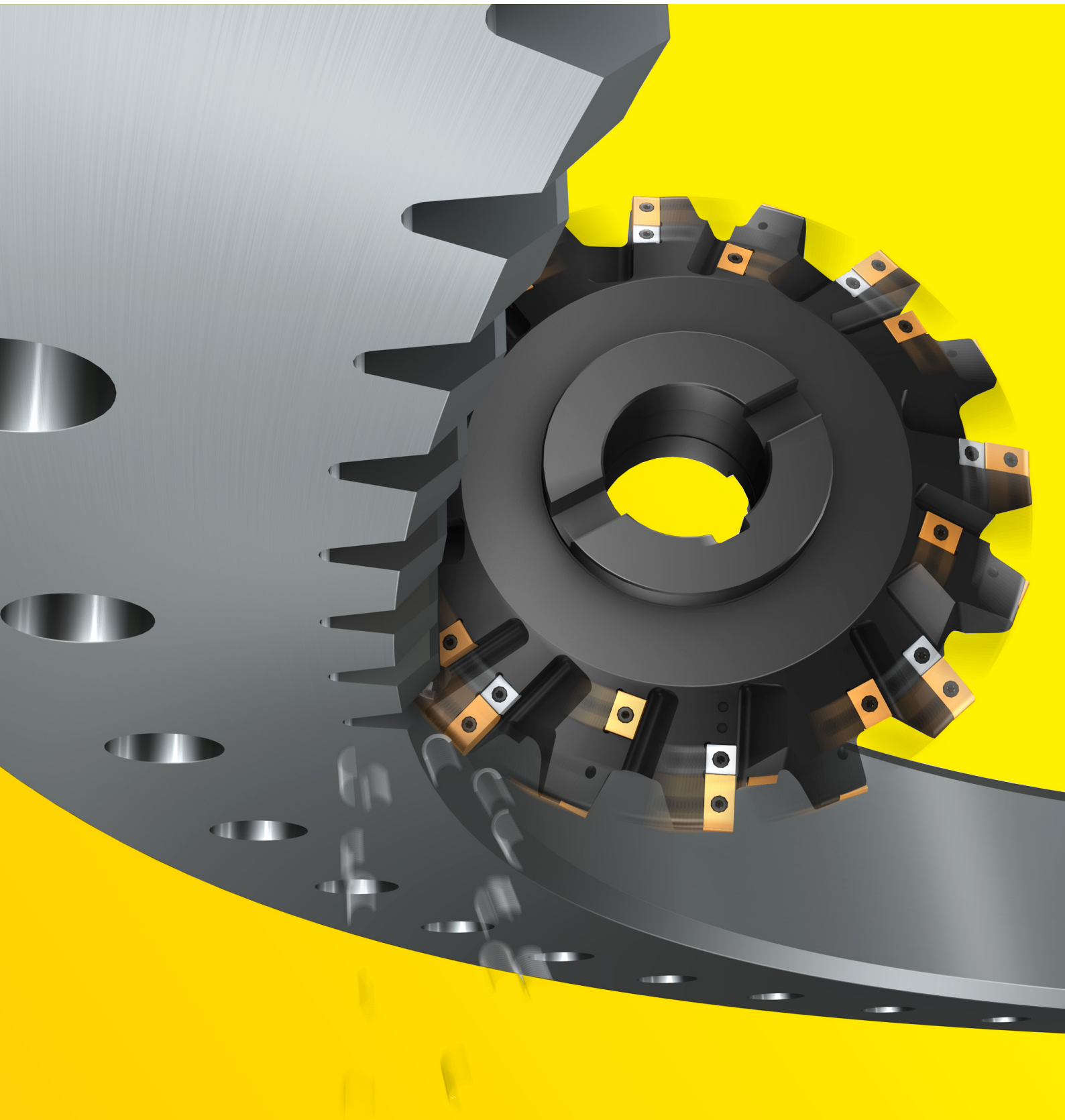


Tooling concepts

Gear milling



Complete gear-cutting solutions optimized for your needs

About ninety percent of all gear wheel manufacturing involves metal cutting. Your main opportunities for rationalizing production and boosting cost-efficiency thus reside in improved, new generation cutting tools and optimized ways of using them. Sandvik Coromant's expanded range of outstanding tools and innovative cutting solutions meet this need.

The higher cutting speeds of new CoroMill® 176 full-profile hob, for example, raise productivity and generate substantial cost-savings in gear milling. New disc cutters achieve similar results. In addition, we have strengthened our result-oriented collaborations with leading machine-tool builders. Together with Heller, we offer uP-Gear Technology, an improved method for bevel gear machining that saves both time and money. Heller's new strategic alliance with Gleason Corporation means even more benefits for gear manufacturers using Sandvik Coromant tools. In addition, innovative new InvoMilling represents a paradigm shift in 5-axis machine operations for small-batch manufacturers.

And as always, our outstanding cutting tools are backed up by high technical competence, a global sales organization, and well-functioning logistics.

We have the gear milling solution for your needs!

