Power Skiving in complete machining
PITTLER T&S GMBH

PITTLER T&S develops and manufactures high-precision turning centres for the soft and hard turning as well as the drilling and milling of rotation-symmetrical components up to 5,000 mm in diameter.

In the spirit of the company founder, power skiving technology in particular has been developed into a highly efficient gearing technology and is established not only within the context of complete machining but also as an individual technology in the PITTLER machine portfolio.

4-axis turning of a truck wheel hub

DVS TECHNOLOGY GROUP

The DVS TECHNOLOGY GROUP is made up of experienced machining companies focusing on the turning, gear cutting and grinding technologies. The DVS TECHNOLOGY GROUP has more than 1,000 employees worldwide and is one of the leading system suppliers for machines, tools and production solutions for the machining of vehicle powertrain components before and after hardening.

The following divisions make up the DVS TECHNOLOGY GROUP:

**DVS Machine Tools & Automation:** Manufactures and sells high-precision machine tools, automation equipment and the associated services.

**DVS Tools & Components:** Develops, manufactures and sells customised machine components, tools and abrasives.

**DVS Production:** Series production of components for passenger cars and commercial vehicles using DVS machine tools.

**DVS International Sales & Service:** Local DVS Contact for Sales and Service on International Markets.
PITTLER PV315 – THE COMPACT MULTI-TALENT.

- Compact design with only 9m² footprint
- Design, manufacturing and conditioning of skiving tools from a single source
- In-house development of clamping tools within the DVS group
- Efficient machining of internal and external gearing within the context of complete machining
- Sturdy tool head for high-precision machining results
- Magazine for up to 20 tools and swarf-protected exchange of measuring sensors
- Automatic generation of machining programs via intuitive user interface

Dimensions:
- 3,600 mm
- 2,669 mm
- 3,800 mm

PITTLER PV315 – THE COMPACT MULTI-TALENT.
FLEXIBLE. EFFICIENT. POWER SKIVING.

Power Skiving is a machining method used for the manufacture of gear teeth, based on the patent by Wilhelm von Pittler from the year 1910. Over the past few years, the latest developments in manufacturing engineering have led to the technology becoming an efficient and flexible alternative for gear components.

Typical for Power Skiving is the diagonal arrangement of the tool axis to the component axis, known as the shaft angle. This adjustment of the tool, a defined axial feed and the coupled speed of tool and component result in a relative movement which effectively “peels” the tooth space from the component along the main cutting direction.

POWER SKIVING – COMPARISON OF TECHNOLOGIES

**Gear shaping**

- Flexible
- Simple technology
- Long machining times due to empty stroke approx. 3-8 x longer
- Costs per workpiece higher
- Cannot be combined with other processes

**Hobbing**

- High machining volume
- Short machining time
- Low tool costs
- Common technology
- Only for external gearing
- Larger outfeed required than for skiving

**Broaching**

- Extremely productive for high quantities
- Very short machining times
- Inflexible
- No compensation e.g. two-ball dimension
- High tool costs
- Long delivery times for tools
- Cannot be used for constraining contours
THE PITTLER PV-SERIES. FROM SMALL TO VERY LARGE.

