

# INNOVATIVE TOOLING SOLUTIONS





# ENHANCING YOUR COMPETITIVENESS DELIVERING **EXCELLENCE AND INNOVATION FOR** TURBINE **MANUFACTURERS**

When you work with Seco, you experience a true partnership based on trust, respect and communication. Our expertise exceeds our milling, holemaking, turning and tool holding products, as we work closely with your team to address and improve every aspect of production. For over 80 years, Seco has developed the tools, processes and services that leading manufacturers turn to for maximum performance. Whatever challenges you encounter, our team is always nearby to help you overcome them through extensive expertise and high quality products.

Seco customers can also access the latest information regarding new products, machining data, manufacturing techniques and other developments by visiting our wind power web site at www.secotools.com/energy.

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Wind power com

Machining wind Case studies .....

Seco's engineerin Seco's business se Global competence Seco's online reso

Seco works closely with wind power manufacturers to create and provide solutions that increase productivity and bolster profitability. With 5,000 team members in over 45 countries, we offer a globally networked resource dedicated to solving your challenges and supporting your operations. Through cooperative partnerships with wind power manufacturers and entities around the world, we monitor trends, identify challenges and develop solutions that overcome the industry's most demanding applications.

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# SUPPLYING WIND POWER **MEETING THE DEMANDS OF WORLDWIDE GROWTH**

for the foreseeable future.

Prior to 2010, Europe provided the largest market for wind power manufacturers, followed by Asia and North America, respectively. Substantial growth in North America has propelled it to the forefront for now, though China is expected to become the world leader by 2016, due to increasing investments and its long coastline and large land mass.

Onshore technology comprises the majority of installations, accounting for approximately 95%. The market share for offshore is growing, but its potential is limited by the higher cost of installation, operation and management for these systems. Horizontal Axis Wind Turbines (HAWT) are by far the most prevalent, accounting for 90% of installations, with Vertical Axis Wind Turbines (VAWT) lagging behind.

A highly competitive market, with few major players, the wind power industry offers tremendous potential for manufacturers who specialise in the segment. Seco has worked closely with European wind power manufacturers for decades, building a foundation of expertise that make us a valuable partner to those serving the industry. We also partner with research institutes, universities and other industry entities to fully understand the challenges wind power manufacturers face and develop the solutions to overcome them. Our own R&D focuses on the advanced technologies, tools, strategies and component solutions that will drive and evolve your processes.

As the wind power industry continues to innovate and grow, Seco will be there to help you understand and overcome the metal cutting challenges your operations encounter.

As the technology behind wind power has become more refined and an increasing number of nations have recognised the importance of sustainable energy sources, the industry has experienced rapid growth. In recent years, the segment has achieved annual growth rates of around 25%, driven by global investments. Forecasts predict continued annual double-digit growth



# **WIND POWER COMPONENTS**





#### **ROTOR HUB**

Responsible for transferring the enormous torque of the blades to the turbine, rotor hubs operate in extremely demanding conditions. Typically produced from cast iron, the geometry of these components requires stable machining with long tool overhangs and also the creation of many holes, which are used to secure the blades.

#### PITCH GEAR

The pitch drive system allows the blades to be turned in order to optimise performance of a wind turbine in varied conditions. Blades can be turned in and out of the wind depending on its strength, and the pitch drive also can be used to stop rotation of the blades. Machined from high grade steel, the large gears used in a pitch drive system require substantial machining to produce a finished product.

## MAIN FRAME

YAW DRIVE WHEEL As the heart of the yaw drive system, these wheels rotate the turbine to optimise performance regardless of the wind's direction. Yaw drive wheels are typically produced from high grade steel and attached to the main frame.

YAW DRIVE FLANGE The yaw drive flange allows rotation of the turbine to account for the wind's direction. Machined from high grade steel, this heavy duty component requires multiple cutting tool applications.

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Forming the foundation of a wind turbine, a main frame brings together all other components to ensure proper operation. These parts require extensive milling and holemaking, and are produced from cast iron.



# **WIND POWER COMPONENTS**







Tower flanges are attached to the ends of segments of a wind turbine's tower and then used to connect those segments as the tower is constructed. A typical tower contains 4 - 6 segments, requiring 8 - 12 flanges. Usually produced from a steel alloy, these components require productive turning operations and machining of many holes.



MAIN SHAFT In most wind turbine designs, the main shaft transfers rotation of the rotor hub to the gearbox, though direct drive designs incorporate a static shaft with the rotating generator outside. Requiring extensive turning and holemaking operations, main shafts are typically machined from a high grade steel.



MAIN BEARING HOUSING component.



## **GEARBOX HOUSING**

In traditional wind turbine designs, the gearbox converts the speed of 5 rpm to 20 rpm according to the size of the wind turbine to approximately 1500 rpm, allowing the wind turbine to provide suitable output. Produced from cast iron, the gearbox requires heavy machining.

RING GEAR Made from high grade steel, ring gears are located in the gearbox housing and require extensive machining of gear teeth.

PLANETARY CARRIER cast iron.

Mounted on the main frame, the main bearing housing contains the main bearing and is made of cast iron. Most wind turbine designs incorporate this

The planetary carrier is a component of the gearbox and typically is made of

- Achieving high productivity with long tool overhangs
- Minimising process times when milling irregular surfaces
- Minimising costs when producing a large number of holes



# **MACHINING WIND POWER COMPONENTS: ROTOR HUB**



**SECO HIGH FEED MILLING (HFM)** SOLUTIONS

#### **YOUR CHALLENGE:**

Achieving high productivity with long tool overhangs.

#### **OUR SOLUTION:**

By taking shallow depths of cut and incorporating very high feed rates, HFM cutters can provide substantial productivity gains. They offer strong performance when working with medium tool overhang, as the lessened pressure on the tool minimises the risk of bending and vibration. Incorporation of Steadyline<sup>TM</sup> tool holders even further enhances HFM cutter performance. Your benefits include aggressive material removal with stability in applications with long tool overhang.



#### STEADYLINE<sup>™</sup> TOOL HOLDERS

#### **YOUR CHALLENGE:**

Achieving high productivity with long tool overhangs.

