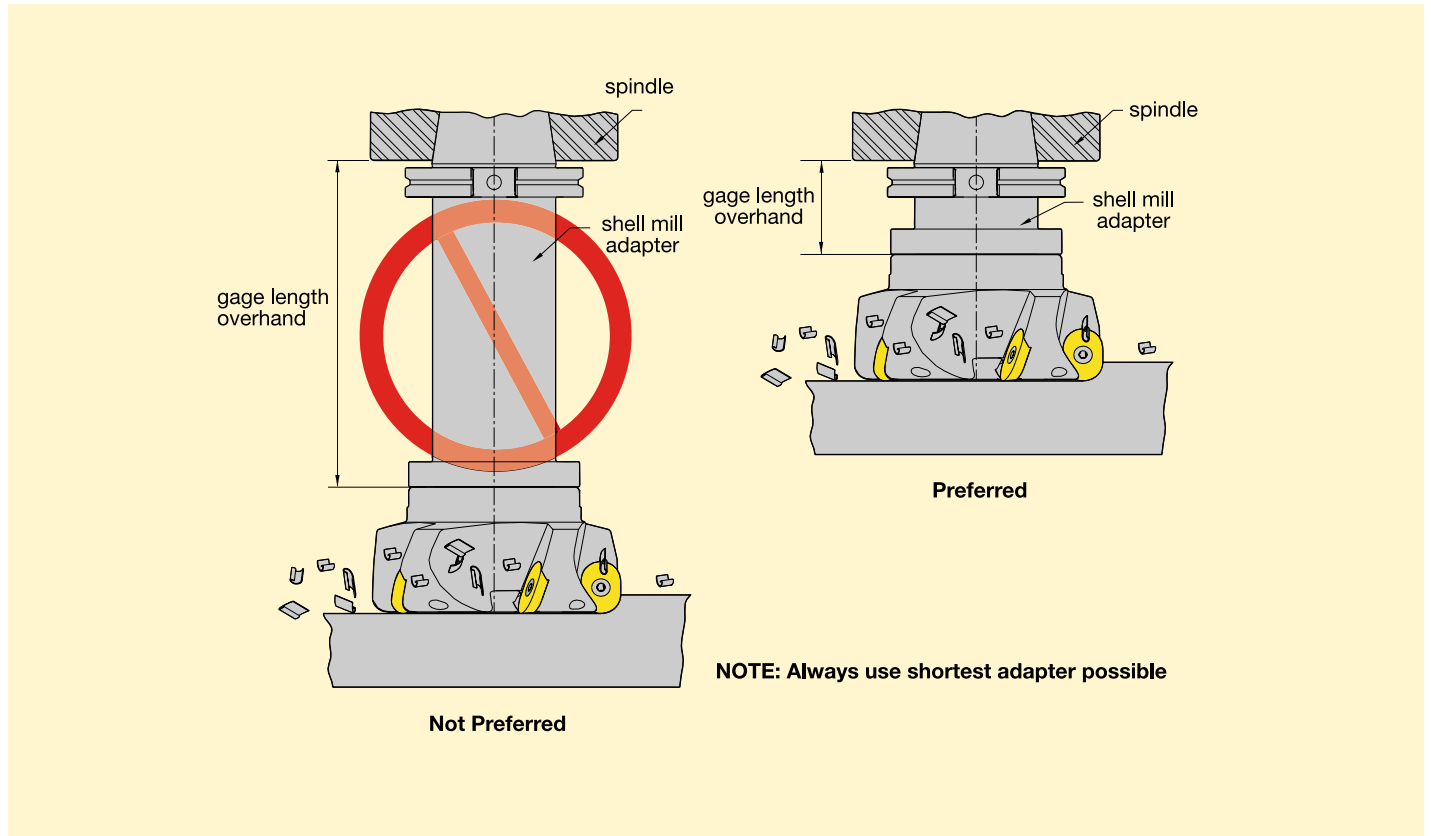
Mounting surfaces of toolholders and adapters must be clean and free of any nicks or gouges that might affect radial and or axial runout.

Storage

Toolholders and adapters should always be stored safely in a dry, clean atmosphere, where the mounting surfaces are protected and not allowed to be damaged by rolling around.

Toolholder and Adapter Length

Always use the shortest possible shell mill, end mill, or collet-style adapter to obtain the best possible rigidity. Deep-pocket milling may require longer adapters, which in turn require lower speed, feed rates, and depth-of-cut to eliminate chatter.