Join the technology shift to indexable carbide tools

A completely new tool generation is now making its presence felt in gear milling, delivering performance benefits not possible with conventional HSS cutters. Improved insert substrates, as well as better coating materials, manufacturing and processes, all give higher metal-removal rates plus longer tool life.

New indexable gear milling tools like CoroMill 170 roughing disc cutter and CoroMill 176 full-profile hob allow higher cutting data and can cut the cost per machined gear wheel considerably. By switching from a HSS cutter to an indexable carbide insert hob, for example, one gear manufacturer reduced cutting time by 50 percent and more than doubled tool life. This released more than 7,000 hours of machine time.

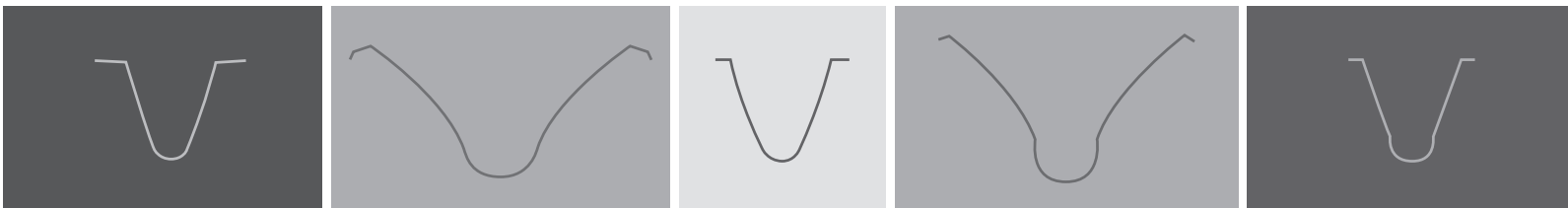
Now take your production to new levels.



Engineered solutions designed by experts

For many years, Sandvik Coromant has designed a wide variety of gear-milling tools for specific production processes. We work closely with gear manufacturers around the world. Based on supplied gear wheel data, our skilled and experienced designers tailor tools for your technical demands. We help optimize every production step from the machining process to tooling solutions and insert/grade selection. This tight cooperation ensures you the best overall production economy. In addition, our worldwide technical support and know-how is at your disposal – often a key factor in delivering turn-key solutions.

Contact your Sandvik Coromant sales representative for more information about the solutions and products that we can offer.



Do you need to machine a special gear profile?

Sandvik Coromant tool solutions cover several gear profiles, including common standard profiles such as DIN 867. But our tools can, of course, also be tailored to your specific profiles. These tools will be designed by skilled designers to exactly match the gear profile you want for your wheels.

Industrial transmission components vs. carbide cutting tools

Our current focus is directed at the gear module range 3 to 40, i.e. heavy vehicles, power generation, train transmissions, wind-power, marine applications and construction. Our high-performing indexable carbide hobs and disc cutters can help you win productivity gains in all areas.

Several new tool concepts as well as new machining methods have been developed for manufacturing cylindrical and bevel gears typically found in the applications illustrated below.



**Full-profile hob
CoroMill 176**

Innovative hob for roughing, semi-finishing and finishing in module range 4 to 8 gears. More productive alternative to HSS tools. Higher number of effective teeth reduces machining time per wheel.



**Multi-segment
hob**

Roughing and semi-finishing of module range 10 to 18 wheels used in gear boxes and transmissions for wind-power and other heavy industry applications. Higher cutting speeds and feed rates compared to HSS tools.



**Roughing disc cutter
CoroMill 170**

Roughing and semi-finishing in module range 12 to 22 gears in accordance with DIN 867 and with tool profile DIN 3972-4. High-performance grades. Reliable and predictable plus extended tool life.



**Finishing
disc cutter**

For module range 8 to 30. Typical components include ring gears for planetary gear boxes, slewing rings for windmills, cranes and other heavy equipment. Secure and stable insert seats ensure reliable performance.



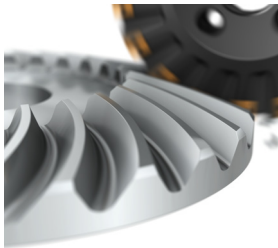
**Double
disc cutter**

A productive and flexible solution for roughing large external gears.



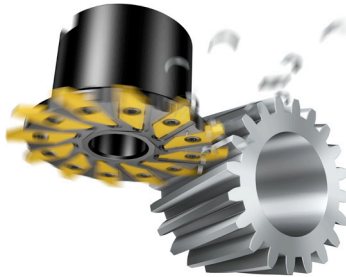
**Duplex
disc cutter**

A productivity booster when finishing large internal gears.



**uP-Gear
Technology**

A flexible and productive method for bevel gear machining.



InvoMilling

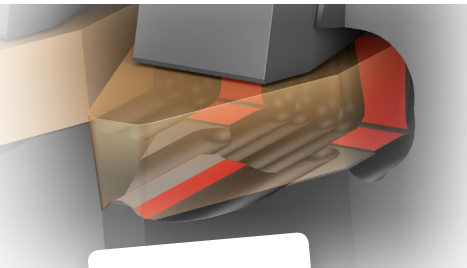
A revolutionary technique for machining involute gear profiles on multi-task machines.



