Technical Information

The Correct Spindle Connection and Application Guide ........................................... M2
Shank Tools .................................................................................................................. M3–M6
Spindle Connections ................................................................................................. M8–M19
  KM4X ......................................................................................................................... M9–M11
  KM ............................................................................................................................. M12–M13
  HSK ......................................................................................................................... M14–M15
  7/24 Face Contact ..................................................................................................... M16–M17
  7/24 ISO Taper ......................................................................................................... M18–M19
Clamping Systems .................................................................................................... M20–M35
  KM Introduction ....................................................................................................... M20–M21
  KM Manual ............................................................................................................. M22–M29
  KM-LOC .................................................................................................................. M30–M31
  KM-LOC II ............................................................................................................. M32–M33
  KM Rapid/Rapid Plus ............................................................................................. M34
  KM Automatic ........................................................................................................ M35
KM ATC Configurations ......................................................................................... M36
KM XMZ Configurations ........................................................................................ M37
KM Application Data .............................................................................................. M38–M51
KM Tooling Mounting Dimensions ...................................................................... M52–M61
KM Micro/KM Mini .................................................................................................. M62–M72
  Clamping Systems .................................................................................................. M62–M69
  Mounting Dimensions ............................................................................................ M70–M72
Balancing ................................................................................................................... M74–M77
Shrink Fit ..................................................................................................................... M78–M81
SAFE-LOCK ............................................................................................................. M82
Hydraulic Chucks ..................................................................................................... M84–M87
HPMC System ......................................................................................................... M88–M89
Tunable Tooling System (TTS) ............................................................................. M90–M91
Tunable Milling .......................................................................................................... M92
Tunable Boring Bars ................................................................................................. M93–M95
Screw-On Adapters ................................................................................................. M96
Through-Coolant Shell Mill Adapters ................................................................ M97
Collet Chuck Styles ................................................................................................ M98–M99
Collets ...................................................................................................................... M100–M103
Gripping Strength Comparison Chart .................................................................. M104–M105

www.kennametal.com
The Correct Spindle Connection and Application Guide

The Spindle Connection
Several different types of spindle connection have been developed or optimized over the last few decades. The 7/24 ISO taper became one of the most popular systems in the market. It has been successfully used in many applications, but its accuracy and high-speed limitations prevent it from growing further due to only having one surface of contact around the gage diameter/uppermost cone. The recent combination of face contact with 7/24 solid taper provides higher accuracy in the Z-axis direction, but this also presents some disadvantages, namely the loss in stiffness at higher speeds or high side loads. Most of these tools on the market are solid and the spindles have relatively low clamping force.

In 1985, WIDIA™ (Krupp WIDIA) and Kennametal initiated a joint program to further develop the concept of taper and face contact interface and a universal quick-change system — now known as KM™ and recently standardized as ISO 26622. The KM system has a very strong design, utilizing three surfaces of contact, the flange face, and lower as well as upper ring of contact of the cone. The polygonal taper-face connection, known as PSC, is now also standardized as ISO 26623, and in the early 1990s, the HSK system started being employed on machines in Europe and later became DIN 69893 and later ISO 12164 with two rings of contact. KM4X™ is the next generation of KM targeted at heavy-duty machining due to the combination of high interference and high clamping forces.
### Taper Specifications

#### KM Micro™ and KM™ Mini

<table>
<thead>
<tr>
<th>D</th>
<th>D2</th>
<th>B1</th>
<th>L2</th>
<th>L5</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.0</td>
<td>10.0</td>
<td>4.2</td>
<td>8.7</td>
<td>13.0</td>
</tr>
<tr>
<td>.427</td>
<td>.394</td>
<td>.167</td>
<td>.264</td>
<td>.512</td>
</tr>
<tr>
<td>16.0</td>
<td>10.0</td>
<td>4.2</td>
<td>8.7</td>
<td>13.0</td>
</tr>
<tr>
<td>.630</td>
<td>.394</td>
<td>.167</td>
<td>.264</td>
<td>.512</td>
</tr>
</tbody>
</table>

#### KM™ — ISO 26622-1

<table>
<thead>
<tr>
<th>D</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>L5</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.0</td>
<td>24.0</td>
<td>28.0</td>
<td>36.45</td>
<td>3.5</td>
<td>20.0</td>
<td>8.0</td>
<td>4.9</td>
<td>10.0</td>
<td>9.0</td>
</tr>
<tr>
<td>1.260</td>
<td>.945</td>
<td>1.142</td>
<td>1.435</td>
<td>.0388</td>
<td>.787</td>
<td>1.102</td>
<td>.0934</td>
<td>.394</td>
<td>.354</td>
</tr>
<tr>
<td>40.0</td>
<td>30.0</td>
<td>37.0</td>
<td>44.45</td>
<td>3.5</td>
<td>20.0</td>
<td>11.0</td>
<td>3.89</td>
<td>12.0</td>
<td>10.1</td>
</tr>
<tr>
<td>1.575</td>
<td>1.181</td>
<td>1.457</td>
<td>1.750</td>
<td>.0388</td>
<td>.984</td>
<td>.433</td>
<td>.232</td>
<td>.472</td>
<td>.398</td>
</tr>
</tbody>
</table>

#### KM4X™

<table>
<thead>
<tr>
<th>D</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>L4</th>
<th>L5</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>83.0</td>
<td>48.0</td>
<td>55.0</td>
<td>72.2</td>
<td>7.0</td>
<td>63.0</td>
<td>42.0</td>
<td>6.3</td>
<td>26.0</td>
<td>32.0</td>
<td></td>
</tr>
<tr>
<td>2.480</td>
<td>1.890</td>
<td>2.165</td>
<td>2.843</td>
<td>.276</td>
<td>2.087</td>
<td>1.654</td>
<td>.248</td>
<td>.709</td>
<td>1.024</td>
<td>1.260</td>
</tr>
<tr>
<td>100.0</td>
<td>75.0</td>
<td>92.0</td>
<td>109.7</td>
<td>7.0</td>
<td>85.0</td>
<td>45.0</td>
<td>10.0</td>
<td>20.0</td>
<td>29.0</td>
<td>50.0</td>
</tr>
<tr>
<td>3.937</td>
<td>2.953</td>
<td>3.622</td>
<td>4.319</td>
<td>.276</td>
<td>3.346</td>
<td>1.772</td>
<td>.394</td>
<td>.787</td>
<td>1.142</td>
<td>1.969</td>
</tr>
</tbody>
</table>
### Taper Specifications

**BT — JIS B6339**

<table>
<thead>
<tr>
<th>D1</th>
<th>D6</th>
<th>L1</th>
<th>F3</th>
<th>A</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>31.75</td>
<td>46.20</td>
<td>48.40</td>
<td>22.00</td>
<td>2.00</td>
</tr>
<tr>
<td>35</td>
<td>38.10</td>
<td>53.00</td>
<td>56.50</td>
<td>24.00</td>
<td>2.00</td>
</tr>
<tr>
<td>40</td>
<td>44.45</td>
<td>63.00</td>
<td>65.40</td>
<td>27.00</td>
<td>2.00</td>
</tr>
<tr>
<td>45</td>
<td>51.15</td>
<td>65.00</td>
<td>68.20</td>
<td>30.00</td>
<td>2.00</td>
</tr>
<tr>
<td>50</td>
<td>69.85</td>
<td>100.00</td>
<td>101.80</td>
<td>38.00</td>
<td>3.00</td>
</tr>
</tbody>
</table>

**DV — DIN 69871**

<table>
<thead>
<tr>
<th>D1</th>
<th>D6</th>
<th>D8</th>
<th>L1</th>
<th>L2</th>
<th>F3</th>
<th>A</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>31.75</td>
<td>49.95</td>
<td>46.50</td>
<td>47.85</td>
<td>35.00</td>
<td>19.05</td>
<td>3.20</td>
</tr>
<tr>
<td>40</td>
<td>44.45</td>
<td>63.00</td>
<td>68.25</td>
<td>35.00</td>
<td>19.05</td>
<td>3.20</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>57.15</td>
<td>82.00</td>
<td>82.55</td>
<td>35.00</td>
<td>19.05</td>
<td>3.20</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>69.85</td>
<td>97.45</td>
<td>101.60</td>
<td>35.00</td>
<td>19.05</td>
<td>3.20</td>
<td></td>
</tr>
</tbody>
</table>

**QC — ERICKSON™ Quick Change**

<table>
<thead>
<tr>
<th>D1</th>
<th>D6</th>
<th>D8</th>
<th>L1</th>
<th>F2 min</th>
<th>F3</th>
<th>A</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>31.75</td>
<td>46.03</td>
<td>35.00</td>
<td>68.38</td>
<td>19.81</td>
<td>10.69</td>
<td>3.58</td>
</tr>
<tr>
<td>40</td>
<td>44.45</td>
<td>63.50</td>
<td>50.80</td>
<td>93.73</td>
<td>20.83</td>
<td>9.88</td>
<td>3.58</td>
</tr>
<tr>
<td>50</td>
<td>69.85</td>
<td>86.30</td>
<td>73.66</td>
<td>127.00</td>
<td>30.73</td>
<td>15.03</td>
<td>3.58</td>
</tr>
</tbody>
</table>

**CAT (CV) — ANSI B5.50**

<table>
<thead>
<tr>
<th>D1</th>
<th>D6</th>
<th>D8</th>
<th>L1</th>
<th>F2 min</th>
<th>F3</th>
<th>A</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>31.75</td>
<td>46.02</td>
<td>47.63</td>
<td>35.00</td>
<td>19.05</td>
<td>3.18</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>44.45</td>
<td>63.05</td>
<td>68.25</td>
<td>35.00</td>
<td>19.05</td>
<td>3.18</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>57.15</td>
<td>82.50</td>
<td>82.55</td>
<td>35.00</td>
<td>19.05</td>
<td>3.18</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>69.85</td>
<td>96.41</td>
<td>101.60</td>
<td>35.00</td>
<td>19.05</td>
<td>3.18</td>
<td></td>
</tr>
</tbody>
</table>

**Form B — Flange Coolant Entry Ports**

<table>
<thead>
<tr>
<th>D</th>
<th>F4</th>
<th>s0.004</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>4.00</td>
<td>.157</td>
</tr>
<tr>
<td>40</td>
<td>4.00</td>
<td>.157</td>
</tr>
<tr>
<td>45</td>
<td>5.00</td>
<td>.197</td>
</tr>
<tr>
<td>50</td>
<td>6.00</td>
<td>.236</td>
</tr>
</tbody>
</table>

**R8 — Bridgeport**

<table>
<thead>
<tr>
<th>D1</th>
<th>D2</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>S1</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>.469</td>
<td>1.241</td>
<td>4.000</td>
<td>938</td>
<td>2.750</td>
<td>1.157</td>
</tr>
<tr>
<td>40</td>
<td>.640</td>
<td>1.800</td>
<td>5.500</td>
<td>1711</td>
<td>3.000</td>
<td>.750</td>
</tr>
</tbody>
</table>

---

**QC — ERICKSON™ Quick Change**

<table>
<thead>
<tr>
<th>D1</th>
<th>D6</th>
<th>D8</th>
<th>L1</th>
<th>F2 min</th>
<th>F3</th>
<th>A</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>31.75</td>
<td>46.03</td>
<td>35.00</td>
<td>68.38</td>
<td>19.81</td>
<td>10.69</td>
<td>3.58</td>
</tr>
<tr>
<td>40</td>
<td>44.45</td>
<td>63.50</td>
<td>50.80</td>
<td>93.73</td>
<td>20.83</td>
<td>9.88</td>
<td>3.58</td>
</tr>
<tr>
<td>50</td>
<td>69.85</td>
<td>86.30</td>
<td>73.66</td>
<td>127.00</td>
<td>30.73</td>
<td>15.03</td>
<td>3.58</td>
</tr>
</tbody>
</table>

---

**R8 — Bridgeport**

<table>
<thead>
<tr>
<th>D1</th>
<th>D2</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>S1</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>.469</td>
<td>1.241</td>
<td>4.000</td>
<td>938</td>
<td>2.750</td>
<td>1.157</td>
</tr>
<tr>
<td>40</td>
<td>.640</td>
<td>1.800</td>
<td>5.500</td>
<td>1711</td>
<td>3.000</td>
<td>.750</td>
</tr>
</tbody>
</table>
## Shank Specifications

### VDI — DIN 69880

<table>
<thead>
<tr>
<th></th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>H2</th>
<th>R1</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>30.00</td>
<td>14.00</td>
<td>68.00</td>
<td>55.00</td>
<td>28.70</td>
<td>40.00</td>
<td>2.00</td>
<td>7.00</td>
<td>20.00</td>
<td>27.00</td>
<td>25.00</td>
</tr>
<tr>
<td></td>
<td>1.181</td>
<td>0.551</td>
<td>2.677</td>
<td>2.165</td>
<td>1.169</td>
<td>1.575</td>
<td>0.079</td>
<td>0.276</td>
<td>0.787</td>
<td>1.063</td>
<td>0.984</td>
</tr>
<tr>
<td>40</td>
<td>40.00</td>
<td>14.00</td>
<td>83.00</td>
<td>63.00</td>
<td>29.70</td>
<td>40.00</td>
<td>3.00</td>
<td>7.00</td>
<td>20.00</td>
<td>36.00</td>
<td>32.00</td>
</tr>
<tr>
<td></td>
<td>1.575</td>
<td>0.551</td>
<td>3.268</td>
<td>2.480</td>
<td>3.169</td>
<td>1.575</td>
<td>0.118</td>
<td>0.276</td>
<td>0.787</td>
<td>1.417</td>
<td>1.260</td>
</tr>
<tr>
<td>50</td>
<td>50.00</td>
<td>16.00</td>
<td>98.00</td>
<td>78.00</td>
<td>35.70</td>
<td>48.00</td>
<td>3.00</td>
<td>8.00</td>
<td>24.00</td>
<td>45.00</td>
<td>37.00</td>
</tr>
<tr>
<td></td>
<td>1.969</td>
<td>0.630</td>
<td>3.858</td>
<td>3.071</td>
<td>0.406</td>
<td>1.890</td>
<td>0.118</td>
<td>0.315</td>
<td>0.945</td>
<td>1.772</td>
<td>1.457</td>
</tr>
<tr>
<td>60</td>
<td>60.00</td>
<td>16.00</td>
<td>123.00</td>
<td>94.00</td>
<td>43.70</td>
<td>56.00</td>
<td>4.00</td>
<td>10.00</td>
<td>28.00</td>
<td>55.00</td>
<td>48.00</td>
</tr>
<tr>
<td></td>
<td>2.362</td>
<td>0.630</td>
<td>4.843</td>
<td>3.701</td>
<td>1.720</td>
<td>2.205</td>
<td>0.157</td>
<td>0.394</td>
<td>1.102</td>
<td>2.165</td>
<td>1.890</td>
</tr>
</tbody>
</table>
KM4X™

The Latest Innovation in Spindle Interface Technology!

Dramatically increase your metal removal rates when machining high-temperature alloys!

- Run jobs at significantly faster feeds and speeds than is achievable with other spindle interfaces.
- Unique use of clamping force and interference level increases clamping capability 2 to 3 times.
- You experience lower cost of ownership, increased throughput, and superior results.

Visit www.kennametal.com or contact your local Authorized Kennametal Distributor.

www.kennametal.com
The Importance of a Strong Connection

Many component materials are switching to lighter, high-strength materials, like titanium, to increase fuel efficiency. To save time and money, machinists are challenged to maximize metal removal rates at low cutting speeds and considerably higher cutting forces. Machine tool builders must also provide greater stiffness and damping in their spindles to minimize undesirable vibrations that deteriorate tool life and part quality.

Though these advances contribute to greater productivity, the weakest point is often the spindle connection itself, which needs high torque and must overcome high-bending applications.

Our response to this traditionally weak point has been the proven KM™ system, and now we are introducing the next generation KM4X™. The combination of the KM4X’s high clamping force and interference level lead to a robust connection and extremely high stiffness and bending load capacity for unmatched performance in titanium machining.

Current Spindle Connections

To fulfill the increasing demand for high productivity, an important element to consider is the tool/spindle connection. This interface must be able to withstand high loads and maintain rigidity throughout the machining process. In most cases, the connection determines how much material can be removed on a given operation until high tool deflection or chatter result.

High-performance machining is accomplished using high feeds and depths of cut. Because of advances in cutting tools, there is a need for spindle connections that utilize available power.

Several different types of spindle connections were developed and/or optimized over the last few decades. Due to its strong cost/benefit position, the 7/24 ISO taper became one of the most popular systems on the market. It has been successfully used in many applications, but its accuracy and high-speed limitations prevent it from becoming a more advanced and productive system.

The advent of face contact represented a major step over the standard 7/24 taper. Combining face contact with a 7/24 solid taper provides higher accuracy. However, this also presents some disadvantages. Loss of stiffness at higher speeds or high side loads are some of the major flaws apparent in this system. Most of these tools are solid, and the spindles have relatively low clamping force.

Choosing What’s Right

With more materials that are tougher to machine and require considerably higher cutting forces from the machine tool, choosing the spindle interface wisely to maximize cutting edge performance is key to success.

The KM spindle connections greatly outperform the conventional 7/24 steep taper and its face taper contact derivatives HSK and PSC systems. KM4X is the best large, heavy-duty spindle connection for rigidity because it has superb balance between bending and torsion capabilities from the machine tool.
**KM4X™ — The Next Generation Spindle Connection System**

As a global tooling supplier and a true customer support partner, we recognize the need to offer tooling products for all spindle interfaces and make available solutions to provide the best cutting edges to gain maximum productivity at the spindle system connection.

KM4X is the latest version of the KM™ spindle interface targeted at heavy-duty machining operations and is a top choice for machining large, structural tough-to-machine materials like titanium for the aerospace industry.

**The Latest Innovation in Spindle Interface Technology**

- KM4X offers the most rigid connection able to withstand extremely high bending due to a combination of high interference and high clamping forces.
- KM4X provides 3x more bending capacity than comparable face contact systems.
- KM is the only connection that maintains stiffness at elevated rotational speeds and is suitable for a range of applications from low speeds with high torque to very high spindle speeds with low torque.
- KM4X maintains a better balance between bending and torsion capabilities.
- The ability to retrofit KM4X to an existing machine tool offers the added advantage of increasing throughput.
- Heavy-duty, rigid configuration with evenly distributed clamping force.
- Simple design enables front-loaded spindle configuration.
- Balanced-by-design for high spindle speed capacity.

KM4X three-surface contact for improved stability and accuracy. Optimized clamping force distribution and interference fit provides higher stiffness.
Why Bending Load Capacity Is Important

When machining tough materials like titanium, cutting speeds are relatively low due to thermal effects on cutting tools. Over the years, machine tool builders responded to this issue by improving stiffness and damping on spindles and machine structures. Spindles have been designed with abundant torque at low rotational speeds. Nevertheless, the spindle connection has remained the weak link in the system.

The spindle connection must provide torque and bending load capacity compatible with the machine tool specifications and the requirements for higher productivity. It becomes obvious that in end-milling applications where the projection lengths are typically greater, the limiting factor is the bending load capacity of the spindle interface.

The lines on the chart to the right represent the load capacity of HSK, PSC, and KM4X. The shaded areas represent the typical requirements for heavy-duty applications in various machining processes. KM4X is the only system that can deliver the torque and bending capacity required for achieving high-performance machining. Some systems may be able to transmit a considerable amount of torque, but the cutting forces also generate bending moments that exceed the interface's limits before torque limits are exceeded.

IMPORTANT
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20-30% should be applied to the loads shown in charts.

Chart shows load-deflection comparison of steep taper with and without face contact — HSK and KM4X.
The KM4X system is the best large, heavy-duty connection. A weak connection can fail to deliver the desired cutting edge performance.

KM4X superior rigidity equals maximum productivity.

**Important**

Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.
The KM Coupling

The KM Quick Change Clamping System is the first step in achieving maximum machine output. Please refer to the Kennametal Machine Utilization Strategy for more information on how we can help you increase your machine throughput. The KM joint achieves rigidity and stiffness by combining unique design elements in both the shank of the tool and the clamping mechanism. The KM joint was developed as a system and takes full advantage of both the tool shank and the mechanism to obtain maximum benefits from the space utilized.

Rigidity

All KM tooling is designed around a short 10:1 tapered shank. Extensive testing of many different lengths, angles, and interference levels provided the optimum combination of dimensions with regard to maximum stiffness. The taper is self-centering, promoting easy tool loading in both manual and automatic applications.

The three-zone contact and the ball track clamping mechanism produces a coupling that closely approaches the ultimate rigidity of a solid piece.

Face and Taper Contact

KM tooling is designed to have simultaneous taper and face contact. Previous efforts to achieve this were concentrated on steep taper applications. However, due to the relatively large angle of the taper, extremely tight tolerances are required on the gage diameters of both the tool and receptacle. The KM taper was designed to avoid these tight tolerances by selecting shallower taper angles that enable elastic deformation of both the taper shank and receptacle during clamping. It also permits larger interference levels* to be used while still achieving taper and face contact during clamping. These interference levels, when combined with the proper clamping force, provide superior static and dynamic stiffness. The system’s interference capability enables the use of lower tolerance levels for gage diameters.

