PROVEN SOLUTIONS FOR STEERING KNUCKLE
By choosing Seco, you get more than just a comprehensive portfolio of advanced metal-cutting solutions and expert services. You get a partnership based on trust, respect and communication and a team that is always ready to help you gain the competitive advantage.

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With a presence in more than 50 countries and 5,000 highly dedicated employees, Seco develops advanced cutting tools, processes and services that manufacturers around the world depend on for maximum productivity and profitability in an industry that is constantly changing. Our broad and diverse selection of milling, turning, holemaking and tool holding products for all industry segments includes more than 30,000 standard items as well as custom solutions for special applications. Through our Component Engineered Tooling (CET) program, we can also engineer a comprehensive tooling process – a single solution or full turnkey operation – for producing a specific part with the highest productivity, efficiency and cost effectiveness possible.

When you choose Seco for your operations, you get more than just a comprehensive portfolio of high-performance products and expert services. You experience a partnership based on trust, respect and communication. Our team is always available to help you gain the competitive advantage in an increasingly challenging global marketplace.

**DRIVING INNOVATION IN AUTOMOTIVE PART PRODUCTION**

With such a diverse and expansive catalogue of products, Seco can optimise most operations with standard tooling. Given the rapid and constant change of the automotive industry, however, there will be those special applications that require a custom solution such as the manufacturing of vehicle steering knuckles. In fact, our engineering and applications experts often work closely with car part manufacturers to develop customised solutions that optimise their manufacturing processes. From quotation to product delivery, we excel in providing ideal results in minimal time, affording these manufacturers the responsiveness needed to succeed in today’s competitive automotive market.

For more information on part manufacturing for the automotive industry, you can visit www.secotools.com/automotive, a comprehensive resource that presents data on materials, cutting processes and other aspects of automotive manufacturing well beyond subjects related to our own cutting tool innovations.
EXCELLENCE AND INNOVATION IN STEERING KNUCKLE PRODUCTION

DEFINITION
Steering knuckles contain wheel hubs or spindles, and attach to the suspension components of a vehicle. The components are critical to front and rear suspension safety, so quality surface finishes, precision radii and perfect machined flatness are required. Processing involves custom tools such as disc mills, drills and reamers.

MATERIALS
Nodular cast iron and forged steel are used for most passenger cars. High-tensile-strength ductile iron is also used for trucks. In order to save weight on the on bigger passenger cars, more and more steering knuckles are made from aluminium. For safety reasons, this aluminium component is forged to improve its mechanical properties and to provide it the needed strength. Forged steel is often used for off road vehicles, light trucks and trucks.

MACHINING
Depending on the material the customer will have to machine, characteristics including rigidity, spindle and attachment size, power and torque, and spindle velocity will be very important to define the most appropriate machine tool. Linear or rotating transfer machines or twin spindle machining centres are still preferred for high production volume. Machining centres (single or twin spindles) will be preferred for lower production batches or mixed production batches.

PROCESS
Achieving top quality and short cycle times are always key goals for process engineers, along with minimising cost per piece.

The steering knuckle is usually produced in one or two set ups on machining centres. Due to a limited number of pockets available in the tool magazine and the desire for short cycle times, tool suppliers often have to supply custom tools that combine multiple operations.

Due to a large variety of component concepts and shapes, Seco describes on the following pages most of the features that customers have to machine on a steering knuckle, and the associated Seco solutions.
OPERATIONS & MODELS

TYPICAL FRONT STEERING KNUCKLE

1. STRUT MOUNT
2. ABS / ABR LOCATION
3. STEERING ARM, TIE ROD LOCATION
4. LOWER BALL JOINT LOCATION
5. BALL BEARING LOCATION O.D. MACHINING
6. BALL BEARING LOCATION
7. BRAKE CALIPER FASTENING HOLES
8. WHEEL SPINDLE

TYPICAL REAR KNUCKLE

TYPICAL FRONT STEERING KNUCKLE
STRUT MOUNT
STRUT MOUNT

YOUR CHALLENGE:
Improve productivity and reduce tool cost per operation as much as possible.

OUR PROVEN SOLUTION:
For productivity and economy, Seco offers multiple custom disc milling cutters to cover a diverse range of components. One of these is disc mill R/L 335.29 with round inserts RPHIT1204MOT for ductile cast iron.