Full profile hob CoroMill 176

Nothing illustrates the technology shift in hobbing tools better than CoroMill 176. This full-profile hob is a cost-effective and highly-productive alternative to HSS. Designed for roughing, semi-finishing and finishing, its higher cutting speeds plus reduce cycle times considerably.

CoroMill 176 is the high-productivity machining choice for industrial transmissions, heavy vehicles and wind-power in module range 4 to 8 on hobbing, multi-tasking and 5-axis machines.



Locked-in precision!

Features and benefits

- High cutting speeds
- Longer tool life with reduced machine downtime as a result
- High number of effective teeth reduce machining time per wheel
- Easy tool indexing and handling
- iLock interface for added precision and tight tolerances
- Inserts tailored to specific profiles



iLock locks in precision performance

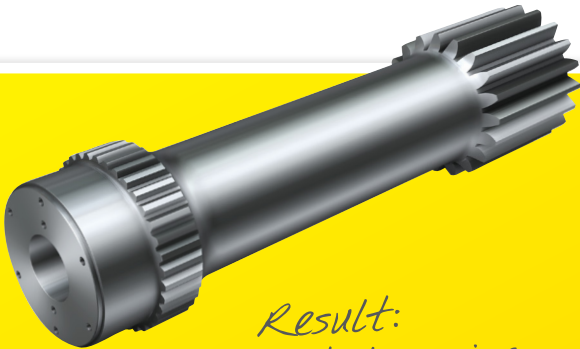
Besides the obvious benefits of higher metal removal rates and longer tool life compared with HSS hobs, CoroMill 176 reduces the number of tools needed to keep your production running from around four to eight HSS hobs down to just one or two.

An iLock interface between the carbide insert and the tool body is a major performance-boosting feature of CoroMill 176. iLock ensures added precision and tight tolerances, and it enables quick and easy insert changes.



Application example

Component:	Shaft with splines
Gear data:	
Module:	5 mm
Number of teeth, z:	30
Tip diameter, d_a :	159 mm
Face width, b:	220 mm
Workpiece material:	Low-alloy steel



*Result:
Total saving
of 180 min per
workpiece!*

Result:	Competitor HSS hob	CoroMill® 176
Roughing	180 min	60 min
Finishing	90 min	30 min
Total	270 min	90 min

Multi-segment hob

This indexable carbide hob features precision ground inserts for higher speeds, feeds and productivity. As yet another productive alternative to HSS, it roughs and semi-finishes gear wheels in the mid-range module sizes 10 to 18.

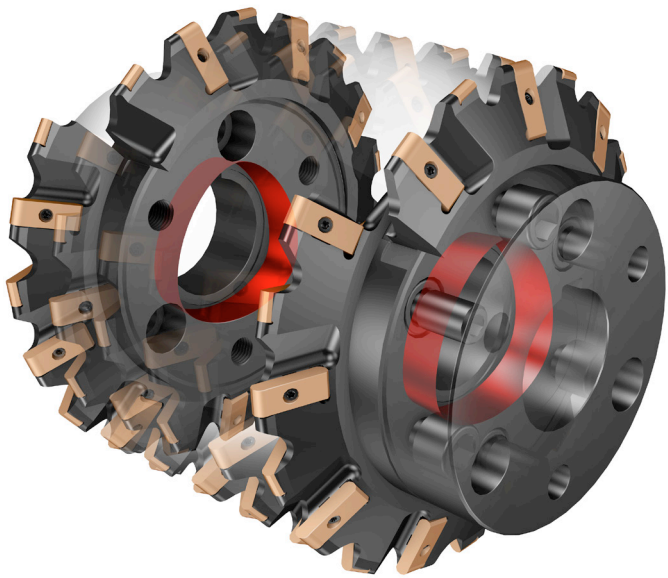
Inserts are offered with or without protuberance and a variety of grades are available.



New hob interface secures strength and precision

The Multi-segment hob comprises multiple cutting segments built up by assembling individual pieces together. The challenge of this construction – how to achieve the high precision required to meet strict component quality demands – has been met by an ingenious interface developed by Sandvik Coromant.

This innovative solution ensures that the Multi-segment hob has the strength to be subjected to the high cutting data experienced under extremely high torque loads, and that the tool delivers the high precision manufacturers demand.



A typical component where productivity can be greatly improved compared to HSS tool is the planetary gears used in gear boxes for wind mills.



