HARD TURNING

Making hard turning less hard than it seems!

FEED the SPEED!
CUBIC BORON NITRIDE

the second hardest material known to mankind
4 - What is Hard Turning?
6 - Tungaloy’s CBN
10 - Benefits of Coated CBN
11 - CBN Grades
12 - Edge Preparations
16 - Chip breakers
20 - Unique CBN Blanks
22 - Ceramic Grades
23 - Carbide Grades
25 - Selection Guide
26 - Field Test Reports
WHAT IS HARD TURNING?

Tungaloy has always been a pathfinder in hard turning applications, making hard turning less hard than it seems...

HARD TURNING commonly refers to turning operations of a part or bar stock harder than 50HRC on a lathe or turning center. In profiling hardened steel parts, grinding had long been the first-choice process for manufacturers to obtain the dimensions required on the workpiece. This was true until polycrystalline cubic boron nitride (PcBN) was introduced in late 1970s, which eventually impelled a shift from time- and energy-consuming grinding operations to hard turning operations.

Hard turning started to rapidly develop in the beginning of the 1990s as the availability of PcBN and ceramics increased, along with further advancement in physical vapor deposition (PVD) coating technologies and the capability of designing and building turning machines that are rigid, stable, and accurate enough to successfully finish hard turning. These advancements have made finish hard turning a viable alternative to grinding, as an accurate finishing operation.
Natural and synthetic diamonds are used for precision turning of non-ferrous metals. The hardest of all materials, however, cannot be used to machine steel because of its strong affinity for iron at high temperature.

**PcBN** solves this problem because of its hardness, which is approximately the same as diamond, and its thermal stability and inertness to iron at elevated temperatures. These unique properties make **PcBN** a perfect cutting tool material for machining hard, abrasive ferrous workpiece materials at higher cutting speeds.

**Ceramic** also have excellent wear resistance at high cutting parameters. Ceramic inserts are economically priced when compared with other insert grades and can be applied to high speed, continuous turning of hardened parts. Their low thermal shock resistance and fracture toughness, however, require blunt cutting edge geometry, which creates a stronger cutting force and lessens the surface finish potential. Tungaloy’s **LX11** is the ceramic grade most suitable for turning hardened steel.

Hard turning on low power machines poses challenges in terms of reliability and cost effectiveness. The **PVD-coated carbide grade** makes a great alternative in such machine setups. Tungaloy’s **AH8000 series** is not only efficient in turning heat-resistant superalloys but also proven to have superior performance in hard turning where high cutting parameters are not attainable. Its superior fracture toughness makes the grades excellent alternatives, over PcBN and ceramic grades, for efficient turning of hardened steel and tempered steel at low speed settings.

**Grade recommendations** for different applications

<table>
<thead>
<tr>
<th>Workpiece hardness (HRC)</th>
<th>T-CBN</th>
<th>Ceramic</th>
<th>PVD Coated Carbide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>Light interrupted</td>
<td>Heavy interrupted</td>
<td></td>
</tr>
</tbody>
</table>
TUNGALOY’S CBN

CBN grain sizes and their effects on surface roughness

CBN inserts are generally used in a finishing process. A CBN insert grade with coarse abrasive grains will output a rough surface and may not be able to achieve the surface quality required. To achieve superior surface quality of Rz = 3.2 or better, always use a fine grain CBN insert.

Grain Size - Coated Grades

Fine: BXM20, BXA20, BXA30, BXA10, BXM10

Medium: BXC50

Grain Size - Uncoated Grades

Fine: BX330, BX360

Medium: BX310

Coarse: BX380
Wear and fracture resistance in terms of CBN content

The lower the CBN content is, the more wear resistant the grade will be, and the higher the CBN content is, the more fracture resistant the grade will be when turning hardened steel.

Cutting conditions
Cutting speed: $V_c = 180$ m/min (590 sfm)
Depth of cut: $a_p = 0.1$ mm (.004"
Feed: $f = 0.1$ mm/rev (.004"
Coolant: Dry
Workpiece material: SCM435 (60HRC)

Cutting conditions
Cutting speed: $V_c = 180$ m/min (590 sfm)
Depth of cut: $a_p = 0.2$ mm (.008"
Feed: $f = 0.1$ mm/rev (.004"
Coolant: Wet
Workpiece material: SCM415 (60HRC)

High CBN content
High fracture resistance

Low CBN content
High wear resistance
Typical parts

- Ring Gear
- Idler Gear
- Transmission Shaft
- CVJ
- Tool Holders
**Coolant effect - Continuous cutting**

Coolant effect - Continuous cutting

Cutting conditions
- Cutting speed: $V_c = 150 \text{ m/min (492 sfm)}$
- Depth of cut: $a_p = 0.2 \text{ mm (.008"})$
- Feed: $f = 0.2 \text{ mm/rev (.008"})$
- Workpiece material: SCM445 (60HRC)

Dry cutting improves tool life for interrupted cutting operations.