The taper and face contact feature provides a radial and axial repeatability of ±2.5 μm (±.0001") for a specific cutting unit in a specific clamping unit. When more than one unit is utilized, the manufacturing and component tolerances of each must be considered. Pre-gaging cutting units before they are used enables the deviations of each tool tip location to be recorded. These deviations can be compensated for by the machine tool control offsets. Checking for deviations prior to use means the first part manufactured will be a good part.

Clamping Mechanism

The KM clamping mechanism is housed inside of the taper shank, which contains two angled holes that function as ball tracks. A cylindrical ball canister fits inside of the taper shank, where wedge shaped forms on a central lock rod force two hardened steel balls outward. The steel balls interact with the angled holes in the tapered shank to produce clamping force. The combination of the angle in the taper shank, the angle of the canister holes, and the lock rod angle produce a measured mechanical advantage that varies between 3.5:1–7:1. The standard manual side activation mechanism has a mechanical advantage of 3.5:1 and fits into the system size diameter.

Locking Sequence

The clamping sequence starts by inserting the cutting unit into the female taper of the clamping unit. The cutting unit first makes contact at a standoff from the face of approximately 0.25mm (.010"). The cutting unit advances until the gage face makes contact with the clamping unit face, where a small amount of elastic deformation takes place at the front of the female taper as locking force is applied. The final amount of torque applied enables the tail of the cutting unit to clamp securely between the steel balls and the clamping unit inside diameter.
Sealed Coolant

Sealed through-the-tool coolant is offered on all standard KM tooling and clamping units. The coolant is sealed using O-rings in both the cutting units and clamping units. This feature ensures that coolant is directed as close as possible to the cutting edge while preventing contaminants from entering the clamping mechanism. Standard Viton® O-rings are utilized on KM.

Fail-Safe Tool Orientation

A unique feature of KM clamping is the ability to ensure that the KM cutting unit can only be installed in one orientation. The direction of this orientation feature can be changed within the clamping unit. To allow greater flexibility, standard KM clamping units are shipped without this feature installed. For more details on this feature, refer to the KM operating instructions section.

Metric Slotted Pins:
- KM32TS — 2.5mm x 4mm Long
- KM40TS — 3mm x 6mm Long
- KM50TS — 4mm x 8mm Long
- KM63TS — 5mm x 10mm Long
- KM80TS — 5mm x 10mm Long
- KM63XMZ — 5mm x 10mm Long
- KM80ATC — 5mm x 10mm Long

Accuracy and Repeatability

Accuracy and repeatability of the coupling are shown in the table below. Accuracy is measured over a gage insert in different cutting units changed in and out of a clamping unit. Accuracy will decrease with inserts of varying tolerances and nose radii. Station-to-station accuracy on a turret requires that all clamping units be set in the same position on the machine tool mechanically or that variations are recorded as offsets in the machine control. Repeatability is measured over the nose radius of a cutting unit through many cycles of changing the cutting unit in and out of a clamping unit.

<table>
<thead>
<tr>
<th></th>
<th>accuracy</th>
<th>repeatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>axial</td>
<td>0.03mm (+/- .001&quot;)</td>
<td>0.0025mm (+/- .0001&quot;)</td>
</tr>
<tr>
<td>radial</td>
<td>0.03mm (+/- .001&quot;)</td>
<td>0.0025mm (+/- .0001&quot;)</td>
</tr>
<tr>
<td>cutting edge height</td>
<td>0.4mm (+/- .016&quot;)</td>
<td>0.025mm (+/- .001&quot;)</td>
</tr>
</tbody>
</table>

Summary

KM coupling offers a very rigid joint with a high degree of repeatability while maintaining a compact envelope. This permits a high degree of versatility without sacrificing cutting performance.
HSK Quick-Reference Identification

HSK hollow-stub taper shanks are a widely used DIN standard for machine tools. HSK tools have a simultaneous 1:10 taper, which generates two surface contact areas: face and taper. Compared with traditional steep-taper shanks, HSK shanks are shorter, hollow, and clamp from the inside. They also incorporate drive keys that engage milled key-slots in machine spindles and offer higher static and dynamic stiffness than standard steep taper tooling.

HSK tooling includes seven toolholder shank forms: A, B, C, D, E, F, and T. Various machine-spindle receivers are available for each. However, the choice of form depends on application requirements such as torque and spindle speed.

Form A
Form A for automatic tool change is the most common shank, typically used on new machining centers and for general service. Form A has a drive slot in the small end of the tapered shank and features coolant through the center, using a coolant tube thread mount inside the shank cavity. In many applications, wrench access holes are provided through the taper as an option for manual clamping and automatic tool change shanks. Form A shanks have mounting holes for an electronic chip.

There are eight different sizes of form A ranging from 32–160mm (1.260–6.299") flange diameter.

Form B
Form B is also for automatic tool change. It is similar in appearance to form A but dimensionally different. Form B provides greater flange support for heavy machining, even though its taper shank size is smaller than form A. This style of shanks have drive slots in the flange and drive keys in the taper. Coolant for form B is fed through ports in the flange. Mounting holes for an electronic chip are also a feature of form B.

For form B there are seven different shank sizes from 40–160mm (1.575–6.299") flange diameter.

Forms C and D
Forms C and D for manual tool change are variations of forms A and B, but the gripper groove and chip holes are eliminated. These two forms always have their access holes through the taper for manual clamping. These manual forms are typically used on transfer lines and non-rotating applications for NC lathes.

There are six different shank sizes for form C ranging from 32–100mm (1.260–3.937") flange diameter. Form D has five different shank sizes from 40–100mm (1.575–3.937") flange diameter.
Forms E and F
Forms E and F with automatic tool change are also variations of forms A and B. These forms are intended for high-speed machining. Design features, such as drive slots, the orientation notch, and chip holes, have been removed to help eliminate imbalance. As a result, these forms are driven by the locking taper and are suitable only for light machining applications such as high-speed metalcutting and woodworking machines.

Form E offers five different shank sizes ranging from 25–63mm (.984–2.480") flange diameter. There are three shank sizes for form F from 50–80mm (1.969–3.150") diameter on the flange.

Form T
Form T shanks are similar to form A, but with tighter key ways for turning. This gives form T improved repeatability over form A. These shanks have new centerline technology for variance and high productivity. They are also available in a wide range of standard toolholders.
7/24 Taper Face Contact V-Flange — Tooling to Fit the BIG-PLUS™ Spindle

The 7/24 Taper Face Contact Spindle Interface, is being found on machining centers and multitasking machines. The basic principle of this system takes the standard 7/24 steep-taper tool and adds material to the back face of the toolholder flange as well as to the front face of the spindle. This is controlled so that the two parts have both face and taper contact when locked into position. The distinctive features of the system are the lead-in chamfers on the drive slots and ground back V-flange. The surface contact creates a system with higher static and dynamic stiffness compared to a regular 7/24 taper and increased axial and radial accuracy.

Technology

With the Taper Face System, toolholders are axially supported on the taper and flange face, which brings about higher rigidity and precision than a conventional 7/24 toolholder. The system utilizes elastic deformation of the machine spindle to achieve simultaneous fitting of both the taper and flange face. Although the tapers are fit prior to clamping the mechanism, the faces are not yet secured because of a small amount of clearance between them. When the toolholder is pulled in by the drawbar mechanism, the machine spindle expands by elastic deformation and the faces are fit, completing the simultaneous fit between both taper and face. This synchronized fit prevents additional axial displacement of the taper providing high accuracy and superior surface finish in operations such as face milling, compared to the industry standard 7/24 V-flange.

Offering

Kennametal supports both the CAT (CV) ANSI B5.50 and BT JIS B6339 versions in 40 and 50 taper sizes:
- Two surface contact.
- Higher static and dynamic stiffness.
- Higher axial and radial accuracy.
- Rigid system.

- CVKV40
- CVKV50
- BTKV40
- BTKV50

Capable of being utilized in a variety of machining applications ranging from low-speed, heavy milling applications to high speeds greater than 20,000 RPM. The systems accuracy, repeatability, and stability should be equal or greater to the performance of current equivalent Taper Face tooling on the market in all applications.
Clamping Mechanism

In some cases, standard 7/24 steep-taper tooling can be used in a face contact 7/24 taper spindle. However, the combination does not offer the same stability or advantages of face contact. As a caution, some spindles have a safety switch that shuts the spindle down if face contact is not achieved. In these cases, tools will need taper face contact for the spindle to operate.

Similar to all interfaces with face contact, special care should be taken regarding the cleanliness of the mating faces as high contact pressures are present. Adequate filtration systems for coolant must be used.

Locking Principle

- **toolholder being loaded**
- **just before clamping**
- **totally clamped**

- taper contact and face clearance 0.020mm (.0008")
- locked taper and face contact
Taper Size
Taper size should be chosen with realistic considerations. When selecting cutting parameters, keep in mind that a machine with a 30 taper spindle will not achieve the same heavy cuts or use cutters as large those on a 50 taper machine.

Pull-Back System
When troubleshooting a problem, assume that the toolholder is at fault is not the correct course of action. The spring pack, drawbar, gripper, and retention knob are major components for the successful operation of a machine tool because wear or breakage of these parts is a major concern.

- **Spring pack** — Can become weak or out of adjustment. This can cause chatter during a milling operation, which causes damage to the adapter taper, spindle taper, cutter, or workpiece.

- **Gripper fingers** — If worn, they may not grip the retention knob correctly, enabling the adapter to move, resulting in chatter and damage to the adapter.

- **Retention knob** — A worn or incorrect retention knob will not enable proper gripping for pull back on the taper. This is a very serious safety hazard due to the movement of the adapter. Using an improper knob may result in a lack of any detectable gripping force.

Form B Coolant
Spindles are now running at higher rates — quickly burning seals, making it difficult to seal coolant as it passes through the drawbar. One option is to direct the coolant around the spindle bearings and enter through the spindle face and toolholder flange.
Kennametal™ toolholders are positioned in the AD coolant form with self-sealing, nylon-coated screws. The coolant screws are designed to completely seal the tool and prevent coolant leakage under pressures up to 1500 psi. However, if form B coolant is desired, the coolant stop screws must be backed out into the form B position.

Form B toolholders can be converted back through the drawbar form AD by simply threading the coolant stop screw and stopping below the flange coolant entry hole. Changing coolant form can be achieved many times before it is necessary to replace the coolant stop screw. All form B capable tooling is supplied with a label designating the required screw components for each steep taper size and information necessary for selecting a wrench to adjust the coolant stop screws.

**IMPORTANT**

When choosing a desired coolant form, the correct retention knob should be used in conjunction with the coolant form applied.
Manual Clamping System

Characteristics

- KM Manual Quick Change tooling is the most economical way to reduce downtime for setup and tool change and is an important first step toward further automation. The machine tool builder or the customer can easily install KM Manual Quick Change tooling.
- All KM manual clamping units require approximately three turns of the activation screw and a specified amount of torque to lock the cutting tool.
- The KM Manual Quick Change clamping mechanism is rigid and compact, with an easily accessible activation screw. The high mechanical advantage of the ball track makes it simple to apply the required locking force.
- All KM Manual Quick Change clamping units accept external and internal cutting tools. Right- or left-hand tooling can be used interchangeably, and cutting tools can be inverted if required. KM Manual Quick Change clamping units support through-the-tool coolant.

KM-LOC™ Clamping System

KM-LOC is an evolutionary step from the conventional KM manual clamping system, the KM-LOC device employs a cam and a pre-loaded disk spring pack to provide positive, stop-to-stop locking and unlocking in only 140° of movement. The spring pack supplies the correct clamping force while the cam permits quick and easy clamping/unclocking in less than one turn, and without using a torque wrench. The KM-LOC clamping device is compact to adapt to a wide variety of machine tool mounting configurations, including flange mounts, square, round, and VDI shanks. The new KM-LOC clamping device offers all the features and benefits of our industry-proven modular KM Quick Change Tooling System and reduces the time required for manual tool changes.

KM-LOC II™ Clamping System

The KM-LOC II clamping device is the latest addition to the Kennametal KM modular quick-change tooling family. An evolutionary step from the conventional KM manual clamping system, the KM-LOC II employs a cam and a preloaded disc spring pack to provide positive, stop-to-stop locking and unlocking in only 145° of movement. The spring pack supplies the correct clamping force without using a torque wrench, while the cam permits quick and easy clamping/unclocking in less than one half of a turn. The KM-LOC II clamping device is compact to adapt to a wide variety of machine tool mounting configurations including flange mounts, square, round, and VDI shanks. The KM-LOC II is capable of handling through-the-tool coolant pressure of 100 bar (1500 psi), and the design permits lubrication of internal components without disassembly. The design also enables the external installation of an orientation screw that restricts the cutting tool to a single orientation.

The latest KM-LOC II clamping device offers all of the features and benefits of our industry-proven modular KM Quick Change Tooling System and reduces the time required for manual tool changes.
Rapid Clamping System

Characteristics
KM Rapid is a compact quick-change clamping system providing outstanding repeatability while, at the same time, allowing fast manual locking and unlocking. KM cutting units are locked and unlocked with only a 115° turn of the actuation cam with no torque wrench required for clamping and unclamping. A stop pin limits the angle of rotation, and actuation is available from the side only.

The KM Rapid, with internal through-the-tool coolant capabilities, is best used in stationary applications on turning centers in high-volume production.

KM Rapid permits the external installation of an orientation screw to restrict the clamping unit to accept the cutting unit in only one orientation.

Rapid Plus Clamping System

Characteristics
The KM Rapid Plus clamping system provides approximately 20% more locating face force versus the KM Rapid. It is designed for retrofitting in dedicated applications enabling cutting units to be locked and unlocked with only a 180° turn of the actuation cam. Actuation is available from the top only.

The Rapid Plus cartridge design allows use in smaller but slightly longer receivers, such as Mullifix™ and Parat™ adapters.

Automatic Clamping System • Spring-Pack Activated

Characteristics
Automatic KM clamping systems enable tools to be locked or unlocked with the push of a button by the machine operator or changed automatically by the machine tool. These units also allow tools to be changed quickly and provide a high level of automation at a moderate cost.

Operation
The pull on the lock rod for the automatic KM clamping unit is provided by disc springs that are an integral part of the clamping unit. Release is accomplished by pushing on the back of the clamping unit with a hydraulic cylinder mounted on the turret assembly. Many machine tool builders design and build the turrets for their machines to be equipped with the KM Automatic Clamping Units.
KM Manual Clamping System

KM Manual Clamping Units

KM Manual clamping units require a torque wrench to operate. Using the proper torque wrench value is critical. Tighter is not better because over tightening can cause damage.

The specific operating torque of the KM manual clamping units is listed on each unit.

The KM connection must be kept clean and free from nicks and burrs. KM plugs are available to ensure cleanliness when a cutting unit is not engaged in the clamping unit.

KM Manual Clamping System • Single-Pin Design

When a KM head is unlocked, the head will bump-off. KM’s 10:1 taper is self-locking, and therefore, requires a mechanical release. This is accomplished within the design of the KM System and does not require operator intervention.

After the head has been released, you will need to turn the torque screw another 3/4–1-1/2 turns. This rotation will feel free of resistance. When the free turning motion stops, the head can be pulled from the clamping unit. Do not turn the torque screw further, as damage can occur to the lockrod and/or bump-off pin.

KM Manual Clamping Components • Functional Definitions

1. Clamping Unit Body
   - Primary component of the clamping unit assembly, less additional hardware.

2. Canister Pin
   - Secures ball canister to clamping unit body.

3. Pin Canister
   - Main component of KM clamping mechanism holds and locates the locking balls and bump-off pin.

4. Torque Screw
   - Rotation moves the lockrod:
     a. Clockwise rotation advances lockrod, securing cutting unit (not shown).
     b. Counterclockwise rotation retracts lockrod, releasing cutting unit (not shown).

5. Lockrod
   - Dual function:
     a. Acts as a wedge when advanced between locking balls, causing them to move outward in the ball canister and pushing the locking balls into the ball tracks of the cutting unit (not shown).
     b. Acts as a wedge when retracted using a raised, tapered key to force the bump-off pin against the cutting unit (not shown).

6. Locking Balls (2)
   - Precision, chrome alloy-steel hardened balls used to transmit pull-back force to the cutting unit.

7. Bump-Off Pin
   - Dual function:
     a. Releases cutting unit from the clamping mechanism.
     b. Prevents lockrod from rotating.

8. Bump-Off Pin Retention Screws (2)
   - Secures bump-off pin in ball canister.
KM™ Manual Clamping System • Functional Definitions

1. Clamping Unit Body
   • Primary component of the clamping unit assembly, less additional hardware.

2. Canister Screw
   • Secures screw canister to clamping unit body.

3. Screw Canister
   • Main component of KM clamping mechanism holds and locates the locking balls and bump-off pin.

4. Canister Pins (4)
   • Prevents canister from rotating.

5. Torque Screw
   • Rotation moves the lockrod:
     a. Clockwise rotation advances lockrod, securing cutting unit (not shown).
     b. Counterclockwise rotation retracts lockrod, releasing cutting unit (not shown).

6. Lockrod
   • Dual function:
     a. Acts as a wedge when advanced between locking balls, causing them to move outward in the ball canister and pushing the locking balls into the ball tracks of the cutting unit (not shown).
     b. Acts as a wedge when retracted using a raised, tapered key to force the bump-off pin against the cutting unit (not shown).

7. Locking Balls (2)
   • Precision, chrome alloy-steel hardened balls used to transmit pull-back force to the cutting unit.

8. Bump-Off Pin
   • Dual function:
     a. Releases cutting unit from the clamping mechanism.
     b. Prevents lockrod from rotating.

9. Bump-Off Pin Retention Screws (2)
   • Secures bump-off pin in ball canister.
KM Manual Clamping Operating Instructions (KM32–KM80)

Locking
Before inserting the KM cutting unit into the clamping mechanism (Figure 1), clean the contact face and taper.

KM Manual clamping units require a torque wrench for proper operation. Turning the torque screw clockwise locks the cutting unit in position. For maximum safety, tighten the torque screw to the specified torque. Using a torque wrench ensures that the proper clamping forces are exerted.

Operating Position
With the balls locked in position, and the face and self-locking taper fully engaged, the cutting unit and clamping unit are rigidly secured together (Figure 2).

Unlocking
Rotate the torque screw counterclockwise until initial resistance is felt. In this position, the locking balls are free of the cutting unit, but the taper interference is still holding the KM unit in the clamping unit. At this point, the bump-off pin is in position to free the cutting unit from the interference fit.

Continue to rotate the torque screw slowly until the cutting unit is no longer making face contact (Figure 3) and is released from the taper. The torque screw will stop rotating and more resistance will be felt. Do not turn the torque screw any further.

CAUTION
Continuing to rotate the torque screw may damage the clamping components.

KM Manual Clamping System • Operating Torque

<table>
<thead>
<tr>
<th>KM size</th>
<th>torque (ft. lbs.)</th>
<th>torque (Nm)</th>
<th>actuation drive size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>7–9</td>
<td>10–12</td>
<td>5mm</td>
</tr>
<tr>
<td>KM40</td>
<td>9–12</td>
<td>12–16</td>
<td>6mm</td>
</tr>
<tr>
<td>KM50</td>
<td>20–25</td>
<td>27–34</td>
<td>10mm</td>
</tr>
<tr>
<td>KM50</td>
<td>20–25</td>
<td>27–34</td>
<td>10mm</td>
</tr>
<tr>
<td>KM63</td>
<td>35–40</td>
<td>47–54</td>
<td>12mm</td>
</tr>
<tr>
<td>KM80</td>
<td>58–63</td>
<td>79–85</td>
<td>14mm</td>
</tr>
</tbody>
</table>

CAUTION
Over tightening can cause damage to the clamping mechanism.
KM Manual Repair Package Components (KM32–KM80)

KM Manual Repair Package Components • Functional Definitions
1. Torque Screw
2. Lockrod
3. Locking Balls (2x)
4. Bump-Off Pin
5. O-Ring
6. Bump-Off Pin Retention Screws (2x)

Operator Maintenance:
All KM Clamping Units showing damage must be replaced or rebuilt. Burrs and nicks should be removed by stoning and/or polishing.
• Use KM Plugs to protect clamping units when not in use.
• Use KM spindle wipers to clean clamping units.