WHEEL SPINDLE

YOUR CHALLENGE:
Improve productivity with minimum tool changes and reduce tool cost per operation as much as possible.

OUR PROVEN SOLUTION:
Excellent performance results from the combination tool for O.D. turning, radius forming and O.D. turning & chamfering. The tool uses standard inserts for productivity and economy. Seco has developed a complete range of new Duratomic® grades, including TP grades that allow working at high cutting parameters in forged steel.
BRAKE CALIPER FASTENING HOLES

YOUR CHALLENGE:
Achieve parallelism, squareness and high surface finish on both faces.

OUR PROVEN SOLUTION:
For productivity, economy and reliability, the square shoulder milling cutter R220.96 using XNEX0806 inserts with 6 cutting edges is the first choice for machining ductile cast iron and forged steel. The use of a standard cutter is Seco’s first solution to decrease tool cost.

<table>
<thead>
<tr>
<th>Cutting data</th>
<th>N</th>
<th>f</th>
<th>Material: Nodular cast iron (GGG) (SMG K4)</th>
<th>Coolant: Water-soluble oil</th>
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<tr>
<td>Metric</td>
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<td>.016</td>
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<tr>
<td>Inch</td>
<td>1561 mm/min</td>
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<td>12.29 ipm</td>
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</tbody>
</table>

Results: Tool cost per piece reduced by 28% due to grade’s suitability for both materials.


BRAKE CALIPER: ASSEMBLY CONTACT FACES

YOUR CHALLENGE:
Achieve parallelism, squareness and high surface finish on both faces.

OUR PROVEN SOLUTION:
For productivity, economy and reliability, the square shoulder milling cutter R220.96 using XNEX0806 inserts with 6 cutting edges is the first choice for machining ductile cast iron and forged steel. The use of a standard cutter is Seco’s first solution to decrease tool cost.

<table>
<thead>
<tr>
<th>Cutting data</th>
<th>N</th>
<th>f</th>
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<tr>
<td>Inch</td>
<td>3673 rpm</td>
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<td>.2 mm</td>
<td>.016</td>
</tr>
<tr>
<td>Metric</td>
<td>.0086&quot;</td>
<td>1.18&quot;</td>
<td>.008&quot;</td>
<td>.016</td>
</tr>
<tr>
<td>Inch</td>
<td>1561 mm/min</td>
<td>6</td>
<td>12.29 ipm</td>
<td>6</td>
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</tbody>
</table>

Results: Tool cost per piece reduced by 28% due to grade’s suitability for both materials.

Material: Nodular cast iron (GGG) (SMG K4)/ forged steel (SMG P5) Coolant: Water-soluble oil Operation: Drilling brake caliper fastening holes Criterion: Tool life Fixturing: Hydraulic clamping fixture Tool: SD265A 12,13-36-14R1 Insert 1: -

BRAKE CALIPER: FASTENING HOLES

YOUR CHALLENGE:
Drill precise holes, optimise the positional accuracy and squareness of both holes.

OUR PROVEN SOLUTION:
When high precision (up to IT7) and productivity are required, the Seco Feedmax™ SD265A is the first choice for drilling either ductile cast iron or forged steel. The drill is fitted in a Shrinkfit toolholder to get the best run out. A wide range of toolholders is available, such as the EPB 5600, 5603 and 5801 series.

<table>
<thead>
<tr>
<th>Cutting data</th>
<th>N</th>
<th>f</th>
<th>Material: Nodular cast iron (GGG) (SMG K4)</th>
<th>Coolant: Water-soluble oil</th>
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<tr>
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<td>3673 rpm</td>
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<td>Inch</td>
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<td>.008&quot;</td>
<td>.016</td>
</tr>
<tr>
<td>Inch</td>
<td>1561 mm/min</td>
<td>6</td>
<td>12.29 ipm</td>
<td>6</td>
</tr>
</tbody>
</table>

Results: Tool life improved by 25%.

Material: Nodular cast iron (GGG) (SMG K4)/ forged steel (SMG P5) Coolant: Water-soluble oil Operation: Drilling brake caliper fastening holes Criterion: Tool life Fixturing: Hydraulic clamping fixture Tool: SD265A 12,13-36-14R1 Insert 1: -

YOUR CHALLENGE:
Drill precise holes, optimise the positional accuracy and squareness of both holes.