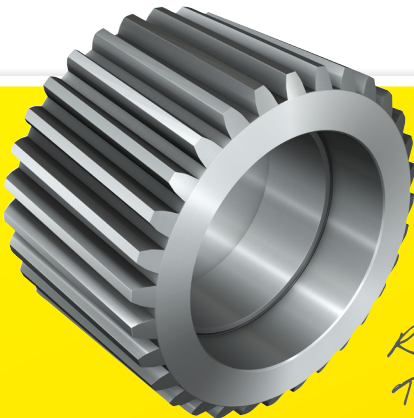
Features and benefits

- Higher cutting speeds and feed rates boost productivity
- Precision inserts ensure good component quality
- Four cutting edges
- Tailored to specific gear profiles

Application example

Component:	Planetary gear
Gear data:	
Module:	16 mm
Number of teeth, z:	36
Pitch diameter, d:	610 mm
Face width, b:	400 mm
Workpiece material:	18CrNiMo6-7

Result:	Competitor tool	Sandvik Coromant Multi-segment hob
Roughing		
Cutting speed, v_c (m/min):	120	120
Feed, f_a (mm/rev):	1.4	1.4
Finishing		
Cutting speed, v_c (m/min):	160	160
Feed, f_a (mm/rev):	4.0	4.0
Tool life (pcs):	36	60



Result:
Tool life
increased by
67%!

Roughing disc cutter CoroMill 170

Coromill 170 is a high-performance cutter for large gears in module range 12 to 22. Its cutter shape gives a high-quality rough gear profile, leaving a minimal and even working allowance for subsequent operations.

When used in combination with our latest high-performance grades, CoroMill 170 cuts time in gear machining. Use it for precision and reliability in roughing both external and internal gears.



Features and benefits

- High-precision cutter body and insert tip seats ensure small run-outs
- Geometry and grade options help optimize tool performance
- Wide range of inserts with secure fixing
- Gear wheel profiles in accordance with DIN 867 and allowance with DIN 3972-4
- Tailored to specific gear profiles

Wide range of insert geometries and grades

With CoroMill 170, Sandvik Coromant offers a range of standard inserts with different geometries and grades. This ensures short lead times for insert deliveries. More importantly, however, it offers manufacturers the possibility to optimize the cutting process, thereby maximizing productivity and reducing the cost per component. Inserts are available with geometries and grades designed for specific feed rates and cutting conditions.

Light



Medium



Heavy



Application example

Component:	Slewing ring
Gear data:	
Module:	16 mm
Number of teeth, z:	191
Pitch diameter, d:	3,200 mm
Face width, b:	200 mm
Workpiece material:	34CrNiMo6-U

*Result:
Reduced cycle time and
tool life increased by 100%!*

Result:	Competitor tool	Sandvik Coromant CoroMill® 170
Cutting speed, v_c (m/min):	133	140
Feed, v_f (mm/min):	375	437
Tool life (pcs):	0.5	1

Finishing disc cutter

This modern finishing disc cutter creates gear profiles with involute forms with or without protuberance on internal and external gear wheels. Applications include ring gears for planetary gearboxes, slewing rings for wind-power gears, cranes and other heavy equipment. The module size range is 8 to 30.

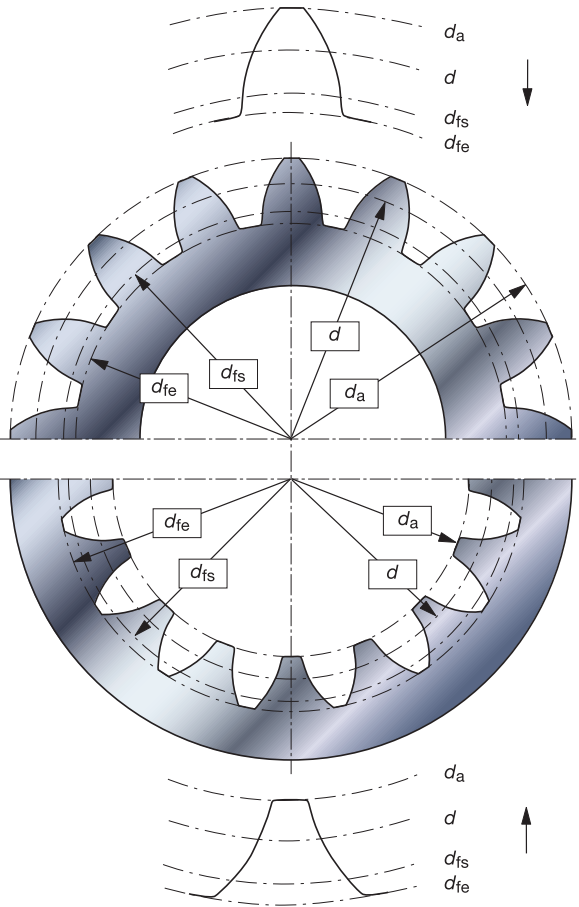


Features and benefits

- Profiles according to DIN 3972-2
- Tailored to specific gear profiles
- Can be used for roughing, semi-finishing and finishing
- Variety of high-performance insert grades available
- Reliable and predictable performance with very good tool life

Designed by gear tool specialists

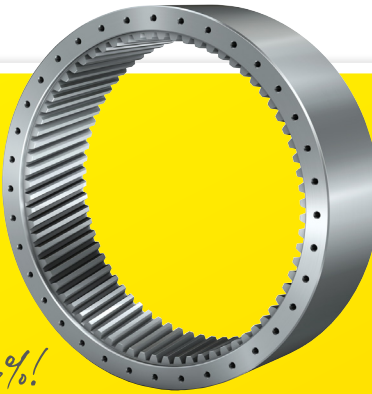
Finishing disc cutters will be designed by Sandvik Coromant specialist tool designers to create the gear profile you want for your wheel. Ground inserts adapted to the gear tooth profile will generate high precision results. And thanks to high performance insert grades and geometries, you can use your new tools for both roughing out the majority of the material in the tooth gap and for creating a quality profile finish.