KM Manual Repair Packages

<table>
<thead>
<tr>
<th>KM Manual Repair Packages</th>
<th>catalog number</th>
<th>3S order number</th>
<th>3L order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32-PKG, 3S or 3L</td>
<td>1023697</td>
<td>1023698</td>
<td></td>
</tr>
<tr>
<td>KM40-PKG, 3S or 3L</td>
<td>1023699</td>
<td>1023700</td>
<td></td>
</tr>
<tr>
<td>KM50-PKG, 3S or 3L</td>
<td>1023728</td>
<td>1023725</td>
<td></td>
</tr>
<tr>
<td>KM63-PKG, 3S or 3L</td>
<td>1013701</td>
<td>1013702</td>
<td></td>
</tr>
<tr>
<td>KM80-PKG, 3S or 3L</td>
<td>1144980</td>
<td>1023701</td>
<td></td>
</tr>
</tbody>
</table>
KM™ Manual Clamping Unit • Disassembly Procedures

1. Remove the two socket-head cap screws that retain the bump-off pin (see Frame 1).

2. Grip the exposed end of the bump-off pin with pliers and pull straight out. Some resistance may be felt due to the O-ring seal around the bump-off pin (see Frame 2).

3. Using the appropriate metric hex wrench, remove the torque screw. The lockrod should come out with the torque screw. Separate the torque screw from the lockrod, remembering the lockrod has left-hand threads (see Frame 3 on next page).

4. Remove the locking balls from within the canister. Grease can cause them to stick inside. Pushing the balls one at a time towards the center of the canister then turning the clamping unit upside down and tapping it against your palm will usually dislodge them. If you must hit the clamping unit harder, be certain you do not damage the gage or locking face of the unit. A small magnetic screwdriver also works well (see Frame 4 on next page).

5. Normally, no further disassembly should be attempted. If the clamping unit body or canister has been damaged, it should be replaced with a new unit. You can also contact your Kennametal Sales office for instructions on how to send the unit to a Kennametal Repair facility.

Tools Required
- Hex wrenches.
- Pliers.
- Kennametal recommends and uses GLEITMO™ 805.
- Clean towels or shop rags.
- Solvent or degreaser that does not leave residue (used to clean inside the taper and canister). Should the unit become contaminated, you can use a degreasing agent or something similar to clean the surfaces.

CAUTION
DO NOT USE silicone cleaner or WD-40™-type lubricants.

<table>
<thead>
<tr>
<th>KM size</th>
<th>hex size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>2mm</td>
</tr>
<tr>
<td>KM40</td>
<td>2.5mm</td>
</tr>
<tr>
<td>KM50</td>
<td>3mm</td>
</tr>
<tr>
<td>KM63</td>
<td>5mm</td>
</tr>
<tr>
<td>KM80</td>
<td>5mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>lubricant</th>
<th>order number</th>
<th>size</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567975</td>
<td>500g cartridge</td>
</tr>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567977</td>
<td>1000g tin</td>
</tr>
</tbody>
</table>
6. Clean locking balls, torque screw, lockrod, and bump-off pin of all grease and inspect for wear, burns, or obvious damage. If rebuilding the unit with a repair parts package, we recommend using all new components contained in the kit. If you are not using the repair package, but are retiming or adjusting the unit, inspect the external threads on the torque screw and lockrod, the locking ball contact surfaces on the lockrod, and the mating surfaces between the lockrod and bump-off pin. Discard any components of questionable condition and replace with new ones. Note the condition of the raised taper key on the lockrod as you will need this later.

7. Inspect inside the KM taper for damage and/or contamination. Clean the taper and canister with solvent. Allow the unit to dry before reassembling. Inspect the torque screw threads in the body for damage.

8. If the unit is equipped for through-coolant capability, you may want to verify that the coolant passages are clear. Clean if required.

### KM™ Manual Clamping Unit • Disassembly Procedures (continued)

<table>
<thead>
<tr>
<th>KM size</th>
<th>torque screw hex size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>5mm</td>
</tr>
<tr>
<td>KM40</td>
<td>6mm</td>
</tr>
<tr>
<td>KM50</td>
<td>10mm</td>
</tr>
<tr>
<td>KM63</td>
<td>12mm</td>
</tr>
<tr>
<td>KM80</td>
<td>14mm</td>
</tr>
</tbody>
</table>

Frame 3

Frame 4
1. Place a small amount of GLEITMO™ 805 grease into the canister where the locking balls make contact, paying particular attention to the inner top surface of the locking ball bores.

2. Lightly coat both locking balls with grease. Insert the balls, one at a time, into the canister’s central bore until it bottoms, then move the ball outward into the locking ball bores, not the torque screw hole (see Frame 5).

3. Lightly coat the threads of the lockrod and torque screw with grease and thread them together finger tight (left-hand threads). The torque screw and lockrod must remain tightly together during the reassembly procedure and rotated as one piece throughout (see Frame 6).

4. Make sure the balls are pushed radially into the bores. Using the metric Allen or T-handle wrench, thread the torque screw lockrod assembly into the body until it makes soft contact with the balls. Be certain the torque screw and lockrod rotate together by looking down into the canister as you thread them. If the lockrod and torque screw become unthreaded, you should remove them, re-tighten, and start Step 4 again.

5. Look into the canister through the bump-off pin bore and note the raised key on the lockrod. Position the key facing outward through the bump-off pin bore, centering it in the bore by backing out the torque screw only enough to properly align the key.

6. Place a KM cutting unit into the clamping unit. If cutting unit does not drop into place, go to Step 7. If the cutting unit drops into place, remove it, push the balls radially back out into the ball bores, and turn the torque screw/lockrod assembly inward a full turn (360°). Repeat Step 6 as many times as necessary until the unit does not drop into the taper.

Tools Required
- Hex wrenches.
- Pliers.
- Kennametal recommends and uses GLEITMO™ 805.
- Clean towels or shop rags.

**CAUTION**
DO NOT USE silicone cleaner or WD-40™-type lubricants.

<table>
<thead>
<tr>
<th>lubricant</th>
<th>order number</th>
<th>size</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567575</td>
<td>500g cartridge</td>
</tr>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567577</td>
<td>1000g tin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KM size</th>
<th>torque screw hex size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>5mm</td>
</tr>
<tr>
<td>KM40</td>
<td>6mm</td>
</tr>
<tr>
<td>KM50</td>
<td>10mm</td>
</tr>
<tr>
<td>KM63</td>
<td>12mm</td>
</tr>
<tr>
<td>KM80</td>
<td>14mm</td>
</tr>
</tbody>
</table>
7. Thread the torque screw/lockrod assembly outward one full turn (360°), making sure the raised key faces outward. Place a KM cutting unit into the clamping unit. It should drop into the taper easily. If it does not, repeat Step 7.

8. Insert the bump-off pin without its O-ring into the bore, being certain the angled surface of the bump-off pin will ride on the angled surface of the lockrod (see Frame 7).

9. When the bump-off pin is properly seated, its largest diameter should be below the end of the canister — it should not rotate. The pin is rotationally restrained by the lockrod key, in the bump-off pin keyway.

10. If all is correct, remove the bump-off pin, install its O-ring, lightly coat with grease paying particular attention to the slot, and reinstall into the bore.

11. Reinstall the socket-head cap screws that retain the bump-off pin (see Frame 8). Check for proper operation of the unit by pushing down on the end of the bump-off pin with your finger while tightening and loosening the torque screw through its full travel. You should feel the bump-off pin move in and out as the direction of the torque screw changes.

12. As a final check, rotate the torque screw outward until it stops. Install a KM cutting unit and tighten the torque screw to the proper torque required for locking. Ensure that there is no air gap between the locking faces of the cutting unit and the clamping unit. Loosen the torque screw. Initially, resistance will be felt while loosening the screw, and again when bumping off the tool from the taper. Only use light force to loosen the screw after the tool has been bumped off. Do not force the torque screw loose after tool bump-off or damage may result. Remove the cutting unit and install protective plastic or steel plug.
Technical Information
KM-LOC™ Clamping System

**KM-LOC™ Clamping Units**

**Operating Instructions**

All KM-LOC Clamping Units utilize disk springs to develop the correct clamping force. This clamping system does not require a torque wrench to achieve proper clamping force. The KM-LOC System provides consistent clamping forces designed to last 50,000 cycles.

**KM-LOC Locking Sequence**

Always ensure that the KM cutting unit and clamping unit are free of dirt and contaminants. When installing the cutting head into the clamping unit, note the key relations of the male and female tapers. The flange face will have about 1mm (.040") standoff from the gage face before lock up. If the amount of standoff is greater than this, the unit is either error proofed or the tapers are contaminated. Rotate the head 180° for correct, free-state standoff.

Next, insert a wrench with the properly sized metric bit into the cam socket. Rotating the cam socket clockwise 140° (where it will stop) locks the head into the clamping unit. The dimples on both the cam and clamping unit body are aligned when a positive stop is reached.

**KM-LOC Unlocking Sequence**

Remove chips or foreign material from around the cutting unit flange and clamping body. Insert the metric bit into the cam and rotate counterclockwise to unlock the unit. During this procedure, the lockrod will make contact with the inside of the cutting unit (this could feel like a positive stop), continue the counterclockwise turn until the head moves apart from the gage face.

When unlocked, a KM head will bump off. The KM System utilizes a 10:1 self-locking taper that requires a mechanical release.

**KM-LOC Activation Drive Size**

<table>
<thead>
<tr>
<th>KM system size</th>
<th>drive size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>6mm</td>
</tr>
<tr>
<td>KM40</td>
<td>8mm</td>
</tr>
<tr>
<td>KM50</td>
<td>10mm</td>
</tr>
<tr>
<td>KM63</td>
<td>10mm</td>
</tr>
</tbody>
</table>

(continued)
KM-LOC™ Clamping Units (continued)

The KM-LOC
Under normal use, the KM-LOC unit is designed to last 50,000 cycles. The KM-LOC units are greased at the factory during assembly. To keep the unit functioning properly, it should be periodically greased and, if operating under normal conditions, done regularly every six months.

How to Grease the KM-LOC
Remove the M6 sealing screw from the front face of the lockrod and thread the grease fitting into the tapped hole. A grease fitting is in the spare parts package included with every KM-LOC clamping unit.

Approximate grease amounts are as follows:
- KM32™..............0.2–0.3 fl. oz
- KM40™..............0.3–0.4 fl. oz.
- KM50™..............0.5–0.6 fl. oz.
- KM63™..............0.5–0.6 fl. oz.

Kennametal uses and recommends GLEITMO™ 805, a white, high-performance grease paste.

<table>
<thead>
<tr>
<th>lubricant</th>
<th>order number</th>
<th>size</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567575</td>
<td>500g cartridge</td>
</tr>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567577</td>
<td>1000g tin</td>
</tr>
</tbody>
</table>

KM-LOC™ Mounting Wedges • Tightening Torque

<table>
<thead>
<tr>
<th>catalog number</th>
<th>wedge screw hex size</th>
<th>ft. lbs.</th>
<th>Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32CLSR/L2050K</td>
<td>4mm</td>
<td>10–14</td>
<td>14–18</td>
</tr>
<tr>
<td>KM32CLSR/L1250B</td>
<td>4mm</td>
<td>10–14</td>
<td>14–18</td>
</tr>
<tr>
<td>KM32CLSR/L1250C</td>
<td>4mm</td>
<td>10–14</td>
<td>14–18</td>
</tr>
<tr>
<td>KM32CLSR/L1650C</td>
<td>4mm</td>
<td>10–14</td>
<td>14–18</td>
</tr>
</tbody>
</table>

NOTE: Use a hex bit socket.
The KM-LOC II clamping system employs a cam and a pre-loaded disk spring pack to provide positive, stop-to-stop locking/unlocking in only 145° of movement. This clamping system does not require a torque wrench to achieve proper clamping force. The KM-LOC II clamping system provides consistent clamping forces designed to last 50,000 cycles.

**KM-LOC II Locking Sequence**

Always ensure that the KM cutting unit and clamping unit are free of dirt and contaminants. When installing the cutting head into the clamping unit, note the key relations of the male and female tapers. The flange face will have about 1mm (.040") standoff from the gage face before lock up. If the amount of standoff is greater than this, the unit is either error proofed or the tapers are contaminated. Rotate the head 180° for correct, free-state standoff.

Next, insert a wrench with the properly sized metric bit into the cam socket. Rotating the cam socket clockwise 145° (where it will stop) locks the head into the clamping unit. The dimples on both the cam and clamping unit body are aligned when a positive stop is reached.

**KM-LOC II Unlocking Sequence**

Remove chips or foreign material from around the cutting unit flange and clamping body. Insert the metric bit into the cam and rotate counterclockwise to unlock the unit. During this procedure, the lockrod will make contact with the inside of the cutting unit (this could feel like a positive stop), continue the counterclockwise turn until the head moves apart from the gage face.

When unlocked, a KM head will bump off. The KM System utilizes a 10:1 self-locking taper that requires a mechanical release.

### KM-LOC II Clamping Units

**Operating Instructions**

<table>
<thead>
<tr>
<th>KM system size</th>
<th>drive size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>6mm</td>
</tr>
<tr>
<td>KM40</td>
<td>8mm</td>
</tr>
<tr>
<td>KM50</td>
<td>10mm</td>
</tr>
<tr>
<td>KM63</td>
<td>10mm</td>
</tr>
</tbody>
</table>
KM-LOC II Clamping Units (continued)

The KM-LOC II
Under normal use, the KM-LOC II unit is designed to last 50,000 cycles. The KM-LOC II units are greased at the factory during assembly. To keep the unit functioning properly, it should be periodically greased and, if operating under normal conditions, done regularly every six months.

How to Grease the KM-LOC II
Remove the standard M4 socket-set screw from the bottom of the cam hex, and thread the grease assembly into the tapped hole. An assembled grease fitting and adapter are in the spare parts package included with every clamping unit.

Approximate grease amounts are as follows:
- KM32™ ..............0.2–0.3 fl. oz
- KM40™ ..............0.3–0.4 fl. oz.
- KM50™ ..............0.5–0.6 fl. oz.
- KM63™ ..............0.5–0.6 fl. oz.

Kennametal uses and recommends GLEITMO™ 805, a white, high-performance grease paste.

<table>
<thead>
<tr>
<th>lubricant</th>
<th>order number</th>
<th>size</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567575</td>
<td>500g cartridge</td>
</tr>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567577</td>
<td>1000g tin</td>
</tr>
</tbody>
</table>

KM-LOC II Mounting Wedges • Tightening Torque

<table>
<thead>
<tr>
<th>catalog number</th>
<th>wedge screw hex size</th>
<th>ft. lbs.</th>
<th>Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM40 CL2SR/L 1260B</td>
<td>6</td>
<td>30–34</td>
<td>41–46</td>
</tr>
<tr>
<td>KM40 CL2SR/L 1660C</td>
<td>7</td>
<td>43–47</td>
<td>58–64</td>
</tr>
<tr>
<td>KM40 CL2SR/L 1660D</td>
<td>7</td>
<td>43–47</td>
<td>58–64</td>
</tr>
<tr>
<td>KM40 CL2SR/L 2060D</td>
<td>7</td>
<td>43–47</td>
<td>58–64</td>
</tr>
<tr>
<td>KM40 CL2SR/L 2560M</td>
<td>7</td>
<td>43–47</td>
<td>58–64</td>
</tr>
<tr>
<td>KM40 CL2SR/L 3260P</td>
<td>7</td>
<td>43–47</td>
<td>58–64</td>
</tr>
<tr>
<td>KM50 CL2SR/L 1675D</td>
<td>7</td>
<td>43–47</td>
<td>58–64</td>
</tr>
<tr>
<td>KM50 CL2SR/L 2075D</td>
<td>8</td>
<td>58–62</td>
<td>79–84</td>
</tr>
<tr>
<td>KM50 CL2SR/L 2575M</td>
<td>7</td>
<td>43–47</td>
<td>58–64</td>
</tr>
<tr>
<td>KM50 CL2SR/L 2575P</td>
<td>7</td>
<td>43–47</td>
<td>58–64</td>
</tr>
<tr>
<td>KM63 CL2SR/L 2090E</td>
<td>8</td>
<td>58–62</td>
<td>79–84</td>
</tr>
<tr>
<td>KM63 CL2SR/L 3290P</td>
<td>8</td>
<td>58–62</td>
<td>79–84</td>
</tr>
</tbody>
</table>

NOTE: Use a six-point socket.
KM Rapid Clamping Units

Operating Instructions
The KM Rapid clamping system is a compact quick-change tooling system that does not require a torque wrench to achieve proper clamping force. The KM Rapid clamping unit spring pack supplies the correct clamping force while the cam permits quick and easy locking/unlocking of the KM cutting unit.

KM Rapid Locking Sequence
At the “unlock” position, which is marked on the housing, the cutting unit can be removed or fitted in the clamping unit. By moving the cam clockwise, the locking balls are pushed outwards and the face stand-off gets closed. Moving the cam further pushes the locking balls further outward and generates clamping force at the locating face. The handling force moves past the maximum position, then slightly back, to reach the “lock” position.

KM Rapid Unlocking Sequence
To unlock the cutting unit, turn the cam counterclockwise. In this position, the locking balls are free of the cutting unit, but the taper interference is still holding the KM cutting unit in the clamping unit. By turning the cam further to overcome the interference, the cutting unit will be released and can be removed. In any case, do not try to push too hard against the unlocking point because it will result in damage to the locating pin and the cam.

The entire locking and unlocking sequence takes a few seconds.

KM Rapid Plus Clamping Units

Operating Instructions
The KM Rapid Plus clamping system is a compact cartridge quick-change tooling system that does not require a torque wrench to achieve proper clamping force. The KM Rapid Plus clamping unit spring pack supplies the correct clamping force while the cam permits quick and easy locking/unlocking of the KM cutting unit.

KM Rapid Plus Locking Sequence
At the “unlock” position, the cutting head can be removed or fitted in the clamping unit. By moving the eccentric shaft clockwise, the axial lockrod is moving, the clamping balls are pushed outward, and the face stand-off is closed. Moving the eccentric shaft further pushes the locking ball over the axial lockrod further outward and generates clamping force at the locating face. The handling force moves past the maximum position, then slightly back, to reach the “lock” position. Do not move the cam further at this position.

KM Rapid Plus Unlocking Sequence
To unlock the cutting unit, turn the eccentric shaft counterclockwise. In this position, the locking balls are free of the clamping unit, but the taper interference is still holding the cutting unit in the clamping unit. By turning the eccentric shaft further to overcome the interference, the cutting head will be released and can be removed.

The entire locking and unlocking sequence takes a few seconds.
Automatic Clamping System

Operating Instructions

The KM automatic clamping system uses a disk spring package to supply force to the lock rod — driving the locking balls and providing clamping force to the cutting unit. The mechanical advantage of the clamping mechanism is designed specifically for a given spring force to supply proper clamping force. Once the cutting unit is clamped in the KM automatic clamping unit, it is securely held in place until released by applying force to the end of the spring end cap. In most cases, this is accomplished using a hydraulic cylinder. KM automatic clamping units contain sealed coolant ports as well as a system for distributing air through the unit.

Air serves two functions: (1) air is used to clean the taper and face area during tool change; (2) it is also used to detect improper tool change. Air is routed to the intersection of the taper and the face. If the faces of the cutting unit and the clamping unit do not totally seal after a tool change, air will continue to escape and can be used to detect a tool change fault. KM automatic clamping units are available in several configurations for application on a wide variety of machines.
KM-TS™ • Kennametal Modular Tool Changing

KM-TS is engineered to provide machine tool builders the capability to design a machine around a very rigid and proven system while maintaining full automation. It is the ultimate in flexible tooling systems and is equipped with four holes in the V-groove.

The next generation of multifunction mill-turn machines demand flexible and high-tech tooling systems. Previously, the V-groove in the KM system permitted automatic tool changing but without the capability for tool identification chips.

Tool Changing Location Features

- Two horizontally opposed holes in the V-groove for the tool changer and storage in the tool magazine. Within these two holes are counterbored holes that can be used for tool orientation.
- Two vertically oriented holes in the V-groove for tool identification chip and balancing.

Additional New Features

- A standard hardness of 50–54 HRC makes the tool durable enough to withstand the forces generated during high-speed tool changes and enables long-term use.
- Optimal toughness from the taper to the insert pocket seat ensures maximum protection against wear at all contact points and the highest stability under high cutting loads.
- The KM-TS tools have a silver, satin-finished surface that provides durability and long-lasting appearance.

Summary of Benefits

- A proven spindle interface for Daewoo®, Nakamura-Tome™, Takisawa™, and many other builders.
- Full compatibility with KM63™ and Kennametal UT63™ tools and adapters.
- Use with manual and fully automatic tool changing on lathes and modern mill/turn machines.
- Precision-ground tool taper and locating face.
- Optimal coolant supplied directly onto the cutting point, guaranteeing the highest-level of performance (see chart below).
- For dry machining, the coolant hole can be easily closed with a screw.

