## CONTENTS

**KAPP NILES at a glance**

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KAPP NILES

precision for motion

KAPP NILES is a global market leader in grinding machines and tools for finishing of gears or profiles. Complementing highly-accurate metrology makes KAPP NILES the best partner for production solutions. Around 800 highly-specialised employees represent the innovative power and the expertise of the company which has grown for over 120 years.

KAPP NILES is the technology partner for companies from the automotive, aviation and compressor industries, from drive engineering, robotics, energy and wind power, exploitation of raw materials and shipbuilding. Machines, tools and technological solutions from KAPP NILES precisely machine gears and profiles up to a thousandth millimetre and up to a diameter of eight metres. Specialists optimise each system solution individually for the customer’s requirements and provide support throughout its life-cycle.

Machines and tools from KAPP NILES guarantee both precision and cost-effectiveness for the manufacturing of sophisticated components. In eight locations, the know-how and quality of “Made in Germany” is present locally in all important markets. In this way, KAPP NILES enables its customers to set their concepts and products in precise motion – on land, on water and in the air.

workpiece range
- gears and shafts
- gear related profiles
- compressor rotors
- ball screw tracks
- worms
- rotary pistons
- pump spindles & metering screws
- gerotors
- vane pump rotors
- cycloidal profiles

range of tools
- non-dressable grinding tools with CBN or diamond coating
- dressable ceramically bonded grinding tools with corundum, SGG or CBN
- dressing rolls and gears with or without tip dresser for workpiece-specific or flexible dressing

machine processes
- generating grinding
- profile grinding
- bore and face grinding in combination with gear processing

options
- integrated dressing unit for generating and profile grinding tools
- integrated gear and profile measuring system incl. compensation of measuring errors
- grinding method for the production of targeted gear modifications
- flexible loading systems for automated production
### MACHINE PROCESSES

**your workpiece - our solution**

<table>
<thead>
<tr>
<th>MACHINE PROCESSES</th>
<th>generating grinding</th>
<th>profile grinding</th>
<th>process combination</th>
</tr>
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<tbody>
<tr>
<td><strong>external gears</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
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<tr>
<td><strong>external profiles</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td><strong>rotors</strong></td>
<td>![Image]</td>
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<td>![Image]</td>
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<tr>
<td><strong>cycloidal discs</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td><strong>internal gears</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td><strong>internal profiles</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td><strong>ball screw tracks</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td><strong>ring pins</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
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</table>
KX 100 / 260 DYNAMIC

• generating grinding of gears
• suitable for medium and large batch production
• shortest set-up times and small footprint
• pick-up concept
• dressable tools
• integrated automation system

Machine concept
The KX 100 DYNAMIC and the KX 260 DYNAMIC represent a systematic further development of the technology already applied in the KX 160 TWIN multiple spindle design. The machine concept makes it possible to minimise the auxiliary process times and to reduce set-up times. The integrated loading function and the optionally available automatic changeover of the workpiece fixtures offer the perfect solution for medium and large batch production of external spur and helical gears.

The KX 100 DYNAMIC includes two separate and pivotable columns, the KX 260 DYNAMIC includes one. A vertically moving pick-up axis is mounted on the column(s); each pick-up axis is equipped with a workpiece spindle. While one workpiece is ground, the second spindle transfers the completely processed workpiece to the handling conveyor and picks up an unprocessed part. The workpiece is aligned outside the working space. Subsequently, the workpiece spindle accelerates to the processing speed in order to minimise the auxiliary process times. The optional multi-functional axis allows discharging of measuring and test pieces. Aside of optimised set-up times machine concepts, KAPP NILES now offers intelligent clamping devices and grinding tools for this series, which provide all process relevant input data within an integrated RFID data storage.

Continuous generating grinding with dressable cylindrical tools is the grinding method. Tools with integrated tip dresser as well as flexible tools with independent tip dressing can be used on the dressing device. Moreover, with the topological generating grinding option, it is possible to produce gears with or without targeted modifications.

Control and software
The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements.

Measuring system
The optional measuring device allows to measure and to evaluate gear qualities against specifications. This functionality is mainly used to optimise the set-up processes in the machine, particularly in order to eliminate non-operational periods due to external measuring processes as much as possible. Alternatively, random samples can be tested during processing.

Automation
The main advantage of this machine concept is the complete integration of the automation functionalities. By using the pick-up design, parts can be automatically loaded and unloaded from a conveyor without any further handling equipment. Moreover, additional functions, such as discharging test parts are possible.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>KX 100 DYNAMIC</td>
<td>125</td>
<td>0.5 – 3</td>
<td>80</td>
<td>± 35</td>
</tr>
<tr>
<td>KX 260 DYNAMIC</td>
<td>260</td>
<td>0.5 – 5</td>
<td>100</td>
<td>± 45</td>
</tr>
</tbody>
</table>
KX 160 / 260 TWIN

**gear centre**

- generating grinding of gears
- suitable for medium and large batch production
- minimised idle time
- 2-spindle concept with index table
- dressable and non-dressable CBN tools
- flexible automation system

<table>
<thead>
<tr>
<th>Type</th>
<th>max. tip diameter [mm]</th>
<th>module range [mm]</th>
<th>max. face width [mm]</th>
<th>max. helix angle [deg]</th>
</tr>
</thead>
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<tr>
<td>KX 160 TWIN</td>
<td>170</td>
<td>0.5 – 4.5</td>
<td>520</td>
<td>± 45</td>
</tr>
<tr>
<td>KX 260 TWIN</td>
<td>260 (280)</td>
<td>0.5 – 5</td>
<td>520</td>
<td>± 45</td>
</tr>
</tbody>
</table>

**machine concept**

The KX 160 TWIN and KX 260 TWIN are designed on a shared modular machine platform with features specifically for continuous generating grinding with dressable tools. The short set-up times are especially worth emphasising in this efficient machine concept.