**Coolant effect - Interrupted cutting**

Coolant effect - Interrupted cutting

Cutting conditions
- Cutting speed: $V_c = 180 \text{ m/min (590 sfm)}$
- Depth of cut: $a_p = 0.2 \text{ mm (.008"})$
- Feed: $f = 0.1 \text{ mm/rev (.004"})$
- Workpiece material: SCM445 (60HRC)

Dry cutting improves tool life for interrupted cutting operations.

**Use of coolant**

<table>
<thead>
<tr>
<th></th>
<th>Dry</th>
<th>Wet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous cutting</td>
<td>❌</td>
<td>✓</td>
</tr>
<tr>
<td>Interrupted cutting</td>
<td>✓</td>
<td>❌</td>
</tr>
</tbody>
</table>
BENEFITS OF COATED CBN

Anti-oxidation wear
PVD coating protects CBN from interacting with oxygen.

Enhanced wear resistance
CBN has high thermal conductivity and plastic deformation resistance, preventing the coating from delaminating under extreme temperatures generated during hard turning process.

Coated Grades: BXA10, BXA20, BXA30, BXM10, BXM20, and BXC50

Insert wear after 6 minutes

Cutting conditions
Cutting speed: \( V_c = 180 \text{ m/min (590 sfm)} \)
Depth of cut: \( a_p = 0.2 \text{ mm (.008")} \)
Feed: \( f = 0.1 \text{ mm/rev (.004")} \)
Coolant: Dry
Workpiece material: SCM415 (60HRC)
# CBN Grades

**Tungaloys hard-turning CBN grades and their properties**

<table>
<thead>
<tr>
<th>Grade</th>
<th>CBN grain size</th>
<th>CBN content</th>
<th>Binder type</th>
<th>Recommended cutting speed (Vc)</th>
<th>Application range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fine</td>
<td>Medium</td>
<td>Coarse</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ceramic</td>
<td>Metal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BXA10</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>100 - 230 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>328 - 754 sfm</td>
<td></td>
</tr>
<tr>
<td>BXA20</td>
<td>•</td>
<td></td>
<td>•</td>
<td>60 - 180 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>197 - 590 sfm</td>
<td></td>
</tr>
<tr>
<td>BXA30</td>
<td>•</td>
<td></td>
<td>•</td>
<td>70 - 250 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>206 - 762 sfm</td>
<td></td>
</tr>
<tr>
<td>BXM10</td>
<td>•</td>
<td></td>
<td>•</td>
<td>150 - 350 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>492 - 1148 sfm</td>
<td></td>
</tr>
<tr>
<td>BXM20</td>
<td>•</td>
<td></td>
<td>•</td>
<td>70 - 220 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>230 - 394 sfm</td>
<td></td>
</tr>
<tr>
<td>BXC50</td>
<td>•</td>
<td></td>
<td>•</td>
<td>70 - 120 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>230 - 394 sfm</td>
<td></td>
</tr>
<tr>
<td>BX310</td>
<td>•</td>
<td></td>
<td>•</td>
<td>100 - 300 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>328 - 984 sfm</td>
<td></td>
</tr>
<tr>
<td>BX330</td>
<td>•</td>
<td></td>
<td>•</td>
<td>50 - 200 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>164 - 656 sfm</td>
<td></td>
</tr>
<tr>
<td>BX360</td>
<td>•</td>
<td></td>
<td>•</td>
<td>50 - 200 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>164 - 656 sfm</td>
<td></td>
</tr>
<tr>
<td>BX380</td>
<td>•</td>
<td></td>
<td>•</td>
<td>70 - 120 m/min</td>
<td>Continuous, Light Interrupted, Heavy Interrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>230 - 394 sfm</td>
<td></td>
</tr>
</tbody>
</table>
Five standard edge preparations are available for BXA10 and BXA20 inserts for hard turning.