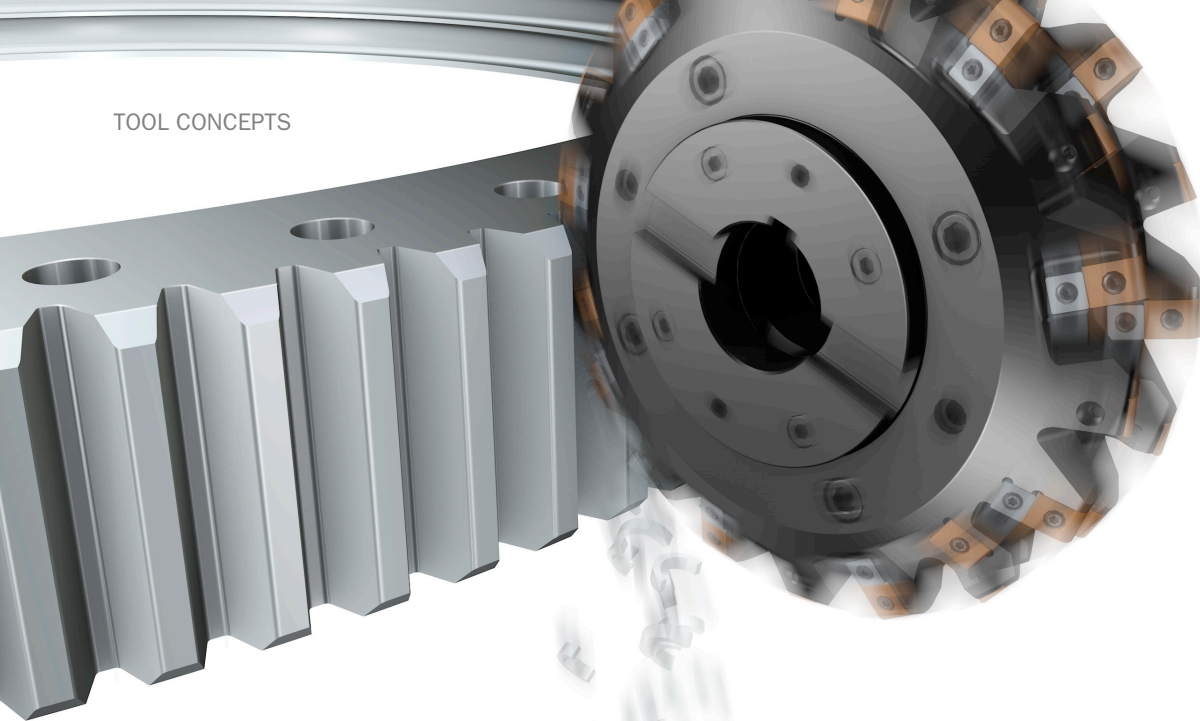
Application example

Component:	Ring gear
Gear data:	
Module:	11 mm
Number of teeth, z:	92
Pitch diameter, d:	1012 mm
Face width, b:	74.5 mm
Workpiece material:	42CrMo4-V

*Result:
Insert
consumption
reduced by 16%!*



Result:	Competitor tool	Sandvik Coromant Finishing disc cutter
Cutting speed, v_c (m/min):	126	134
Feed per tooth, f_z (mm):	0.42	0.40
Feed, v_f (mm/min):	612	612
Batch size (pcs):	20	20
Number of insert edges used per batch:	57	48

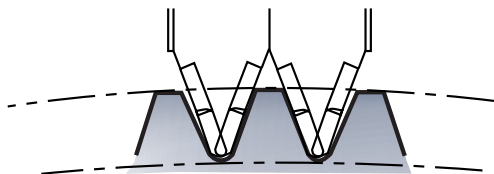


Double disc cutter

This tool is designed for productive rough machining of large external gear wheels. Comprising two disc cutters (that you can also use separately), it can even be designed so that the same two discs can machine components with different module sizes – a very smart solution if you have components in the same module range.

Double disc

Double disc cutters are roughing tools that machine two tooth gaps at the same time, keeping the machining allowance on the gear profile down to a minimum.