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>PV 315 1-1Y</th>
<th>PV 630 1-1Y</th>
<th>PV 1250 1-1Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. diameter mm</td>
<td>400</td>
<td>630</td>
<td>1250</td>
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<tr>
<td>Length mm</td>
<td>400</td>
<td>600</td>
<td>800</td>
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<table>
<thead>
<tr>
<th>Linear axis</th>
<th>PV 315 1-1Y</th>
<th>PV 630 1-1Y</th>
<th>PV 1250 1-1Y</th>
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</thead>
<tbody>
<tr>
<td>X-axis travel</td>
<td>900</td>
<td>1500</td>
<td>2200</td>
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<tr>
<td>Z-axis travel mm</td>
<td>800</td>
<td>800</td>
<td>1000</td>
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<tr>
<td>Y-axis travel mm</td>
<td>0 - 200</td>
<td>+250/-110</td>
<td>+/- 300</td>
</tr>
<tr>
<td>Feed force x,y,z kN</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>X-axis speed m/min</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Z-axis speed m/min</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Y-axis speed m/min</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Main spindle</th>
<th>PV 315 1-1Y</th>
<th>PV 630 1-1Y</th>
<th>PV 1250 1-1Y</th>
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</thead>
<tbody>
<tr>
<td>Spindle speed rpm</td>
<td>4000</td>
<td>1500</td>
<td>700</td>
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<tr>
<td>Main spindle drive kW</td>
<td>31</td>
<td>39</td>
<td>104</td>
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<tr>
<td>C-axis torque Nm</td>
<td>425</td>
<td>1375</td>
<td>7440</td>
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<table>
<thead>
<tr>
<th>Multi-function head B-axis</th>
<th>PV 315 1-1Y</th>
<th>PV 630 1-1Y</th>
<th>PV 1250 1-1Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pivoting angle degrees</td>
<td>110</td>
<td>240</td>
<td>270</td>
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<tr>
<td>Skiving drive kW</td>
<td>29</td>
<td>29</td>
<td>29</td>
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<tr>
<td>Skiving spindle torque Nm</td>
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<td>141</td>
<td>141</td>
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<tr>
<td>max. module</td>
<td>6</td>
<td>8</td>
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<table>
<thead>
<tr>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hollow ring</td>
</tr>
<tr>
<td>Number of teeth</td>
</tr>
<tr>
<td>Module</td>
</tr>
<tr>
<td>Inner diameter (mm)</td>
</tr>
<tr>
<td>Width of tooth (mm)</td>
</tr>
<tr>
<td>Tool life per regrinding</td>
</tr>
<tr>
<td>Number of regrinding</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Two-stage planetary gear</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>Number of teeth</td>
</tr>
<tr>
<td>Module</td>
</tr>
<tr>
<td>Outer diameter (mm)</td>
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<tr>
<td>Width of tooth (mm)</td>
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<tr>
<td>Tool life per regrinding</td>
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</thead>
<tbody>
<tr>
<td>Number of teeth</td>
</tr>
<tr>
<td>Module</td>
</tr>
<tr>
<td>Inner tip circle diameter (mm)</td>
</tr>
<tr>
<td>Width of tooth (mm)</td>
</tr>
<tr>
<td>Tool life per regrinding</td>
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</table>
The tools and associated blade geometries are another important factor in Power Skiving. They are designed individually for each gear unit (module and number of teeth). Roughing tools, which are used for gear units with a module larger than 3 and which carry out approximately 80% of the machining, are equipped with standard reversible blades. Use of such blades makes a decisive contribution to reducing skiving tool wear.

Powder-metal coated cylindrical or tapered tools are used for the finishing process. At the end of tool life, these can be stripped, reground and then re-coated. PITTLER offers a complete tool service from a single source – from design of the tool to post-machining.

The tool magazine of the PV-series is the key to more flexibility during production of complex parts. With room for up to 20 tools it permits the efficient implementation of upstream and downstream processes such as turning or deburring, right through to complete machining.

In terms of cost saving, changing between the different tools has a major impact, since this goes easy on the high-quality skiving tool with high stock removal.

The PITTLER MultiTool increases the capacity of the tool magazine. With up to 6 turning tools on one adapter, there is more room for other tools. The PITTLER MultiTool reduces the tool change time to just 2 seconds.

The key to precision can often be found in a machine’s chucking concept. PITTLER works together with SWS Spannwerkzeuge GmbH from Schlüchtern on the development of chucking tools. As an association partner company, SWS works for the entire DVS TECHNOLOGY GROUP and develops complete solutions as well as standard and customized chucking devices “Made in Germany”.

An in-house manufacturing depth of almost 100% guarantees the SWS quality which lays claim to guaranteeing 100% reproducibility through a significantly longer service life thanks to larger useful width.

- Symmetrical profile
- Simple positioning and technology guiding
- High flexibility

- Significantly higher service life thanks to larger useful width
- Constant profile through regrinding
- Complicated profiles possible (e.g. protuberance)

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Thanks to the easy navigation of the skiving user interface, which can be used to control both gear cutting and measuring processes, PITTLER Skiving Centers can be operated without in-depth programming knowledge being necessary. Once the geometry and process data have been entered, the control software automatically calculates the program and starts machining.

To monitor quality, various measuring processes can be controlled and evaluated with the aid of the skiving user interface. Thus the two-ball dimension and the quality of the flank line can be evaluated. Corrections as well as specific corrections of the profile and flank line angle are possible.

The position of the tool can be adjusted in the menu item “Tool correction” in order to compensate any tool profile faults. For workpieces with large modules and high precision requirements, the user interface permits the control of up to three skiving tools per machining cycle, so that the right and left flank can be machined separately during the finishing process.

Every production plant has its own philosophy as far as achieving maximum efficiency is concerned. For this reason, PITTLER offers tailor-made automation solutions for individual companies. The engineers at PITTLER have a huge range of experience to draw on, which includes robot arm-supported manufacturing islands or pivoting grippers with connected conveyor belt integrated in the work chamber.

PITTLER can offer complete system solutions from a single source for the development of the machine technology and the design of suitable tools to the procurement and set-up of the automation system.