<table>
<thead>
<tr>
<th>order number</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975161</td>
<td>M5 Coolant Nozzle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KM size</th>
<th>catalog number</th>
<th>order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32TS</td>
<td>OR00614070V90</td>
<td>1850414</td>
</tr>
<tr>
<td>KM40TS</td>
<td>OR00739070V90</td>
<td>1779959</td>
</tr>
<tr>
<td>KM50TS</td>
<td>OR00987103V90</td>
<td>1284041</td>
</tr>
<tr>
<td>KM63TS</td>
<td>OR01234139V90</td>
<td>1608616</td>
</tr>
<tr>
<td>KM80TS</td>
<td>OR01734139V90</td>
<td>1586813</td>
</tr>
</tbody>
</table>
KM63XMZ™

KM63XMZ has been engineered to work specifically on Mazak® INTEGREX® Mark IV Series of Integrex machines. The Mazak INTEGREX combines a high-powered turning center and a full-function machining center to produce parts in a single setup. KM63XMZ is an integral part of the success and ingenuity of these machines.

A standard hardness of 50–54 HRC enables long-term use and durability to withstand the forces generated during high-speed tool changes. KM63XMZ standard material provides optimal toughness from the taper to the insert pocket seat. This ensures maximum protection against wear at all contact points and the highest stability under high cutting loads. The tools have a silver, satin-finished surface that provides a durable and long-lasting appearance.

Conventional machine tools require multiple setups, extra manpower for part handling, in-process inventory, larger floor space, and increased tooling and workholding expenses.

• KM63XMZ will help reduce your overall manufacturing cost with multitask piece part processing.
• KM63XMZ will optimize your machining operations — however challenging your particular application!
• The world's most economical, rigid, and accurate modular quick-change tooling!
• Dramatically reduce your machine downtime and increase productivity!
• Large product selection for your machining needs!
• Special design tools available for unique applications!
• A proven tooling system for multitasking machines like the Mazak INTEGREX Machine Tool System!

### KM63XMZ Tool Orientation Specification

#### Left-Hand Orientation

For turning clockwise toward the main spindle.
Catalog Number: KM63XMZMCLNLF12Y

#### Right-Hand Orientation

For turning counterclockwise toward the main spindle.
Catalog Number: KM63XMZMCLNR12Y

<table>
<thead>
<tr>
<th>O-ring</th>
<th>KM size</th>
<th>catalog number</th>
<th>order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM63XMZ</td>
<td>OR01237103M90</td>
<td>1979353</td>
<td></td>
</tr>
</tbody>
</table>
Operating Conditions

The KM tooling joint is an extremely rigid and stable system that is specifically designed to supply consistent results. As with any mechanical coupling, KM has limits that, if exceeded, could result in mechanical damage to the joint and/or its components. To help you stay within these limits, Kennametal has established maximum safe tangential loads for each system size. These loads are described as a certain amount of force at the standard “F” and “L1” dimensions for each given system size.

Example of Calculation:

Where:  

\[ P = \frac{K}{\sqrt{(0.8 \times L1)^2 + F^2}} \]

Given:  

The KM integral shank boring bar, ordering code K4M07S S32G-MCLNR12  

Dimensions:  

\[ L1 = 90 \text{mm (3.543")} \]  
\[ F = 22 \text{mm (0.866")} \]  

Required:  

What is maximum permissible tangential load?

\[ P = \frac{383600}{\sqrt{(0.8 \times 90)^2 + 22^2}} = 5095 \text{ N} \]
Technical Information

Operating Conditions (continued)

IMPORTANT
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

The following example illustrates how to use Charts 1, 3, 5, 7, and 9

Given: KM40™ integral shank boring bar, ordering code KM40TS-S32G-MCLNR12
Dimensions: KM40 integral shank boring bar, ordering code KM40TS-S32G-MCLNR12 — L1 = 90mm, F = 22mm
Required: What is maximum permissible tangential load?
Solution: To determine the tangential load:
  a) Determine the correct chart to use. (This is a KM40 tool, so use Chart 3).
  b) Find the intersection point of the two lines that correspond to the dimensions L1 = 90mm, F = 22mm. These two lines intersect just above the 6670 N (1500 lbs) curve.
  c) The permissible tangential load is the approximate load at the point of intersection.
     The point of intersection is at approximately 6890 N (1550 lbs).

As you can see from the calculation, the actual value is 6790 N (1528 lbs). Small variations are to be expected from reading the approximate location on the chart but should be inconsequential.

The following example illustrates how to use Charts 2, 4, 6, 8, and 10

Given: KM40 integral shank boring bar, ordering code KM40TS-S32G-MCLNR12
  feed rate: 0.016 IPR
  depth of cut: .200" (doc)
Required: What is approximate tangential force?
Solution: To determine the tangential force:
  a) Determine the correct chart to use. (This is a KM40 tool, so use Chart 4).
  b) Find the intersection point of the two lines that correspond to the 0.016 IPR feed rate and the .200" doc.
  c) The approximate tangential force is the force at the point of intersection.
     The point of intersection is at approximately 4450 N (1000 lbs).

Please remember that these are approximate values and should be used only as a reference. If there is any doubt whether these charts are accurate enough, the actual cutting force should be calculated.

These charts were designed to determine conditions within the limits of the various KM tooling system sizes. However, in actual cutting conditions, there are many other limitations, such as insert strength or excessive overhangs, that may limit the cutting forces to values far lower than those represented in the charts.
Technical Information
KM™ Application Data

Operating Conditions • KM32TS™ • Metric

**IMPORTANT**
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

**Chart 1**
F and L1 Dimensions (mm) vs. Tangential Loads (N) for KM32TS

**Chart 2**
Depth of Cut (mm) and Feed Rate (mm/rev) vs. Tangential Forces (N) for KM32TS
**Operating Conditions • KM32TS™ • Inch**

**IMPORTANT**

Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

**Chart 1**

**F and L1 Dimensions (inch) vs. Tangential Loads (lbs) for KM32TS**

**Chart 2**

**Depth of Cut (inch) and Feed Rate (IPR) vs. Tangential Forces (lbs) for KM32TS**
Technical Information
KM™ Application Data

Operating Conditions • KM40TS™ • Metric

IMPORTANT
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

Chart 3
F and L1 Dimensions (mm) vs. Tangential Loads (N) for KM40TS

Chart 4
Depth of Cut (mm) and Feed Rate (mm/rev) vs. Tangential Forces (N) for KM40TS
Operating Conditions • KM40TS™ • Inch

**IMPORTANT**
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

**Chart 3**
F and L1 Dimensions (inch) vs. Tangential Loads (lbs) for KM40TS

**Chart 4**
Depth of Cut (inch) and Feed Rate (IPR) vs. Tangential Forces (lbs) for KM40TS
Operating Conditions • KM50TS™ • Metric

IMPORTANT
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

Chart 5
F and L1 Dimensions (mm) vs. Tangential Loads (N) for KM50TS

Chart 6
Depth of Cut (mm) and Feed Rate (mm/rev) vs. Tangential Forces (N) for KM50TS
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

Chart 5
F and L1 Dimensions (inch) vs. Tangential Loads (lbs) for KM50TS

Chart 6
Depth of Cut (inch) and Feed Rate (IPR) vs. Tangential Forces (lbs) for KM50TS
Operating Conditions • KM63TS™ and KM63XMZ™ • Metric

**IMPORTANT**
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

**Chart 7**
F and L1 Dimensions (mm) vs. Tangential Loads (N) for KM63TS and KM63XMZ

**Chart 8**
Depth of Cut (mm) and Feed Rate (mm/rev) vs. Tangential Forces (N) for KM63TS and KM63XMZ
Operating Conditions • KM63TS™ and KM63XMZ™ • Inch

IMPORTANT
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

Chart 7
F and L1 Dimensions (inch) vs. Tangential Loads (lbs) for KM63TS and KM63XMZ

Chart 8
Depth of Cut (inch) and Feed Rate (IPR) vs. Tangential Forces (lbs) for KM63TS and KM63XMZ
Operating Conditions • KM80TS™ and KM80ATC™ • Metric

IMPORTANT
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

Chart 9
F and L1 Dimensions (mm) vs. Tangential Loads (N) for KM80TS and KM80ATC

Chart 10
Depth of Cut (mm) and Feed Rate (mm/rev) vs. Tangential Forces (N) for KM80TS and KM80ATC
Operational Conditions • KM80TS™ and KM80ATC™ • Inch

**IMPORTANT**
Information shown on the following charts was developed exclusively for use with KM tooling in static conditions. Do not use for any other tooling system because the results will not apply. To account for cutting force fluctuations in dynamic conditions, a reduction of 20–30% should be applied to the loads shown in charts.

**Chart 9**
F and L1 Dimensions (inch) vs. Tangential Loads (lbs)
for KM80TS and KM80ATC

**Chart 10**
Depth of Cut (inch) and Feed Rate (IPR) vs. Tangential Forces (lbs)
for KM80TS and KM80ATC
VDI Application Guide

Clockwise Spindle Rotation

VDI Clamp Wedge • Top

![Diagram of VDI Clamp Wedge Top for Clockwise Spindle Rotation](image)

VDI Clamp Wedge • Bottom

![Diagram of VDI Clamp Wedge Bottom for Clockwise Spindle Rotation](image)

Counterclockwise Spindle Rotation

VDI Clamp Wedge • Top

![Diagram of VDI Clamp Wedge Top for Counterclockwise Spindle Rotation](image)

VDI Clamp Wedge • Bottom

![Diagram of VDI Clamp Wedge Bottom for Counterclockwise Spindle Rotation](image)
Mounting Details • NCM Square Shank Conversion

KM Toolholder Replacement — Square Shank Toolholder — Style MCLNL shown

<table>
<thead>
<tr>
<th>KM replacement unit</th>
<th>square shank equivalent</th>
<th>B*</th>
<th>B</th>
<th>H</th>
<th>L1</th>
<th>F</th>
<th>F2</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32-NCM4040</td>
<td>20 x 20</td>
<td>20</td>
<td>40</td>
<td>40</td>
<td>45</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>KM32-NCM5040</td>
<td>25 x 25</td>
<td>25</td>
<td>40</td>
<td>50</td>
<td>45</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>KM40-NCM5044</td>
<td>25 x 25</td>
<td>25</td>
<td>44</td>
<td>50</td>
<td>40</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>KM40-NCM6044</td>
<td>32 x 32</td>
<td>32</td>
<td>44</td>
<td>64</td>
<td>40</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>KM50-NCM6045</td>
<td>32 x 32</td>
<td>32</td>
<td>54</td>
<td>64</td>
<td>50</td>
<td>35</td>
<td>28</td>
</tr>
</tbody>
</table>

*For MCLNL holders.

<table>
<thead>
<tr>
<th>KM replacement unit</th>
<th>square shank equivalent</th>
<th>B*</th>
<th>B</th>
<th>H</th>
<th>L1</th>
<th>F</th>
<th>F2</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32-NCM4040</td>
<td>20 x 20</td>
<td>20</td>
<td>40</td>
<td>40</td>
<td>45</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>KM32-NCM5040</td>
<td>25 x 25</td>
<td>25</td>
<td>40</td>
<td>50</td>
<td>45</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>KM40-NCM5044</td>
<td>25 x 25</td>
<td>25</td>
<td>44</td>
<td>50</td>
<td>40</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>KM40-NCM6044</td>
<td>32 x 32</td>
<td>32</td>
<td>44</td>
<td>64</td>
<td>40</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>KM50-NCM6045</td>
<td>32 x 32</td>
<td>32</td>
<td>54</td>
<td>64</td>
<td>50</td>
<td>35</td>
<td>28</td>
</tr>
</tbody>
</table>

*For MCLNL holders.

NOTE: F equals the dimension from the centerline of the KM cutting unit over the nose radius of the gage insert.
F2 equals the dimension from the back of the clamping unit to the centerline of the KM cutting unit (see column F2 above).
The offset is identical with most KM cutting units, except for positive lead angle units and neutral units.

Technical Information
KM™ Application Data

Toolholder Replacements • Metric

<table>
<thead>
<tr>
<th>KM replacement unit</th>
<th>square shank equivalent</th>
<th>B*</th>
<th>B</th>
<th>H</th>
<th>L1</th>
<th>F</th>
<th>F2</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM replacement unit</td>
<td>square shank equivalent</td>
<td>B*</td>
<td>B</td>
<td>H</td>
<td>L1</td>
<td>F</td>
<td>F2</td>
</tr>
<tr>
<td>KM32-NCM2425</td>
<td>3/4 x 3/4</td>
<td>3/4</td>
<td>1</td>
<td>1.562</td>
<td>1.500</td>
<td>1.378</td>
<td>0.866</td>
</tr>
<tr>
<td>KM32-NCM4025</td>
<td>1 x 1</td>
<td>1</td>
<td>1</td>
<td>1.562</td>
<td>2.000</td>
<td>1.378</td>
<td>0.866</td>
</tr>
<tr>
<td>KM40-NCM5028</td>
<td>1-1/4 x 1-1/4</td>
<td>1-1/4</td>
<td>1</td>
<td>1.750</td>
<td>2.000</td>
<td>1.575</td>
<td>1.063</td>
</tr>
<tr>
<td>KM40-NCM6034</td>
<td>1-1/4 x 1-1/4</td>
<td>1-1/4</td>
<td>1</td>
<td>1.750</td>
<td>2.500</td>
<td>1.575</td>
<td>1.063</td>
</tr>
</tbody>
</table>

*For MCLNL holders.

Technical Information

www.kennametal.com

M51
## Technical Information

### KM™ Tooling Mounting Dimensions

**KM Manual NCM-F Flanges**

| KM Size | D1   | D2   | D3   | D4   | D5   | D6   | F   | L1   | L2   | L3   | L4   | L5   | L6   | L7   | L8   | L9   | B | G | W1 | W2 | O-ring |
|---------|------|------|------|------|------|------|-----|------|------|------|------|------|------|------|------|-----|---|----|----|--------|
| KM32   | 3.02 | 3.30 | 2.40 | 4.00 | 4.00 | 6.34 | 1.80 | 26.37| 25.00| 0.50 | 21.50| 17.81| 12.33| 11.18| 11.00| 11.00| 11.00| M6   | 70° | 35° | OR0987103V75 |
|        | 1.261| 1.193| 0.945| 1.693| 0.157|       |     |      |      |      |      |      |      |      |      |      |    |   |    |    |        |
| KM40   | 4.02 | 3.51 | 2.91 | 5.00 | 5.00 | 6.34 | 2.20 | 31.88| 30.61| 0.80 | 27.00| 22.12| 15.49| 11.18| 18.01| 12.75| 12.70| M10  | 70° | 35° | OR1174103V75 |
|        | 1.575| 1.398| 1.142| 2.126| 0.197|       |     |      |      |      |      |      |      |      |      |      |    |   |    |    |        |
| KM50   | 5.00 | 4.20 | 3.71 | 6.00 | 5.00 | 7.90 | 2.70 | 39.58| 38.81| 1.00 | 33.50| 27.44| 19.22| 12.70| 18.01| 18.24| 17.50| M15  | 70° | 35° | OR1487103V75 |
|        | 1.970| 1.685| 1.457| 2.638| 0.256|       |     |      |      |      |      |      |      |      |      |      |    |   |    |    |        |
| KM63   | 6.03 | 5.90 | 4.81 | 8.00 | 8.00 | 14.00| 3.50 | 46.89| 45.82| 1.50 | 41.00| 31.70| 25.99| 19.99| 25.00| 23.50| 21.49| M12  | 78° | 39° | OR1925103V75 |
|        | 2.481| 2.122| 1.890| 3.228| 0.315|       |     |      |      |      |      |      |      |      |      |      |    |   |    |    |        |
| KM80   | 8.03 | 6.60 | 6.00 | 10.00| 9.00 | 16.07| 4.50 | 58.39| 57.12| 1.50 | 52.50| 41.61| 32.01| 25.00| 30.00| 23.50| 23.00| M16  | 75° | 37° | OR2245103V75 |
|        | 3.151| 2.622| 2.362| 4.134| 0.354|       |     |      |      |      |      |      |      |      |      |      |    |   |    |    |        |

**NOTE:** Contact Kennametal for the latest dimensional data.

---

**Technical Information**

### KM Manual NCM-F Flanges

- **D1**: Min coolant supply
- **D2**: Max thru hole
- **D3**: Min coolant supply
- **D4**:
- **D5**: O-ring
- **D6**:
- **F**: O-ring
- **L3**: O-ring
- **L4**: O-ring
- **L5**: O-ring
- **L6**: O-ring
- **L7**: O-ring
- **L8**: O-ring
- **L9**: O-ring
- **B**: O-ring
- **G**: O-ring
- **W1**: O-ring
- **W2**: O-ring
- **O-ring**: O-ring

---

**Technical Information**
Technical Information

KM™ Tooling Mounting Dimensions

KM LOC-II™ CL2NS/T-EF Flanges • KM Manual NCM-EF Flanges

<table>
<thead>
<tr>
<th>KM size</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>D6</th>
<th>F</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>G</th>
<th>W1</th>
<th>W2</th>
<th>O-ring</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>32.02</td>
<td>30.30</td>
<td>24.00</td>
<td>43.50</td>
<td>4.00</td>
<td>6.37/6.348</td>
<td>20.01</td>
<td>15.81</td>
<td>15.62</td>
<td>0.80</td>
<td>27.00</td>
<td>22.12</td>
<td>15.49</td>
<td>11.18</td>
<td>18.50</td>
<td>M6</td>
<td>70°</td>
<td>35°</td>
<td>OR00987103V75</td>
</tr>
<tr>
<td>KM40</td>
<td>40.02</td>
<td>35.51</td>
<td>29.01</td>
<td>54.00</td>
<td>5.00</td>
<td>6.37/6.348</td>
<td>22.00</td>
<td>16.89</td>
<td>16.62</td>
<td>0.80</td>
<td>27.00</td>
<td>27.08</td>
<td>22.62</td>
<td>15.49</td>
<td>18.01</td>
<td>M8</td>
<td>70°</td>
<td>35°</td>
<td>OR01174103V75</td>
</tr>
<tr>
<td>KM50</td>
<td>50.03</td>
<td>42.80</td>
<td>37.01</td>
<td>67.01</td>
<td>6.50</td>
<td>7.05/7.95</td>
<td>27.01</td>
<td>21.97</td>
<td>20.60</td>
<td>1.00</td>
<td>33.50</td>
<td>27.44</td>
<td>19.22</td>
<td>12.70</td>
<td>18.01</td>
<td>M10</td>
<td>70°</td>
<td>35°</td>
<td>OR1487103V75</td>
</tr>
<tr>
<td>KM63</td>
<td>63.03</td>
<td>53.90</td>
<td>48.01</td>
<td>81.99</td>
<td>8.00</td>
<td>14.07/14.06</td>
<td>35.99</td>
<td>21.87</td>
<td>20.60</td>
<td>1.50</td>
<td>41.60</td>
<td>31.70</td>
<td>25.99</td>
<td>19.99</td>
<td>30.00</td>
<td>M12</td>
<td>78°</td>
<td>39°21'</td>
<td>OR21925103V75</td>
</tr>
<tr>
<td>KM80</td>
<td>80.03</td>
<td>66.60</td>
<td>60.00</td>
<td>105.00</td>
<td>9.00</td>
<td>16.07/16.06</td>
<td>45.00</td>
<td>26.89</td>
<td>25.62</td>
<td>1.50</td>
<td>52.50</td>
<td>41.61</td>
<td>32.01</td>
<td>25.00</td>
<td>50.00</td>
<td>M16</td>
<td>79°</td>
<td>37°34'</td>
<td>OR22425103V75</td>
</tr>
</tbody>
</table>

min coolant supply
max thru hole
D3 min coolant supply
D5 max thru hole

www.kennametal.com
Technical Information
KM™ Tooling Mounting Dimensions

KM Rapid RNS-EF

<table>
<thead>
<tr>
<th>KM size</th>
<th>D4</th>
<th>D5 H11</th>
<th>D6</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>L9 min</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM40</td>
<td>40</td>
<td>10</td>
<td>5</td>
<td>16</td>
<td>21,7</td>
<td>27</td>
<td>13</td>
<td>12</td>
<td>15</td>
<td>44</td>
<td>M8</td>
</tr>
<tr>
<td>KM50</td>
<td>50</td>
<td>12</td>
<td>6,5</td>
<td>20</td>
<td>28,7</td>
<td>35</td>
<td>16</td>
<td>14</td>
<td>20</td>
<td>46</td>
<td>M10</td>
</tr>
<tr>
<td>KM63</td>
<td>63</td>
<td>14</td>
<td>8</td>
<td>26</td>
<td>31,7</td>
<td>41</td>
<td>20</td>
<td>16</td>
<td>24</td>
<td>52</td>
<td>M12</td>
</tr>
</tbody>
</table>

NOTE: Chart values shown are metric.
KM Rapid Plus RPNT-F

| KM size | D  | D2 | D3 | D4 | D5 | L4 | L5 | L6 | L7 | L8 | L9 | L10 | L11 | L12 | L13 | L14 | G1  | G2  | Screw DIN-ISO 7380 |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------------------|
| KM40    | 40 | 30 | 6  | 13.5| 17.2| 5  | 16 | 21 | 24 | 12 | 46 | 80  | 15 | 20.5| 25.5| 12.5| M8  | M6  | M6x6             |
| KM50    | 50 | 40 | 6  | 18.5| 22.2| 8  | 20 | 25.5| 29.2| 12 | 59 | 105 | 25 | 26  | 43.8| 33.5| 16.5| M10 | M8  | M8x10           |
| KM63    | 63 | 45 | 10 | 24.5| 28.5| 8  | 26 | 31.7| 38.5| 20 | 18 | 120 | 30 | 35  | 58.5| 41.3| 19.5| M12 | M8  | M8x10           |