**Edge preparation - Selection guide**

Based on the performance of the insert with standard edge preparation, the following solutions are recommended.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generates burrs</td>
<td>-LF (S00515)</td>
</tr>
<tr>
<td>Generates flank wear</td>
<td>-L (S01315)</td>
</tr>
<tr>
<td>Generates crater wear</td>
<td>-LC (S00535)</td>
</tr>
<tr>
<td>Generates fractures</td>
<td>-H (S01835)</td>
</tr>
</tbody>
</table>
**Edge preparation - Continuous cutting**

![Graph showing tool life vs. negative land angle for continuous cutting.](image)

<table>
<thead>
<tr>
<th>Negative land angle (deg)</th>
<th>Tool life (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>50</td>
</tr>
<tr>
<td>-35</td>
<td>75</td>
</tr>
<tr>
<td>-30</td>
<td>100</td>
</tr>
<tr>
<td>-25</td>
<td>125</td>
</tr>
<tr>
<td>-20</td>
<td>150</td>
</tr>
</tbody>
</table>

The smaller the negative land angle is, the more wear resistant the cutting edge will be in continuous cuts.

**Edge preparation - Interrupted cutting**

![Graph showing relative tool life vs. negative land angle for interrupted cutting.](image)

<table>
<thead>
<tr>
<th>Negative land angle (deg)</th>
<th>Relative tool life (-25° = 100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>0</td>
</tr>
<tr>
<td>-35</td>
<td>50</td>
</tr>
<tr>
<td>-30</td>
<td>100</td>
</tr>
<tr>
<td>-25</td>
<td>200</td>
</tr>
<tr>
<td>-20</td>
<td>300</td>
</tr>
</tbody>
</table>

The larger the negative land angle is, the more fracture resistant the cutting edge will be in interrupted cuts.
**Edge preparation - Cutting loads**

The -L and -LF edge preparations provide reduced cutting loads over the insert with standard edge preparation.

![Graph showing reduced cutting loads](image)

Cutting speed: \( V_c = 100 \text{ m/min (328 sfm)} \)
Feed: \( f = 0.3 \text{ mm/rev (.012")} \)
Depth of cut: \( a_p = 0.2 \text{ mm (.008")} \)
Coolant: Dry
Workpiece material: SCM415 (60HRC)

**Edge preparation - Flank wear**

The -L and -LF edge preparations provide reduced flank wear over the insert with standard edge preparation.

![Graph showing reduced flank wear](image)

Cutting speed: \( V_c = 130 \text{ m/min (426 sfm)} \)
Feed: \( f = 0.15 \text{ mm/rev (.006")} \)
Depth of cut: \( a_p = 0.2 \text{ mm (.008")} \)
Coolant: Wet
Workpiece material: SCM415 (60HRC)

**Edge preparation - Crater wear**

The -LC edge preparation provides reduced crater wear over the insert with standard edge preparation. As a result, insert fracture induced by crater wear is reduced.

![Images showing crater wear](image)

Cutting speed: \( V_c = 200 \text{ m/min (656 sfm)} \)
Feed: \( f = 0.1 \text{ mm/rev (.004")} \)
Depth of cut: \( a_p = 0.2 \text{ mm (.008")} \)
Coolant: Dry
Workpiece material: SCM415 (60HRC)
FEED the SPEED - TUNGALOY ACCELERATED MACHINING
CHIPBREAKERS

Negative Inserts

Three standard types of chipbreakers are available for negative inserts:

HP: For standard finishing
HF: For removable carburized layer (at light DOC) of case-hardened steel
HM: For removable carburized layer (at great DOC) of case-hardened steel

Positive Inserts

HP: For standard finishing
HP - HardBreakers for finishing hardened steel

Innovative 3D chipbreaker for efficient chip control

- By separating the chipbreaker from the cutting edge, the cutting force imposed on the cutting edge during machining is significantly reduced, thus providing long tool life.

- The cutting edge preparation is designed to ensure easy cutting at low cutting forces, while maintaining close tolerances with no deviations.

- The HP style chipbreaker, combined with built-in wipers, yields excellent surface quality and good chip control.

Consistent and durable chip breaking

Innovative 3D chipbreaker for efficient chip control

Optimized edge preparation for low cutting force

HP chipbreaker

Wiper

Chatter-free machining

Due to low cutting force, chatter stability is greatly improved.