#### **OUR SOLUTION:**

Steadyline<sup>™</sup> tool holders incorporate a unique damping design to eliminate the detrimental effects of vibration on milling applications. Offering three times the dynamic rigidity of comparable solid holders, Steadyline<sup>™</sup> products provide optimal cutting performance in overhangs of up to 5xD. Your benefits include longer tool life, better surface finishes and the ability to use higher cutting data.



#### SECO FACE MILLING CUTTERS

#### **YOUR CHALLENGE:**

Minimising process times when milling irregular surfaces.

#### **OUR SOLUTION:**

Seco offers a variety of face milling cutters designed to provide top performance in tough applications. From the Double Octomill<sup>TM</sup> to the R220.60 cutter, our family of tools features robust bodies and thick inserts that address all of your needs for face milling casing castings. Your benefits include high metal removal rates with long tool life and reliable results.



#### SECO DRILLING SOLUTIONS

#### **YOUR CHALLENGE:**

Minimising costs when producing a large number of holes.

#### **OUR SOLUTION:**

By offering a wide array of highly productive drilling solutions with optimised coatings, tip geometries and insert design, Seco ensures a perfect fit for your unique application. From Seco Feedmax<sup>™</sup> solid carbide drills to Crownloc® exchangeable tip drills to Performax® indexable insert drills, we provide the technology to meet your goals. Your benefits include the ability to meet your customers' requirements as productively and cost effectively as possible.



- Optimising productivity when milling
- Ensuring adequate chip evacuation in large holes
- Boring large, high precision holes with complete repeatability



# **MACHINING WIND POWER COMPONENTS: ROTOR HUB**



SECO SQUARE SHOULDER MILLING CUTTERS

#### **YOUR CHALLENGE:**

Optimising productivity when milling.

#### **OUR SOLUTION:**

Turbo square shoulder mills incorporate hardened steel cutter bodies and strong, thick inserts to achieve incredibly reliable performance. Seco also provides the newly designed Square 6<sup>™</sup> square shoulder milling cutter, which offers economical performance by incorporating six cutting edges per insert. Both families achieve process security and high productivity in a wide range of milling applications and materials. Your benefits include increased confidence in the stability of your applications and substantial time savings.



PERFOMAX<sup>®</sup> SD600

#### YOUR CHALLENGE:

Ensuring adequate chip evacuation in large holes.

#### **OUR SOLUTION:**

Created to maximise productivity in large and deep holes, the Perfomax® SD600 modular drill head system features strong square inserts and a cartridge system to provide flexible high performance. This unique tool incorporates a strong pilot drill design and is HTS and ABS compatible, with a Graflex<sup>®</sup> connection. Your benefits include cost reduction via greater throughput and lowered tool cost.



#### **YOUR CHALLENGE:**

Boring large, high precision holes with complete repeatability.

#### **OUR SOLUTION:**

Applicable to both rough and finish machining, the Seco modular boring system simplifies the creation of a solution matched to your requirements. Already high in rigidity and precision, Seco boring tools achieve incredible performance in holes ranging from 15 mm all the way to 2155 mm. Your benefits include repeatable accuracy in any size of rotor hub hole.



- Maintaining constant cutting depth when machining gear teeth
- Achieving high gear quality without secondary grinding operations
- Minimising costs when producing a large number of holes
- Maximising productivity, tool life and chip control



# **MACHINING WIND POWER COMPONENTS: PITCH GEAR**



#### SECO ROUGHING GEAR GASHERS

#### YOUR CHALLENGE:

Maintaining constant cutting depth when machining gear teeth.

#### **OUR SOLUTION:**

For internal and external gears, Seco offers roughing gear gashers that incorporate ground inserts to ensure a constant cutting depth. The cutters feature optimised radial and axial rakes that enable smooth cutting, and can be used with inserts that provide 2, 4 or 8 edges. Your benefits include obtaining reliable results with high productivity.



#### SECO FINISHING GEAR GASHERS

#### YOUR CHALLENGE:

Achieving high gear quality without secondary grinding operations.

#### **OUR SOLUTION:**

Seco's finishing gear gashers use high precision insert pockets to ensure repeatability. The cutters offer excellent performance in internal and external gears, and use concave and convex inserts to maximise accuracy and surface finish. Your benefits include saving time and improving process flow by eliminating grinding operations from your gear machining.



#### **SECO DRILLING SOLUTIONS**

#### **YOUR CHALLENGE:**

Minimising costs when producing a large number of holes.

#### **OUR SOLUTION:**

By offering a wide array of highly productive drilling solutions with optimised coatings, tip geometries and insert design, Seco ensures a perfect fit for your unique application. From Seco Feedmax<sup>™</sup> solid carbide drills to Crownloc® exchangeable tip drills to Performax<sup>®</sup> indexable insert drills, we provide the technology to meet your goals. Your benefits include the ability to meet your customers' requirements as productively and cost effectively as possible.



**DURATOMIC® INSERT GRADES** 

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#### YOUR CHALLENGE:

Maximising productivity, tool life and chip control.

#### **OUR SOLUTION:**

With the Duratomic<sup>®</sup> process, Seco manipulates aluminium oxide at an atomic level to create insert coatings that eliminate much of the traditional trade off between strength and toughness. Available in grades for steel, stainless steel, cast and ductile irons and hardened steels, Duratomic coated inserts dramatically improve tool life, productivity and process reliability. Your benefits include increased throughput and cost savings.





- Maximising productivity, tool life and chip control
- Minimising costs when producing a large number of holes



# **MACHINING WIND POWER COMPONENTS: TOWER FLANGE**





**DURATOMIC® INSERT GRADES** 

#### YOUR CHALLENGE:

Maximising productivity, tool life and chip control.

## **OUR SOLUTION:**

With the Duratomic<sup>®</sup> process, Seco manipulates aluminium oxide at an atomic level to create insert coatings that eliminate much of the traditional trade off between strength and toughness. Available in grades for steel, stainless steel, cast and ductile irons and hardened steels, Duratomic coated inserts dramatically improve tool life, productivity and process reliability. Your benefits include increased throughput and cost savings.



SECO DRILLING SOLUTIONS

#### YOUR CHALLENGE:

Minimising costs when producing a large number of holes.