The machines of the KX TWIN type are particularly designed for medium and large batch production of gears and shafts where quality levels are especially demanding.

The machine includes two identical workpiece spindles arranged at opposing sides of an index table. While machining one part, the second workpiece spindle simultaneously unloads / loads and aligns another part. Thus, many of the auxiliary functions are carried out during the machining time, cutting the auxiliary processing time to a minimum.

A total of ten NC axes align the gear wheel with the tool and perform the necessary linear and rotary motions during grinding. The index table and both tailstocks are designed as NC axes. The workpiece spindle and tool spindle are directly driven.

The design of these machines includes an integrated single spindle dresser for conventional grinding worms. Mounted staggered to the workpiece spindles, the dressing unit is assembled on the tailstock column, too.

For the dressing process the profile dressing unit is aligned with the tool by turning the tailstock column.

**control and software**

The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements.

**measuring system**

The optional measuring device allows to measure and to evaluate gear qualities against specifications. This functionality is mainly used to optimise the set-up processes in the machine, particularly in order to eliminate non-operational periods due to external measuring processes as far as possible. Alternatively, random samples can be tested during processing.

**automation**

The machines are optimised for automatic loading. As a standardised turnkey solution, a combination of pallet conveyer and gantry loader is provided according to the specific application. Alternative automation methods, such as pallet or robot systems, can also be utilised.
KX 300 P

gear centre

- generating and profile grinding of gears
- suitable for prototyping to large batch production
- customised configuration
- vertical machine design
- dressable and non-dressable CBN tools
- customised automation

<table>
<thead>
<tr>
<th>type</th>
<th>max. tip diameter [mm]</th>
<th>module range [mm]</th>
<th>max. face width [mm]</th>
<th>max. helix angle [deg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KX 300 P</td>
<td>300</td>
<td>0.5 – 8</td>
<td>0.5 – 10</td>
<td>320 ± 45</td>
</tr>
</tbody>
</table>

**machine concept**

Based on a modular system in combination with the application possibilities of different tool and process technologies, user-specific, optimal production solutions can be configured. The following methods are possible:

- continuous generating grinding
- discontinuous profile grinding
- combination of both methods

Thanks to the flexible system and loading options, the KX 300 P is equally suitable for all gear requirements and production volumes.

In this series the following tool concepts are offered:

- dressable ceramic tools for the flexible requirements of prototype machining as well as medium and high-volume machining
- non-dressable CBN tools for the highly productive manufacturing of medium and high-volume series

Since the tool spindle (with counterbearing) can hold several tools, the cut segmentation is possible due to the sequential use of roughing and finishing tools in one single workpiece set-up. Alternatively, several gears can be machined in one set-up. In addition to the mainly used cylindrical grinding worms, single or multi-set CBN profile grinding wheels can be used for full-form machining as an alternative.

A total of six NC axes align the gear wheel and tool with each other. They swivel the tool to the axes cross angle and carry out the linear and rotary motions necessary for the machining process. Workpiece and tool are directly driven.

In the machine configuration for the use of dressable tools, the profile dressing unit is integrated. From an easily accessible parking position this unit is automatically swivelled into the working area of the machine. By using the machine axes for dressing, the dressing of the cylindrical grinding worms as well as the profile grinding wheels can be performed very quickly and with a high degree of flexibility.

**control and software**

The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements.

**measuring system**

The optional measuring device allows to measure and to evaluate gear qualities against specifications. This functionality is mainly used to optimise the set-up processes in the machine, particularly in order to eliminate non-operational periods due to external measuring processes as far as possible. Alternatively, random samples can be tested during processing.

**automation**

There are several loading systems at your disposal which can be integrated in the machine arrangement.
machine concept
The patented KX 500 FLEX is based on a shared modular machine platform. Application-specific production solutions can be configured on this versatile machine utilizing flexible process technologies, such as:
- continuous generating grinding
- discontinuous profile grinding
- combination of both methods

The KX 500 FLEX is designed to perform diverse processing jobs efficiently and economically. Thus, it is suitable for the production of single pieces as well as for the serial production of high-quality gears.

In this series the following tool concepts are offered:
- dressable ceramic tools for prototype machining and grinding of medium to high-volume series
- non-dressable tools for the manufacturing of medium to high-volume series as well as the grinding of more challenging gear geometry

The profile dressing unit can accommodate a single or twin spindle dresser. According to the applied solution, different technologies can be used for the dressing process, such as topological dressing of grinding worms with a radius tool.

control and software
The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements.

measuring system
The optional measuring device allows to measure and to evaluate gear qualities against specifications. This functionality is mainly used to optimise the set-up processes in the machine, particularly in order to eliminate non-operational periods due to external measuring processes as far as possible. Alternatively, random samples can be tested during processing.

automation
The KX 500 FLEX can be loaded manually and automatically. Automation options include a standardised combination of pallet conveyor and gantry loader or a robot system. For manual loading the index table swivels the part 90° to the machine operator. For automatic loading it turns 180° to the left side. A detailed configuration is created for each specific application.
Through the KN³ series KAPP NILES offers users an inexpensive entry into precision machining in the field of gear grinding. Designed on a common platform, the KN³ 3P profile grinding machine and the KN³ 3G generating grinding machine are designed as solutions for the flexible production of small and medium lot sizes.