For more information

www.tungaloy.com
HF & HM - HardBreakers for removing carburized layer

Two types of chipbreakers provide excellent chip control in a wide application range

**HF & HM - HardBreakers for removing carburized layer**

**HF chipbreaker**

- Single-sided CBN insert provides high stability in heavy machining
- Excellent chip control in small depth of cut due to the high functional nose
- Delivers exceptional surface finishes

**HM chipbreaker**

- Single-sided CBN insert provides high stability in heavy machining
- Provides ideal chip control in large depth of cut with the well-designed chipbreaker
- Suitable for medium cutting or roughing

**Feed:**

- Metric: 0.05 0.1 0.15 0.2 0.25 0.5 0.75 1.0
- Imperial: 0.002" 0.004" 0.006" 0.008"

**Depth of cut:**

- Metric: 0.002" 0.004" 0.006" 0.008" 0.01" 0.02" 0.03" 0.04"
- Imperial: 0.002" 0.004" 0.006" 0.008"

**HF chipbreaker**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Depth of cut (mm)</th>
<th>Feed: f (mm/rev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>0.5</td>
<td>0.75</td>
</tr>
<tr>
<td>0.05</td>
<td>0.1</td>
<td>0.15</td>
</tr>
<tr>
<td>0.2</td>
<td>0.1</td>
<td>0.15</td>
</tr>
<tr>
<td>0.075</td>
<td>0.15</td>
<td>0.2</td>
</tr>
</tbody>
</table>

**HM chipbreaker**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Depth of cut (mm)</th>
<th>Feed: f (mm/rev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0.5</td>
<td>0.75</td>
</tr>
<tr>
<td>0.05</td>
<td>0.1</td>
<td>0.15</td>
</tr>
<tr>
<td>0.15</td>
<td>0.15</td>
<td>0.2</td>
</tr>
<tr>
<td>0.2</td>
<td>0.15</td>
<td>0.2</td>
</tr>
</tbody>
</table>

**Imperial**

<table>
<thead>
<tr>
<th>Depth of cut (inch)</th>
<th>Feed: f (in/rev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.002&quot;</td>
<td></td>
</tr>
<tr>
<td>0.004&quot;</td>
<td></td>
</tr>
<tr>
<td>0.006&quot;</td>
<td></td>
</tr>
<tr>
<td>0.008&quot;</td>
<td></td>
</tr>
</tbody>
</table>
Tungaloy is the market leader of CBN Blanks

Made by Tungaloy

Carefully-selected micron-sized cubic boron nitride powers are sintered with a ceramic or metallic binder under high-temperature, high-pressure (HTHP) environment of over 5 GPa (over 725,189 psi) at 1400 °C -1500 °C (2552 °F - 2730 °F) in Tungaloy’s latest sintering equipment. The CBN blanks will then undergo strict quality screening before being fabricated into CBN inserts.

Tungaloy welcomes customers to collaborate with its Advanced Materials Team to develop customized CBN grades perfectly tailored to the customer’s specific hard turning needs. Tungaloy offers a high level of performance in the most challenging hard turning applications but can also bring these unique products to the customers in a short time span.
Wavy Joint
New brazing technology for increased machining efficiency - “WavyJoint”

For high depth of cut in hard turning up to 0.8 mm
Great performance for continuous to heavy interrupted cutting at low and medium speeds

Strong joint
The “wavy” contact surface enhances the brazing strength.

CBN Tip Size: 200% larger for improved wear resistance of the cutting edge
Brazing Area: 160% larger for enhanced brazing strength

WavyJoint

Vs.

Standard

www.tungaloy.com
CERAMIC SERIES

Medium speed, continuous turning of hardened steel

Ceramic

Ceramic cutting tools make a great alternative for efficient and economical hard turning generally due to its excellent wear resistance at high cutting speeds. However, ceramics suffer lack of fracture toughness and thermal shock resistance, and, as the result, any type of shocks or impact during machining must be avoided to prevent chipping or fracture.

LX11 is Tungaloy’s oxide-based ceramic grade composed of aluminum oxide (Al₂O₃), or alumina, in a titanium nitride (TiN) coating. It is suited for hard turning in continuous to light-interrupted cuts, where surface finish requirements are moderate.

LX21 is another alumina-based ceramic grade of Tungaloy with higher bend strength than LX11 to enhance the grade’s fracture resistance. Designed with fracture toughness, LX21 is best suited for interrupted cuts or large removal applications, such as hard turning of steel rolls.

Ceramic Grades

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grain size</th>
<th>Main component</th>
<th>Recommended cutting speed (Vc)</th>
<th>Application range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fine</td>
<td>Medium</td>
<td>Coarse</td>
<td>Al₂O₃-TiC</td>
</tr>
<tr>
<td>LX11 TiN monolayer</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>LX21</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>60 - 150 m/min</td>
</tr>
</tbody>
</table>
PVD COATED CARBIDE SERIES

Cost-effective solution for turning hardened steel

The AH8000 series
Tungaloy’s AH8000 series features a nano multi-layered PVD coating with high Al content. This provides the grades with multiple characteristics, including high hardness, good cutting edge integrity, and strong adhesion to the tough carbide substrate, all of which are vital for efficient turning of hardened steel. The AH8000 series is particularly suited for hard turning applications using moderate cutting speeds of up to 50 m/min and large depths of cut of 0.5 mm or greater.