OUR PROVEN SOLUTION:
When high precision (up to IT7) and productivity are required, the Seco Feedmax™ SD265A is the first choice for drilling either ductile cast iron or forged steel. The drill is fitted in a Shrinkfit toolholder to get the best run out. A wide range of toolholders is available, such as the EPB 5600, 5603 and 5801 series.
ABS/ABR SENSOR LOCATION

YOUR CHALLENGE:
Drilling numerous holes with low cycle times, high hole quality, and excellent application security.

OUR PROVEN SOLUTION:
The Seco Feedmax™ chamfer drill SD203A with N geometry is the first choice for drilling aluminium components. The Feedmax N has a free cutting geometry and special edge preparation to increase process security and tool life. The drill also incorporates a low friction coating. It is fitted in the high precision collet chuck EPB 5672 toolholder to obtain minimum runout and high locking torque. The tooling excels in high speed machining of aluminium steering knuckles.

Material: Aluminium (AS 7) (SMG N1)
Coolant: Water-soluble oil
Operation: Drilling of ABS/ABR sensor location
Criterion: Tool life and hole quality
Fixturing: Hydraulic clamping fixture
Tool: SD203A-5.0-20-6R1-N
Insert 1: -
Cutting data
<table>
<thead>
<tr>
<th>Metric</th>
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<th>v_i</th>
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</tr>
<tr>
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<td>19000 rpm</td>
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<td>.0094 ipr</td>
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<td>.0047*</td>
<td>.1968*</td>
<td>179.52 ipm</td>
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</tr>
</tbody>
</table>

Inch

Results: Tool life increased by 27% and no exit burr

ABS/ABR SENSOR LOCATION

YOUR CHALLENGE:
Tapping numerous holes with high quality and with high reliability.

OUR PROVEN SOLUTION:
To obtain the best possible results, use the new Threadmaster™ Tap, a universal tap especially designed for short chipping materials like cast iron. This tool can be used for both blind and through holes. Threadmaster Tap has a TiCN coating that offers clear advantages for machining of high-strength steels and abrasive materials. If machine has a synchronised spindle, preferably a tapholder for synchronised tapping should be used. This solution is available as a standard product under the family of EPB 5867 synchronized tapping.

Material: Nodular cast iron (GGG) (SMG K4)
Coolant: Water-soluble oil
Operation: Tapping of M6 fastening holes
Criterion: -
Fixturing: Hydraulic clamping fixture
Tool: MTS-M6X1.00ISO6HX-XC-S005
Insert 1: -
Cutting data
<table>
<thead>
<tr>
<th>Metric</th>
<th>N</th>
<th>v_i</th>
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<tr>
<td>Inch</td>
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<td>Inch</td>
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<td>Inch</td>
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<td>Inch</td>
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</tbody>
</table>

Results: Tool life improved by 32%
STEERING ARM, TIE ROD LOCATION

Excellent precision with minimal radial and axial runout

Location per PESS

1 RADIAL AND AXIAL SUPPORTS

2 BOTTOM SUPPORT SURFACE
STEERING ARM

YOUR CHALLENGE:
Achieve the best performance in productivity and cost. Reduce cutting forces and obtain the required surface finish.

OUR PROVEN SOLUTION:
To provide an optimal solution, this custom disc milling cutter combines a Double Octomill™ to machine the top face and L335.29 using RPHT12 04-M0 inserts to achieve the requested radius on the bottom face of the steering arm. This selection of inserts reduces the tool cost per piece and maintains high machining performance.

STEERING ARM: TIE ROD LOCATION

YOUR CHALLENGE:
Rough form the taper in a single pass to minimise the amount of finishing work.

OUR PROVEN SOLUTION:
A solid-carbide taper drill with the same form as the finish reamer provides an excellent solution. The drill produces the taper in a single pass to near net shape in preparation for the finish ream operation.