**ergonomics**
The KN³ series has been optimised for manual ergonomic loading. Thanks to the low height of the machine bed and the short distance to the machine elements, all operations can be carried out without means.

**measuring system**
The integrated measuring device allows to measure and to evaluate gear qualities against specifications. This function is used both for the optimisation of the set-up process and for the alignment of the toothing with optimised measurement switch (KN³ 3P in particular).

**control and software KNgrind**
The control system Sinumerik 840D sl is used on a 19” touch screen. The innovative, operator-friendly user interface KNgrind allows a machine-oriented and intuitive parameterisation of the machining task. The operator is guided and supported during the input of workpiece and technology data. Via process control a flexible machining sequence is subsequently defined. In a process monitoring the operator is able to observe and to influence the machining status at any time.

**features of KN³ 3P**
The profile grinding machine KN³ 3P features a grinding spindle with high drive power for components up to module 10 mm. The directly driven rotary table is generously dimensioned for a table load of up to 350 kg. The dresser sits stationary against the tool axis and even allows the use of small grinding wheels of up to 65 mm. The working area can be used without any restrictions at large helix angles. Alternatively, the swivel range of the machine allows the grinding of worms.

**features of KN³ 3G**
An outstanding feature of the KN³ 3G grinding machine is the tool drive. It combines high speeds of up to 6,700 min⁻¹ for a constant cutting speed, even with a slimmer worm, with high stability. Thanks to the absence of a counter-bearing and an integrated automatic HSK interface for tool holding, the worm change can be carried out in the shortest possible time. The alignment-free level indicator on the tool axis rounds up the optimised set-up design. The retractable dresser offers all relevant dressing procedures from the form-bound roll for higher or recurring lots up to topological dressing for prototypes and small batches. The standardised interface allows the customer easily to connect own automation systems, such as robots, to the machine.
gear centre

- generating and profile grinding of gears
- any application - from prototype to large batch production
- manual or automated loading
- cylindrical and conical external gears
- more productivity for rail, print and energy technology

machine concept
The ZX series combines both, continuous generating grinding and discontinuous profile grinding, in one machine. Thus, a machine can be provided with high-end productivity, even for bigger gears and larger modules. On the other hand, the requirements for an outstanding flexibility can easily be achieved, too.

For the highly dynamic generating grinding technology, a very rigid basis was developed. All main components are made of vibration-absorbing ductile cast iron. The bed is a single unit, offering extremely high stability. The machine needs no special foundation. The rotary table is largely dimensioned and accepts high table loads. It is driven by an electrical high-accuracy direct drive, providing the required positioning accuracy for profile grinding as well.

The one-piece machine bed is characterised by a compact design and a very good accessibility, especially for manual part loading. The compact design enables all operations and set-up from the shop floor. The change-over between the different grinding processes is very fast and reliable, allowing the use of the optimal process, no matter if it is prototype grinding, small batches or series production. The tool spindle has a counter support for better rigidity and surface finish.

Several dressing processes are available, e.g. double flank dressing with simultaneous tip dressing for mass production or single flank dressing with separate tip dressing for economical costs on small lots and beyond that topological dressing for almost unlimited modifications and gear types for prototypes.

control and software
The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements. Instructions, e.g. tool change are shown at the control screen. Automatic functions assist in order to choose the right grinding tool and generate it to workpiece and dresser.

measuring system
Another essential factor for flexible machining is the ability to measure the finished parts right in the machine. Especially large module gears tend to heat distortions. They can easily be determined with the help of the measuring unit. This option also allows the operator to inspect and evaluate the quality achieved without disturbing the clamping – thus shortening set-up times considerably.

<table>
<thead>
<tr>
<th>type</th>
<th>max. tip diameter [mm]</th>
<th>module range [mm]</th>
<th>stroke length [mm]</th>
<th>max. helix angle [deg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZX 630 / 800 / 1000</td>
<td>650 / 800 / 1,000</td>
<td>0.5 – 12</td>
<td>480 (520)</td>
<td>± 15</td>
</tr>
</tbody>
</table>
WEISSER-KAPP MultiCELL

hard turning/grinding / gear grinding

• finishing of gears
• suitable for medium and large batch production
• processing of reference geometries and gears
• merging two processes in one cell
• dressable tools
• minimised automation expenses

machine concept
The WEISSER-KAPP MultiCELL is an innovative gear grinding centre for the highly productive finishing of gears. This integrated system merges the WEISSER hard turning/grinding process for finishing of the reference surfaces and KAPP gear grinding. Especially for medium and large batch production, this process integration causes significant effects.

Reference surfaces are machined by the UNIVERTOR AC-1 within the cell. The WEISSER rotational turning, usable for OD-, ID-turning and facing, is considerably shortening processing times compared to conventional procedures as well as gaining excellent surfaces free of lead. The rotational turning allows using considerably higher infeed and cutting speed.