#### **OUR SOLUTION:**

By offering a wide array of highly productive drilling solutions with optimised coatings, tip geometries and insert design, Seco ensures a perfect fit for your unique application. From Seco Feedmax<sup>TM</sup> solid carbide drills to Crownloc® exchangeable tip drills to Performax<sup>®</sup> indexable insert drills, we provide the technology to meet your goals. Your benefits include the ability to meet your customers' requirements as productively and cost effectively as possible.



## YOUR CHALLENGE:

Maximising productivity, tool life and chip control.

#### **OUR SOLUTION:**

With the Duratomic<sup>®</sup> process, Seco manipulates aluminium oxide at an atomic level to create insert coatings that eliminate much of the traditional trade off between strength and toughness. Available in grades for steel, stainless steel, cast and ductile irons and hardened steels, Duratomic coated inserts dramatically improve tool life, productivity and process reliability. Your benefits include increased throughput and cost savings.

### YOUR MANUFACTURING CHALLENGES:

- Maximising productivity, tool life and chip control
- Minimising costs when producing a large number of holes

# **MACHINING WIND POWER COMPONENTS: MAIN SHAFT**





**SECO DRILLING SOLUTIONS** 

#### YOUR CHALLENGE:

Minimising costs when producing a large number of holes.

#### **OUR SOLUTION:**

By offering a wide array of highly productive drilling solutions with optimised coatings, tip geometries and insert design, Seco ensures a perfect fit for your unique application. From Seco Feedmax<sup>TM</sup> solid carbide drills to Crownloc® exchangeable tip drills to Performax<sup>®</sup> indexable insert drills, we provide the technology to meet your goals. Your benefits include the ability to meet your customers' requirements as productively and cost effectively as possible.

- Achieving high productivity with long tool overhangs
- · Minimising costs when producing a large number of holes
- Minimising process times when milling irregular surfaces
- Boring large, high precision holes with complete repeatability
- Optimising productivity when milling



# **MACHINING WIND POWER COMPONENTS:** MAIN FRAME



#### STEADYLINE<sup>™</sup> TOOL HOLDERS

#### **YOUR CHALLENGE:**

Achieving high productivity with long tool overhangs.

#### **OUR SOLUTION:**

Steadyline<sup>TM</sup> tool holders incorporate a unique damping design to eliminate the detrimental effects of vibration on milling applications. Offering three times the dynamic rigidity of comparable solid holders, Steadyline<sup>™</sup> products provide optimal cutting performance in overhangs of up to 5xD. Your benefits include longer tool life, better surface finishes and the ability to use higher cutting data.



SECO HIGH FEED MILLING (HFM) SOLUTIONS

#### **YOUR CHALLENGE:**

Achieving high productivity with long tool overhangs.

#### **OUR SOLUTION:**

By taking shallow depths of cut and incorporating very high feed rates, HFM cutters can provide substantial productivity gains. They offer strong performance when working with medium tool overhang, as the lessened pressure on the tool minimises the risk of bending and vibration. Incorporation of Steadyline<sup>™</sup> tool holders even further enhances HFM cutter performance. Your benefits include aggressive material removal with stability in applications with long tool overhang.



#### SECO DRILLING SOLUTIONS

#### YOUR CHALLENGE:

Minimising costs when producing a large number of holes.

#### **OUR SOLUTION:**

By offering a wide array of highly productive drilling solutions with optimised coatings, tip geometries and insert design, Seco ensures a perfect fit for your unique application. From Seco Feedmax<sup>TM</sup> solid carbide drills to Crownloc® exchangeable tip drills to Performax® indexable insert drills, we provide the technology to meet your goals. Your benefits include the ability to meet your customers' requirements as productively and cost effectively as possible.



#### SECO FACE MILLING CUTTERS

#### **YOUR CHALLENGE:**

Minimising process times when milling irregular surfaces.

#### **OUR SOLUTION:**

Seco offers a variety of face milling cutters designed to provide top performance in tough applications. From the Double Octomill™ to the R220.60 cutter, our family of tools features robust bodies and thick inserts that address all of your needs for face milling casing castings. Your benefits include high metal removal rates with long tool life and reliable results.



#### SECO BORING TOOLS

#### **YOUR CHALLENGE:**

Boring large, high precision holes with complete repeatability.

#### **OUR SOLUTION:**

Applicable to both rough and finish machining, the Seco modular boring system simplifies the creation of a solution matched to your requirements. Already high in rigidity and precision, Seco boring tools achieve incredible performance in holes ranging from 15 mm all the way to 2155 mm. Your benefits include repeatable accuracy in any size of main frame hole.





#### SECO SQUARE SHOULDER MILLING CUTTERS

#### **YOUR CHALLENGE:**

Optimising productivity when milling.

#### **OUR SOLUTION:**

Turbo square shoulder mills incorporate hardened steel cutter bodies and strong, thick inserts to achieve incredibly reliable performance. Seco also provides the newly designed Square 6<sup>™</sup> square shoulder milling cutter, which offers economical performance by incorporating six cutting edges per insert. Both families achieve process security and high productivity in a wide range of milling applications and materials. Your benefits include increased confidence in the stability of your applications and substantial time savings.

- Achieving high productivity with long tool overhangs
- Optimising productivity when milling
- Maximising productivity in features that require disc milling
- Boring large, high precision holes with complete repeatability
- Minimising process times when milling irregular surfaces



# **MACHINING WIND POWER COMPONENTS:** MAIN BEARING HOUSING



**SECO HIGH FEED MILLING (HFM)** SOLUTIONS

#### **YOUR CHALLENGE:**

Achieving high productivity with long tool overhangs.

#### **OUR SOLUTION:**

By taking shallow depths of cut and incorporating very high feed rates, HFM cutters can provide substantial productivity gains. They offer strong performance when working with medium tool overhang, as the lessened pressure on the tool minimises the risk of bending and vibration. Incorporation of Steadyline<sup>™</sup> tool holders even further enhances HFM cutter performance. Your benefits include aggressive material removal with stability in applications with long tool overhang.



SECO SQUARE SHOULDER MILLING CUTTERS

#### **YOUR CHALLENGE:**

Optimising productivity when milling.