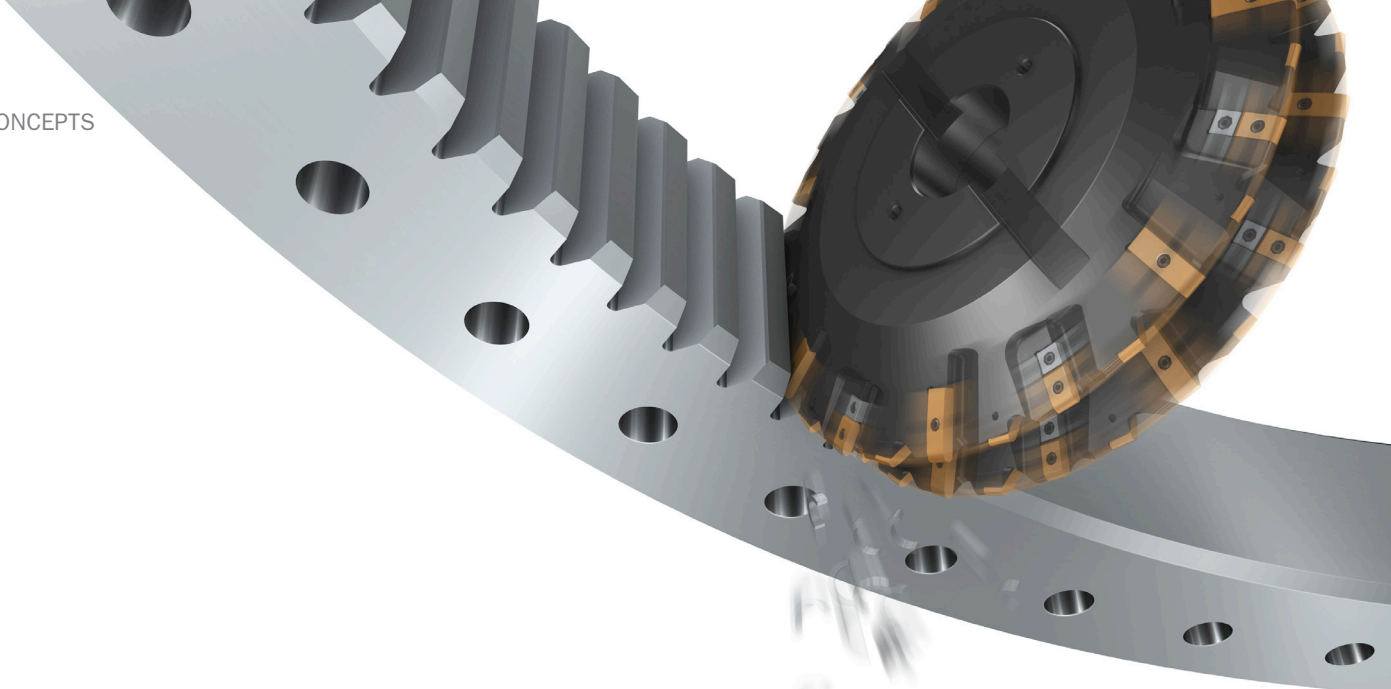
Application example

Component:	Slewing ring
Gear data:	
Module:	14 mm
Number of teeth, z:	132
Pitch diameter, d:	1848 mm
Face width, b:	155 mm
Workpiece material:	34CrNiMo6

Result:	HSS hob
Cutting speed, v_c (m/min):	40
Total time in cut, roughing:	290 (2 passes)

*Result:
Massive reduction in
cycle time by 81%!*

Sandvik Coromant Double disc cutter
135
54 min (1 pass)

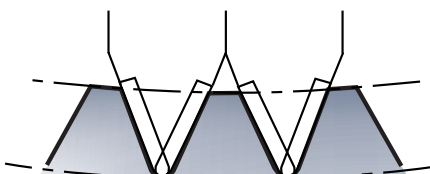


Duplex disc cutter

This high precision tool is adapted for finish machining applications in large internal gear wheels when maximum productivity is a priority. As with the single finishing disc cutter, both the tool and its inserts will be designed for your specific involute gear profile.

Duplex disc

Duplex disc cutters are designed to generate a gear profile that leaves an involute profile in two tooth gaps at the same time.



uP-Gear Technology

Whether you manufacture bevel gears for construction machinery, marine propulsion systems or trains, the challenges you face are similar: machining accuracy, low cost-per-part and high productivity. Sandvik Coromant, in collaboration with machine-tool builder HELLER, meets these challenges with uP-Gear Technology. And as well as improved machining solutions, you also benefit from a new strategic manufacturing alliance formed the Gleason Corporation.

A HELLER 5-axis machine equipped with user-friendly software and a Sandvik Coromant tool set for bevel gear machining is flexible, productive and cost-efficient. For example, multi-purpose machining centres can be used for a variety of gear-tooth geometries, as well as for other components. Machining times are also faster than traditional end-mill processes, and the production cost per bevel gear can be reduced considerably.

Machining in soft and hard conditions

uP-Gear Technology is for medium batch sizes of gear wheels starting at module 4 and up to 1,850 mm (72 inches) in diameter. What's more, Sandvik Coromant tools are now available for semi-finishing and finishing gear parts in both soft and hard conditions.

Gleason

HELLER

About HELLER and Gleason

HELLER is a machine-tool builder headquartered in Nürtingen, Germany. With over 2,300 employees and production facilities around the globe, HELLER has sales and service bases in all major markets.