NOTE: Chart values shown are metric.
## KM™ Tooling Mounting Dimensions

### KM-LOC™ CLNS/T-EF

<table>
<thead>
<tr>
<th>KM size</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>B</th>
<th>G</th>
<th>H</th>
<th>W1</th>
<th>W2</th>
<th>O-ring</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>32.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>10.00</td>
<td>30.00</td>
<td>10.00</td>
<td>30.00</td>
<td>10.00</td>
<td>30.00</td>
<td>10.00</td>
<td>M6</td>
<td>60.00</td>
<td>70°</td>
<td>35°</td>
<td>OR0145070V75</td>
<td></td>
</tr>
<tr>
<td>KM40</td>
<td>40.00</td>
<td>36.00</td>
<td>36.00</td>
<td>36.00</td>
<td>44.00</td>
<td>12.00</td>
<td>44.00</td>
<td>12.00</td>
<td>44.00</td>
<td>12.00</td>
<td>44.00</td>
<td>12.00</td>
<td>M8</td>
<td>70.00</td>
<td>70°</td>
<td>35°</td>
<td>OR00176070V75</td>
<td></td>
</tr>
<tr>
<td>KM50</td>
<td>50.00</td>
<td>47.00</td>
<td>47.00</td>
<td>47.00</td>
<td>49.00</td>
<td>14.00</td>
<td>49.00</td>
<td>14.00</td>
<td>49.00</td>
<td>14.00</td>
<td>49.00</td>
<td>14.00</td>
<td>M10</td>
<td>85.00</td>
<td>70°</td>
<td>35°</td>
<td>OR00208070V75</td>
<td></td>
</tr>
</tbody>
</table>

- **D5**: Coolant supply
- **L3**: (3,5)
- **D4**: (0,1) ± (0,024)
- **L8 min**: 0,5 ± (0,02)
- **L1 min**: 1 × 45°

---

**Technical Information**

[www.kennametal.com](http://www.kennametal.com)
## KM LOC-II™ CL2NS/T-BC Boring Cartridge

### Technical Information

#### KM™ Tooling Mounting Dimensions

<table>
<thead>
<tr>
<th>KM size</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>D6</th>
<th>D7</th>
<th>F</th>
<th>F1</th>
<th>H</th>
<th>H1</th>
<th>L1</th>
<th>L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM40</td>
<td>47.04</td>
<td>44.54</td>
<td>60.00</td>
<td>6.36</td>
<td>10.80</td>
<td>15.00</td>
<td>5.50</td>
<td>50.00</td>
<td>25.00</td>
<td>80.00</td>
<td>40.00</td>
<td>90.00</td>
<td>78.50</td>
</tr>
<tr>
<td></td>
<td>1.852</td>
<td>1.754</td>
<td>2.362</td>
<td>0.250</td>
<td>0.425</td>
<td>0.591</td>
<td>0.217</td>
<td>1.969</td>
<td>0.984</td>
<td>3.150</td>
<td>1.575</td>
<td>3.543</td>
<td>3.091</td>
</tr>
<tr>
<td>KM50</td>
<td>58.29</td>
<td>54.10</td>
<td>74.00</td>
<td>7.94</td>
<td>10.80</td>
<td>18.00</td>
<td>6.50</td>
<td>64.00</td>
<td>32.00</td>
<td>96.00</td>
<td>48.00</td>
<td>100.0</td>
<td>88.00</td>
</tr>
<tr>
<td></td>
<td>2.295</td>
<td>2.130</td>
<td>2.913</td>
<td>0.313</td>
<td>0.425</td>
<td>0.709</td>
<td>0.256</td>
<td>2.520</td>
<td>1.260</td>
<td>3.780</td>
<td>1.890</td>
<td>3.937</td>
<td>3.465</td>
</tr>
<tr>
<td>KM63</td>
<td>74.04</td>
<td>69.92</td>
<td>94.00</td>
<td>14.04</td>
<td>12.80</td>
<td>20.00</td>
<td>6.50</td>
<td>18.00</td>
<td>38.00</td>
<td>122.0</td>
<td>61.00</td>
<td>115.0</td>
<td>100.80</td>
</tr>
<tr>
<td></td>
<td>2.915</td>
<td>2.753</td>
<td>3.701</td>
<td>0.553</td>
<td>0.504</td>
<td>0.787</td>
<td>0.256</td>
<td>3.071</td>
<td>1.535</td>
<td>4.803</td>
<td>2.402</td>
<td>4.528</td>
<td>1.535</td>
</tr>
</tbody>
</table>

### Optional Customer Coolant Port Access Area

- 360º to coolant port access area

---

**View A**
- Top access cam location
- Side access cam location

**View B**
- To coolant port access area
- Optional customer coolant port access area

---

**Additional Technical Information**
- Optional customer coolant port access area 360º
- W1, W2, O-ring
- L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, G, W1, W2, O-ring

---

**Website**

www.kennametal.com
### Technical Information

#### KM™ Tooling Mounting Dimensions

**KM RACA and NAC**

<table>
<thead>
<tr>
<th>KM Size</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>D6</th>
<th>D7</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>52.00</td>
<td>51.60</td>
<td>10.08</td>
<td>5.00</td>
<td>5.00</td>
<td>47.08</td>
<td>85.00</td>
<td>9.00</td>
<td>72.00</td>
<td>85.00</td>
<td>24.00</td>
</tr>
<tr>
<td></td>
<td>2.047</td>
<td>2.032</td>
<td>0.397</td>
<td>0.196</td>
<td>0.196</td>
<td>1.853</td>
<td>3.346</td>
<td>0.354</td>
<td>2.835</td>
<td>3.346</td>
<td>0.945</td>
</tr>
<tr>
<td>KM40</td>
<td>62.00</td>
<td>61.70</td>
<td>10.08</td>
<td>7.70</td>
<td>7.70</td>
<td>55.08</td>
<td>100.00</td>
<td>10.00</td>
<td>78.50</td>
<td>95.00</td>
<td>30.00</td>
</tr>
<tr>
<td></td>
<td>2.441</td>
<td>2.421</td>
<td>0.397</td>
<td>0.303</td>
<td>0.303</td>
<td>2.168</td>
<td>3.937</td>
<td>0.394</td>
<td>2.168</td>
<td>3.937</td>
<td>1.181</td>
</tr>
<tr>
<td>KM50</td>
<td>72.00</td>
<td>71.70</td>
<td>12.08</td>
<td>8.00</td>
<td>8.00</td>
<td>65.08</td>
<td>120.00</td>
<td>10.00</td>
<td>97.00</td>
<td>115.00</td>
<td>34.00</td>
</tr>
<tr>
<td></td>
<td>2.836</td>
<td>2.815</td>
<td>0.475</td>
<td>0.315</td>
<td>0.315</td>
<td>2.562</td>
<td>4.724</td>
<td>0.384</td>
<td>2.562</td>
<td>4.724</td>
<td>1.339</td>
</tr>
<tr>
<td>KM63</td>
<td>85.00</td>
<td>84.60</td>
<td>16.08</td>
<td>9.50</td>
<td>9.50</td>
<td>75.08</td>
<td>140.00</td>
<td>12.00</td>
<td>124.50</td>
<td>145.00</td>
<td>35.35</td>
</tr>
<tr>
<td></td>
<td>3.346</td>
<td>3.327</td>
<td>0.633</td>
<td>0.374</td>
<td>0.374</td>
<td>2.956</td>
<td>5.512</td>
<td>0.472</td>
<td>2.956</td>
<td>5.512</td>
<td>1.392</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KM Size</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>L9</th>
<th>L10</th>
<th>L11</th>
<th>L12</th>
<th>L13</th>
<th>L14</th>
<th>L15</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>11.50</td>
<td>32.00</td>
<td>32.00</td>
<td>27.50</td>
<td>34.00</td>
<td>24.00</td>
<td>32.00</td>
<td>27.50</td>
<td>70.00</td>
<td>38.00</td>
<td>14.50</td>
</tr>
<tr>
<td></td>
<td>0.453</td>
<td>1.260</td>
<td>1.260</td>
<td>1.083</td>
<td>1.339</td>
<td>0.945</td>
<td>0.945</td>
<td>1.083</td>
<td>2.756</td>
<td>1.496</td>
<td>0.571</td>
</tr>
<tr>
<td>KM40</td>
<td>15.00</td>
<td>37.00</td>
<td>39.50</td>
<td>32.00</td>
<td>40.00</td>
<td>26.50</td>
<td>39.50</td>
<td>32.00</td>
<td>40.00</td>
<td>26.50</td>
<td>22.00</td>
</tr>
<tr>
<td></td>
<td>0.591</td>
<td>1.457</td>
<td>1.555</td>
<td>1.298</td>
<td>1.575</td>
<td>1.043</td>
<td>1.043</td>
<td>1.339</td>
<td>3.307</td>
<td>1.811</td>
<td>0.866</td>
</tr>
<tr>
<td>KM50</td>
<td>16.50</td>
<td>45.00</td>
<td>46.00</td>
<td>42.00</td>
<td>48.00</td>
<td>34.00</td>
<td>46.00</td>
<td>42.00</td>
<td>102.00</td>
<td>54.00</td>
<td>22.00</td>
</tr>
<tr>
<td></td>
<td>0.650</td>
<td>1.772</td>
<td>1.811</td>
<td>1.654</td>
<td>1.890</td>
<td>1.339</td>
<td>1.339</td>
<td>1.654</td>
<td>4.016</td>
<td>2.126</td>
<td>0.866</td>
</tr>
<tr>
<td>KM63</td>
<td>18.80</td>
<td>51.70</td>
<td>55.00</td>
<td>46.00</td>
<td>55.00</td>
<td>42.15</td>
<td>55.00</td>
<td>47.00</td>
<td>117.00</td>
<td>65.00</td>
<td>24.00</td>
</tr>
<tr>
<td></td>
<td>0.740</td>
<td>2.035</td>
<td>2.165</td>
<td>1.811</td>
<td>2.165</td>
<td>1.659</td>
<td>1.659</td>
<td>1.850</td>
<td>4.606</td>
<td>2.559</td>
<td>0.945</td>
</tr>
</tbody>
</table>

**Note:**
- Coolant supply
- Air supply
- G: M5-1.25x20 (.79) deep
- M10-1.5x25 (.98) deep
- M12-1.75x25 (.98) deep
- M16-2.0x30 (1.18) deep
KM RACA and NACA Spring-Pack Cylinder

Technical Information
KM™ Tooling Mounting Dimensions

### KM RACA and NACA Spring-Pack Cylinder

<table>
<thead>
<tr>
<th>KM size</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32</td>
<td>85.00</td>
<td>76.50</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>3.346</td>
<td>3.012</td>
<td>0.118</td>
</tr>
<tr>
<td>KM40</td>
<td>95.00</td>
<td>83.20</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>3.740</td>
<td>3.276</td>
<td>0.118</td>
</tr>
<tr>
<td>KM50</td>
<td>115.00</td>
<td>103.00</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>4.528</td>
<td>4.055</td>
<td>0.118</td>
</tr>
<tr>
<td>KM63</td>
<td>145.00</td>
<td>131.00</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>5.709</td>
<td>5.167</td>
<td>0.118</td>
</tr>
</tbody>
</table>

### NCA Spring-Pack Mounting Details

<table>
<thead>
<tr>
<th>KM size</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32-NCA-DS31</td>
<td>51.00</td>
<td>50.50</td>
<td>8.00</td>
<td>3.20</td>
<td>3.20</td>
<td>36.00</td>
<td>10.50</td>
<td>27.50</td>
<td>19.50</td>
<td>6.00</td>
<td>44.00</td>
<td>9.00</td>
<td>M8-1.25x20 (0.79) deep</td>
</tr>
<tr>
<td></td>
<td>2.008</td>
<td>1.988</td>
<td>0.315</td>
<td>0.126</td>
<td>0.126</td>
<td>1.417</td>
<td>0.413</td>
<td>1.083</td>
<td>0.768</td>
<td>0.236</td>
<td>1.732</td>
<td>0.354</td>
<td></td>
</tr>
<tr>
<td>KM40-NCA-DS40</td>
<td>62.00</td>
<td>61.50</td>
<td>12.00</td>
<td>4.50</td>
<td>4.50</td>
<td>45.00</td>
<td>13.00</td>
<td>34.01</td>
<td>24.00</td>
<td>9.00</td>
<td>53.01</td>
<td>11.00</td>
<td>M10-1.5x20 (0.79) deep</td>
</tr>
<tr>
<td></td>
<td>2.441</td>
<td>2.421</td>
<td>0.472</td>
<td>0.177</td>
<td>0.177</td>
<td>1.772</td>
<td>0.512</td>
<td>1.339</td>
<td>0.945</td>
<td>0.354</td>
<td>2.087</td>
<td>0.433</td>
<td></td>
</tr>
<tr>
<td>KM50-NCA-DS50</td>
<td>78.00</td>
<td>71.50</td>
<td>15.00</td>
<td>5.50</td>
<td>5.50</td>
<td>56.00</td>
<td>16.00</td>
<td>42.00</td>
<td>28.00</td>
<td>6.00</td>
<td>74.00</td>
<td>12.00</td>
<td>M12-1.75x30 (1.18) deep</td>
</tr>
<tr>
<td></td>
<td>3.071</td>
<td>2.815</td>
<td>0.591</td>
<td>0.217</td>
<td>0.217</td>
<td>2.205</td>
<td>0.630</td>
<td>1.654</td>
<td>1.102</td>
<td>0.236</td>
<td>2.913</td>
<td>0.472</td>
<td></td>
</tr>
</tbody>
</table>
**KM™ Tooling Mounting Dimensions**

**KM32 NCA**

<table>
<thead>
<tr>
<th>KM size</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM32-NCA-DS16</td>
<td>51.00</td>
<td>50.80</td>
<td>6.04</td>
<td>5.00</td>
<td>5.00</td>
<td>29.37</td>
<td>10.89</td>
<td>23.93</td>
<td>20.09</td>
<td>20.00</td>
<td>65.00</td>
<td>11.20</td>
<td>32.25</td>
<td>M8-1.25x15 (.59) deep</td>
</tr>
</tbody>
</table>

Air inlet: L1
Coolant inlet: L3
Left-hand mounting: G
D1: 51.00
D2: 50.80
D3: 6.04
D4: 5.00
D5: 5.00
L1: 29.37
L2: 10.89
L3: 23.93
L4: 20.09
L5: 20.00
L6: 65.00
L7: 11.20
L8: 32.25
G: M8-1.25x15 (.59) deep
KM™ Tooling Mounting Dimensions

**Technical Information**

**XGL – Static**

- **D3** coolant supply
- **D6** air supply
- **D5** hydraulic inlet

**KM80**

<table>
<thead>
<tr>
<th>KM size</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>D6</th>
<th>D7</th>
<th>G</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L7</th>
<th>L8</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>W4</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM80</td>
<td>92.177</td>
<td>92.177</td>
<td>4.213</td>
<td>12.045</td>
<td>6.35</td>
<td>6.35</td>
<td>M10</td>
<td>M12</td>
<td>18.00</td>
<td>81.95</td>
<td>53.525</td>
<td>14.00</td>
<td>30.00</td>
<td>32.00</td>
<td>35°</td>
<td>17°30'</td>
<td>17°30'</td>
<td></td>
</tr>
</tbody>
</table>

---

www.kennametal.com

Technical Information
The KM Micro/KM Mini Coupling

The rigidity and stiffness of the patented KM Micro/KM Mini joint are achieved through a combination of unique design elements incorporated in both the shank of the tool and the clamping mechanism. The KM Micro/KM Mini joint was developed as a system and takes full advantage of both the tool shank and the mechanism to obtain maximum benefit from the space utilized.

Taper Shank

All KM Micro/KM Mini tooling is designed around a short 10:1 tapered shank. Extensive testing of many different lengths and angles proves this combination provides the maximum stiffness and input forces required for locking/unlocking. The taper is self-centering to promote easy tool loading and unloading.

Face and Taper Contact

KM Micro/KM Mini tooling is designed to have simultaneous taper and face contact. Two alternate methods provide metal-to-metal contact. One method is to manufacture both halves of the coupling holding very close tolerances. The other is to design a small amount of elastic deformation into the assembly. With KM Micro/KM Mini tooling, elastic deformation takes the form of expansion of the female taper (on the clamping unit) as the larger male taper (on the cutting unit) is pulled back during lockup.

Our testing proved that an optimum combination of pull-back force and elastic deformation (rather than a close tolerance) provides greater static and dynamic stiffness and achieves a metal-to-metal fit.

Clamping Mechanism

The mechanism design consists of two components: the torque screw and the wedge nut. This simple, yet highly effective clamping mechanism allows the user to lock and unlock the cutting unit by simply using a preset torque wrench. This KM Micro/KM Mini clamping mechanism fits inside the taper shank of the KM Micro/KM Mini cutting unit and utilizes a coincidental cone design that maximizes the contact area between the clamping mechanism and the cutting unit. As a result, the cutting unit and clamping mechanism are on a shared axis and provide accurate axial and radial repeatability of ±.00008" (± 2 micron) for a specific cutting unit in a specific clamping unit.

When more than one cutting unit is used, the accuracy of each cutting unit must be considered. Pre-gaging (when changing tools) measures the deviations of each tool from the nominal. These deviations can then be compensated for by the machine tool control offsets.
Locking Sequence

The clamping sequence starts with the insertion of the cutting unit into the female taper of the clamping unit. The cutting unit first makes contact at a stand-off from the gage face of approximately .010" (0.25mm). The torque screw is then activated by a preset torque wrench at a right angle to the centerline of the cutting tool, located behind the gage face of the clamping unit. A small amount of elastic deformation takes place at the front of the female taper as the locking force is applied. As the torque screw is further tightened to the preset torque of 25–30 ft. lbs. (34–40 Nm), (.4-1/4 turns), the cutting unit advances until the gage face makes contact with the face of the clamping unit. The final amount of torque applied allows the tail of the cutting unit to spread to clamp securely between the clamping mechanism and the clamping unit inside diameter. Once the proper operational torque is achieved, continuing to rotate the torque screw may damage the clamping components.

Installation

When initially clamping the KM Micro/KM Mini shank in a machine tool slot, it is recommended to have a cutting unit in the shank.

Lubrication

Using the appropriate wrench, back out the torque screw against the positive stop and generously apply grease to the threads and conical surface of the component hardware. Also, apply grease to the female taper surface. This should be done periodically. Recommended grease: GLEITMO™ 805.

Summary

The KM Micro/KM Mini coupling offers a very rigid joint with a high degree of repeatability while maintaining a very compact envelope. This permits a high degree of versatility without sacrificing cutting performance.
Locking
Before inserting the KM Micro and KM Mini unit into the clamping mechanism (Figure 1), clean the contact face and taper. KM Micro and KM Mini manual clamping units require a torque wrench for proper operation. Turning the torque screw clockwise locks the cutting unit in position. For maximum safety, tighten the torque screw to the specified torque. Using a torque wrench ensures that the proper clamping forces are exerted.

Operating Position
With the torque screw and nut to the proper torque, coincidental cones locked in position, and the face and self-locking taper fully engaged, the cutting unit and clamping unit are rigidly secured together (Figure 2).

Unlocking
Rotate the torque screw counterclockwise until initial resistance is felt. In this position, the locking cones are free of the cutting unit, but the taper interference is still holding the KM™ unit in the clamping unit. At this point, the bump-off angle is in position to free the cutting unit from the interference fit.

Continue to rotate the torque screw slowly until the cutting unit is no longer making face contact (Figure 3) and is released from the taper. The torque screw will stop rotating and more resistance will be felt. Do not turn the torque screw any further.

CAUTION
Continuing to rotate the torque screw may damage the clamping components.