#### **OUR SOLUTION:**

Turbo square shoulder mills incorporate hardened steel cutter bodies and strong, thick inserts to achieve incredibly reliable performance. Seco also provides the newly designed Square 6<sup>™</sup> square shoulder milling cutter, which offers economical performance by incorporating six cutting edges per insert. Both families achieve process security and high productivity in a wide range of milling applications and materials. Your benefits include increased confidence in the stability of your applications and substantial time savings.



**DISC MILLING SOLUTIONS** 

#### **YOUR CHALLENGE:**

Maximising productivity in features that require disc milling.

#### **OUR SOLUTION:**

Seco offers the industry's most comprehensive disc milling family, with a range of grades, geometries and radii that addresses every application. Inserts feature a positive rake angle to reduce vibration and cutting forces, while robust cutter bodies further stabilise operations to boost accuracy and tool life. Your benefits include obtaining high accuracy and surface finish quality as efficiently as possible.



#### SECO BORING TOOLS

#### **YOUR CHALLENGE:**

Boring large, high precision holes with complete repeatability.

#### **OUR SOLUTION:**

Applicable to both rough and finish machining, the Seco modular boring system simplifies the creation of a solution matched to your requirements. Already high in rigidity and precision, Seco boring tools achieve incredible performance in holes ranging from 15 mm all the way to 2155 mm. Your benefits include repeatable accuracy in any size of main bearing housing hole.





#### SECO FACE MILLING CUTTERS

#### YOUR CHALLENGE:

Minimising process times when milling irregular surfaces.

#### **OUR SOLUTION:**

Seco offers a variety of face milling cutters designed to provide top performance in tough applications. From the Double Octomill<sup>™</sup> to the R220.60 cutter, our family of tools features robust bodies and thick inserts that address all of your needs for face milling casing castings. Your benefits include high metal removal rates with long tool life and reliable results.

- Achieving high gear quality without secondary grinding operations
- Maintaining constant cutting depth when machining gear teeth
- Minimising costs when producing a large number of holes

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- Increasing machining flexibility while reducing costs
- · Maximising productivity, tool life and chip control



# **MACHINING WIND POWER COMPONENTS: YAW DRIVE FLANGE & YAW DRIVE WHEEL**



SECO FINISHING GEAR GASHERS

Achieving high gear quality

without secondary grinding

Seco's finishing gear gashers

pockets to ensure repeatabili-

ty. The cutters offer excellent

performance in internal and

accuracy and surface finish.

Your benefits include saving

time and improving process

flow by eliminating grinding operations from your gear

external gears, and use concave

and convex inserts to maximise

use high precision insert

**YOUR CHALLENGE:** 

operations.

**OUR SOLUTION:** 

machining.



#### SECO ROUGHING GEAR GASHERS

#### **YOUR CHALLENGE:**

Maintaining constant cutting depth when machining gear teeth.

#### **OUR SOLUTION:**

For internal and external gears, Seco offers roughing gear gashers that incorporate ground inserts to ensure a constant cutting depth. The cutters feature optimised radial and axial rakes that enable smooth cutting, and can be used with inserts that provide 2, 4 or 8 edges. Your benefits include obtaining reliable results with high productivity.



#### SECO DRILLING SOLUTIONS

#### **YOUR CHALLENGE:**

Minimising costs when producing a large number of holes.

#### **OUR SOLUTION:**

By offering a wide array of highly productive drilling solutions with optimised coatings, tip geometries and insert design, Seco ensures a perfect fit for your unique application. From Seco Feedmax<sup>™</sup> solid carbide drills to Crownloc® exchangeable tip drills to Performax<sup>®</sup> indexable insert drills, we provide the technology to meet your goals. Your benefits include the ability to meet your customers' requirements as productively and cost effectively as possible.



### SECO GEAR HOBS

#### **YOUR CHALLENGE:**

ty while reducing costs.

#### **OUR SOLUTION:**

To maximise the efficiency of gear cutting, Seco provides gear hob cutters with indexable carbide inserts. These tools incorporate a spiral, extendable design and come in a variety of profiles. A range of insert grades and coatings allows the cutters to be applied across a range of materials. Your benefits include a flexible, cost-efficient cutter for the machining of gears.







Increasing machining flexibili-



## **DURATOMIC® INSERT GRADES**

#### **YOUR CHALLENGE:**

Maximising productivity, tool life and chip control.

#### **OUR SOLUTION:**

With the Duratomic<sup>®</sup> process, Seco manipulates aluminium oxide at an atomic level to create insert coatings that eliminate much of the traditional trade off between strength and toughness. Available in grades for steel, stainless steel, cast and ductile irons and hardened steels, Duratomic coated inserts dramatically improve tool life, productivity and process reliability. Your benefits include increased throughput and cost savings.

- Boring large, high precision holes with complete repeatability
- Minimising process times when milling irregular surfaces
- Optimising productivity when milling
- Minimising costs when producing a large number of holes

- Reaming with high precision and reliability
- Boring small to medium holes with high precision and reliability





# **MACHINING WIND POWER COMPONENTS: GEARBOX HOUSING**



**SECO BORING TOOLS** 

#### **YOUR CHALLENGE:**

Boring large, high precision holes with complete repeatability.

#### **OUR SOLUTION:**

Applicable to both rough and finish machining, the Seco modular boring system simplifies the creation of a solution matched to your requirements. Already high in rigidity and precision, Seco boring tools achieve incredible performance in holes ranging from 15 mm all the way to 2155 mm. Your benefits include repeatable accuracy in any size of rotor hub hole.



#### SECO FACE MILLING CUTTERS

**YOUR CHALLENGE:** Minimising process times when milling irregular surfaces.

#### **OUR SOLUTION:**

Seco offers a variety of face milling cutters designed to provide top performance in tough applications. From the Double Octomill™ to the R220.60 cutter, our family of tools features robust bodies and thick inserts that address all of your needs for face milling casing castings. Your benefits include high metal removal rates with long tool life and reliable results.



SECO SQUARE SHOULDER MILLING CUTTERS

#### YOUR CHALLENGE:

Optimising productivity when milling.