Material: Nodular cast iron (GGG) (SMG K4)
Coolant: Water-soluble oil
Operation: Face milling both sides of the steering arm
Criterion: Ability to alternate between machining both materials
Fixturing: Hydraulic clamping fixture
Tool: Gang of custom disc milling cutters
Insert 1: ONMU090520ANT0-M12 MP2500
Insert 2: RPHT1204MOT.4FM10 T350M

Cutting data

<table>
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<th>Material</th>
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<td>Inch</td>
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<td>11</td>
<td>6.3&quot;</td>
<td>-</td>
<td>-</td>
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</table>

Results: Flexibility increased through grade MS2500’s suitability to machining both materials

Material: Nodular cast iron (GGG) (SMG K4)
Coolant: Water-soluble oil
Operation: Drilling a tapered hole
Criterion: With a single pass, drill to near net shape for the finish ream operation
Fixturing: Hydraulic clamping fixture
Tool: Custom solid carbide tapered drill
Insert 1: -
Insert 2: -

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>N</th>
<th>v₀</th>
<th>f₀</th>
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<td>Inch</td>
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</table>

Results: Output per tapered reamer increased and hole quality improved due to good hole geometry

Material: Nodular cast iron (GGG) (SMG K4)
Coolant: Water-soluble oil
Operation: Reaming a tapered hole in the ball joint
Criterion: Cost per hole
Fixturing: Hydraulic clamping fixture
Tool: Tapered Bifix with guide pads
Insert 1: P9008-EN46-12, CP15
Insert 2: -

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>N</th>
<th>v₀</th>
<th>f₀</th>
<th>Insert 1</th>
<th>Insert 2</th>
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</thead>
<tbody>
<tr>
<td>Metric</td>
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<tr>
<td>Inch</td>
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<td>.032&quot;</td>
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<tr>
<td>Metric</td>
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<tr>
<td>Inch</td>
<td>160 mm/min</td>
<td>6.3 ipm</td>
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</table>

Results: Cost reduced by 40%

Material: Nodular cast iron (GGG) (SMG K4)
Coolant: Water-soluble oil
Operation: Reaming a tapered hole
Criterion: Cost per hole
Fixturing: Hydraulic clamping fixture
Tool: Tapered Bifix with guide pads
Insert 1: P9008-EN46-12, CP15
Insert 2: -

Cutting data

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<thead>
<tr>
<th>Material</th>
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<th>f₀</th>
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<tr>
<td>Metric</td>
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</tr>
<tr>
<td>Inch</td>
<td>200 rpm</td>
<td>36 sfm</td>
<td>.032&quot;</td>
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<td>Metric</td>
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<td>.004&quot;</td>
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<tr>
<td>Inch</td>
<td>160 mm/min</td>
<td>6.3 ipm</td>
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</table>

Results: Cost reduced by 40%

STEERING ARM: TIE ROD LOCATION

YOUR CHALLENGE:
Meeting productivity and quality requirements when finishing the tapered bore.

OUR PROVEN SOLUTION:
To allow for high table feed while maintaining accuracy, the Bifix™ reamer uses a coated blade and multiple guide pads to maintain stability. The coated blade provides long tool life and excellent surface finishes. Your benefits include highly productive precision machining with lower production costs.
YOUR CHALLENGE:
Improve productivity and reduce tool cost per operation in roughing.

OUR PROVEN SOLUTION:
Step rough boring tool using double-sided ISO / ANSI inserts. Seco has developed a complete range of new Duratomic® grades which allow application of high cutting parameters on forged steel with TP grades and on nodular cast iron with TK grades.

Material: Nodular cast iron (GGG) (SMG K4)
Coolant: Water-soluble oil
Operation: Rough boring bearing location
Criterion: Tool life & cycle time
Fixturing: Hydraulic clamping fixture
Tool: Custom step boring bar
Insert 1: TNMG160408-M5, TK2001
Insert 2: SCMT09T308-M3, TK2001
Insert 3: -
Cutting data:

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</tr>
</tbody>
</table>

Results: Tool life improved by 35% and cutting speed increased by 30%.

Material: Aluminium (AS7) (SMG N1)
Coolant: Water-soluble oil
Operation: Rough boring bearing location
Criterion: Chip control
Fixturing: Hydraulic clamping fixture
Tool: Custom boring bar Ø82 / 92 + chamfer
Insert 1: TCCT160408FAL-KX
Insert 2: -
Insert 3: -
Cutting data:

<table>
<thead>
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<th>Cutting data</th>
<th>Metric</th>
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<th>N</th>
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</tr>
</tbody>
</table>

Results: Tool cost per piece reduced and chip control improved.