Finally, the tooth flanks are being ground in the gear centre KX 100 DYNAMIC, using generating grinding. The machine includes two vertically moving pick-up axes; both are mounted on separate pivoting workpiece columns. Each pick-up axis is equipped with a workpiece spindle. While one workpiece is ground, the second spindle transfers the completely processed workpiece to the handling conveyor and picks up an unprocessed part. By means of the optional multi-functional axis, measuring and test pieces can be sorted out by the machine.

control and software
The Sinumerik 840D sl is employed for the UNIVERTOR AC-1 as well as the KX 100 DYNAMIC. The control of the UNIVERTOR AC-1 is easy to handle due to lathe/grinding machine specific tailor-made screens and images. The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements.

automation
The automation of the material flow between the two systems realises significant ratio effects. Following the machining of the reference surfaces, the parts are placed on a conveyor and transferred to the final process step for gear grinding. The two spindle pick-up design of the gear centre integrates all automation functions: parts can be loaded and unloaded from the conveyor without any further handling devices.

<table>
<thead>
<tr>
<th>type</th>
<th>max. tip diameter [mm]</th>
<th>module range [mm]</th>
<th>max. face width [mm]</th>
<th>max. helix angle [deg]</th>
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<tbody>
<tr>
<td>MultiCELL</td>
<td>125</td>
<td>0.5 – 3</td>
<td>80</td>
<td>± 35</td>
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</table>
The gear profile grinding machines of the ZE series are designed for precise grinding of external and internal gears. The ZE machine concept represents accuracy, long lifetime and ergonomics.

Even the basic machines are equipped with coolant filtration unit, dresser, tailstock, in-process measuring system, balancing unit, acoustic emission sensor and comprehensive software for grinding and measuring of involute profiles. The compact design enables all operations and set-up from the shop floor. No anchoring or fixing of the machine is necessary. Further outstanding features of the ZE machines are, amongst others, a well dimensioned rotary table with electrical direct drive, hydrostatic bearing and large table bores and an ergonomic machine design.

The machine perfectly fits to customer-specific requirements, no matter if it is prototype grinding, small batches or series production. All machines of the ZE series can be equipped with internal gear grinding attachment. From standard applications to customer-specific grinding tasks, either with dressable wheels or CBN grinding wheels; KAPP NILES will provide the right solution for your requirements.

Multiple spindle configurations are available. The machine can be equipped with a stronger motor and grinding spindle and optimised axes with increased stroking speed for productive grinding of large module workpieces. Gears with short run-out or workpieces with interfering shoulders can be ground with a spindle and wheel adaptor for smallest grinding wheels.

The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements. Workpiece data can be entered and handled directly from the drawing including modifications. The software supports the operator to choose the right grinding process. The programme automatically calculates grinding and dressing technology based on the important process parameters.

The standard software package comes with very sophisticated alignment and measuring modules as automatic synchronisation, including the autonomous locating of the tooth gap, and inspection of the blank profile. This determines the amount of stock and thereby the grindability of the gear. The control can be expanded further by application-specific software packages.

The highly precise measuring system is an integrated part of the machine. Besides the various alignment, analysis and correction possibilities the system allows the final evaluation of the ground gear by measuring of all relevant gear parameters. The measuring results can be evaluated according to DIN and AGMA also under consideration of modifications.

<table>
<thead>
<tr>
<th>type</th>
<th>max. tip diameter [mm]</th>
<th>max. module [mm]</th>
<th>stroke length [mm]</th>
<th>max. helix angle [deg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZE 400 / 500</td>
<td>400 / 500</td>
<td>15 / 20 / 25</td>
<td>400</td>
<td>± 45 / ± 120</td>
</tr>
<tr>
<td>ZE 630 / 800</td>
<td>650 / 800</td>
<td>15 / 20 / 25</td>
<td>600</td>
<td>± 45 / ± 120</td>
</tr>
</tbody>
</table>
machining of gears and special profiles
suitable for prototyping and small batch production
machining parts of complex geometry
designed for internal and external gears
dressable and non-dressable CBN tools

machining according to the so-called GMG strategy (grinding – measuring – grinding). The dressing and grinding programme is automatically generated based on the entered gear data.

control and software
The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements. By entering the required workpiece and technology data profile modifications and lead modifications, technological corrections as well as axes-corrections can be done via editor.

measuring system
The optional device allows to measure and to evaluate gear qualities against specifications. This functionality is mainly used to optimise the set-up processes in the machine, particularly in order to eliminate non-operational periods due to external measuring processes as far as possible. Alternatively, random samples can be tested during processing.

<table>
<thead>
<tr>
<th>type</th>
<th>max. tip diameter [mm]</th>
<th>max. workpiece length [mm]</th>
<th>module range [mm]</th>
<th>max. feed travel [mm]</th>
<th>swivel range of grinding head [deg]</th>
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<tbody>
<tr>
<td>VX 55</td>
<td>500</td>
<td>1,000</td>
<td>0.5 – 16</td>
<td>700</td>
<td>± 90</td>
</tr>
<tr>
<td>VX 59</td>
<td>630</td>
<td>1,650</td>
<td>0.5 – 16</td>
<td>1,000</td>
<td>± 90</td>
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</tbody>
</table>
The ZP series is worldwide well known for profile grinding of external and internal gears. The ZP machine concept represents great quality, durability and outstanding flexibility.

Even the basic machines are equipped with coolant filtration unit, dresser, in-process measuring system, balancing unit, acoustic emission sensor, and comprehensive software for grinding and measuring of involute profiles. Further outstanding features are, amongst others, a well dimensioned rotary table with electrical direct drive and large table bores; optional hydrostatic bearing and guideways for highly accurate positioning, excellent load capacity and almost unlimited lifetime. The latest drive and control technology enables grinding of even very complex gear geometries, using a five axes interpolation. The machine perfectly fits to customer-specific requirements, no matter if it is prototype grinding, small batches or series production.