<table>
<thead>
<tr>
<th>KM size</th>
<th>torque (ft-lbs)</th>
<th>torque (Nm)</th>
<th>actuation drive size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM12</td>
<td>5–6</td>
<td>7–8</td>
<td>25IP</td>
</tr>
<tr>
<td>KM1612</td>
<td>7–8</td>
<td>10–11</td>
<td>27IP</td>
</tr>
<tr>
<td>KM16</td>
<td>7–8</td>
<td>10–11</td>
<td>27IP</td>
</tr>
<tr>
<td>KM20</td>
<td>14–16</td>
<td>19–22</td>
<td>5mm</td>
</tr>
<tr>
<td>KM25/50</td>
<td>14–16</td>
<td>19–22</td>
<td>5mm</td>
</tr>
<tr>
<td>KM25</td>
<td>25–30</td>
<td>34–40</td>
<td>6mm</td>
</tr>
<tr>
<td>KM32/25</td>
<td>25–30</td>
<td>34–40</td>
<td>6mm</td>
</tr>
</tbody>
</table>

CAUTION
Over tightening can cause damage to the clamping mechanism.
KM Micro™/KM™ Mini Center Height Adjustment Feature for Flange Clamping Units

KM Micro flange mounts can adjust insert center height via a cam pin to be purchased separately. To do this:

1. Remove the locating pin that is installed in the flange mount clamping unit.
2. Install the adjusting cam in the toolblock-locating pin hole.
3. Install the flange mount clamping unit to the toolblock, ensuring the cam portion of the adjusting pin locates within the slot on the back side of the flange.
4. To adjust, simply access the hex through the locating pin hole of the flange unit and rotate to set center height with mounting screws loose.
5. Tighten the mounting bolts to the required torque for the specific bolt size.

<table>
<thead>
<tr>
<th>KM size</th>
<th>order number</th>
<th>catalog number</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1925860</td>
<td>MICROCAM12</td>
</tr>
<tr>
<td>16, 25, 32, 25</td>
<td>1851803</td>
<td>MICROCAM16</td>
</tr>
</tbody>
</table>

What is KM1612/KM2016/KM2520/KM3225 for ID Machining?

The KM1612/KM2016/KM2520/KM3225 is the ID endworking tooling product line to complement the KM12/KM16/KM20/KM25 OD turning tooling product line.

- Products are through-coolant capable.
- External tapers are the same as KM12/KM16/KM20/KM25.

Major difference is center height location of the insert.

- KM12/KM16/KM20/KM25
  - Square shank cutting units
  - Insert is above centerline
- KM1612/KM2016/KM2520/KM3225
  - Centerline cutting units
  - Insert is on centerline
Technical Information
KM Micro™/KM™ Mini Manual Clamping System

KM Micro/KM Mini Manual Clamping Repair Package Components

Square Shank

KM Manual Clamping Components • Functional Definitions

1. Torque Screw
   • Rotation moves the locking cones.
   ○ Clockwise rotation secures cutting unit.
   ○ Counterclockwise rotation releases cutting unit.
   • Provides bump-off angle.

2. Wedge Nut
   • Contains anti-rotation feature.

3. Containment Screw
   • Provides unlocking positive stop.
   • Provides anchor for wedge nut anti-rotation feature.

Operator Maintenance

All KM Micro/KM Mini clamping units showing damage must be replaced or rebuilt. Burrs and nicks should be removed by stoning and/or polishing.

• Use KM Micro/KM Mini Plugs to protect clamping units when they are not in use.
  For KM Micro Plugs, see page A117.
  For KM Mini Plugs, see page A186.

KM Micro/KM Mini Manual Clamping Repair Packages

<table>
<thead>
<tr>
<th>KM size</th>
<th>catalog number</th>
<th>order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM12</td>
<td>KM12NAPKG</td>
<td>3953388</td>
</tr>
<tr>
<td>KM16</td>
<td>KM16NAPKG</td>
<td>3953386</td>
</tr>
<tr>
<td>KM20</td>
<td>KM20NAPKG</td>
<td>3645146</td>
</tr>
<tr>
<td>KM25</td>
<td>KM25NAPKG</td>
<td>3645145</td>
</tr>
</tbody>
</table>
KM Manual Clamping Components • Functional Definitions

1. Torque Screw
   • Rotation moves the locking cones.
     ◦ Clockwise rotation secures cutting unit.
     ◦ Counterclockwise rotation releases cutting unit.
   • Provides bump-off angle.

2. Wedge Nut
   • Contains anti-rotation feature.

3. Containment Pin
   • Provides unlocking positive stop.
   • Provides anchor for wedge nut anti-rotation feature.

Operator Maintenance:
All KM Micro/KM Mini Clamping Units showing damage must be replaced or rebuilt.
Burr and nicks should be removed by stoning and/or polishing.

- Use KM Micro/KM Mini Plugs to protect clamping units when they are not in use.
  - For KM Micro Plugs, see page A117.
  - For KM Mini Plugs, see page A186.

KM Micro/KM Mini Manual Clamping Repair Packages

<table>
<thead>
<tr>
<th>KM size</th>
<th>catalog number</th>
<th>order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM12</td>
<td>KM12NRPKG</td>
<td>1925658</td>
</tr>
<tr>
<td>KM16</td>
<td>KM16NRPKG</td>
<td>1851801</td>
</tr>
<tr>
<td>KM20</td>
<td>KM20NRPKG</td>
<td>3645148</td>
</tr>
<tr>
<td>KM25</td>
<td>KM25NAPKG</td>
<td>2396037</td>
</tr>
<tr>
<td>KM32</td>
<td>KM32SNAPKG</td>
<td>2656552</td>
</tr>
</tbody>
</table>

Technical Information
KM Micro™/KM™ Mini Manual Clamping System
KM Micro/KM Mini • Assembly/Disassembly Instructions

1. Apply GLEITMO™ 805 grease generously to threads, cones on torque screw and nut, and bump-off area (behind threads) of the torque screw. Also, apply grease generously to the female taper on the shank.

2. Screw the torque screw and the nut together.

3. Insert the torque screw and nut into the shank (as one unit) as shown in (Frame 1).

4. Install the containment screw as shown (Frame 2).

5. When initially clamping the KM Micro shank in a machine tool slot, it is recommended that a cutting unit be in the shank.

6. Disassembly is the reverse of assembly procedure.

Tools Required
- Hex wrenches.
- Pliers.
- Kennametal recommends and uses GLEITMO™ 805.
- Clean towels or shop rags.
- Solvent or degreaser that does not leave residue (used to clean inside the taper and canister). Should the unit become contaminated, you can use a degreasing agent or something similar to clean the surfaces.

CAUTION
DO NOT USE silicone cleaner or WD-40™-type lubricants.

<table>
<thead>
<tr>
<th>lubricant</th>
<th>order number</th>
<th>size</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567575</td>
<td>500g cartridge</td>
</tr>
<tr>
<td>GLEITMO 805 grease</td>
<td>1567577</td>
<td>1000g tin</td>
</tr>
</tbody>
</table>
Maintenance Schedule

Disassemble the shanks once a month and re-apply new grease. Grease should also be applied 1 or 2 times per week to the torquw screw, nut, and both tapers (internal and external) in the release position without the need to disassemble.

Before re-applying grease, shop air should be used to blow out oil coolant.

If contamination of the grease is evident, then the old grease should be immediately removed and the shank cleaned. Then new grease should be re-applied according to procedure.

NOTE: Apply grease with a coarse bristle brush to prevent shedding of bristles.

<table>
<thead>
<tr>
<th>KM size</th>
<th>hex size</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM12</td>
<td>2.5mm</td>
</tr>
<tr>
<td>KM16</td>
<td>3mm</td>
</tr>
<tr>
<td>KM20</td>
<td>4mm</td>
</tr>
<tr>
<td>KM25</td>
<td>5mm</td>
</tr>
</tbody>
</table>
## KM Micro/KM Mini NCM-SF

<table>
<thead>
<tr>
<th>KM Size</th>
<th>D1</th>
<th>D3</th>
<th>G</th>
<th>L1</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>L9</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM12</td>
<td>10,025/10,050</td>
<td>4,064/4,077</td>
<td>M3</td>
<td>5,0</td>
<td>8,25</td>
<td>8,00</td>
<td>5,13</td>
<td>6</td>
<td>8</td>
<td>10,0</td>
<td>22</td>
</tr>
<tr>
<td>KM16</td>
<td>14,025/14,050</td>
<td>5,055/5,075</td>
<td>M4</td>
<td>6,5</td>
<td>10,75</td>
<td>10,25</td>
<td>6,00</td>
<td>10</td>
<td>12</td>
<td>15,0</td>
<td>28</td>
</tr>
<tr>
<td>KM20</td>
<td>18,025/18,050</td>
<td>5,055/5,075</td>
<td>M5</td>
<td>8,0</td>
<td>13,00</td>
<td>12,25</td>
<td>7,75</td>
<td>10</td>
<td>12</td>
<td>15,0</td>
<td>34</td>
</tr>
<tr>
<td>KM25</td>
<td>24,025/24,050</td>
<td>5,055/5,075</td>
<td>M6</td>
<td>8,5</td>
<td>15,75</td>
<td>14,50</td>
<td>10,50</td>
<td>10</td>
<td>15</td>
<td>18,0</td>
<td>40</td>
</tr>
</tbody>
</table>
KM Micro™/KM™ Mini Mounting Dimensions

**KM Micro/KM Mini NCM-SF with Coolant**

<table>
<thead>
<tr>
<th>KM size</th>
<th>D1</th>
<th>D3</th>
<th>D4</th>
<th>G</th>
<th>L1</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>L9</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM1612</td>
<td>17.025/17.050</td>
<td>4.06/4.080</td>
<td>6 - 12</td>
<td>M4</td>
<td>6</td>
<td>11.00</td>
<td>9.75</td>
<td>6.75</td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>27.5</td>
</tr>
<tr>
<td>KM2016</td>
<td>20.025/20.050</td>
<td>5.05/5.075</td>
<td>6 - 16</td>
<td>M5</td>
<td>8</td>
<td>13.25</td>
<td>12.00</td>
<td>8.00</td>
<td>7</td>
<td>13</td>
<td>18</td>
<td>34.0</td>
</tr>
<tr>
<td>KM2520</td>
<td>26.025/26.050</td>
<td>5.05/5.075</td>
<td>6 - 22</td>
<td>24.5</td>
<td>8</td>
<td>16.15</td>
<td>14.50</td>
<td>10.00</td>
<td>10</td>
<td>12</td>
<td>18</td>
<td>39.0</td>
</tr>
</tbody>
</table>

www.kennametal.com
KM Mini NCM-SF with Coolant

<table>
<thead>
<tr>
<th>KM size</th>
<th>D1</th>
<th>D3</th>
<th>D4</th>
<th>G</th>
<th>L1</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>L7</th>
<th>L8</th>
<th>L9</th>
<th>L10</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM322S</td>
<td>24,025/24,050</td>
<td>5,106/5,126</td>
<td>3</td>
<td>M6</td>
<td>8.5</td>
<td>14.7</td>
<td>9.5</td>
<td>17</td>
<td>13</td>
<td>10</td>
<td>15</td>
<td>18</td>
<td>16.5</td>
<td>45</td>
</tr>
</tbody>
</table>
KM Micro™ Quick Change Tooling System

A smaller, more compact version of the internationally renowned KM™ system.

- Quick-change cutter heads reduce indexing and set-up times by 66%.
- Specially designed for use with automatic and smaller universal lathes.
- Unique flange attachment system increases machine tool capacity.
- KM Micro square shank adapters can be installed quickly and easily in existing tool block adapters.

Experience the advantages at your Authorized Kennametal Distributor or at www.kennametal.com.
Balancing

Kennametal offers a range of balanced and balanced-by-design toolholders capable of extending spindle and tool life and improving part quality at higher machining speeds.

Definitions for Balance

**Standard Toolholder**

A toolholder that may contain uncorrected features (unbalanced drive slots, notches, locking screws, etc.). Standard toolholders have no compensating features added to correct balance, used in basic, low-speed applications.

**Balanced-by-Design**

A toolholder designed with compensating features to correct any unbalance caused by 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.

**Balanceable**

A toolholder with a built-in mechanism that can adjust to correct any unbalance inaccuracies incurred during normal manufacturing. The fully assembled tool (toolholder and cutting tool) can be balanced as a system using a balancing device.

**Balanced**

A toolholder has been balanced to predetermined specification after manufacture 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.

When machining at higher speeds, responsible machining practices must be observed. Unbalance is caused by uneven mass distribution in the tool or toolholder. Potential sources of unbalance are movable parts (adjustable cartridges, set screws, spindle spring pack, and clamping mechanisms), manufacturing tolerances, and design.

Forces caused by unbalance increase with the rotational speed squared. Excessive unbalance can cause premature wear to the tool and spindle bearing, which can adversely affect surface finish and accuracy.

(continued)
Balancing (continued)

The balance quality is usually specified by the balance grade G, according to ISO 1940-1 and ANSI S2.19 standards.

The balance quality grade (G) was derived from practical experience, which is expressed in millimeters per second (mm/s) and ranges from 0.16–4000. For rotating tooling and general machinery parts, it is usually specified to be G 2.5 or G 6.3. A lower number designates better balance quality.

The permissible residual unbalance can be calculated by the following equation:

\[ U_{\text{per}} = \frac{9549 \times G \times M}{n} \]

Where:
- \( U_{\text{per}} \) = permissible unbalance, expressed in gram millimeters (gmm)
- \( G \) = desired balance grade
- \( M \) = rotor mass in kilograms (kg)
- \( n \) = operating speed in rotations per minute (RPM)

Example:
- Rotor mass = 2 kg
- \( n \) = 10,000 RPM
- Desired balancing grade = G 6.3

\[ U_{\text{per}} = \frac{9549 \times 6.3 \times 2}{10,000} = 12 \text{ gmm} \]

The same value can be obtained from the chart on the following page. It gives the permissible specific unbalance in gram millimeters (gmm) as a function of the rotational speed and the balance quality (G). For the example above, at 10,000 RPM and for grade G 6.3, the maximum residual unbalance would be 6 gmm/kg. The toolholder assembly (including the tool) has a mass equal to 2 kg, the permissible unbalance is \([6 \text{ gmm/kg} \times 2 \text{ kg}]\), which equals 12 gmm.
From the approach described in ISO 1940-1, the requirements for maximum residual unbalance become very strict as speed increases. For example, a G 2.5 balancing grade can become unpractical at 25,000 RPM for a tool with a mass of 1 kg. The chart shows that the maximum residual unbalance would be 1 gmm, which could be very time consuming to be achieved or even beyond the accuracy of the balancing machine.

Comparing the cutting forces can provide a reference for the balancing requirements. Generally, finishing operations generate lower cutting forces and require a better balance quality. Though rotating components should always be balanced, in most cases it is sufficient to keep the unbalance forces to 5–10% of the cutting forces.
Balancing (continued)

The permissible residual unbalance can be calculated by the following equation:

\[ F = U \times \left( \frac{n}{9,549} \right)^2 \text{ (Newtons)} \]

Where:
- \( U \) = unbalance in gram millimeters (gmm)
- \( N \) = rotational speed (RPM)

In this particular case, the unbalanced induced force would be \( F = 1 \times (25,000/9,549)^2 = 6.9 \) N. The cutting forces generated are likely to be orders of magnitude greater than that.

Good balancing quality does not necessarily guarantee safe operation at higher speeds. Other variables (spindle connection, type of operation, cutting parameters, machine stiffness, bearing condition, etc.) should always be considered.

Unbalance can be corrected by material removal (drilling, milling, grinding), material addition (set screws), and material redistribution (balancing rings or set screws).

For a given unbalance, the following formula can be used to determine the hole depth (L) necessary to correct for the unbalance*:

\[ L = \frac{D - \sqrt{D^2 - U \times 1300/d^2}}{2} \]

Where:
- \( U \) = unbalance (gmm)
- \( D \) = diameter of placement (mm)
- \( d \) = hole diameter (flat bottom) (mm)
- \( L \) = hole depth (mm)

* Formula for steel components only.
The Concept

Heat shrinking is not a new process in the machine tool industry. However, the concept was only recently implemented as a quick-change toolholding mechanism for clamping cylindrical cutting tools for high-speed machining applications.

The Shrink Fit process begins by applying a quick and precise heat to the holding end of a toolholder. This causes the internal bore, which is slightly smaller than the shank of a cutting tool, to expand, allowing a tool to be inserted. As the toolholder cools, the bore shrinks to create 360° of uniform pressure along the entire length of the bore, resulting in an evenly distributed clamping force that mechanical toolholding cannot beat.

Due to the design, flatted-style, Weldon®, and Whistle Notch™ cutting tool shanks can employ Shrink Fit technology. To gain full benefits of the technology, fully cylindrical tool shanks are recommended. As long as the heating processes are kept within the elastic range of the toolholder material, this clamping operation can be repeated for several thousand cycles.

Shrink Fit Tooling Advantages:

- Low runout — cutting tools are gripped 360° along the entire length of the cutting tool shank for an evenly distributed clamping force.
- Clamping forces are greater than collets or hydraulic chucks.
- During testing, tool material properties break down and shear before slippage occurs.
- Slim and short toolholder profile designs are achievable because no moving parts are used.
- Well suited for high-speed operations because their symmetry provides the best possible balance.
- Sealing stop screws are not required — designed interference between the cutting tool and toolholder forms a seal that enables coolant to flow only through designated passages.

These advantages enable Shrink Fit technology to work at greater speeds and feeds, produce better finishes, deliver increased tool and spindle life, and generate more productivity.
Heat-Activating Systems
Shorter cycle time, less cooling downtime, localized heating, and integrated cooling systems are essential for a safe and simple heating system. Shrink Fit heating systems include induction, hot-air, and open-flame methods, with induction being the easiest and fastest of these systems.

Toolholders

- Slim design.
- Balanced.
- Flatted-style, Weldon®, and Whistle Notch™ shanks can be gripped. Optimal results are obtained with smooth, cylindrical shank cutting tools — without flats and/or notches.
- Avoid using carbide tools with polished shanks. This will reduce torque values by 60%.

HT (High Torque) Shrink Fit Toolholders
HT Shrink Fit holders have a high interference level that offers 30–50% greater torque than competitive systems. This line is only to be used with carbide tools because of their low thermal expansion coefficient. These toolholders require a machine with at least 10 kW of power to apply heat quick enough to avoid heating the tool.

GP (General Purpose) Shrink Fit Toolholders
GP toolholders enable the use of all materials and extensions because they have lower interference levels. Operators should use this style if not generating high cutting forces.

Ideal Surface Quality

- Metric (ISO standard) Ra ≥0.8 μm surface finish.
- Inch (industry standard) Ra ≥32 μin surface finish.
Shrink Fit (continued)

Straight shank toolholder extensions are a great complement to the Shrink Fit system. Use caution and do not overheat Slim Line products. Overheating can cause warping or other permanent damage. Toolholder life drastically reduces if activating heat is not properly controlled.