Gleason, headquartered in Rochester, New York, is a world leader in the development, manufacture and sale of gear production machinery. Its customers include the automotive, truck, aircraft, wind-power and construction industries.

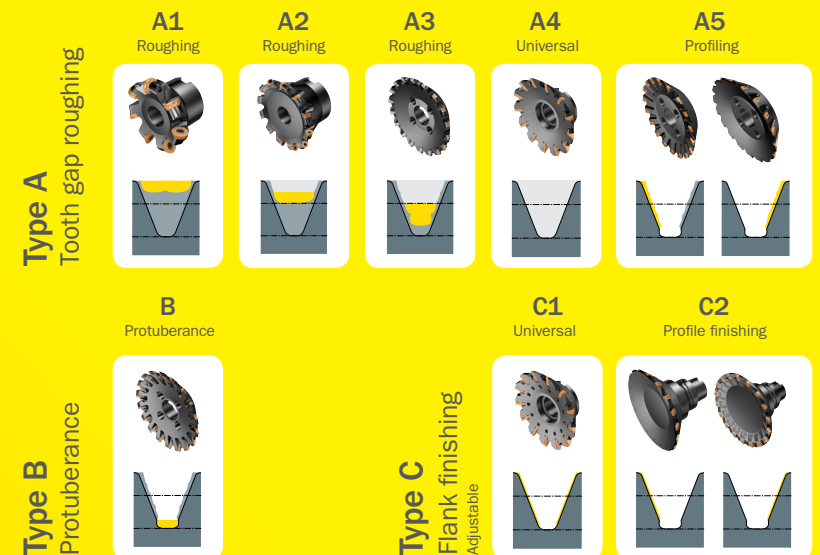
Gleason will act as the exclusive distributor of machining centres incorporating HELLER's existing gear solutions, and the two companies will cooperate to further improve producing gears on such a platform. As HELLER's focus is directed towards flexible solutions for machining gears in small to medium batch sizes, the two world-leaders complement each other well.

High precision tools

uP-Gear Technology requires a set of high-precision tools for milling the gear-tooth geometry. This not only reduces manufacturing costs, but also allows the same tool set to be used for a range of gear-tooth profiles and sizes.

Our tools for uP-Gear Technology cover three main operations; opening the tooth gap, machining the protuberance, and finishing the gear flanks. All are optimized for machining the component before and after heat treatment. The specific type and number required depends on the gear module as well as the selected machining strategy.

uP-Gear tool classification:



Application example

Roughing before heat treatment

Workpiece data

Diameter: 778 mm (30.630 inch)
 Module /DP: 14.2 mm / 1.789
 Number of teeth: 38
 Machine: Heller MCH 280-C

Process time

uP-Gear cycles = 90 minutes





InvoMilling

A revolutionary solution from Sandvik Coromant

Sandvik Coromant's new InvoMilling technique is a unique approach to milling spur and helical gears using indexable insert cutters. InvoMilling opens up new, cost-efficient ways to produce geared components without dedicated hobbing machines. Since complete components can now be machined with just one set-up in just one machine, overall production times can be reduced dramatically. And our new generation of indexable carbide insert gear cutters will increase cutting data and lower the cost per machined gear wheel significantly.

Flexible and fast at the same time

- Versatile method for manufacturing gears in modern multi-task machines or 5-axis machining centres
- Same tool can be used for different gear wheel sizes and profiles
- In many cases the manufacturing process can be reduced to one machine and one setup
- More environmentally-friendly - runs dry, does not use cutting oil

Easy to program

InvoMilling combines intelligent CNC programming with precision cutters. Developed by Sandvik Coromant, the process (pat. pending) has now been adapted Mori Seiki to the machine control software Mori-AP in order to simplify programming of different gear sizes and modules.

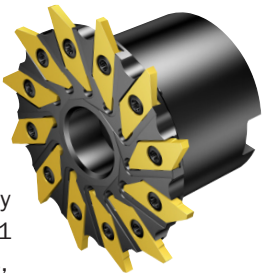
Programming is exceptionally easy. In the software menu:

1. Select the type of gear to be machined – spur or helical
2. Describe the spur gear form, i.e. number of teeth, module (DP), pressure angle, face width
3. Describe the spur gear modifications, i.e. finishing stock, tip chamfer, tip relief

Tools for different module sizes

CoroMill® 161

CoroMill 161 cutter is for manufacturing smaller module gears. High-precision insert seats ensure low tool run-out plus excellent component quality. Furthermore, modules from 1 to 4 can be efficiently covered with only a limited range of inserts. CoroMill 161 cutter is supplied in various diameters, starting at 66 mm, in both Coromant Capto® and arbor coupling configurations.



CoroMill® 162

CoroMill 162 cutter uses a unique iLock interface between the insert and tool body to ensure both stability and precision. CoroMill 162 comes in two sizes. Size 4 is ideal for the efficient manufacturing of module 4 to 8 gears starting with a diameter of 88 mm, while size 6 performs equally well for manufacturing module 6 to 12 gears. Tools are available with different arbor coupling sizes.