All machines of the ZP series can be equipped with internal gear grinding attachment. From standard applications to customer-specific grinding tasks, either with dressable wheels or CBN grinding wheels; KAPP NILES will provide the right solution for your requirements.

The ZP series is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements. Workpiece data can be entered and handled directly from the drawing, including modifications. The software supports the operator to choose the right grinding process. The programme automatically calculates grinding and dressing technology based on the important process parameters. The standard software package comes with very sophisticated alignment and measuring modules as automatic synchronisation, including the autonomous locating of the tooth gap, and inspection of the blank profile. This determines the amount of stock and thereby the grindability of the gear. The control can be expanded further by application-specific software packages.

The highly precise measuring system is an integrated part of the machine. Besides the various alignment, analysis and correction possibilities the system allows the final evaluation of the ground gear by measuring of all relevant gear parameters. The measuring results can be evaluated according to DIN and AGMA also under consideration of modifications.

Gears with short run-out or workpieces with interfering shoulders can be ground with a spindle and wheel adaptor for smallest grinding wheels. A design with two grinding spindles is possible.

<table>
<thead>
<tr>
<th>Type</th>
<th>max. tip diameter [mm]</th>
<th>max. module [mm]</th>
<th>stroke length [mm]</th>
<th>max. helix angle [deg]</th>
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</thead>
<tbody>
<tr>
<td>ZP 10 / 12</td>
<td>1,000 / 1,350</td>
<td>35</td>
<td>750 / 1,000 / 1,500</td>
<td>-45 / +120</td>
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<tr>
<td>ZP 16 - 28</td>
<td>1,600 / 2,000 / 2,400 / 2,800</td>
<td>40</td>
<td>1,000 / 1,500 / 1,800</td>
<td>-45 / +120</td>
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<tr>
<td>ZP 30 - 80</td>
<td>3,200 / 4,000 / 5,000 / 6,000 / 8,000</td>
<td>50</td>
<td>1,550 / 1,750</td>
<td>± 40</td>
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</tbody>
</table>
ZP B

profile, bore and face grinding of gears
complete machining in one set-up
optimised throughput and set-up time
external planetary and bull gears
highest precision for wind power and marine gear centre

machine concept
The machines of the ZP B type are designed for the complete hard finishing of external spur and helical gears. Special features of this series – tooth spaces, bores and faces of the gears may be machined in one set-up, using two independent machine columns. Since the implementation of the electrical direct drive, the combination of gear and bore grinding became possible. This hybrid process allows maximum positioning accuracy in gear grinding in connection with a fast rotation for the bore grinding.

The machines of the ZP B type were designed and built to comply with the highest demands in large gear grinding. Thanks to the combination of two machining processes, they offer further advantages:
- savings in set-up, aligning and idle times
- realisation of smaller stock allowances
- no machining of auxiliary surfaces
- reduction of cycle times
- reduction of scrap and reworking percentage
- smaller space required

Various tools are used on the ZP B machines. For grinding of gears as well as for bore and face grinding, dressable wheels for flexible machining options are offered. Non-dressable wheels may alternatively be used for gear grinding.

The machines of the ZP B type are equipped with two dressing devices. For gear grinding, the customer-specific profiles can be generated via the machine control and control-led axes. A second dresser profiles the tool for bore and face grinding. The cup-shaped dressing tool can dress the outer diameter and the faces of the grinding tool.

control and software
The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES, to match the specific machining requirements. The operation and data input for gear grinding is already known from the ZP series. Additionally, a comfortable operator interface for bore and face grinding was developed.

measuring system
Besides the well-known standard features the in process measuring system can also be used in order to determine the optimum center position of the gear to minimise the volume of grinding stock.

<table>
<thead>
<tr>
<th>type</th>
<th>max. tip diameter [mm]</th>
<th>max. module [mm]</th>
<th>stroke length [mm]</th>
<th>max. helix angle [deg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZP 12 B</td>
<td>1,350</td>
<td>40</td>
<td>1,000 / 1,500</td>
<td>- 45 / + 120</td>
</tr>
<tr>
<td>ZP 30 B</td>
<td>3,000</td>
<td>40</td>
<td>1,550 / 1,750</td>
<td>± 40</td>
</tr>
</tbody>
</table>
ZP I/E
gear profile grinding machine

- profile grinding of gears
- heavy grinding head with integrated dresser
- changeover to external grinding within 30 min
- internal / external gears and special profiles
- accuracy and productivity in wind power

machine concept
The ZP I/E type is developed for high-precision profile grinding of internal gears with large modules and gear widths. The ZP I/E type offers remarkably high efficiency and optimised solutions for such grinding tasks and at the same time the flexibility our customers need to grind external gears by merely swiveling the grinding arm by 180°.

The internal grinding attachment is mounted directly onto a large machine column and carries the complete grinding arm, including a dressing and measuring unit. The grinding wheel is dressed by a patented method, using the tangential axis of the grinding head and a dressing axis. The CNC dressing device is located directly above the grinding wheel, which allows the wheel to be dressed in its grinding position. This eliminates long dressing paths and reduces the process times significantly. The grinding spindle is driven by a timing belt. This concept increases the torque on the grinding wheel, allows the grinding spindle to be thermally separated from the motor, and provides a compact design. The strong drive delivers enough power for high material removal also when using large and wide grinding wheels.