The AH8000 Series

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grain size</th>
<th>Main component</th>
<th>Recommended cutting speed (Vc)</th>
<th>Application range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH8005</td>
<td>Fine</td>
<td>AlTiN multilayer</td>
<td>~ 50 m/min ~ 164 sfm</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td></td>
<td></td>
<td>Light Interrupted</td>
</tr>
<tr>
<td></td>
<td>Coarse</td>
<td></td>
<td></td>
<td>Heavy Interrupted</td>
</tr>
<tr>
<td>AH8015</td>
<td>Fine</td>
<td>AlTiN multilayer</td>
<td>~ 50 m/min ~ 164 sfm</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td></td>
<td></td>
<td>Light Interrupted</td>
</tr>
<tr>
<td></td>
<td>Coarse</td>
<td></td>
<td></td>
<td>Heavy Interrupted</td>
</tr>
</tbody>
</table>

For more information
Tungaloy’s recommended solutions for hard turning

Get started!

Is the workpiece hardened to 50 HRC or higher?

NO

PVD Grade

AH8000 Series

YES

Cutting Condition

Continuous

Light Interrupted

Heavy Interrupted

First Recommendations

BXA10
Edge preparation - Standard

BXA20
Edge preparation - Standard

BXA20
Wavy Joint
Edge preparation - H

More Solutions

For reduce burr

BXA10
Edge preparation - LF

BXA10
Edge preparation - LC

For improved fracture resistance

BXA20
Edge preparation - H

For low cutting speed

BX360
Edge preparation - Standard

For better surface finish

BXA20
Edge preparation - Standard

For improved chip control

BXA10
with Hardbreaker HP

For an economical solution

LX11

Other Solutions
FIELD TEST REPORTS

Industry: Automotive / Gear
Material: 18CrMo4 / SCM420 (62HRC)
Toolholder: ACLNL2525M12-A
Insert: 2QP-CNGA120408
Grade: BXA10
Cutting conditions:
- $V_c = 100$ m/min (328 sfm)
- $f = 0.05$ mm/rev (.002 ipr)
- $a_p = 0.15$ mm (.006")
- Coolant = Wet

Application: Face turning
Machine: NC lathe

Industry: Automotive / CVT
Material: 18CrMo4 / SCM420 (HV720 - 850)
Toolholder: A32S-PDUNL15-D400
Insert: 2QP-DNGA150408
Grade: BXA10
Cutting conditions:
- $V_c = 130$ m/min (426 sfm)
- $f = 0.1$ mm/rev (.004 ipr)
- $a_p = 0.15$ mm (.006")
- Coolant = Wet

Application: Internal turning
Machine: NC lathe
Industry: Automotive / Stator
Material: 18CrMo4 / SCM420 (62HRC)
Toolholder: SDJCR2020K11
Insert: 2QP-DCGW11T308
Grade: BXA10
Cutting conditions:
- $V_c = 168 \text{ m/min (551 sfm)}$
- $f = 0.08 \text{ mm/rev (.003 ipr)}$
- $ap = 0.2 \text{ mm (.008"), x2 passes}$
- Coolant = Wet
Application: Face turning
Machine: NC lathe

Industry: General Engineering / Nut
Material: 20CrMo4 / SCM420 (58HRC)
Toolholder: ATGNR2525M16-A
Insert: 3QP-TNGA160408
Grade: BXA20
Cutting conditions:
- $V_c = 200 \text{ m/min (656 sfm)}$
- $f = 0.08 \text{ mm/rev (.003 ipr)}$
- $ap = 0.15 \text{ mm (.006"), x2 passes}$
- Coolant = Wet
Application: External turning
Machine: NC lathe

Industry: Automotive / Input shaft
Material: 20Cr4 / SCr420 (63HRC)
Toolholder: E12G-SCLCR06-D160
Insert: 2QP-CCGW060204
Grade: BXA20
Cutting conditions:
- $V_c = 120 \text{ m/min (394 sfm)}$
- $f = 0.1 \text{ mm/rev (.004 ipr)}$
- $ap = 0.1 \text{ mm (.004"), x2 passes}$
- Coolant = Wet
Application: Internal turning
Machine: NC lathe

Tool life 1.7 times!

Tool life 1.3 times!