YOUR CHALLENGE:
Improve productivity and reduce tool cost per operation in roughing and semi-finishing.

OUR PROVEN SOLUTION:
Roughing and semi-finishing with a step boring tool using adjustable cartridges fitted with positive ISO / ANSI inserts. For a strong balance of speed and economy on aluminium steering knuckles, Seco recommends use of the -AL geometry in grade KX or grade PCD20-tipped inserts.
BALL BEARING LOCATION

YOUR CHALLENGE:
Obtain the required groove and under cut with a minimum cycle time.

OUR PROVEN SOLUTION:
A step multi-tooth grooving tool using tailor-made grooving inserts for the circlip groove and ISO / ANSI turning inserts to machine the under cut groove. This tool concept provides the capability to machine different workpiece materials by choosing different insert grades and cutting parameters.

BALL BEARING LOCATION

YOUR CHALLENGE:
Establishing an efficient and secure process for the finishing cut on the bearing location.

OUR PROVEN SOLUTION:
Maintaining high precision output while minimising cycle times, the Xfix™ reamer uses up to nine teeth to provide high feed rates, while holding tolerances as tight as IT6. Strong and stable insert cartridges ensure process security, while preloaded guide pads prevent vibration and increase stability. Your benefits include achieving tight tolerances without sacrificing the productivity of your production line.

BALL BEARING LOCATION: OUTER DIAMETER

YOUR CHALLENGE:
Obtain the required part geometry with minimal tools and tool changes.

OUR PROVEN SOLUTION:
Excellent performance results from this combination O.D. turning, radius-forming and O.D. chamfering tool that uses standard inserts for the chamfering and turning and altered standards for the radius forming. For productivity and economy, Seco has developed a complete range of new Duratomic® grades that allows working at high cutting parameters on forged steel with TP grades and on nodular cast iron with TK grades. For aluminium steering knuckles we recommend using -AL in grade or grade or grade PCD20.

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Material: Nodular cast iron (GGG) (SMG K4)
Coolant: Water-soluble oil
Operation: Circlips groove and under cut on ball bearing location
Criterion: Surface finish and no burr
Fixturing: Hydraulic clamping fixture
Tool: Multi-tooth custom cutter Ø 68
Insert 1: TCMT110208-F1, TP1500
Insert 2: Custom triangular insert 340 FG
Insert 3: -
Cutting data Metric 1030 rpm 220 m/min 0.75 mm 0.029
Inch 1030 rpm 720 sfm .09
Cutting data Metric 970 rpm 250 m/min 0.9 mm 0.35
Inch 970 rpm 817 sfm .0118
Results Tool life increased by 25%
## LOWER BALL JOINT LOCATION

**YOUR CHALLENGE:**
Increase productivity by reducing cycle times and tooling CPU (cost per unit).

**OUR PROVEN SOLUTION:**
Custom multi-step boring bar that roughs, finishes and chamfers using ISO / ANSI positive inserts. To achieve the best possible results, Seco has developed a complete range of new Duratomic® grades that allows application of high cutting parameters in forged steel with TP grades and in nodular cast iron with the TK grades. For aluminium steering knuckles, we recommend use of the AL-KX geometry and grade for roughing, or grade PCD20.

### Cutting Data

<table>
<thead>
<tr>
<th>Material</th>
<th>N</th>
<th>(v_c)</th>
<th>(f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nodular cast iron (GGG) (SMG K4)/ forged steel (SMG P5)</td>
<td>1768 rpm</td>
<td>250 m/min</td>
<td>0.25 mm/rev</td>
</tr>
<tr>
<td>Water-soluble oil</td>
<td>1768 rpm</td>
<td>817 sfm</td>
<td>0.25 mm/rev</td>
</tr>
<tr>
<td>Roughing, finishing and chamfering the ball point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool cost per piece</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fixturing:**
Hydraulic clamping fixture

**Tool:**
Custom multi-step boring bar

**Insert 1:**
SCMT120412-M3, TK2001

**Insert 2:**
CCMT09T308-M3, TK2001

| Criterion | Tool change time decreased by 30% due to combined tool |

Results
LOWER BALL JOINT LOCATION

YOUR CHALLENGE:
Achieve the best performance in terms of productivity and cost. Reduce cutting forces on less-rigid clamping fixture, obtain the required surface finish.