CV Shank

BT Shank

DV Shank

HSK Shank

Straight Shank

Collets/Sleeves

Accessories

Toolholding Technical Data

Toolholding Systems

Index



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End Mill Adapters:

End mill adapters are generally adequate for holding high-speed steel end mills and other cutting tools when operated at relatively low rpms. They are inexpensive and strong.

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End mill adapters use set screws to prevent axial and radial slippage of the cutting tool shank. Set screws push the tool off center (centerline deviation). Normal end mill shank diameter tolerance plus the adapter bore tolerance combine to cause a maximum Total Indicator Reading (T.I.R.) of up to .0013. This runout will be a factor in tool life, workpiece surface finish and balance of the cutting tool. The set screw(s) also push the cutting tool shank against a thin line contact. This creates two large areas where the tool is not being held securely, and may lead the tool into a rocking motion when used in severe operating conditions. See the illustration to the right.

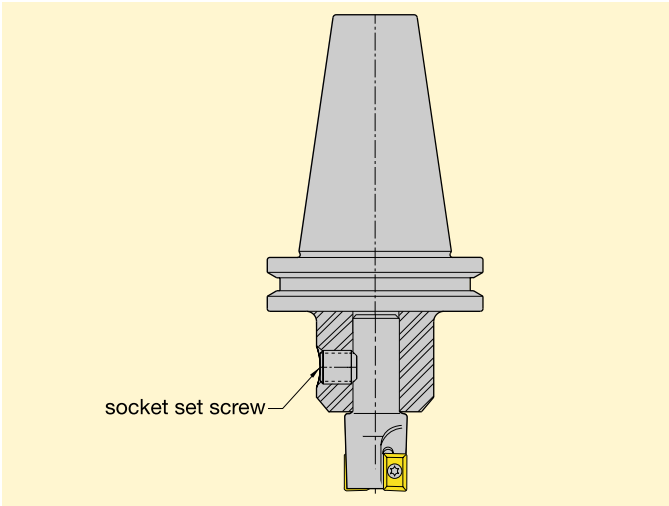
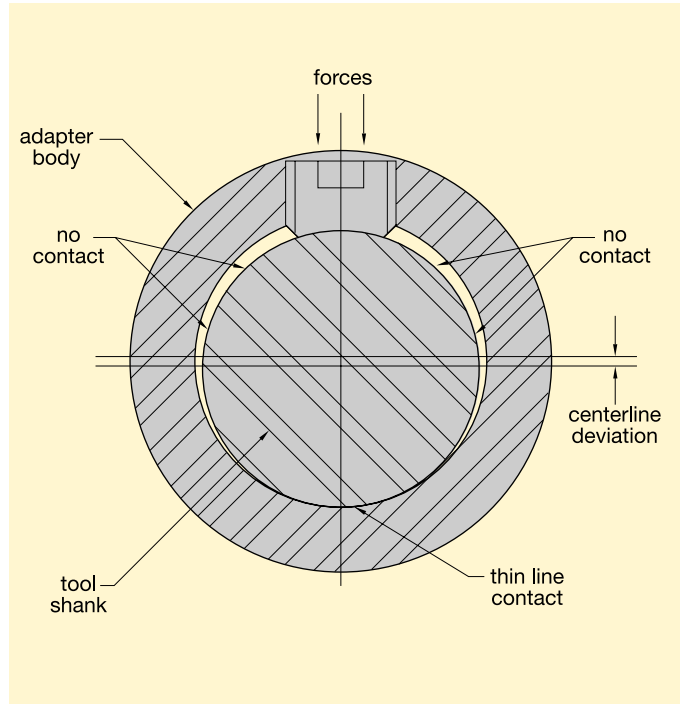
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Straight Shank

Collets/Sleeves

Accessories



Troubleshooting Matrix–End Mill Holder

problem	possible cause	corrective action
<ul style="list-style-type: none"> poor life/balance/workpiece surface finish 	<ul style="list-style-type: none"> Lack of concentricity due to set screw pushing tool off center. Amplified out of balance condition due to high speeds (rpm). 	Change to “TG” non-pullout (TGNP) collet chuck, Powergrip chuck, or Shrink Fit toolholder for better concentricity.
<ul style="list-style-type: none"> chatter/vibration 	<ul style="list-style-type: none"> Set screw pushes the cutting tool shank against a thin line contact, creating two areas where tool is not held securely; may force the tool into a rocking motion in severe conditions. 	