### Cutting Tool Requirements

<table>
<thead>
<tr>
<th>cutting tool shank diameters (metric)</th>
<th>tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3mm</td>
<td>2.997</td>
</tr>
<tr>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td>4mm</td>
<td>3.996</td>
</tr>
<tr>
<td></td>
<td>4,000</td>
</tr>
<tr>
<td>5mm</td>
<td>4.985</td>
</tr>
<tr>
<td></td>
<td>5,000</td>
</tr>
<tr>
<td>6mm</td>
<td>5.992</td>
</tr>
<tr>
<td></td>
<td>6,000</td>
</tr>
<tr>
<td>8mm</td>
<td>7.991</td>
</tr>
<tr>
<td></td>
<td>8,000</td>
</tr>
<tr>
<td>10mm</td>
<td>9.991</td>
</tr>
<tr>
<td></td>
<td>10,000</td>
</tr>
<tr>
<td>12mm</td>
<td>11.989</td>
</tr>
<tr>
<td></td>
<td>12,000</td>
</tr>
<tr>
<td>14mm</td>
<td>13.989</td>
</tr>
<tr>
<td></td>
<td>14,000</td>
</tr>
<tr>
<td>16mm</td>
<td>15.989</td>
</tr>
<tr>
<td></td>
<td>16,000</td>
</tr>
<tr>
<td>18mm</td>
<td>17.989</td>
</tr>
<tr>
<td></td>
<td>18,000</td>
</tr>
<tr>
<td>20mm</td>
<td>19.987</td>
</tr>
<tr>
<td></td>
<td>20,000</td>
</tr>
<tr>
<td>25mm</td>
<td>24.987</td>
</tr>
<tr>
<td></td>
<td>25,000</td>
</tr>
<tr>
<td>32mm</td>
<td>31.984</td>
</tr>
<tr>
<td></td>
<td>32,000</td>
</tr>
<tr>
<td>40mm</td>
<td>39.984</td>
</tr>
<tr>
<td></td>
<td>40,000</td>
</tr>
<tr>
<td>50mm</td>
<td>49.984</td>
</tr>
<tr>
<td></td>
<td>50,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>cutting tool shank diameters (inch)</th>
<th>tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>.1249</td>
</tr>
<tr>
<td></td>
<td>.1247</td>
</tr>
<tr>
<td>3/16</td>
<td>.1874</td>
</tr>
<tr>
<td></td>
<td>.1872</td>
</tr>
<tr>
<td>1/4</td>
<td>.2489</td>
</tr>
<tr>
<td></td>
<td>.2498</td>
</tr>
<tr>
<td>5/16</td>
<td>.3124</td>
</tr>
<tr>
<td></td>
<td>.3121</td>
</tr>
<tr>
<td>3/8</td>
<td>.3749</td>
</tr>
<tr>
<td></td>
<td>.3746</td>
</tr>
<tr>
<td>7/16</td>
<td>.4375</td>
</tr>
<tr>
<td></td>
<td>.4371</td>
</tr>
<tr>
<td>1/2</td>
<td>.5000</td>
</tr>
<tr>
<td></td>
<td>.4996</td>
</tr>
<tr>
<td>9/16</td>
<td>.5625</td>
</tr>
<tr>
<td></td>
<td>.5621</td>
</tr>
<tr>
<td>5/8</td>
<td>.6250</td>
</tr>
<tr>
<td></td>
<td>.6246</td>
</tr>
<tr>
<td>11/16</td>
<td>.6875</td>
</tr>
<tr>
<td></td>
<td>.6871</td>
</tr>
<tr>
<td>3/4</td>
<td>.7500</td>
</tr>
<tr>
<td></td>
<td>.7495</td>
</tr>
<tr>
<td>7/8</td>
<td>.8750</td>
</tr>
<tr>
<td></td>
<td>.8745</td>
</tr>
<tr>
<td>1</td>
<td>1.0000</td>
</tr>
<tr>
<td></td>
<td>.9995</td>
</tr>
<tr>
<td>1-1/4</td>
<td>1.2500</td>
</tr>
<tr>
<td></td>
<td>1.2495</td>
</tr>
<tr>
<td>1-1/2</td>
<td>1.5000</td>
</tr>
<tr>
<td></td>
<td>1.4995</td>
</tr>
<tr>
<td>2</td>
<td>2.0000</td>
</tr>
<tr>
<td></td>
<td>1.9995</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>tolerance (metric)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>h4</td>
<td>0.000/0.003</td>
</tr>
<tr>
<td>h5</td>
<td>0.000/0.004</td>
</tr>
<tr>
<td>h6</td>
<td>0.000/0.008</td>
</tr>
<tr>
<td>3/8</td>
<td>0.000/0.009</td>
</tr>
<tr>
<td>7/16</td>
<td>0.000/0.009</td>
</tr>
<tr>
<td>1/2</td>
<td>0.000/0.009</td>
</tr>
<tr>
<td>9/16</td>
<td>0.000/0.009</td>
</tr>
<tr>
<td>5/8</td>
<td>0.000/0.011</td>
</tr>
<tr>
<td>11/16</td>
<td>0.000/0.011</td>
</tr>
<tr>
<td>3/4</td>
<td>0.000/0.011</td>
</tr>
<tr>
<td>7/8</td>
<td>0.000/0.011</td>
</tr>
<tr>
<td>1</td>
<td>0.000/0.011</td>
</tr>
<tr>
<td>1-1/4</td>
<td>0.000/0.011</td>
</tr>
<tr>
<td>1-1/2</td>
<td>0.000/0.011</td>
</tr>
<tr>
<td>2</td>
<td>0.000/0.011</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>tolerance (inch)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.0001/-0.0003</td>
<td></td>
</tr>
<tr>
<td>-0.0001/-0.0004</td>
<td></td>
</tr>
<tr>
<td>-0.0001/-0.0004</td>
<td></td>
</tr>
<tr>
<td>0.0000/-0.0004</td>
<td></td>
</tr>
<tr>
<td>0.0000/-0.0004</td>
<td></td>
</tr>
<tr>
<td>0.0000/-0.0004</td>
<td></td>
</tr>
<tr>
<td>0.0000/-0.0004</td>
<td></td>
</tr>
<tr>
<td>0.0000/-0.0004</td>
<td></td>
</tr>
<tr>
<td>0.0000/-0.0004</td>
<td></td>
</tr>
<tr>
<td>0.0000/-0.0004</td>
<td></td>
</tr>
</tbody>
</table>
Axial Adjustment Gages

Cutting tool length adjustment is performed using a special axial adjusting gage (b) before shrinking the cutting tool into the toolholder. This gage (b) is placed on the toolholder (a) along with the cutting tool (c). The length difference of the setting gage (l2) is calculated into the required tool assembly length. The whole assembly can then be placed into a length presetter for adjustment. Rotating the gage moves the axial stop screw and presets the assembled tool to the required length. After removing the gage, the cutting tool can then be shrunk into the toolholder.
SAFE-LOCK™ is a pull-out protection system for high-performance machining, in particular for heavy-duty cutting. This is achieved by helical grooves that are ground into the tool shank. These, together with the respective pin drivers in a shrink fit holder, prevent the tool from being pulled out, even during extreme machining conditions.

By locking the cutting tool in the holder, this pull-out security ensures optimum process reliability in conjunction with shrink fit runout accuracies and rigidity for longer tool life and maintains higher productivity and part accuracies for our customers.
High-Performance Milling Chucks

- Heavy- and fine-milling capabilities.
- Prebalanced G6.3 @ 20,000 RPM — six threaded M6 holes to accept set screws for fine balancing.
- Heavy milling — tighten locknut until O-ring on back face of locknut just touches the flange on the chuck body to achieve runout .0004” 3 x D1.
- Fine milling — tighten as above, then back the locknut off 1/8–1/4 turn to achieve runout .0002” 3 x D1.
- Sub-zero heat treatment for material stability.
- Through-the-toolholder coolant capability using stop screw as sealing device.
- 3/8” axial adjustment stop screw.

Experience the advantages at your Authorized Kennametal Distributor or at www.kennametal.com.
Kennametal hydraulic chucks provide optimum performance for clamping full-cylindrical straight shanks, such as solid carbide drills and end mills. Activation of the chuck is achieved by turning the piston screw, which pressurizes the hydraulic fluid and exerts force on a thin-walled membrane along the length of the clamping bore. This highly concentric clamping force not only holds the tool shank more securely, but also produces a dampening effect that reduces vibration and helps eliminate microcracking on cutting edges.

A safety stop prevents chuck damage caused by over-tightening either with or without the cutting tool in place. Another unique feature is the special spiral wiper groove in the chuck’s clamping bore that securely grips oily tool shanks. All Kennametal hydraulic chucks utilize a range of sealed, cutting-tool-reducing sleeves to maximize chuck versatility. Reducing sleeves can also be used for converting bores from inch to metric and vice versa.

Slim Line hydraulic chucks have a sophisticated shape for universal application and maximum precision. After the chucking process, safety is guaranteed if a minimum clamping force or a transmittable torque (determined according to the clamping diameter) is reached. This is achieved through the clamping screw operation and the stroke of the clamping piston that force the hydraulic oil into the thin-walled expansion chamber with high pressure.

Standard Line/HP Line hydraulic chucks offer maximum precision at an attractive price. This system provides the same accuracy specifications as the Standard Line except with an axial back-up screw through the chuck bore to achieve the 3/8" radial adjustment of the cutting tool length. SEFAS™ chamfering rings also can be used with our Trend Line chucks.

Trend Line hydraulic chucks offer maximum precision at an attractive price. This system provides the same accuracy specifications as the Standard Line except with an axial back-up screw through the chuck bore to achieve the 3/8" radial adjustment of the cutting tool length. SEFAS™ chamfering rings also can be used with our Trend Line chucks.

Basic Line hydraulic chucks have a high-quality runout specification of .0001. These chucks are balanced-by-design for speeds up to 10,000 RPM. Like the Trend Line, Basic Line chucks utilize an axial back-up screw through the chuck bore to achieve a 3/8” radial adjustment. Larger body diameters give this chuck a higher torque transmission (grip) of 220 ft. lbs. Please note that the standard SEFAS chamfering ring cannot be used in this chuck design.
General Design

Function
Tightening the piston clamping screw exerts force on the pressure piston, which presses the hydraulic fluid, exerting force on the thin-walled expansion sleeve. This pressure causes the sleeve to compress around the tool shank, creating a highly concentric clamping force.

Effect
The hydraulic clamping system has a dampening effect. Vibration in a mechanical clamping system can cause microcracking on insert cutting edges. This is prevented by the hydraulic expansion chuck and results in higher production quality and up to 4x better tool life.

Accuracy
The accuracy shown is based on a round shank (no flats) with h6 tolerance and no reducing sleeve.

Features
- Turning the external set screw adjusts axial tool length. There is no need to remove the cutting tool or coolant supply unit for standard designs.
- Maintained contact with the tool-length adjusting sleeve ensures that the tool is safely held. 10mm of adjustment is provided.
- A sealed bore and a large hole through the tool-length adjusting screw enable maximum coolant to flow through coolant-fed cutting tools.
- A uniquely designed piston clamping screw prevents damage from overtightening and accidentally actuating the hydraulic mechanism without a tool in the chuck.
- High-performance balanced chucks can be converted to balanceable chucks by adding a set of Kennametal balance rings that compensate for cutter imbalance and optimize performance.
- Wiper grooves inside the bore safely grip oily shanks, sealing the bore to eliminate contamination from chips, dirt, or coolant.
- SEFAS™ chamfering rings can be added to chucks, reducing the need for step drills and secondary chamfering operations.
- A wide assortment of reducer sleeves are available to increase the application range of hydraulic chucks. When using a bushing, the runout could be up to twice as high as the example shown.

(continued)
General Design (continued)

Application
Hydraulic expansion chucks work best when clamping these style shanks:

- Shanks to DIN-6535 — forms HA, HB, and HE.
- Shanks to DIN-1835 — forms A and B (with shank tolerance h6 and Ra minimum of 0.3 μm).
- Forms HA and A — plain cylindrical shank, 6–32mm diameter.
- Forms HB and B — Whistle Notch™ shank, 6–20mm maximum diameter.
- Form HE — Whistle Notch shank, 6–20mm maximum diameter. (Kennametal suggests the use of a reducer collet).
- Inch straight shanks:
  - 1/4–5/8" (.0004 under nominal diameter maximum).
  - 3/4–1-1/4" (.0005 under nominal diameter maximum).

Slim Line Design

Weldon® shanks with a maximum diameter of 20mm (3/4") can be gripped without reducer collets. However, Kennametal recommends using reducer collets for all flatted shanks. Highest accuracy is obtained with plain, cylindrical shanks.

Using a sleeve gives higher grip torque:

Formula: \[ \text{sleeve bore} \times \text{chuck torque} = \text{assembled torque} \]

Example: 12mm (sleeve bore) \times 220 Nm = 132 Nm
20mm (chuck bore)

While chart shows for a 12mm Hydraulic Chuck = 70 Nm approx.
2x grip advantage
Setting Up New Hydraulic Chucks

Length adjustment for:
Standard/HP Line and Slim/Standard Line

1. Remove all grease from the hydraulic chuck before using.
2. Insert the cutting tool into the clamping bore as far as the stop pin/stop screw will allow.
3. Adjust the cutting tool length with a hex wrench.

Length adjustment for:
Trend Line, Basic Line, and Slim/Trend Line

4. Always tighten the clamping screw with a hex wrench as far as the limit stop by hand tightening. Never try to adjust the stop pin when the hydraulic chuck is in the clamped position.
5. The tool is now clamped and ready for use.

Maintenance

Kennametal hydraulic chucks are maintenance-free and deliver long service life. It is important that the clamping function be checked with a test pin on a regular basis. Any dirt in the bore can be removed with a nylon cleaning brush.

- The clamping function can be tested quickly and easily using the test pin.
- Insert the test pin into the clamping bore as far as the stop pin/stop screw allow.
- Tighten the clamping screw with a hex wrench as far as the limit stop by hand tightening.
- The chuck is functioning correctly if the test pin cannot be moved by normal hand pressure.

Reducing sleeves are available; see page J4.

Cleaning brushes are available; see page L15.

Test pins are available; see page L14.

IMPORTANT

Never tamper with the oil-loading orifice (sealed with a cap) as this could destroy the clamping ability of the hydraulic chuck and require it to be sent to Kennametal for service.

In the event of small tool crashes or misuse of the chuck, please contact your local Kennametal Service and Repair Department to have your Kennametal hydraulic chuck serviced or repaired by qualified Kennametal service technicians.
The HPMC System is ideal for holding round shank cutting tools and extensions on various applications because it offers greater versatility. This makes it an excellent choice for end mills, reamers, indexable cutters, drills, straight shank extensions, and boring systems. The HPMC System, with its powerful gripping torque, provides the maximum performance for tough roughing and high metal removal applications, as well as delivering first-rate accuracy for finishing applications — all with the same chuck.

These toolholders are through-coolant capable with the use of supplied backup screws. Threaded holes in the chucks accept set screws for fine balancing, and reducing sleeves allow the same holder to be converted for smaller gripping sizes.

Design

The HPMC System is comprised of an inner chuck body, a needle roller bearing assembly, and a thick-walled outer locknut. The inner chuck body, with radial and axial grooves at the inside bore, acts as a master collet by compressing around the cutting tool, exerting a very strong grip. The chuck bore is compressed by roller bearings as they track up a taper of approximately 4°. The roller bearings are held in a retainer (four per window to maximize contact) at an angle slightly skewed from that of the chuck taper angle. The locknut bearing retainer’s wall thickness is greater than that of the chuck body nose. Therefore, as the locknut is rotated clockwise, the roller bearings track in a helical movement, gradually climbing the shallow taper.

There are no threads in the HPMC System. As the two tapers are forced together, a tremendously high, uniform force is created. This squeezes the chuck body inward, conforming it to the cutting tool shank. Radial grooves assist the internal diameter by evenly collapsing inward, which improves gripping torque, accuracy, and prevents fretting. Force continues to be applied until the locknut’s back face bottoms out on the chuck’s body face. This is the maximum gripping torque position. Oil residue left on cutting tool shanks can cause slippage, but axial grooves minimize this by draining contaminants.

Shallow contact angles produce a self-locking effect, so the chuck will not release during operation. Because of this strong grip, no torque wrench is required. Also, the high gripping force of the HPMC enhances its ability to transmit energy to the machine tool, so vibration, deflection, and runout are minimized. The cutting tool shank offers an advantage over collet chucks because there is no axial drawback as the locknut is tightened.

A single toolholder provides 5–10% more gripping torque for heavy milling, and the same chuck is versatile enough to do finishing work, too.

To get the maximum accuracy out of the HPMC System, tighten the locknut to the face stop and then back off half a turn. As this is done, be sure the O-ring on the back face of the locknut stays in contact with the chuck face.

Stop screws are included with all HPMC Systems for length adjustment or coolant feed. These screws are designed with a cone face and reversible flat face and an O-ring for coolant sealing options.

HPMC Systems are subjected to sub-zero treatment to stabilize the material and prevent pitting on the bearing contact surface. This helps to ensure long, worry-free tool life.
The HPMC (High-Performance Milling Chuck) System (continued)

**Cutting Tool Requirements**

The outside diameter of the cutting tool shank and the inside diameter of the HPMC System must be wiped with a clean dry cloth before assembly. Any contamination will increase runout and reduce gripping force.

Carefully monitor the cutting tools used in these chucks so they do not exceed h6 (nominal to -0.0005") on the shank diameter. Use tools as close to nominal as possible. Cutting tool shank roundness should be within 0.003mm (.0001"). Undersized tools cause excessive stress and may cause chuck failure.

Optimal chuck performance is attained when the cutting tool shank is round, without flats. Cutting tools with small flats may be held, but they will increase runout. Whistle and flattened cutting tool shanks are recommended in conjunction with reducing sleeves. For best performance, keep shank flats to a minimum.

The minimum length of engagement is 2x the diameter of the cutting tool shank. Short holding length may cause the tool and/or chuck to break. This could dislodge the cutting tool and result in serious injury to the operator.

The milling chuck should never be tightened without a cutting tool inside the bore. High gripping forces will cause permanent deformation to the inside diameter.

**Maintenance Operations**

Greasing the needle bearing is the only required maintenance. Follow the procedure below to ensure maintenance is properly performed:

1. Tighten the locknut clockwise to obtain clearance from the retaining ring.
2. Remove the retaining ring from the chuck.
3. Unlock the locknut counterclockwise, and lift the nut assembly from the chuck.
4. Wipe off old grease from the milling chuck and all other components.
5. Recoat the needle bearings in the locknut liberally with a quality, water-resistant grease.
6. Regrease the outside diameter of the milling chuck where the locknut is housed.
7. Reinstall the locknut on the milling chuck body and tighten to gain clearance for reinserting the retaining ring.
8. Tighten and loosen the locknut several times. Recheck the retaining ring for correct fitting.
9. Wipe away any excess grease.

Please contact the Kennametal Service and Repair Department to have your Kennametal products serviced or repaired by qualified Kennametal service technicians.

**Setting the Accuracy of the Milling Chuck**

**Heavy Milling**

- Tighten the locknut all the way down with a milling chuck wrench until the O-ring on the locknut just touches the flange of the milling chuck body (O-ring should not be compressed).

- Accuracy 10–20 μm (.0004–.0008") at 3x diameter up to 50mm (2").

**Finish Cut**

- Back the locknut off 1/8–1/4 of a turn from above position.
- Best accuracy — 5 μm (.0002") at 3x diameter up to 50mm (2").

---

**CAUTION**

DO NOT over tighten the milling chuck without a tool shank inserted. This may cause serious damage to the milling chuck or loss of performance.
When machining with extended length setups, undesirable regenerative vibrations (chatter) can arise, causing poor surface finish, dimensional control issues, and tool breakage. To avoid chatter, machine operators are generally forced to reduce cutting parameters, which decreases metal removal rates and diminishes productivity.

Cutting force fluctuates when chip thickness varies. This is caused by waves left on the workpiece from the previous pass. These waves may create chatter when the cutting tool and workpiece interact. Continued chatter can further produce variation in cutting force, leading to more vibration. If not addressed, the amplitude of vibration may eventually reach levels that cause the tool to bounce out of the workpiece or even result in catastrophic failure.

This problem can be approached in many different ways. Chatter can be avoided by drastically reducing cutting speeds to increase process damping (friction between flank face and workpiece), which dissipates energy to reduce vibrations. Another approach utilizes milling cutters that have inserts with differential spacing. This minimizes the regenerative effect by creating a disturbance on the wave pattern left on the workpiece. However, this approach provides limited success as chip loads are no longer evenly distributed over the cutting edges and may require the feed rate to be restricted. Also, because the spacing is not even, the surface quality could be negatively affected.

The problem with these solutions is that they do not allow high metal removal rates to be maintained. To uphold high rates, the dynamic stiffness of the system must be increased. Dynamic stiffness is proportional to the product of static stiffness and damping ratio. Static stiffness can be increased through using shorter setups or larger toolholder diameters. Materials with a higher modulus of elasticity can also increase static stiffness.

The Kennametal Tunable Tooling System (TTS) provides a means for maximizing the dynamic stiffness of boring bars and milling adapters by suppressing vibrations with a passive dynamic absorber. TTS is designed with an internal mass that vibrates close to the natural frequency of the most dominant vibration mode in the system. The motion of the internal mass will dissipate energy and prevent chatter. The overall result depends on a machine’s dynamic characteristics and the rigidity of the connection between tool and machine tool. Manufacturing tolerances, preload, and wear may change the dynamic response of a machine and adversely affect overall results.

*Machines from same builder and model are not dynamically identical.

While passive dampening improves the dynamic stiffness of an extended reach tool, the damping mechanism will not perform the same with every machine. Not only does the natural frequency of the tool affect its dynamic stiffness, frequencies inherent to the machine do as well. Because machine tools have their own dynamic signature, a tool that is tuned on one machine may not be tuned on another. Unlike other products on the market that are pretuned, Kennametal tunable boring bars and milling adapters are tunable. They allow users to adjust the passive damper, optimally tuning the tool for a specific machine or setup. This enables extended reach tooling to be retuned to match a machine’s dynamic signature, even as it changes over time. A key benefit of Kennametal’s tunable boring bars and milling adapters is that they can be optimally tuned for any given setup. While Kennametal standard tunable products come pretuned from the factory, it may be beneficial to further optimize them once installed.
Tunable Tooling System (TTS) (continued)

With the Kennametal TTS System, longer L:D ratio toolholders can be used for larger DOC, better surface finishes, and longer tool life. When TTS is applied to milling adapters, using greater insert density on milling cutters or increasing ADOC or WOC enables higher MRR. Better surface finishes and tool life can also be expected from these adjustments.

The benefits of using Kennametal’s Tunable Systems go beyond increased metal removal rates. In metalcutting tests, a good correlation between dynamic stiffness and vibration levels were measured at the spindle. Vibrations can not only cause premature tool life, but also limit spindle bearing life. Preventing vibration from propagating through the machine promotes longer life for spindle-related components and maintains machine accuracy over time.

Dynamic Stiffness

Figure 1 shows the relative dynamic stiffness of a tunable boring bar as a function of adjusting screw tightness — loose to tightened (left to right).

The chart shows that for the given bar, optimal tuning occurs at about 70% or when the relative performance equals 1.

It is also important to note that performance decreases more severely when the tool is over-tuned, compared to when it is under-tuned. For this reason, it is best to slightly under-tune the system.
The Kennametal Tuned Tooling System offers a full line of tunable milling adapters capable of performing at maximum output without the hindrance of vibration. Tunable milling adapters are through-coolant capable, and, because the internal damper can be adjusted to alleviate chatter, they provide optimum surface finish and longer tool life.