OUR PROVEN SOLUTION:
A custom double disc milling cutter combining Double Octomill and R335.18 cutters. The R335.18 cutter uses LNKT standard inserts that feature a positive chip groove to perform the back face milling operation and achieve the required radius value on the bottom face of the lower ball joint.

Material: Nodular cast iron (GGG) (SMG K4)/ forged steel (SMG P5)
Coolant: Water-soluble oil
Operation: Back square shoulder milling of lower ball joint location with radius of 2.4 mm
Criterion: Tool life
Fixturing: Hydraulic clamping fixture
Tool: Custom double disc milling cutter
Insert 1: LNKT080524PPTN-M06, F40M
Insert 2: LNKT080524PPTN-M06, F40M
Cutting data
<table>
<thead>
<tr>
<th>Metric</th>
<th>N (rpm)</th>
<th>v (m/min)</th>
<th>f (mm/rev)</th>
<th>a (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>458</td>
<td>230</td>
<td>0.949</td>
<td></td>
</tr>
<tr>
<td>Metric</td>
<td>350</td>
<td>150</td>
<td>0.157</td>
<td></td>
</tr>
</tbody>
</table>
Cutting data
<table>
<thead>
<tr>
<th>Metric</th>
<th>N (rpm)</th>
<th>v (m/min)</th>
<th>f (mm/rev)</th>
<th>a (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>458</td>
<td>230</td>
<td>0.949</td>
<td></td>
</tr>
<tr>
<td>Metric</td>
<td>350</td>
<td>150</td>
<td>0.157</td>
<td></td>
</tr>
</tbody>
</table>

Results
Flexibility increased through grade F40M’s suitability to machining both materials

LOWER ARM BALL JOINT LOCATION

YOUR CHALLENGE:
Achieve the best performance in terms of productivity and cost. Reduce cutting forces on less-rigid clamping fixture, obtain the required surface finish.

OUR PROVEN SOLUTION:
A custom double disc milling cutter combining Double Octomill and R335.18 cutters. To machine the top face, the economical choice is the Double Octomill, with double-sided inserts that feature 16 cutting edges and a positive chip groove in order to reduce cutting forces and limit the risk of vibration.

Material: Nodular cast iron (GGG) (SMG K4)/ Forged steel (SMG P5)
Coolant: Water-soluble oil
Operation: Face milling the lower ball joint location
Criterion: Tool life
Fixturing: Hydraulic clamping fixture
Tool: Custom double disc milling cutter
Insert 1: ONMU090520ANTN-M12, MP2500
Insert 2: -
Cutting data
<table>
<thead>
<tr>
<th>Metric</th>
<th>N (rpm)</th>
<th>v (m/min)</th>
<th>f (mm/rev)</th>
<th>a (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>458</td>
<td>209</td>
<td>0.078</td>
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</tr>
<tr>
<td>Metric</td>
<td>350</td>
<td>150</td>
<td>0.047</td>
<td></td>
</tr>
</tbody>
</table>

Results
Flexibility increased through grade MS2500’s suitability to machining both materials

LOWER ARM BALL JOINT LOCATION

YOUR CHALLENGE:
Achieve the best performance in terms of productivity and cost. Reduce cutting forces on less-rigid clamping fixture, obtain the required surface finish.

OUR PROVEN SOLUTION:
A custom double disc milling cutter combining Double Octomill and R335.18 cutters. To machine the top face, the economical choice is the Double Octomill, with double-sided inserts that feature 16 cutting edges and a positive chip groove in order to reduce cutting forces and limit the risk of vibration.