Double tool life!
Industry: Automotive / Input shaft  
Material: SNCM420 (58HRC)  
Toolholder: E20S-STUPR1103-D220  
Insert: 3QP-TPGW110308  
Grade: BXA20  
Cutting conditions:  
Vc = 170 m/min (558 sfm)  
f = 0.08 mm/rev (.003 ipr)  
ap = 0.10 mm (.004")  
Coolant = Wet  
Application: Internal turning  
Machine: NC lathe  

Industry: Automotive / Gear wheel  
Material: SCM420 (58HRC)  
Toolholder: ACLNL2525M12-A  
Insert: 4QS-CNGA120412-H  
Grade: BXA20  
Cutting conditions:  
Vc = 100 m/min (328 sfm)  
f = 0.15 mm/rev (.006 ipr)  
ap = 1.0 mm (.039")  
Coolant = Wet  
Application: External turning & facing  
Machine: NC lathe  

Industry: Heavy Industries / Movable arm shaft  
Material: S45C (50HRC)  
Toolholder: ACLNR2020K12-A  
Insert: 4QS-CNGA120408-H  
Grade: BXA20  
Cutting conditions:  
Vc = 180 m/min (591 sfm)  
f = 0.10 mm/rev (.04 ipr)  
ap = 0.5 mm (.020")  
Coolant = Dry  
Application: External turning  
Machine: NC lathe
Industry: Automotive / Gear part  
Material: 20Cr4 / SCR420 (60HRC)  
Toolholder: D25T-DCLNR1204-32  
Insert: 2QP-GNGA120408  
Grade: BX2A20  
Cutting conditions:  
\[ V_c = 120 \text{ m/min (394 sfm)} \]  
\[ f = 0.10 \text{ mm/rev (.004 ipr)} \]  
\[ a_p = 0.10 \text{ mm (.004")} \]  
Coolant = Wet  
Application: Internal turning  
Machine: NC lathe

Industry: Automotive / CVJ part  
Material: SCR420 (60HRC)  
Toolholder: ACLNR2525M11-A  
Insert: 2QP-CNGM120408-HP  
Grade: BX2M10  
Cutting conditions:  
\[ V_c = 250 \text{ m/min (820 sfm)} \]  
\[ f = 0.20 \text{ mm/rev (.08 ipr)} \]  
\[ a_p = 0.20 \text{ mm (.08")} \]  
Coolant = Wet  
Application: External turning & facing  
Machine: NC lathe

Industry: Automotive / Shaft  
Material: SCM420 (59HRC)  
Toolholder: SDJCR2525M11  
Insert: 2QP-DCGT11T304-HP  
Grade: BX2M10  
Cutting conditions:  
\[ V_c = 120 \text{ m/min (394 sfm)} \]  
\[ f = 0.05 \text{ mm/rev (.002 ipr)} \]  
\[ a_p = 0.20 \text{ mm (.08")} \]  
Coolant = Wet  
Application: External turning  
Machine: NC lathe

Tool life 1.3 times!  
Tool life 1.2 times!
**Industry:** Automotive / Sprocket

**Material:** SCM415 (55HRC)

**Toolholder:** ACLNL2020K12-A

**Insert:** 2QP-CNGM120404WL-HP

**Grade:** BXA20

**Cutting conditions:**
- $V_c = 120 \text{ m/min (394 sfm)}$
- $f = 0.05 \text{ mm/rev (.002 ipr)}$
- $a_p = 0.10 \text{ mm (.04")}$
- Coolant = Wet

**Application:** External turning

**Machine:** NC lathe

---

**Industry:** Die&Mold / Guide pin

**Material:** D2 tool steel (60 HRC)

**Toolholder:** ADJNR2525M15

**Insert:** DNGA432

**Grade:** LX11

**Cutting conditions:**
- $V_c = 120 \text{ m/min (394 sfm)}$
- $f = 0.2 \text{ mm/rev (.008 ipr)}$
- $a_p = 1.0 \text{ mm (.04")}$
- Coolant = Wet

**Application:** External turning

**Machine:** NC lathe

---

**Industry:** Automotive / Guide starter gear

**Material:** 16MnCr5 (58 HRC)

**Toolholder:** ACLNL2525M12-A

**Insert:** CNGA120408

**Grade:** LX11

**Cutting conditions:**
- $V_c = 90 \text{ m/min (295 sfm)}$
- $f = 0.08 \text{ mm/rev (.003 ipr)}$
- $a_p = 0.05 \text{ mm (.002")}$
- Coolant = Wet

**Application:** External turning

**Machine:** NC lathe

---

**Double tool life!**

**Double tool life!**

**Tool life 250%!**
Industry: **General Engineering** / Toggle pin
Material: Tool steel (49 HRC)
Toolholder: PCLNR3232P19E
Insert: CNMG190616-HRM
Grade: AH8005
Cutting conditions:

- \( V_c = 66 \text{ m/min (216 sfm)} \)
- \( f = 0.6 \text{ mm/rev (.023 ipr)} \)
- \( a_p = 1.25 \text{ mm (.010")} \)
- Coolant = Dry

Application: External turning
Machine: NC lathe

---

Industry: **Die & Mold** / Pin for die set
Material: SKH51 (63 HRC)
Toolholder: PTGNR2525M16
Insert: TNMG160408-HRF
Grade: AH8005
Cutting conditions:

- \( V_c = 30 \text{ m/min (98.4 sfm)} \)
- \( f = 0.1 \text{ mm/rev (.004 ipr)} \)
- \( a_p = 1.0 \text{ mm (.040")} \)
- Coolant = Wet

Application: External turning
Machine: NC lathe

---

Industry: **Heavy Industries** / Roll
Material: SKD11 (60 HRC)
Toolholder: PRGCL2525M12
Insert: RCMT1204M0-RS
Grade: AH8005
Cutting conditions:

- \( V_c = 80 \text{ m/min (262 sfm)} \)
- \( f = 0.2 \text{ mm/rev (.008 ipr)} \)
- \( a_p = 2.0 \text{ mm (.08")} \)
- Coolant = Wet

Application: External turning
Machine: NC lathe

---

**Double tool life!**

**Double tool life!**

**Tool life 1.7 times!**
Stay tuned with our new website, e-catalog and our App!
Worldwide Network

Tungaloy Corporation
Head Office
11-1 Yoshima Kogyodanchi
Iwaki-city, Fukushima 970-1144 Japan
Phone: +81-246-36-9501
Fax: +81-246-36-8542
www.tungaloy.com

Iwaki Plant
Products: Cutting Tools

Nagoya Plant
Products: Cutting Tools

Kyushu Plant
Products: PCBN
PCD Tools
Deep Hole Drills

Nirasaki Plant
Products: Cutting Tools
Friction Materials (TungFric)
Wear Resistant Tools
Civil Engineering Tools

Tungaloy America, Inc.
3726 N Ventura Drive
Arlington Heights,
IL 60004, U.S.A.
Phone: +1-888-554-8394
Fax: +1-888-554-8392
www.tungaloy.com/us

Tungaloy Canada
432 Elgin St. Unit 3, Brantford
Ontario N5S 7P7, Canada
Phone: +1-519-758-5779
Fax: +1-519-758-5791
www.tungaloy.com/ca

Tungaloy de Mexico S.A.
C Los Arellano 113,
Parque Industrial Siglo XXI
Aguascalientes, AGS,
Mexico 20290
Phone: +52-449-929-5410
Fax: +52-449-929-5411
www.tungaloy.com/mx

Tungaloy do Brasil Ltda.
Avd. Independencia N4158
Residencial Flora
13280-000 Vinhedo,
São Paulo, Brazil
Phone: +55-19-38262757
Fax: +55-19-38262757
www.tungaloy.com/br

Tungaloy Germany GmbH
An der Alten Ziegelei 1
D-40789 Monheim, Germany
Phone: +49-2173-90420-0
Fax: +49-2173-90420-19
www.tungaloy.com/de

Tungaloy France S.A.S.
ZA Courtaboeuf - Le Roi
1 rue de la Terre de feu
F-91952 Courtaboeuf Cedex, France
Phone: +33-1-6486-4300
Fax: +33-1-6907-7817
www.tungaloy.com/fr

Tungaloy Italia S.r.l.
Via E. Andolfiato 10
I-20126 Milano, Italy
Phone: +39-02-282012-1
Fax: +39-02-282012-65
www.tungaloy.com/it

Tungaloy Czech s.r.o
Turanka 115
CZ-627 00 Brno, Czech Republic
Phone: +420-532 123 391
Fax: +420-532 123 392
www.tungaloy.com/cz

Tungaloy Ibérica S.L.
C/Miquel Servet, 43B, Nau 7
Pol. Ind. Bufalvent
ES-08243 Manresa (BCN), Spain
Phone: +34 93 113 1360
Fax: +34 93 876 2798
www.tungaloy.com/es

Tungaloy Scandinavia AB
Bultgatan 38, 442 40
Kungälv, Sweden
Phone: +46-462119200
Fax: +46-462119207
www.tungaloy.com/se

Tungaloy Rus, LLC
Andropova avenue, h.18/7,
11 floor, office 3, 115432,
Moscow, Russia
Phone: +7-499-683-01-80
Fax: +7-499-683-01-81
www.tungaloy.com/ru