#### **OUR SOLUTION:**

Turbo square shoulder mills incorporate hardened steel cutter bodies and strong, thick inserts to achieve incredibly reliable performance. Seco also provides the newly designed Square 6<sup>™</sup> square shoulder milling cutter, which offers economical performance by incorporating six cutting edges per insert. Both families achieve process security and high productivity in a wide range of milling applications and materials. Your benefits include increased confidence in the stability of your applications and substantial time savings.



## **SECO DRILLING SOLUTIONS**

#### **YOUR CHALLENGE:**

Minimising costs when producing a large number of holes.

#### **OUR SOLUTION:**

By offering a wide array of highly productive drilling solutions with optimised coatings, tip geometries and insert design, Seco ensures a perfect fit for your unique application. From Seco Feedmax<sup>™</sup> solid carbide drills to Crownloc® exchangeable tip drills to Performax® indexable insert drills, we provide the technology to meet your goals. Your benefits include the ability to meet your customers' requirements as productively and cost effectively as possible.



SECO REAMING SOLUTIONS

#### YOUR CHALLENGE:

Reaming with high precision and reliability.

#### **OUR SOLUTION:**

Seco offers a variety of reaming families to minimise your cost per hole while achieving the quality you need. Our Precimaster<sup>™</sup>, Bifix<sup>®</sup>, Nanofix<sup>TM</sup>, Precifix<sup>TM</sup> and Xfix<sup>TM</sup> reamers provide a comprehensive range of reaming solutions, guaranteeing a productive and high quality solution for holes ranging from 2.97 mm to 155 mm in diameter. Your benefits include reducing costs while maintaining exacting tolerances and surface finish requirements.



#### **SECO FINE BORING HEADS**

#### YOUR CHALLENGE:

Boring small to medium holes with high precision and reliability.

#### **OUR SOLUTION:**

For high precision holes ranging from 3 mm to 205 mm in diameter, Seco fine boring heads provide user-friendly, highly productive performance. The cutters allow micrometric adjustment within 2.5 µm on the diameter and provide hole diameter precision of up to IT5. Cutting speeds of up to 1500 m/min can be used with the fine boring heads and through-coolant further maximises productivity. Your benefits include achieving extreme levels of precision with minimal cycle times.

- Maintaining constant cutting depth when machining gear teeth
- Achieving high gear quality without secondary grinding operations
- Maximising productivity, tool life and chip control
- Reaming with high precision and reliability

- Minimising costs when producing a large number of holes
- Boring small to medium holes with high precision and reliability



# **MACHINING WIND POWER COMPONENTS: RING GEAR**



**SECO ROUGHING GEAR GASHERS** 

#### **YOUR CHALLENGE:**

Maintaining constant cutting depth when machining gear teeth.

#### **OUR SOLUTION:**

For internal and external gears, Seco offers roughing gear gashers that incorporate ground inserts to ensure a constant cutting depth. The cutters feature optimised radial and axial rakes that enable smooth cutting, and can be used with inserts that provide 2, 4 or 8 edges. Your benefits include obtaining reliable results with high productivity.



## **DURATOMIC® INSERT GRADES**

YOUR CHALLENGE:

### Maximising productivity, tool life and chip control.

#### **OUR SOLUTION:**

With the Duratomic<sup>®</sup> process, Seco manipulates aluminium oxide at an atomic level to create insert coatings that eliminate much of the traditional trade off between strength and toughness. Available in grades for steel, stainless steel, cast and ductile irons and hardened steels, Duratomic coated inserts dramatically improve tool life, productivity and process reliability. Your benefits include increased throughput and cost savings.



#### SECO DRILLING SOLUTIONS

#### **YOUR CHALLENGE:**

Minimising costs when producing a large number of holes.

#### **OUR SOLUTION:**

By offering a wide array of highly productive drilling solutions with optimised coatings, tip geometries and insert design, Seco ensures a perfect fit for your unique application. From Seco Feedmax<sup>™</sup> solid carbide drills to Crownloc® exchangeable tip drills to Performax<sup>®</sup> indexable insert drills, we provide the technology to meet your goals. Your benefits include the ability to meet your customers' requirements as productively and cost effectively as possible.



#### SECO REAMING SOLUTIONS

#### **YOUR CHALLENGE:**

Reaming with high precision and reliability.

#### **OUR SOLUTION:**

Seco offers a variety of reaming families to minimise your cost per hole while achieving the quality you need. Our Precimaster™, Bifix<sup>®</sup>, Nanofix<sup>TM</sup>, Precifix<sup>TM</sup> and Xfix<sup>TM</sup> reamers provide a comprehensive range of reaming solutions, guaranteeing a productive and high quality solution for holes ranging from 2.97 mm to 155 mm in diameter. Your benefits include reducing costs while maintaining exacting tolerances and surface finish requirements.





## SECO FINE BORING HEADS

#### **YOUR CHALLENGE:**

Boring small to medium holes with high precision and reliability.

#### **OUR SOLUTION:**

For high precision holes ranging from 3 mm to 205 mm in diameter, Seco fine boring heads provide user-friendly, highly productive performance. The cutters allow micrometric adjustment within  $2.5 \,\mu m$  on the diameter and provide hole diameter precision of up to IT5. Cutting speeds of up to 1500 m/min can be used with the fine boring heads and through-coolant further maximises productivity. Your benefits include achieving extreme levels of precision with minimal cycle times.

- Achieving high productivity with long tool overhangs
- Maximising productivity in features that require disc milling
- Optimising milling of irregular surfaces



# **MACHINING WIND POWER COMPONENTS: PLANETARY CARRIER**



STEADYLINE<sup>™</sup> TOOL HOLDERS

#### **YOUR CHALLENGE:**

Achieving high productivity with long tool overhangs.

#### **OUR SOLUTION:**

Steadyline<sup>™</sup> tool holders incorporate a unique damping design to eliminate the detrimental effects of vibration on milling applications. Offering three times the dynamic rigidity of comparable solid holders, Steadyline<sup>TM</sup> products provide optimal cutting performance in overhangs of up to 5xD. Your benefits include longer tool life, better surface finishes and the ability to use higher cutting data.