Even the basic machines are equipped with coolant filtration unit, dresser, in-process measuring system, balancing unit, acoustic emission sensor and comprehensive software for grinding and measuring of involute profiles. The use of high-strength, vibration-absorbing and durable spheroidal cast iron is one of the key features for the machine accuracy. Further outstanding features are, amongst others, a well dimensioned rotary table with electrical direct drive and hydrostatic bearing for highly accurate positioning, excellent load capacity and almost unlimited lifetime.

control and software
The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements.

measuring system
A specialty of the internal grinding arm is the in-process measuring system, which is located below the grinding spindle drive and swivels into position for measuring. The measuring system provides reliable centring, accurate stock determination and gear measurement after grinding. To reduce set-up times, especially for large and heavy workpieces, clamping eccentricities can be evaluated with the in-process measuring system and subsequently compensated by the control. The compensation works in all kinds of machine functionalities, such as stock determination, grinding and measuring.

<table>
<thead>
<tr>
<th>type</th>
<th>max. root / tip diameter [mm]</th>
<th>max. module [mm]</th>
<th>max. helix angle [deg]</th>
<th>max. immerse depth [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZP 20</td>
<td>2,000</td>
<td>25</td>
<td>± 15</td>
<td>600</td>
</tr>
<tr>
<td>ZP I/E 25</td>
<td>2,500</td>
<td>3,000</td>
<td>25</td>
<td>± 15</td>
</tr>
<tr>
<td>ZP I/E 30</td>
<td>2,900</td>
<td>3,600</td>
<td>25</td>
<td>± 15</td>
</tr>
</tbody>
</table>
profile grinding of gears
change between external and internal grinding without set-up
modular system according to customer’s requirements
external / internal gears and special profiles
flexibility and precision for job shop manufacturing

machine concept
The machine concept is based on the use of two independent grinding columns similar as in the ZP B type. Besides the regular ZV grinding column for external gear grinding, the machine is equipped with an additional ZPI grinding column for internal gear grinding. Both grinding columns allow optimum machining without limitation. The biggest advantage is the ease of changing the machine set-up. Especially on large machines it takes a lot of time to replace the whole grinding head. The switch between external and internal gear grinding on a ZP E/I machine does not require a set-up time at all. Thus, machines will be used by job shops primarily. The use of a common rotary table and peripheral units like the coolant filtration unit significantly reduces the investment cost and floor space compared with two single machines. Nevertheless, full functionality for external and internal gear grinding is still available.

The machine concept can be tailored according to the customers’ requirements. Therefore, it can be chosen from multiple rotary table groups and grinding column bases out of the ZP machine series larger than 3 m. The machine layout can be straight – both columns against each other – or as an L-shape.

control and software
The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements. Workpiece data can be entered and handled directly from the drawing including modifications. The software supports the operator to choose the right grinding process. The programme automatically calculates grinding and dressing technology based on the important process parameters. The standard software package comes with very sophisticated alignment and measuring modules as automatic synchronisation, including the autonomous locating of the tooth gap, and inspection of the blank profile. This determines the amount of stock and thereby the grindability of the gear. The control can be expanded further by application-specific software packages.

measuring system
The highly precise measuring system is an integrated part of the machine. Besides the various alignment, analysis and correction possibilities the system allows the final evaluation of the ground gear by measuring all relevant gear parameters. The measuring results can be evaluated according to DIN and AGMA also under consideration of modifications.
RX 120

**rotor grinding machine**

- generating and profile grinding of rotor profiles
- suitable for batch production
- concept for high-productive manufacturing
- non-dressable CBN tools
- + optimised loading concept
- + deburring parallel to grinding operation (optional)

**machine concept**

The patented rotor grinding machine RX 120 uses the advantages of continuous generating grinding in manufacturing rotor profiles. Generating grinding or, alternatively, discontinuous profile grinding is used for roughing of the rotor. For the finishing operation profile grinding is used only. Applying this process combination up to 40% reduction of grinding times can be realised compared to conventional grinding times on established machine concepts.

The rotor grinding machine RX 120 is designed for highly productive and economic series production of small and midsize screw compressors. The machine is equipped with directly driven tool and workpiece axes for minimised main and non-productive times during the grinding process.

The RX 120 uses only non-dressable CBN tools.

**control and software**

The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements.

**measuring system**

The optional measuring device allows to measure and to evaluate profile parameters against specifications. This function is mainly used to optimise the set-up processes in the machine, particularly in order to eliminate non-operational periods due to external measuring processes as far as possible. Alternatively, random samples can be tested during processing.

**automation**

The RX 120 was specially designed for the connection of an automation system, providing a simple and cost-effective integration of a deburring station for the ground rotors as well.

---

<table>
<thead>
<tr>
<th>type</th>
<th>max. profile OD [mm]</th>
<th>max. profile length [mm]</th>
<th>max. profile width [mm]</th>
<th>max. profile height [mm]</th>
<th>max. workpiece length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX 120</td>
<td>120</td>
<td>220</td>
<td>120</td>
<td>30</td>
<td>425</td>
</tr>
</tbody>
</table>
**RX 55 / 59**

**rotor grinding machine**

- profile grinding of rotor profiles
- suitable for batch production
- high stock removal capability for efficient manufacturing
- roughing and finishing in one set-up
- non-dressable CBN tools
- customised automation system

**machine concept**

The RX series machines are designed exclusively for discontinuous profile grinding. A special highlight is the extremely high stock removal capability, which is required for efficient grinding of rotor profiles and which is made possible by the drive power.