Tungaloy Polska Sp. z o.o.
Ul. Irysowa 1, 55-040 Bielany
Wrocławskie, Poland
Phone: +48 607 907 237
www.tungaloy.com/pl

Tungaloy U.K. Ltd
Gallan Park, Watling Street,
Cannock, WS110XG, UK
Phone: +44 121 4000 231
Fax: +44 121 270 9694
www.tungaloy.com/uk
FEED the SPEED - TUNGALOY ACCELERATED MACHINING

Tungaloy Hungary Kft
Erzsébet királyné útja 125
H-1142 Budapest, Hungary
Phone: +36 1 781-6846
Fax: +36 1 781-6866
www.tungaloy.com/hu

Tungaloy Turkey
Serifali Mah. bayraktar Bulvari Kule Sk. No:26
34775 Ümraniye / Istanbul / Turkey
Phone: +90 216 540 04 67
Fax: +90 216 540 04 87
www.tungaloy.com/tr

Tungaloy Benelux b.v.
Tjalk 70
NL-2411 NZ Bodegraven, Netherlands
Phone: +31 172 630 420
Fax: +31 172 630 429
www.tungaloy.com/nl

Tungaloy Croatia
Ulica bana Josipa Jelačića 87, 10430, Samobor, Croatia
Phone: +385 1 3327 604
Fax: +385 1 3327 683
www.tungaloy.com/hr

Tungaloy Cutting Tool (Shanghai) Co.,Ltd.
Rm No 401 No.88 Zhabei Jiangchang No.3 Rd
Shanghai 200436, China
Phone: +86-21-3632-1880
Fax: +86-21-3621-1918
www.tungaloy.com/cn

Tungaloy Cutting Tools (Thailand) Co.,Ltd.
Interlink tower 4th Fl.
1858/5-7 Bangna-Trad Road
km.5 Bangna, Bangna, Bangkok
10260 Thailand
Phone: +66-2-751-5711
Fax: +66-2-751-5715
www.tungaloy.com/th

Tungaloy Cutting Tools (Taiwan) Co.,Ltd.
9F. No.293, Zhongyang Rd,
Xinzhuang Dist, New Taipei City,
24251 Taiwan
Phone: +886-2-8521-9986
Fax: +886-2-8521-8935
www.tungaloy.com/tw

Tungaloy Singapore (Pte.), Ltd.
62 Ubi Road 1,
#06-11 Oxley BizHub 2
Singapore 408734
Phone: +65-6391-1833
Fax: +65-6299-4557
www.tungaloy.com/sg

Tungaloy Vietnam
L604.38, Lexington Residence
67 Mai Chi Tho St., Dist. 2,
Ho Chi Minh City, Vietnam
Phone: +84-2837406660
www.tungaloy.com/vn

Tungaloy India Pvt. Ltd.
Indiabulls Finance Centre,
Unit # 902-A, 9th Floor,
Tower 1, Senapati Bapat Marg,
Elphinstone Road (West),
Mumbai -400013, India
Phone: +91-22-6124-8804
Fax: +91-22-6124-8899
www.tungaloy.com/in

Tungaloy Korea Co., Ltd
#1312, Byucksan Digital Valley 5-cha
Beotkkot-ro 244, Geumcheon-gu
153-788 Seoul, Korea
Phone: +82-2-2621-6161
Fax: +82-2-6393-8952
www.tungaloy.com/kr

Tungaloy Malaysia Sdn Bhd
50 K-2, Kelana Mall, Jalan SS6/14 Kelana Jaya, 47301
Petaling Jaya, Selangor Darul Ehsan
Malaysia
Phone: +603-7805-3222
Fax: +603-7804-8563
www.tungaloy.com/my

Tungaloy Australia Pty Ltd
Unit 68 1470 Ferntree Gully Road
Knoxfield 3180 Victoria, Australia
Phone: +61-3-9755-8147
Fax: +61-3-9755-6070
www.tungaloy.com/au

PT. Tungaloy Indonesia
Kompleks Grand Wisata Block AA-10
No.3-5 Cibitung
Bekasi 17610, Indonesia
Phone: +62-21-8261-5808
Fax: +62-21-8261-5809
www.tungaloy.com/id

Official Distributor in South Africa - Star Tooling CC
P.O. Box 11316
Selcourt 1567
Springs, South Africa
Phone: +27 011 818-2259
Fax: +27 011 818-2250
www.startooling.co.za

www.tungaloy.com
FEED the SPEED!

HARD TURNING SERIES

www.tungaloy.com