#### SECO HIGH FEED MILLING (HFM) SOLUTIONS

#### **YOUR CHALLENGE:**

Achieving high productivity with long tool overhangs.

#### **OUR SOLUTION:**

By taking shallow depths of cut and incorporating very high feed rates, HFM cutters can provide substantial productivity gains. They offer strong performance when working with medium tool overhang, as the lessened pressure on the tool minimises the risk of bending and vibration. Incorporation of Steadyline<sup>™</sup> tool holders even further enhances HFM cutter performance. Your benefits include aggressive material removal with stability in applications with long tool overhang.



#### **DISC MILLING SOLUTIONS**

#### **YOUR CHALLENGE:**

Maximising productivity in features that require disc milling.

#### **OUR SOLUTION:**

Seco offers the industry's most comprehensive disc milling family, with a range of grades, geometries and radii that addresses every application. Inserts feature a positive rake angle to reduce vibration and cutting forces, while robust cutter bodies further stabilise operations to boost accuracy and tool life. Your benefits include obtaining high accuracy and surface finish quality as efficiently as possible.



#### SECO COPY MILLING SOLUTIONS

### **YOUR CHALLENGE:**

surfaces.

#### **OUR SOLUTION:**

Round insert cutters offer incredible flexibility in 3D milling and excel in roughing and semi-finishing for face and copy milling applications, including pocket milling. Seco offers inserts ranging from 5 mm to 20 mm in diameter, with cutters available in shankstyle and arbor mounting for the entire range. Your benefits include productive and accurate machining of irregular surfaces.





Optimising milling of irregular

- Optimising productivity when milling
- Maximising productivity, tool life and chip control
- Boring large, high precision holes with complete repeatability



# MACHINING WIND POWER COMPONENTS: PLANETARY CARRIER



SECO SQUARE SHOULDER MILLING CUTTERS

#### **YOUR CHALLENGE:**

Optimising productivity when milling.

#### **OUR SOLUTION:**

Turbo square shoulder mills incorporate hardened steel cutter bodies and strong, thick inserts to achieve incredibly reliable performance. Seco also provides the newly designed Square 6<sup>TM</sup> square shoulder milling cutter, which offers economical performance by incorporating six cutting edges per insert. Both families achieve process security and high productivity in a wide range of milling applications and materials. Your benefits include increased confidence in the stability of your applications and substantial time savings.



#### **DURATOMIC® INSERT GRADES**

#### YOUR CHALLENGE:

Maximising productivity, tool life and chip control.

#### **OUR SOLUTION:**

With the Duratomic® process, Seco manipulates aluminium oxide at an atomic level to create insert coatings that eliminate much of the traditional trade off between strength and toughness. Available in grades for steel, stainless steel, cast and ductile irons and hardened steels, Duratomic coated inserts dramatically improve tool life, productivity and process reliability. Your benefits include increased throughput and cost savings.



## SECO BORING TOOLS

#### **YOUR CHALLENGE:**

Boring large, high precision holes with complete repeatability.

#### **OUR SOLUTION:**

Applicable to both rough and finish machining, the Seco modular boring system simplifies the creation of a solution matched to your requirements. Already high in rigidity and precision, Seco boring tools achieve incredible performance in holes ranging from 15 mm all the way to 2155 mm. Your benefits include repeatable accuracy in any size of rotor hub hole.





# CASE **STUDIES**

The true test of a potential solution is its real world application. The following examples provide a sample of the documented results Seco products and processes have achieved.

ROTOR	HUB –	SECO	FACE	MILLING	CUTTERS
Matorial.	00000		100		

Coolant:	No					
Operation:	Face mill	Face milling				
Criterion: Productivity						
Tool:	R220.48-	-8160-09-12S				
Insert:	ONMU09	0520ANTN-M12, MP25	00			
Cutting		Vc	fz			
data	Metric	240 m/min	0.65 mm/tooth			
	Inch	787 sf/min	0.026" ipt			
Cutting		ap	a <sub>e</sub>			
data	Metric	4 mm	70-90%			
	Inch	0.157"	70-90%			
Results	50% inc	crease to tool life and	33% more cutting			
	edges.					

Cutting

30% reduction of cycle time.



ROTOR Cutter	HUB – S S	SECO SQUARE SI	HOULDER MILLING	
Material:	GGG40/	EN GJS 400		
Coolant:	No			
Operation:	Interpola	tion		
Criterion:	Productiv	vity		
Tool:	R220.69-	R220.69-8160-18-12AN		
Insert:	X0MX180620TR-M14, MP2500			
Cutting data	Metric Inch	v₀ 250 m/min 820 sf/min	f <sub>z</sub> 0.5 mm/tooth 0.020" ipt	
Cutting		ap	a <sub>e</sub>	
data	Metric Inch	12.5 mm 0.492"	25 mm 0.984"	
Results	30% rei	duction of cycle time.		



Results	30% reduction of cycle time.				
	Inch	459 sf/min	0.016" ipt	1.240"	
data	Metric	140 m/min	0.4 mm/tooth	31.5 mm	
Cutting		Vc	fz	a <sub>e</sub>	
Tool:	Gear gasher				
Criterion:	Productiv	vity			
Operation:	Gear mill	ing			
Coolant:	Yes	Yes			
Waterial:	42011/104 / 34011/11/100				





#### MAIN FRAME – SECO SQUARE SHOULDER MILLING CUTTERS

Material:	GGG40	/ EN GJS 400
Coolant:	No	
Operation:	Backfac	cing
Criterion:	Product	ivity
Tool:	R220.6	9-8330-18.12 C
Insert:	XOMX18	30616TR-M14, N
Cutting		Vc
data	Metric	225 m/m
	Inch	738 sf/m
Cutting		ap
data	Metric	2 mm
	Inch	0.079"
Results	18% r	eduction of cyc

#### MAIN FRAME – STEADYLINE™ TOOL HOLDERS & SECO HIGH FEED MILLING SOLUTIONS

Results	Increa and el	ise of metal rei imination of vit
	Inch	0.079"
data	Metric	2 mm
Cutting		ap
	Inch	823 sf/n
data	Metric	251 m/m
Cutting		Vc
Insert:	SCET12	0630T-MD16, N
Tool:	R220.2	1-0080-SC12.6
Criterion:	Product	ivity
Operation:	Interpol	ation long overl
Coolant:	No	
Material:	GGG40	/ EN GJS 400