The machines of the RX series are employed for pre-finish and finish grinding of pre-profiled steel and cast iron profiles. The part spectrum covers screw-type compressor rotors, rotary pistons, screw-type pump spindles etc.

The RX series uses only non-dressable CBN tools. The directly driven grinding spindle of the RX machine can hold two grinding wheels, whereas the tools are sequentially moved into the grinding position. This allows the pre-finish and finish grinding in one set-up.

Due to the innovative drive concept on the tool side, the machines of the RX series reach up to 46 kW in the speed range of 2,000 to 8,000 min⁻¹. Especially for roughing, this high performance is resulting in highest stock removal rates and is shortening machining times considerably. In combination with an optimally adapted tool technology, a highly productive and efficient working process will be guaranteed.

**control and software**

The control system Sinumerik 840D sl is equipped with an operator-friendly menu-driven user interface, developed by KAPP NILES to match the specific machining requirements.

The following options are available, including:

- alignment of pre-machined profiles using a non-contact sensor in reference to one or all gaps
- precise alignment of pre-machined profiles with a measuring probe
- runout inspection on bearing journal at tailstock side
- adaptive control of the feed axis to prevent overloading the grinding process due to excessive stock removal amounts

**measuring system**

The optional measuring device allows to measure and evaluate profile parameters against specifications. This functionality is mainly used to optimise the set-up processes in the machine, particularly in order to eliminate non-operational periods due to external measuring processes as far as possible. Alternatively, random samples can be tested during processing.

**automation**

Several loading systems can be integrated in the machine installation. Depending on the task definition, the type and volume of the workpiece loading, as well as additional functions embedded in the automatic sequence, can be freely defined.

<table>
<thead>
<tr>
<th>type</th>
<th>max. profile OD [mm]</th>
<th>max. profile length [mm]</th>
<th>max. profile width [mm]</th>
<th>max. profile height [mm]</th>
<th>max. workpiece length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RX 55</td>
<td>320</td>
<td>550</td>
<td>180</td>
<td>80</td>
<td>1,200</td>
</tr>
<tr>
<td>RX 59</td>
<td>320</td>
<td>550</td>
<td>180</td>
<td>80</td>
<td>1,650</td>
</tr>
</tbody>
</table>
**GAS / GIS / HGS**

**special solutions**

- individual solutions for finishing of
  - special profiles, e.g. slots
  - external threads and drive worms
  - internal threads and vane pump rotors
- dressable and non-dressable CBN tools

---

**GAS**

Machines from the GAS model range are used for processing external threads and similar profiles. Typical components for these machines are external ball screws for automotive steering systems, as well as drive worms, small pumps and metering components.

In line with the shaft-type geometry of the components, these machines are designed with a horizontal workpiece axis and have correspondingly long travelling paths.

Parts are machined by discontinuous profile grinding only; the tool concept is adapted to the corresponding component requirements:

- non-dressable CBN profile grinding wheels
- dressable ceramic grinding wheels

For specific applications, various tools can also be combined.

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**GIS**

Machines of this type are used for the hard finishing of internal threads in ball screw tracks or similar profiles. Typical applications besides vehicle steering are recirculating ball screws in the field of automotive.

Parts are machined by discontinuous profile grinding.

Non-dressable CBN profile grinding wheels are exclusively used, typically in a combination of roughing and finishing tools.

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**HGS**

The high-speed grinding machine HGS is mainly used for grinding of slots in pump rotors into the solid, through-hardened material. Slot widths of 0.5 to 2.0 mm can be produced with high efficiency due to package clamping and automatic unloading and loading. The in-process measuring control ensures maintaining slot-width tolerances.

The HGS uses non-dressable CBN profile grinding wheels only.
KAPP manufactures non-dressable, electroplated CBN and diamond grinding tools for hard and soft finishing of gears and profiles. In addition, there are dressing tools for dressing of ceramic or CBN tools in the product line. KAPP grinding tools have the best reputation since more than 30 years worldwide guaranteeing highest quality, efficiency and economic grinding.

dressing tools

profile grinding
diamond form rolls
sintered design for dressing of vitrified profile grinding wheels

Either as an economic version with natural diamond or as a long life tool with handset CVD diamond. These tools can be reground several times and exhibit high tool life.

gear honing
diamond dressing gears
for profile dressing of vitrified honing rings

Also available as a set with DDG and integrated tip dressing roll.

generating grinding
diamond profile rolls and -form rolls
for flexible or topological dressing of vitrified or dressable CBN worms for the continuous generating grinding of external gears

For serial production an integrated tip dresser is used for defined grinding of the gear root area.

multi-ribbed diamond profile rolls
for high efficiency dressing of vitrified grinding worms in large batch production

grinding tools

CBN profile grinding wheels
single or multi-ribbed roughing and finishing wheels suitable for:
- grinding of external and internal gears
  for automotive and aircraft industry
- radial, screw, rotor and worm profile wheels
- high speed grinding of profiles and gears
- lunge grinding, abrasive cutting, cylindrical grinding

CBN grinding worms
roughing and finishing worms in cylindrical form for high efficient grinding of gears and other profiles as well as in globoidal form for grinding external gears with interfering contours

Grinding worms and profile wheels are often used in combination.