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**SKIVING USER INTERFACE FOR SIMPLE GEAR CUTTING.**

**CUSTOMISED AUTOMATION SOLUTIONS FOR MASS PRODUCTION.**

- **Your advantage**
  - Simple operation possible without in-depth programming knowledge
  - Profile faults on the tool are easy to compensate
  - Straightforward control and evaluation of integrated measuring processes
  - Specific correction of profile and flank possible

- **Your advantage**
  - Automation solutions tailor-made to your production requirements
  - Turnkey system solution from a single source
  - Loading and unloading in under 10 seconds
  - Integrated post-process measurement
PITTLER T&S offers the Power Skiving process in conjunction with complete machining. An integrated tool magazine allows this efficient gearing technology to be presented without compromise in a 5-axis machine alongside the processes turning, milling, drilling, grinding, thread cutting and measuring. The flexible use of technology allows machining with a maximum of 2 chucking processes, thus guaranteeing high precision of tolerances.

5+1 AXIS-SKIVING-CENTER

The machines of the PITTLER PV-series have six axes. These six axes result in five axes for Power Skiving due to the electronic coupling of the C1 and C3 axis. The electronic gear controls the cutting speed amongst other things.

The shaft angle can be set using the B-axis, which is also used to modify the flank line or the profile angle. The Z-axis regulates the feed movement. Axis offset and additional flank line modifications are defined using the X- and Y-axis.

Your advantage

- Shorter cycle time due to reduction of retooling, transport and holding times
- Increase in manufacturing quality by avoiding rechuck faults
- Minimum footprint required
- Lower investment and life cycle costs
- More flexible manufacturing and bottleneck planning
Mitglieder der DVS TECHNOLOGY GROUP
Members of the DVS TECHNOLOGY GROUP

DVS MACHINE TOOLS & AUTOMATION

BUDERUS Schleiftechnik GmbH | www.buderus-schleiftechnik.de
Innenrundschleifen – Außenrundschleifen – Gewinde schleifen – Hartdrehen
I.D. grinding – O.D. grinding – Thread grinding – Hard turning

TRPKEC WERKE Schleiftechnik GmbH | www.trpkec-werke.de
Planen-Schleifen – Doppel-Planen-Schleifen – Sonderbearbeitung
Face grinding – Double face grinding – Special machining

PITTLE T&S GmbH | www.pittler.de
Vertikal-Drehbearbeitungszentren & Pick-up-Systeme – Verzahnen in der Komplettbearbeitung
Vertical turning center & Pick-up systems – Gear cutting for complete machining

PRÄWEMA Antriebstechnik GmbH | www.praewema.de
Verzahnungshonen/-schleifen – Verzahnungsfräsen – Anspitz-/Hinterlegungsfräsen
Gear honing – Gear grinding – Hobbing/Fly-cutting – Chamfering

WMS Werkzeugmaschinenbau Sinsheim GmbH | www.wms-sinsheim.de
Service-Dienstleistungen – Generalsüberholungen – Reparatur von Baugruppen
Maintenance – Machine Retrofit – Repairs

WMZ Werkzeugmaschinenbau Ziegenhain GmbH | www.wmz-gmbh.de
Dreh- & Kombinationsbearbeitung wellenförmiger Bauteile – Motorspindeln
Turning & Combined machining of shafts – Motor spindles

DVS TOOLS & COMPONENTS

DVS TOOLING GmbH | www.dvs-tooling.de
Werkzeuflösungen und Technologiesupport für das PRÄWEMA Verzahnungshonen
Tool solutions and technology support for PRÄWEMA gear honing

NAXOS-DISKUS Schleifmittelwerke GmbH | www.naxos-diskus.de
Konventionelle Schleifwerkzeuge – CBN & Diamantwerkzeuge
Conventional grinding tools – CBN & Diamond tools

DVS PRODUCTION

DVS Production GmbH | www.dvs-production.de
DVS Technologien in der Serienfertigung für PKW-Komponenten
DVS Technologies in mass production for passenger car components

FRÖHLICH CNC Produktion GmbH | www.cnc-froehlich.de
DVS Technologien in der Serienfertigung für Nutzfahrzeug-Komponenten
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DVS Sales & Service in China

DVS Technology Europe GmbH | www.dvs-technology.com
DVS Sales & Service in South Europe

PITTLE T&S GmbH
Johannes-Gutenberg-Straße 1
63128 Dietzenbach
Germany
www.dvs-technology.com

Tel +49 (0) 6074 4873 - 0
Fax +49 (0) 6074 4873 - 294
Mail info@pittler.de
www.pittler.de