Cutter	Ideal module range	Possible module range
CoroMill 161	1-4	>1
CoroMill 162 [size 4]	4-8	>4
CoroMill 162 [size 6]	6-12	>6

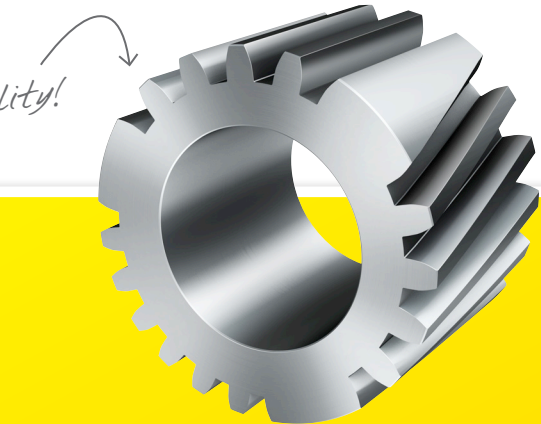
Sandvik Coromant and DMG/Mori Seiki

The InvoMilling process is invented by Sandvik Coromant (pat. pending) and is licensed to be exclusively implemented on Mori Seiki machines.

Application example

Gear wheel data
Module, mn/diametral pitch, DP: 6 mm/4.23 inch-1
Number of teeth, z: 27
Helix angle, β: 17 degrees
Face width, b: 130 mm/5.12 inch
Pitch circle, d: 170 mm/6.69 inch

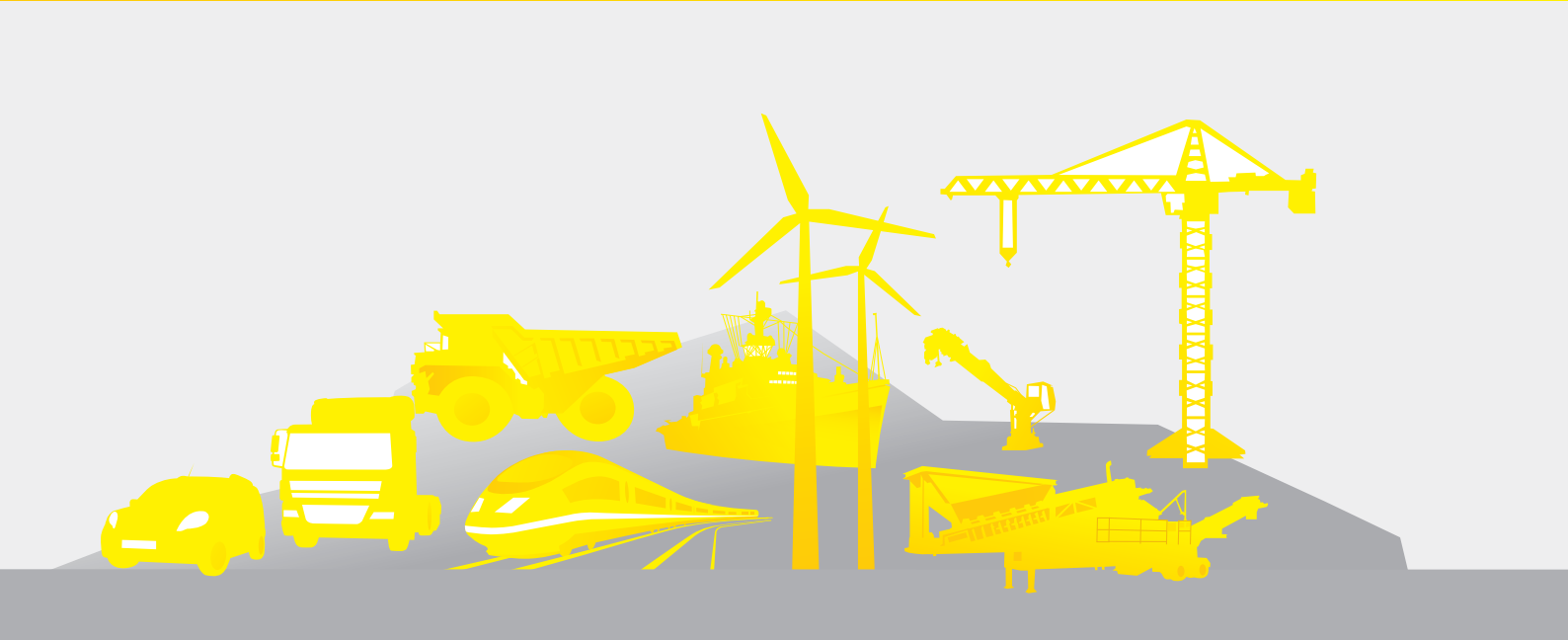
Result:
1 pass HSS hob
stable hobbing machine
31.5 minutes
2 passes HSS hob
"old" hobbing machine
57 minutes
New method on multi-task machine
23 minutes



Full flexibility!

The preferred solution for small to medium batch sizes!

First choice for large batch sizes - CoroMill 176.



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Your success in focus