#### YAW DRIVE FLANGE - SECO GEAR HOBS

Material:	42CrMo4 / 34CrNiMo6					
Coolant:	Yes	Yes				
Operation:	Gear mi	lling				
Criterion:	Producti	ivity/ cost				
Tool:	M16 hul	o milling cutter				
Cutting		Vc	fz			
data	Metric	180 m/min	0.9 mm/rev			
	Inch	591 sf/min	0.035" ipr			
Cutting		ap				
data	Metric 4.0-5.5 mm/rev (workpiece)					
	Inch	nch 0.315"				
Results	30% reduction of cycle time.					





ing						
Steadyl	ine: E3471555627320					
2500						
	fz					
n	2 mm/tooth					
n	0.079" ipt					
	ae					
	75%					
	75%					
oval rate to 1200 cm³/min ation.						











# CASE **STUDIES**

OWER	FLAN	GE – DURAT(	DMIC <sup>®</sup> INSERT	GRADES	
Naterial:	S355J2	G4			
Coolant:	No				
)peration:	Turning				
Criterion:	Product	tivity			
ool:	-				
nsert:	CNMM1	90624-R7, TP25	00		
Cutting		Vc	fn	ap	
lata	Metric	180 m/min	0.9 mm/rev	8 mm	
	Inch	591 sf/min	0.035" ipr	0.315"	
Results	Tool lif compo chin co	e increased to f nent, higher pro ontrol.	ull 40-minute pass ocess stability, and	required by improved	

TOWER FLANGE - SECO DRILLING SOLUTIONS

SD503-39-117-40R7 special = SD509 chamfer & Graflex<sup>®</sup>

20% reduction of cycle time, significantly lower noise level, and cost effective drilling of holes.

fn

0.2 mm/rev

0.008" ipr

SPGX12T3-C1, T400D, SCGX120408-P2, DP3000

Vc 275 m/min

902 sf/min

Material: S355J2G4 Coolant: Yes Operation: Drilling Criterion: Productivity

> Metric Inch

Tool:

Insert: Cutting

data

Results







## MAIN SHAFT – DURATOMIC<sup>®</sup> INSERT GRADES

Material:	42CrMo4 / 34CrNiMo6			
Coolant:	No			
Operation:	Heavy	roughing		
Criterion:	Produc	tivity		
Tool:	-			
Insert:	LNMX5	LNMX501432-RR96, TP2500		
Cutting		Vc	fn	ap
data	Metric	40 m/min	2.2 mm/rev	45 mm
	Inch	131 sf/min	0.0087" ipr	1.772"
Results	Incre	ase of metal re	moval rate to 4000	cm³/min.





Coolant:	Yes	
Operation:	Mediur	n roughing
Criterion:	Process	s stability/ produ
Tool:	-	
Insert:	RCMX2	00600, TP0500
Cutting		Vc
data	Metric	220 m/min
	Inch	722 sf/min
Results	<b>25</b> % i	ncrease to tool

#### MAIN BEARING HOUSING - SECO BORING TOOLS

Results	60%	reduction of cyc	
	Inch	1394 sf/min	
data	Metric	425 m/min	
Cutting		Vc	
Insert:	TCGW110208S-01525-I		
Tool:	EPB Graflex® Jumbo 1 Ø		
Criterion:	Surface polish/ product		
Operation:	Finishing		
Coolant:	No		
Material:	GGG40 / EN GJS 400		

MAIN B	EARING	HUU	SING -
SHOULI	DER MIL	LING.	CUTTE
Material	GGG40 /	EN GIS	/100

Results	62% and s	reduction of cyclo ignificantly lower	
	Inch	0.295"	
data	Metric	7.5 mm	
Cutting		ap	
	Inch	974 sf/mi	
data	Metric	297 m/mi	
Cutting		Vc	
Insert:	XOMX1	.80616TR-M14, M	
Tool:	R220.69-0063-18.6A, St		
Criterion:	Productivity		
Operation:	Side milling long overha		
Coolant:	No		
material.	000407 LN 033 400		



## MAIN SHAFT – DURATOMIC® INSERT GRADES









#### - SECO SQUARE ERS







# CASE **STUDIES**

054000				01.0
GEARBUX HUUSING - SECU BURING TUULS				
Material:	GGG40	/ EN GJS 400		
Coolant:	Yes			
Operation: Fine boring				
Criterion: Process stability/ productivity				
Tool: Graflex <sup>®</sup> boring bar A731030				
Insert: Inserts: CCMT09T308W-F1, TP2500				
Cutting		Vc	fn	ap
data	Metric	325 m/min	0.23 mm/rev	0.3 mm

0.009" ipr

0.012"

Results

GEARBOX HOUSING - SECO SQUARE SHOULDER MILING CUTTERS

1066 sf/min

40% reduction of cycle time.

Inch

Results 20% reduction of cycle time and cost-effective			ie and cost-effective		
	Inch	0.039"	0.039"		
data	Metric	1 mm	1 mm		
Cutting		ap	a <sub>e</sub>		
	Inch	984 sf/min	0.006" ipt		
data	Metric	300 m/min	0.15 mm/tooth		
Cutting		Vc	fn		
Insert:	XNEX080608TR-M13, MP2500				
Tool:	R220.96-0100-08-11A				
Criterion:	Process	Process stability/ productivity			
Operation:	Face/ s	Face/ square shoulder milling fine			
Coolant:	No				
Material:	GGG40 / EN GJS 400				







Results	25% 25%	reduction of cycle increase to tool life
	Inch	0.197"
data	Metric	5 mm
Cutting		ap
	Inch	787 sf/min
data	Metric	300 m/min
Cutting		Vc
Insert:	RPKW1	605M0T-MD20, MK
Tool:	R220.2	29-8160-08.9
Criterion:	Produc	tivity
Operation:	Interpo	olation roughing
Coolant:	No	
Material:	GGG70	/ EN GJS 700

### PLANETARY CARRIER – GRAFLEX® BORING TOOLS

Results	30% r	eduction of cy	
	Inch	738 sf/min	
data	Metric	225 m/min	
Cutting		Vc	
Insert:	CCMT120412-F2, TK20		
Tool:	Graflex boring bar A731		
Criterion:	Productivity		
Operation:	Rough boring		
Coolant:	No		
Material:	GGG70 / EN GJS 700		

le time.