**General Guidelines for Milling with Extended Reach Adapters**

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 good surface finish is achieved. You may need to use small increments to find an optimal position.
5. Back the adjusting screw off a 1/4–1/2 turn in the negative direction.
6. Tighten both clamping screws and take a test cut to confirm desired results.

*The TTS Milling Adapters will need to be re-tuned if the milling cutter is replaced with another with different mass.*
Tunable Boring Bars

The Kennametal complete portfolio of Tunable Boring Bars helps prevent chatter and other problems associated with an internal dampening package designed for deep-hole boring applications.

Advantages

- **Optimal Rigidity**
  Eliminates vibration to improve surface quality and tolerance.

- **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 results.

- **Tunable Damping Mechanism**
  To account for different vibration behavior, bars can be tuned on the machine, and tools can be adjusted.

Relative Stability

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 enables greater depth of cut.
Technical Information

Tunable Boring Bars

General Guidelines for Boring with Extended Reach Bars

1. Select the largest boring bar diameter possible. Larger diameter bars are stiffer and more stable. Remember to leave enough space for chip evacuation.

2. While larger diameters are more stable, the diameter may also be too large, preventing proper chip evacuation, 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. For Tunable Boring Bars, select the shortest bar possible.

4. Balance machining parameters to prevent the occurrence of uncontrolled vibrations and resonance.

5. The tool setting angle should be as close as possible to 90°.

6. Make sure the insert is in the correct center position.

7. By choosing a small corner radius you can reduce forces on the workpiece.

8. Use cutting heads with a negative back-rake angle that is as small as possible.

9. Using inserts with a positive chip former is preferred.

10. Change inserts when any flank wear is detected because radial back forces will increase in proportion to wear.

Selecting the Correct Bar

Kennametal offers TTS Boring Bars with KM™ back-ends or straight shanks, KM front-ends, or bolt-on head connections, and they are available in either steel or carbide.

To find the appropriate boring bar, first consider that 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 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 pretuned straight shank tunable bars are pretuned 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.

Holding Method

The holding method is as critical to performance as selecting and tuning the boring 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 2.5x the diameter of the bar.

Various connection methods are shown below and listed from most stable to 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

---

For more information, visit www.kennametal.com
Tuning the Bar

Standard tunable boring bars are pretuned at our factory. Though they may work right out of the box on some machines, for others, they may chatter because of differences in dynamic response. Chatter can be eliminated by optimally tuning the boring bar for a given setup, and the key benefit of our tunable boring bars is that they can be adjusted for any application. Therefore, corrections can be made to put the tool in tune with your machine, optimizing dynamic stiffness and negating chatter.

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. (A) Once chatter is eliminated, note that it 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. (B) Once the adjusting screw setting that causes chatter is determined, back the adjusting screw off a 1/2 turn in the negative direction.
6. Tighten both clamping screws and take a test cut to confirm desired results.
Screw-On Adapters

The universal design of Kennametal Screw-On Milling Cutter Adapters enables old and new tool styles to be used interchangeably yet maintain a rigid connection. All adapters offer superior runout accuracy, high metal removal rates, and through-coolant capability. Screw-On Milling Cutter Adapters can be used with Kennametal’s wide range of best-in-class inserts to guarantee excellent cutting results, performance, and productivity.

Screw-On products can also be used with a variety of machining applications ranging from low-speed milling applications to rates greater than 20,000 RPM, with the added feature of coolant directed to the cutting edge. The system’s accuracy, repeatability, and stability should be equal or greater to the performance of any similar systems on the market today in all applications.

Features, Functions, and Benefits

- All adapters have through-coolant capability.
- All products are stock standard products.
- High accuracy — low runout.
- Stable system for helix, pocket milling, contour cutting, and ramping.
- KM™, HSK, and steep taper prebalanced to G6.3 at 16,000 RPM.
- Extensions and reducers are designed with through-coolant prevision.
- The fine-tuned Screw-On indexable end mill cutters and the KM/ERICKSON™ toolholders together with a wide range of best-in-class inserts ensure excellence in cutting results, performance, and productivity.

A. Ground pilot and face for high rigidity and accuracy.
B. Extended shanks have sloe taper for added rigidity.
C. Thread locking system.
D. Through coolant on all adapters.
E. Designed for long reach.
F. Balanced.

Applying Screw-On Adapters

Heavy-Metal Adapters

- Devibration extensions with heavy metal (Densimet™ D176).
- Internal threads with accurate mating surface for best possible concentric and axial runout with the extended tools.
- Through-coolant capability.

Extensions with Weldon® Shank

- Screw-On type extension with Weldon shank, as per DIN 1835-B.
- Shank manufactured as per DIN 1835-B, internal-coolant capability.

Reducers

- Adapter uses Screw-On tools with smaller size.
- Through-coolant capability.
- Mating surface helps generate accurate concentric and axial runout.

Extensions

- Adapter uses Screw-On tools with larger thread size.
- Through-coolant capability.
- Mating surface helps generate accurate concentric and axial runout.

For instructions on how to scan, please see page xxxiii.
Through-Coolant Shell Mill Adapters

Shell mill adapters with high-pressure and high-volume through-coolant capability are now available as standard offerings. Their unique design enables maximum coolant flow to be channeled directly to a tool’s cutting edge.

These latest shell mill adapters with through coolant are ideal for holding indexable milling cutters. Together, the toolholder and cutter ensure excellence in tool life, surface quality, and productivity. With this combination, high-pressure or high-volume coolant can dramatically improve surface finishes, reduce tool wear, decrease cutting force, and control chip shape and evacuation. This makes through-coolant shell mill adapters perfect for machining hardened steels and other difficult-to-cut materials like titanium.

Options
- Extended lengths available in standard stocked offering.
- Drive keys upgraded to high-strength material, allowing for high-torque capability.
- Adapters are set for form AD coolant and can be converted to form B flange coolant using adjusting screws.
- No extra components necessary to buy for standard tools.

Coolant Flow Options
- Through holes in the face of the pilot.
- Through the center.

Tightening Torque Milling Head

<table>
<thead>
<tr>
<th>Connecting thread size</th>
<th>Tightening torque (Nm)</th>
<th>Mounting key size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M10</td>
<td>40</td>
<td>15</td>
</tr>
<tr>
<td>M12</td>
<td>60</td>
<td>17</td>
</tr>
<tr>
<td>M16</td>
<td>80</td>
<td>24</td>
</tr>
</tbody>
</table>

www.kennametal.com
Collet Chuck Styles

TG Collet Chucks
Primarily for gripping straight shanks, TG collet chucks are the ERICKSON™ industry standard. These chucks offer flexibility for drilling, milling, and tapping applications and are also capable of gripping Whistle Notch™ cutters. TG collet chucks should be used for medium to light operations.

TG collet chucks have a range of dedicated milling and tap collets available. Balanceable locknuts are offered for operating at relatively high speeds. Sealing/coolant locknuts and bonded collets are also available for chucks utilizing through coolant.

- Clamping range of 0.3mm (.016”).
- Good rigidity and gripping power of 3:1.
- Good concentricity.

ER Collet Chucks
As the DIN 6499 industry standard, ER collet chucks are designed to grip straight shanks. They are flexible for drilling, light milling, and tapping applications. ER collet chucks are used for medium to light applications at medium speeds.

Dedicated tap collets are available for this style collet chuck. For ER collet chucks using through coolant, sealing and coolant locknuts are available.

- Wide clamping range of 1mm (.040”).
- Fair rigidity and gripping power of 2:1.
- Good concentricity.

(continued)
Collet Chuck Styles (continued)

DA Collet Chucks
DA collet chucks are an ERICKSON™ industry standard. They are intended for gripping straight shanks, but the DA style also has the ability to grip drill margins. This eliminates center drilling by shortening the drill. DA collet chucks also offer flexibility for drilling, milling, and tapping.

Milling and tap collet styles dedicated to the DA style are available. These chucks can also make use of bonded collets when employing through coolant. DA collet chucks can utilize three styles of locknuts.
- Clamping range of 0.8mm (.031”).
- Fair rigidity and gripping power of 1:1.
- Concentricity >0.025mm (.001”).

DA — 01 Series
Extended Nose Style
Long nosepiece bearing and compensating locknut delivery offer proper axial position and prevent twisting. This style is ideal when extreme accuracy is required.

DA — 04 Series
Close Center Style
Designed at the minimum safe outside diameter to solve close center problems. This style should be used where reach and close proximity of workpiece problems are encountered.

DA — 08 Series
Stub Nose Style
This DA style has a compensating nose ring with the locknut that allows collets to find their own axial position and prevent twisting. They should be used when better rigidity is required.
Technical Information
Collets

TG • Tremendous Grip
- Provides Tremendous Grip and accuracy for all drilling applications.
- 0.4mm [1/64" (.016") range of collapse.
- Grips on back taper and margin of drill for maximum feed rates and more accurate holes.
- Manufactured to DIN 6499 Class 2 accuracy.

TGC • Tremendous Grip Coolant
- Rubber-filled slots seal collet for coolant-fed tool applications.
- Suitable for coolant pressure up to 100 bar (1500 psi).
- Unique design features permit easy entry into nosepiece.
- Available from stock in all popular sizes.
- Fits all standard TG-style collet chucks.
- 0.13mm (.005") range collapse.
- Design enables flutes of drills to enter collet, unlike competitive designs.

TGHP • Tremendous Grip High Precision
- Twice as accurate as standard TG- and ER-style collets.
- Available from stock in all popular sizes.
- Can be used in all standard TG-style collet chucks.
- 0.25mm (.010") range of collapse.
- Manufactured to DIN 6499 Class 1 accuracy.

TGCHP • Tremendous Grip Coolant High Precision
- Rubber-filled slots seal collet for coolant-fed tool applications.
- Suitable for coolant pressure up to 100 bar (1500 psi).
- Unique design features permit easy entry into nosepiece.
- Available from stock in all popular sizes.
- Fits all standard TG-style collet chucks.
- 0.13mm (.005") range collapse.
- Manufactured to DIN 6499 Class 1 accuracy.

TGNP • Tremendous Grip Non-Pullout, Weldon® Style
- Positive retention and drive provided by drive wedge in collet.
- Eliminates inaccuracy created by solid end mill holders.
- 0.13mm (.005") range of collapse.
- Fits all standard TG-style collet chucks.

TGST • Tremendous Grip Single-Angle Tap Collet
- Designed to grip the tap on the shank and square.
- Fits all standard TG-style collet chucks.
- 0.13mm (.005") range of collapse.

TGSTC • Tremendous Grip Single-Angle Tap Collet, Coolant Style
- Rubber-filled slots seal collet for coolant-fed tool applications.
- Suitable for coolant pressure up to 70 bar (1000 psi).
- Designed to grip the tap on the shank and square.
- Fits all standard TG-style collet chucks.
- 0.13mm (.005") range of collapse.
ER • Single Angle
- Provides good grip and accuracy for all drilling applications.
- Wide clamping range.
- Available in both inch and metric bores.
- 1mm (.040”) range of collapse.
- Manufactured to DIN 6499 Class 2 accuracy.

ERTC • Single-Angle Tap Collet
- Designed to grip taps on shank and square to eliminate slippage.
- Fits all standard ER-style collet chucks.
- 0.13mm (.005”) range of collapse.

ERTCT • Single-Angle Tap Collet with Axial Compensation
- Designed to grip taps on shank and square to eliminate slippage.
- Tension only, cost-effective solution for machines that require axial compensation for tapping.
- Fits all standard ER-style collet chucks.

ER • Single Angle
- Provides good grip and accuracy for all drilling applications.
- Wide clamping range.
- Available in both inch and metric bores.
- 1mm (.040”) range of collapse.
- Manufactured to DIN 6499 Class 2 accuracy.

DA • Double-Angle
- 0.8mm [1/32” (.031”) range of collapse.

DAC • Double-Angle Coolant
- Rubber-filled slots seal coolant-fed tool applications.
- Suitable for coolant pressure up to 70 bar (1000 psi).
- Fits all standard DA-style collet chucks.
- 0.13mm (.005”) range of collapse.

DANP • Double-Angle Non-Pullout — Weldon® Style
- Designed to grip end mills with Weldon-style shanks.
- Positive retention and drive provided by drive wedge in collet.
- Eliminates inaccuracy created by solid end mill adapters.
- Fits all standard DA-style collet chucks.
- 0.13mm (.005”) range of collapse.
TG Collet Series

The TG collet series is the first choice when high precision, gripping torque, and versatility are required. These single-angle collet chucks grip at approximately 3:1 for grip torque versus tightening torque without a stop screw. The taper’s slow angle produces a sticking action, so collets must be snapped into the locknut before assembling the locknut onto the chuck. Follow the procedure on page M103 for assembly/disassembly instructions.

Standard Collet

- 0,40mm (.016") maximum collapse.

DA Collet Series

DA-style collet chucks have a grip of approximately 1:1 tightening torque versus grip torque.

Bonded Seal Collet

- 0,13mm (.005") maximum collapse.
- 100 bar (1,500 psi) coolant pressure.

ER Collet Series

The ER collet series is an international standard style used for many applications. Collets from this series are ideal for boring, milling, reaming, tapping, and grinding.

ER collets are manufactured from alloy steel and hardened for long life. They offer a grip of approximately 2:1 tightening torque versus grip torque. See page M103 for assembly/disassembly instructions.
TG and ER Collet Assembly/Disassembly Instructions

• First, place the locknut with nose ring over collet nose. Apply force on the locknut until it snaps into place. The nose ring is now seated into the collet undercut and should turn freely.

• To remove the collet from the locknut, hold the nut firmly in one hand and apply a bending action on the collet with the other hand until the collet snaps free from the nose ring.

**NOTE**
Inserting the cutting tool less than 2/3 the gripping length into the collet can permanently damage the collet. The full length of the gripping bore needs to be maintained to achieve maximum accuracy and safety. Collet accuracies are based on size-for-size conditions. Using the collapsible range can influence the accuracy and gripping powers. Never try to stretch collets by clamping oversized cutting tools.

**Technical Information**

**Collets**

**TG and ER Collet Assembly/Disassembly Instructions**

**Maximum Runout Error**

<table>
<thead>
<tr>
<th>L</th>
<th>D</th>
<th>0.008mm (0.0003&quot;)</th>
<th>0.010mm (0.0004&quot;)</th>
<th>0.015mm (0.0006&quot;)</th>
<th>0.020mm (0.0008&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50mm (1.969&quot;)</td>
<td>18–28mm (.71–1.02&quot;)</td>
<td>Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50mm (1.969&quot;)</td>
<td>10–18mm (.39–.71&quot;)</td>
<td>Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25mm (.984&quot;)</td>
<td>6–10mm (.24–.39&quot;)</td>
<td>Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16mm (.630&quot;)</td>
<td>3–6mm (.12–.24&quot;)</td>
<td>Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10mm (.394&quot;)</td>
<td>1.6–3mm (.06–.12&quot;)</td>
<td>Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6mm (.236&quot;)</td>
<td>1–1.6mm (.04–.06&quot;)</td>
<td>Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TGHP (precision) = DIN 6499 Class 1**

**TG (standard) = ER — DIN 6499 Class 2**
### Gripping Strength Comparison Chart • Metric

<table>
<thead>
<tr>
<th>ER collet chuck based on ER40</th>
<th>TG collet chuck based on TG100</th>
<th>standard hydraulic</th>
<th>Slim Line hydraulic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>mm</strong></td>
<td><strong>Nm</strong></td>
<td><strong>mm</strong></td>
<td><strong>Nm</strong></td>
</tr>
<tr>
<td>3</td>
<td>—</td>
<td>3</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>—</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>—</td>
<td>5</td>
<td>—</td>
</tr>
<tr>
<td>6</td>
<td>38</td>
<td>6</td>
<td>—</td>
</tr>
<tr>
<td>8</td>
<td>52</td>
<td>8</td>
<td>115</td>
</tr>
<tr>
<td>10</td>
<td>70</td>
<td>10</td>
<td>144</td>
</tr>
<tr>
<td>12</td>
<td>103</td>
<td>12</td>
<td>300</td>
</tr>
<tr>
<td>14</td>
<td>108</td>
<td>14</td>
<td>312</td>
</tr>
<tr>
<td>16</td>
<td>118</td>
<td>16</td>
<td>325</td>
</tr>
<tr>
<td>18</td>
<td>156</td>
<td>18</td>
<td>339</td>
</tr>
<tr>
<td>20</td>
<td>206</td>
<td>20</td>
<td>384</td>
</tr>
<tr>
<td>25</td>
<td>255</td>
<td>25</td>
<td>536</td>
</tr>
<tr>
<td>32</td>
<td>—</td>
<td>32</td>
<td>569</td>
</tr>
<tr>
<td>40</td>
<td>—</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>50</td>
<td>—</td>
<td>50</td>
<td>—</td>
</tr>
</tbody>
</table>

### Gripping Strength Comparison Chart • Inch

<table>
<thead>
<tr>
<th>ER collet chuck based on ER40</th>
<th>TG collet chuck based on TG100</th>
<th>standard hydraulic</th>
<th>Slim Line hydraulic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>in</strong></td>
<td><strong>ft. lbs.</strong></td>
<td><strong>in</strong></td>
<td><strong>ft. lbs.</strong></td>
</tr>
<tr>
<td>1/8</td>
<td>—</td>
<td>1/8</td>
<td>—</td>
</tr>
<tr>
<td>3/16</td>
<td>—</td>
<td>3/16</td>
<td>—</td>
</tr>
<tr>
<td>1/4</td>
<td>28</td>
<td>1/4</td>
<td>—</td>
</tr>
<tr>
<td>5/16</td>
<td>38</td>
<td>5/16</td>
<td>85</td>
</tr>
<tr>
<td>7/16</td>
<td>—</td>
<td>7/16</td>
<td>—</td>
</tr>
<tr>
<td>1/2</td>
<td>76</td>
<td>1/2</td>
<td>221</td>
</tr>
<tr>
<td>9/16</td>
<td>80</td>
<td>9/16</td>
<td>230</td>
</tr>
<tr>
<td>5/8</td>
<td>87</td>
<td>5/8</td>
<td>240</td>
</tr>
<tr>
<td>11/16</td>
<td>115</td>
<td>11/16</td>
<td>250</td>
</tr>
<tr>
<td>7/8</td>
<td>—</td>
<td>7/8</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>188</td>
<td>1</td>
<td>395</td>
</tr>
<tr>
<td>1 1/4</td>
<td>—</td>
<td>1 1/4</td>
<td>420</td>
</tr>
<tr>
<td>1 1/2</td>
<td>—</td>
<td>1 1/2</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>—</td>
<td>2</td>
<td>—</td>
</tr>
</tbody>
</table>

**NOTE:** Torque values in in. lbs.
Minimum values calculated for maximum bore size and minimum shank size.
Maximum values calculated for minimum bore size and maximum shank size.
### Gripping Strength Comparison Chart • Metric

<table>
<thead>
<tr>
<th>milling chuck</th>
<th>Shrink Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>Nm</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>—</td>
</tr>
<tr>
<td>6</td>
<td>—</td>
</tr>
<tr>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>12</td>
<td>—</td>
</tr>
<tr>
<td>14</td>
<td>—</td>
</tr>
<tr>
<td>16</td>
<td>—</td>
</tr>
<tr>
<td>18</td>
<td>—</td>
</tr>
<tr>
<td>20</td>
<td>1127</td>
</tr>
<tr>
<td>25</td>
<td>1666</td>
</tr>
<tr>
<td>32</td>
<td>2347</td>
</tr>
<tr>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>50</td>
<td>—</td>
</tr>
</tbody>
</table>

### Gripping Strength Comparison Chart • Inch

<table>
<thead>
<tr>
<th>milling chuck</th>
<th>Shrink Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>in</td>
<td>ft. lbs.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1/8</td>
<td>—</td>
</tr>
<tr>
<td>3/16</td>
<td>—</td>
</tr>
<tr>
<td>1/4</td>
<td>—</td>
</tr>
<tr>
<td>5/16</td>
<td>—</td>
</tr>
<tr>
<td>3/8</td>
<td>—</td>
</tr>
<tr>
<td>7/16</td>
<td>—</td>
</tr>
<tr>
<td>1/2</td>
<td>—</td>
</tr>
<tr>
<td>9/16</td>
<td>—</td>
</tr>
<tr>
<td>5/8</td>
<td>—</td>
</tr>
<tr>
<td>11/16</td>
<td>—</td>
</tr>
<tr>
<td>3/4</td>
<td>831</td>
</tr>
<tr>
<td>7/8</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>1229</td>
</tr>
<tr>
<td>1 1/4</td>
<td>1731</td>
</tr>
<tr>
<td>1 1/2</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>—</td>
</tr>
</tbody>
</table>

**NOTE:** Torque values in in. lbs.
Minimum values calculated for maximum bore size and minimum shank size.
Maximum values calculated for minimum bore size and maximum shank size.

www.kennametal.com