Material: Nodular cast iron (GGG) (SMG K4)/ Forged steel (SMG P5)
Coolant: Water-soluble oil
Operation: Back square shoulder milling of lower ball joint location with radius of 2.4 mm
Criterion: Tool life
Fixturing: Hydraulic clamping fixture
Tool: Custom double disc milling cutter
Insert 1: LNKT080524PPTN-M06, F40M
Insert 2: LNKT080524PPTN-M06, F40M
Cutting data
<table>
<thead>
<tr>
<th>Metric</th>
<th>N (rpm)</th>
<th>v (m/min)</th>
<th>f (mm/rev)</th>
<th>a (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>458</td>
<td>230</td>
<td>0.949</td>
<td></td>
</tr>
<tr>
<td>Metric</td>
<td>350</td>
<td>150</td>
<td>0.157</td>
<td></td>
</tr>
</tbody>
</table>

Results
Tool cost per operation decreased by 45% due to use of round insert with four cutting edges
**TRUCK & BUS APPLICATIONS**

**BALL BEARING LOCATION**

**YOUR CHALLENGE:**
Increase productivity by reducing cycle time and tooling cost per unit.

**OUR PROVEN SOLUTION:**
Custom multi-step boring bar that roughs, semi-finishes and chamfers. The grooving tool uses double sided ISO / ANSI inserts. The illustrated special boring tool performs a rough and semi-finish bore for the bearing seat and chamfers its lead edge all in one motion. The special groove cutter mounted at the end of the boring head is designed to interpolate a retaining ring groove in the bearing bore once the finish bore tool clears the part upon retraction.

---

**Material:** Nodular cast iron (GGG) (SMG K4)  
**Coolant:** Water-soluble oil  
**Operation:** Interpolate the retaining ring groove in the bearing bore  
**Criterion:** No burrs allowed  
**Fixturing:** Hydraulic clamping fixture  
**Tool:** Custom grooving cutter  
**Insert 1:** Custom grooving insert CP500  
**Insert 2:** Custom grooving insert CP500

<table>
<thead>
<tr>
<th>Cutting data</th>
<th>N</th>
<th>vc</th>
<th>f</th>
<th>Insert 1</th>
<th>Insert 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metric</td>
<td>1293</td>
<td>256 m/min</td>
<td>0.1 mm</td>
<td>1293</td>
<td>226 m/min</td>
</tr>
<tr>
<td>Inch</td>
<td>7 mm</td>
<td>937 sfm</td>
<td>.0039&quot;</td>
<td>7 mm</td>
<td>1500 sfm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cutting data</th>
<th>N</th>
<th>vc</th>
<th>f</th>
<th>Insert 1</th>
<th>Insert 2</th>
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</thead>
<tbody>
<tr>
<td>Metric</td>
<td>799 rpm</td>
<td>937 sfm</td>
<td>.0039&quot;</td>
<td>799 rpm</td>
<td>937 sfm</td>
</tr>
<tr>
<td>Inch</td>
<td>.011 ipr</td>
<td>776 mm/rev</td>
<td>6</td>
<td>.011 ipr</td>
<td>1200 mm/rev</td>
</tr>
</tbody>
</table>

**Results**
Burrs removed during machining due to profiled insert geometry

---

**Material:** Nodular cast iron (GGG) (SMG K4)  
**Coolant:** Water-soluble oil  
**Operation:** Roughing & semi-finishing of bearing bore  
**Criterion:** Reduce machining time  
**Fixturing:** Hydraulic clamping fixture  
**Tool:** Custom multi-step boring bar  
**Insert 1:** SNMG120412-M5, TK2001 (roughing)  
**Insert 2:** SNMG120408-M3, TP1500 (semi finishing)

<table>
<thead>
<tr>
<th>Cutting data</th>
<th>N</th>
<th>vc</th>
<th>f</th>
<th>Insert 1</th>
<th>Insert 2</th>
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<tbody>
<tr>
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<tr>
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<td>937 sfm</td>
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</tr>
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</table>

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<tr>
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<th>vc</th>
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<th>Insert 1</th>
<th>Insert 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metric</td>
<td>799 rpm</td>
<td>937 sfm</td>
<td>.0039&quot;</td>
<td>799 rpm</td>
<td>937 sfm</td>
</tr>
<tr>
<td>Inch</td>
<td>.011 ipr</td>
<td>776 mm/rev</td>
<td>6</td>
<td>.011 ipr</td>
<td>1200 mm/rev</td>
</tr>
</tbody>
</table>

**Results**
Tool change time reduced due to combined tool for step boring & milling
STEERING ARM LOCATION

YOUR CHALLENGE:
Increase productivity by reducing cycle time and tooling cost per unit.