diamond coroning rings and -gears
suitable for coroning of external and internal gears as well as shoulder gears, even with small crossed axes angle
SERVICE

your requirements – our portfolio

- 24/7-service hotline
- comprehensive training programmes
- remote diagnosis
- immediate delivery of spare parts
- competent consulting

after sales
Personal contact occurs less and less in our age of social networking. For us, it is very important to establish and maintain interpersonal relationships with our customers. We do this through:
- competent consulting
- updates on innovations
- offering alternatives for obsolete components

technical support
Our machine technicians are highly trained specialists who are there to make sure your machine performs at its optimum. They have the know-how and techniques to help you in every situation. In addition to on-site support they are available for:
- phone support
- 24 hour reaction time
- remote diagnosis

tooling
Do your workpieces face new requirements or do you intend to manufacture other products? We are your partner, starting at consulting up to the production-ready solution:
- collision inspection
- clamping devices and tooling
- tools for grinding and dressing
- installation and training

spare parts
Our strategy is to provide the right part at the right time to the right place. Minimum downtime is the benefit of your decision for an original KAPP NILES spare part. We provide:
- new spare parts
- repair service
- exchange service for key components

overhaul and modernisation
Our modernisation programme keeps your production equipment state-of-the-art. At the same time, spare parts availability can be secured for many years. To meet these goals, we offer:
- partial overhaul
- general overhaul (mechanical and electrical)
- additional applications and software updates

maintenance
Your machine is your capital. For this reason, it is critical that it remains fully functional at all times. To meet this requirements, we offer:
- maintenance contract
- preventive maintenance
- maintenance and repair

training
High-end manufacturing demands a perfect synergy between machine and human. Our training programmes are designed to prepare your employee to meet that challenge. We provide:
- technology training
- operator training
- maintenance training

service performances
To us, service means much more than helping you in a difficult situation. KAPP NILES service promises you support through your entire production process. This includes:
- machine installations
- connection of machine and automation
- relocation
- prototyping
- job shop grinding and measuring
- protective coating
• gear measuring machines KNM X
• ultra-precise universal measuring machines KNM C
• portable gear- and 3D-measuring machines KNM P
• single / double flank test devices SFT / DFT, DOB measuring devices
• REPOWER

The KNM X series offers highest precision with shortest measuring times thanks to high precision mechanics, air bearing or hydrostatic rotary tables and state-of-the-art drive technology.

Designed for highly accurate measurements of all gear types, bevel gears, shaft components, tools, bearing rings etc.

The machines of the KNM C series guarantee ultimate form-, gear- and 3D-measuring technology, also for medium size and large workpieces.

In connection with a direct driven, air bearing rotary table (active 4th axis) the metrological characteristics of a form measuring machine are combined with the strengths of a gear- respectively coordinate measuring machine.

For the first time with the KNM P series, portable CNC-controlled measuring machines for larger gear sizes, ring shaped parts, housings etc. are introduced for the use directly on the production machine or “stand-alone” in the factory.

Outstanding characteristics of these measuring machines are:
- any workpiece diameters
- easy transport from A to B
- measuring sequences without operator influence
- prompt measuring readiness

The single flank test device SFT 100 is the convenient test equipment for workpieces up to 300 mm in diameter at a max. speed of 30 min⁻¹ with max. 5 Nm torque.

The double flank test devices of the DFT series offer the automatic evaluation for the rating of gears in regard to total composite error $F_{tu}$, tooth-to-tooth error $F_{tu}$, composite runout error $F_{ru}$, mean centre deviation $d_{a}$ as well as nicks and burns.

With the DOB measuring devices, the two-ball dimension of internal and external gears is determined easily with quick change part fixturing.

Alternative to an investment into a new gear measuring machine is the REPOWER programme, an upgrade of a used gear measuring machine with completely new guide systems for all linear drives, PC and evaluation software.
KAPP NILES

E-Mail: info@kapp-niles.com
Internet: www.kapp-niles.com

KAPP NILES GmbH & Co. KG
Callenberger Str. 52
96450 Coburg
Germany
Phone: +49 9561 866-0
Fax: +49 9561 866-1003

KAPP NILES GmbH & Co. KG
Berlin Plant
Nordring 20
12681 Berlin
Germany
Phone: +49 30 93033-0
Fax: +49 30 93033-4003

KAPP Technologie GmbH
Gärtnersleite 2
96450 Coburg
Germany
Phone: +49 9561 866-0
Fax: +49 9561 866-2003

KAPP NILES Metrology GmbH
Daimlerstraße 17
63741 Aschaffenburg
Germany
Phone: +49 6021 58335-0
Fax: +49 6021 58335-20

KAPP TECHNOLOGIES L.P.
2870 Wilderness Place
Boulder, CO 80301
USA
Phone: +1 303 447-1130
Fax: +1 303 447-1131

KAPPTÉC INDÚSTRIA E COMÉRCIO DE MÁQUINAS E FERRAMENTAS LTDA.
Rua Solimões, 60
09930-570 Diadema S.P.
Brazil
Phone: +55 11 4091-5355
Fax: +55 11 4091-5355

KAPP ASIA TECHNOLOGIES (JIASHAN) CO., LTD.
Kapp Road 8
DaYun Industry Zone
JiaShan 314113 ZheJiang
P.R. China
Phone: +86 573 8466-3888
Fax: +86 573 8466-3666

KAPP NILES Russland LLC
Warschavskoye Chaussee 42
Office 2320/1
115230 Moscow
Russia
Phone: +7 495 150-31-78