Toolholding Technical Data

Toolholding Systems

Index



Taper Size

Realistic tooling decisions need to be made based on your machine's taper size. When choosing cutting parameters, you need to realize that a machine with a 30 taper spindle will not be able to achieve the same heavy cuts or use as large a cutter as a 50 taper machine.

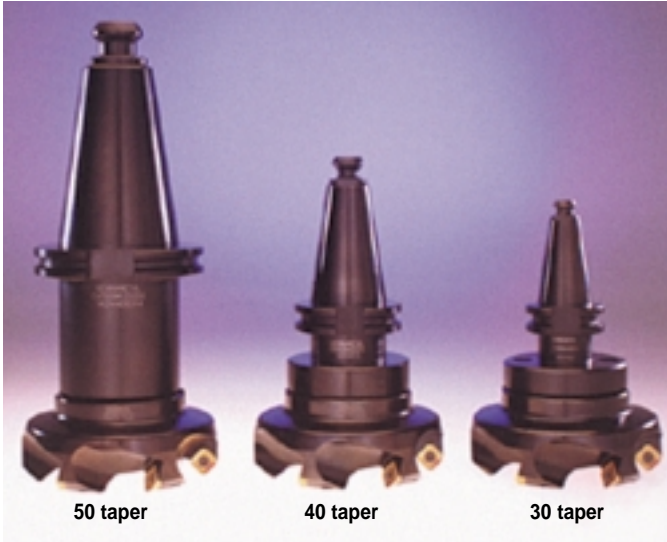
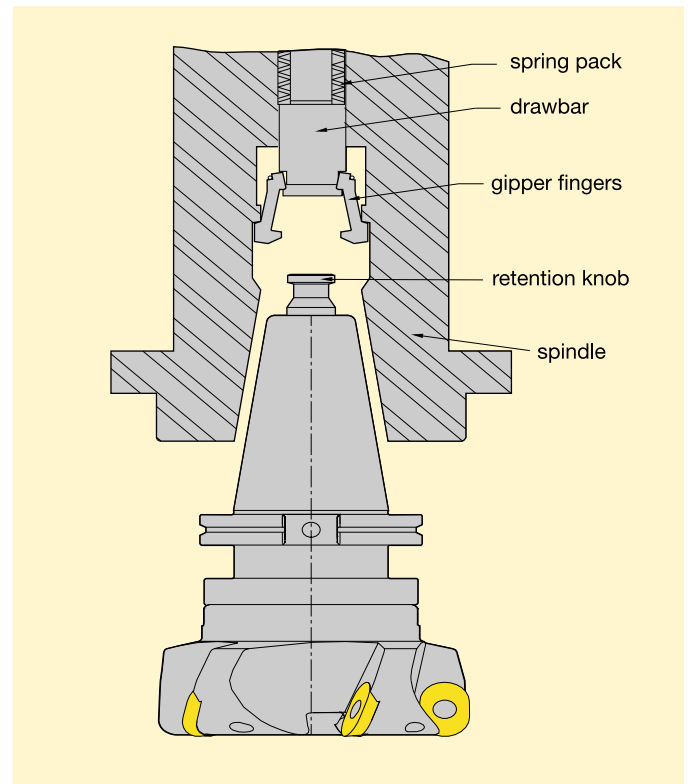


Figure 1, above, shows four-inch diameter cutters mounted to 50, 40, and 30 taper adapters. It's unrealistic to try to achieve the same heavy cut with the 30 taper as you can with a 50 taper.

Pullback System

It should not be automatically assumed that the toolholder is at fault when troubleshooting a problem. The spring pack, drawbar, gripper, and retention knob are major components in the successful operation of a machine tool. Wear or breakage of these parts is a major concern (see below).

- **spring pack:** Can become weak or out of adjustment. This can cause chatter during a milling operation which can cause damage to the adapter taper, spindle taper, cutter, or workpiece.
- **gripper fingers:** If worn, they may not grip the retention knob correctly, allowing movement of the adapter which can cause chatter and damage to the adapter.
- **retention knob:** A worn or incorrect retention knob will not allow proper gripping for pull back on the taper. This can be a very serious safety hazard, allowing movement of the adapter in the spindle. In fact, use of an improper knob may not allow any gripping at all.



CV Shank

BT Shank

DV Shank

HSK Shank

Straight Shank

Collets/Sleeves

Accessories

Toolholding Technical Data

Toolholding Systems

Index