## RING GEAR – SECO ROUGHING GEAR GASHERS

Results 30% tool-life increase. 30% lower cycle time.					
	Inch	459 sf/min	0.016" ipt	1.240"	
Cutting data	Metric	v <sub>c</sub> 140 m/min	ť <sub>z</sub> 0.4 mm/tooth	a <sub>e</sub> 31.5 mm	
Tool:	335.42-0420-M14.0Z097-16153				
Criterion:	Product	Productivity			
Operation:	Gear mi	Gear milling roughing/ semi-finishing			
Coolant:	Yes				
Material:	42CrMo4 / 34CrNiMo6				





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## **SOLUTIONS MADE FOR YOU**

# **SECO'S** ENGINEERING **SERVICES**

When striving to perfect a manufacturing process, having the right tooling partner is critical. Seco provides an extensive unique engineering service, providing full applications support and the necessary expertise to understand your productivity requirement and deliver a winning solution.

#### **NETWORK OF APPLICATION EXPERTS**

Seco offers through their Strategic Engineering Group a global support network, consisting of international component specialists having an in-depth knowledge and understanding of the relevant industry segment. Together with locally based Seco application experts, this team ensures that you get the very best support to the component you are machining.

### INTEGRATED ENGINEERING SUPPORT

Seco's Component Engineered Tooling (CET) offers a comprehensive approach to process design and optimisation that ensures you achieve the highest levels of productivity, efficiency and cost effectiveness. Specialising in project management from conception to completion, the globally networked CET teams work together with our customers, and can integrate relevant representatives from providers of complementary equipment, such as machine tools, workholding and automation systems.

#### DOCUMENTED PROCESS **OPTIMISATION**

We can assist you with current process evaluation and optimisation using the Seco **Productivity** and Cost Analysis software (PCA). This tool allows us to benchmark existing processes, documenting them against our proposal for potential improvements. PCA can be fully scaled to meet your unique needs, from assessing a single machining application to evaluating workflows throughout your facility.

#### TAILOR-MADE SOLUTIONS

Seco will ensure that you always get the ultimate tooling solution best suited to your individual requirement, whether it is for standard tooling products or tailor-made solutions. Seco Custom Tooling offers complete support to you in these situations, analysing your application and developing a unique solution around it. With 19 state-of-the-art production facilities worldwide, Seco Custom Tooling is always available to make your challenge our priority.



## **DELIVERING PERSONAL COMMITMENT**

# **SECO'S BUSINESS SERVICES**

#### **100% RELIANCE**

Seco is fully committed to constantly improving to set new standards in Quality Assurance as is evident in our global ISO 9001 certification. We rigorously evaluate our processes to ensure that every product we produce is capable of meeting and exceeding our customers' expectations.

Our total commitment to quality is evident in the level of documentation we provide which meets the vigorous requirements of traceability set by our customers. When you partner with Seco, quality becomes a constant you can count on.

#### LONG-TERM SUSTAINABILITY

Seco has established and maintains a used carbide Recycling Programme; with a commitment to minimising our environmental footprint and conserving non-renewable materials. All aspects of this programme operate within the principles of our ISO 14001 certification, and we make it easy for you to participate. When you recycle used carbide, you not only positively impact the environment, you also recoup a portion of your original expense and help us minimise the cost of tools in the future.



## **KEEPING THE CUTTING EDGE**

Tool Reconditioning is critical to maintain the quality standards required on your workpiece but often, when a tool is removed from use as they show signs of wear, this means discarding an entire cutter when only a small portion of it has been worn. Seco's tool reconditioning service eliminates this potential waste by applying advanced regrinding and recoating processes to bring a tool's geometry, edge preparation and coating back to its original specifications.

#### **INVENTORY MANAGEMENT**

Using Seco Point - Inventory Management is made simple and efficient. This can be achieved through our userfriendly, point-of-use tool dispensers, tool consumption and inventory levels are tracked and monitored. Inventory replenishment can be automated and you receive reports that make it easy to identify where consumption can be reduced.





## **BUILDING EXPERTISE IN OUR**

# **GLOBAL COMPETENCE CENTRES**

#### **SECO GLOBAL TECHNICAL CENTRES**

Seco's Technical Centres are used to engage with our existing and potential customers to facilitate the transfer of expertise and knowledge, for product introduction, industry specific events and engineer customer specific solutions. In addition, Seco representatives from diverse nations gather to share information and discuss winning solutions developed in their home markets, working together to ensure that we understand and are prepared for the trends and challenges you face.

#### **SECO TECHNICAL EDUCATION PROGRAMME (STEP)**

Available at our global technical centres or on-site at your own facility, Seco STEP provides training courses on every aspect of metal cutting, at every level of expertise. Whether instructing your apprentices on the basics of cutting processes or helping your experts stay abreast of the latest technological innovations, Seco STEP is an invaluable resource in maximising workforce knowledge.

## **SECO WIND POWER WEBSITE**

As part of our commitment to wind turbine manufacturers, Seco developed a comprehensive web resource dedicated to the industry. Featuring a wide variety of video and written content, the website provides information on current trends, process innovations, tool data and documented application successes. The user-friendly site incorporates an interactive wind turbine model to easily obtain data relevant to machining specific components. To learn more, visit www.secotools.com/ energy.

Scan this code to see more. www.secotools.com/energy



### **SECO CUSTOMER ZONE & ONLINE STORE**

To achieve an even greater level of personal interaction with wind turbine manufacturers, we provide you with access to the Seco Customer Zone - www. secotools.com/customerzone. This unique web tool provides a wealth of content tailored to your specific needs. From technical applications and product information to interactive training and online ordering. At Seco, we believe that you should always be able to place and monitor the status of orders, regardless of your location or the date or time. The Seco Online Store allows you to research technical information, check product availability, purchase tooling and follow the status of your orders.



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