OUR PROVEN SOLUTION:
Seco built a special arbor to combine a set of standard disc mills with a standard Square 6™ mill to create a combo straddle mill / face mill gang cutter. All cutters use standard inserts. The resulting savings include the time that would otherwise be spent on an additional tool change and multiple refixturings.

BALL BEARING LOCATION FINISHING

YOUR CHALLENGE:
Obtain the required bore geometry with a low cost per operation.

OUR PROVEN SOLUTION:
Biix reamer is the right solution to meet the simultaneous requirements of high quality and low tool cost per operation. Biix technology features an indexable cutting blade and multiple guide pads that provide roundness and excellent surface finish. Different grades and geometries are available to cover nodular cast iron and forged steel.

LOWER ARM BALL JOINT LOCATION

YOUR CHALLENGE:
Meeting productivity and quality requirements when finishing long tapered bores on truck steering knuckles.

OUR PROVEN SOLUTION:
To allow for high table feed while maintaining accuracy, the Biix reamer uses a coated blade and multiple guide pads to maintain stability. The coated blade provides long tool life and excellent surface finishes. Your benefits include highly productive precision machining with lower production cost.

---

### Material

- Nodular cast iron (GGG 50) (SMG K4)

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### Coolant

- Water-soluble oil

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### Operation

- Face milling

---

### Criterion

- Tool life

---

### Fixturing

- Hydraulic clamping fixture

---

### Tool

- Custom Biix reamer

---

### Insert 1:

<table>
<thead>
<tr>
<th>Cutting data</th>
<th>N</th>
<th>v&lt;sub&gt;c&lt;/sub&gt;</th>
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<th>a&lt;sub&gt;y&lt;/sub&gt;</th>
<th>v&lt;sub&gt;f&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
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<td>120 m/min</td>
<td>0.25 mm/rev</td>
<td>0.13 mm</td>
<td>821 mm/min</td>
</tr>
<tr>
<td>Inch</td>
<td>530 rpm</td>
<td>392 sfm</td>
<td>.01 ipr</td>
<td>.0551&quot;</td>
<td>32.32 ipm</td>
</tr>
<tr>
<td>Metric</td>
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<td>0.2 mm</td>
<td>132.5 mm/min</td>
<td>3 mm</td>
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</tr>
<tr>
<td>Inch</td>
<td>.01&quot;</td>
<td>.0078&quot;</td>
<td>5.19 rpm</td>
<td>118&quot;</td>
<td>18</td>
</tr>
</tbody>
</table>

---

### Cutting data

- Improved both component quality (roundness, straightness) and surface finish by 30%
THE POWER OF SHRINKFIT

**BENEFITS:**

- Run out max. 3µm at 3xD, for high precision machining
- High gripping forces
- Slender, symmetrical design, accurately balanced, ideal for high speed machining on 5-axis machines
- Wide range with different designs: EPB 5603 DIN 4.5° type, EPB 5801 slim type for long reaches, EPB 5600 for heavy duty applications, cylindrical extensions, and the Easyshrink® shrinking device

HYDRAULIC, EFFICIENT AND VERY SIMPLE

**BENEFITS:**

- Run out max. 3µm at 3xD, for high precision machining
- Very easy to use, fast tool replacement
- Accurately balanced, ideal for high speed machining
- Offered in a Heavy Duty version with high gripping forces appropriate for milling operations

VERSATILITY OF COLLET CHUCKS

**BENEFITS:**

- Flexible system allows various tool shank diameters to be held using the same tool holder body
- Offered in two versions - Standard ER collet chucks EPB 5675 with 10µm runout at 3xD- High Precision collet chucks EPB 5672 combining a 3µm runout at 3xD, a high clamping force, and symmetrical design. Chrome coated.
- Accurately balanced for high speed applications

STEADYLINE™: YOUR PRODUCTIVITY BOOSTER

**BENEFITS:**

- Full range of vibration-damping tool holders for long reaches, higher cutting parameters

HIGH PRECISION BORING

**BENEFITS:**

- A complete range of boring heads for roughing and finishing from ø 0.3 to 3201 mm
- Graflex modular connection for best precision and flexibility