

PITTLER T&S

pSkive

Highest Quality for Internal and External Gears





PITTLER T&S

PITTLER develops and produces high-precision multifunctional lathes and skiving machines. They are optimized for soft and hard turning as well as drilling and milling rotationally symmetrical components with a diameter of up to four meters.

In the spirit of the company's founder Wilhelm von Pittler, the skiving technology was further developed into an efficient gear cutting technology, which has established itself in PITTLER's machine portfolio both in the context of complete machining as well as an individual technology.

PITTLER T&S offers the skiving process as a single process or in combination with complete machining. An integrated tool magazine makes it possible to use this efficient gear cutting technology alongside turning, milling, drilling, grinding, thread production, and measuring in a single machine without compromise. The flexible use of technology enables machining in maximum two clampings, thus guaranteeing high levels of accuracy. Coolant, oil, compressed air, or a combination thereof can be used for cooling and better chip flow.

A DVS TECHNOLOGY GROUP COMPANY

The DVS TECHNOLOGY GROUP is a group of experienced companies engaged in the machining technologies of turning, gear cutting, grinding and honing. The DVS TECHNOLOGY GROUP employs more than 1050 staff worldwide and is considered a leading system provider of machines, tools, and manufacturing solutions for the soft and hard-fine machining of components.

The DVS TECHNOLOGY GROUP includes the following divisions:

DVS Machine:

Manufacture and sale of high-precision machine tools and automation systems

DVS International Sales & Service:

Local DVS partners for sales and service in international markets.

DVS Services & Tools:

Customer-specific development, manufacturing, and sale of machine components, tools, and abrasives and related services.

FOCUS ON CORE TECHNOLOGIES



TURNING



MILLING



DRILLING



PITTLER SKIVING



GRINDING



MEASURING

pSkive

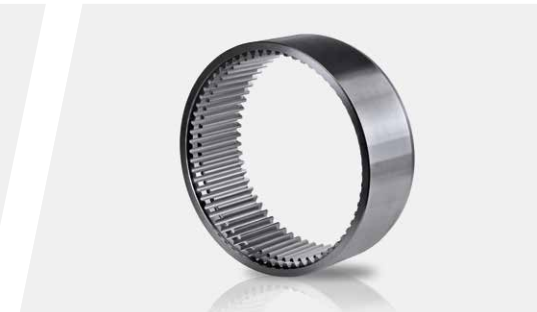
Highest Quality for Internal and External Gears

pSkive was specially developed and built in conjunction with the PITTLER SKIVING technology. With this machine, internal and external gears can be manufactured highly productively and in exceptional quality.

The pSkive in the PV315 version offers impressive flexibility from module 0.3 to module 5. Workpieces with a diameter

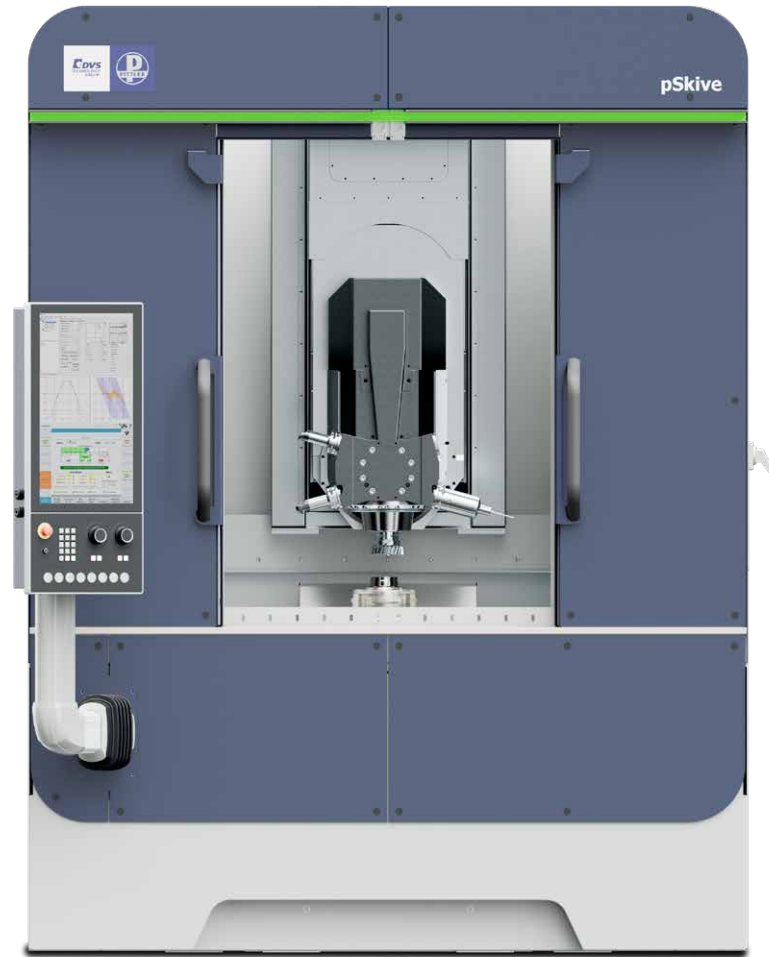
of up to \varnothing 315 mm can be machined. Thanks to the PITTLER SKIVING technology, internal and external gears can be produced with maximum accuracy and quality. pSkive is therefore the ideal solution for companies that want to produce high-quality geared parts in medium and large quantities.

PRECISION IN THE MICRO RANGE FROM SMALL TO MEDIUM





DUO head for
two gear cutting tools



MONO head for
individual gear cutting tools

pSkive with MONO head

The standard MONO-head variant of the pSkive offers many advantages when machining ring gears. With its driven workpiece spindle and up to four fixed mounts for turning tools and/or an in-process measuring probe, pSkive enables the efficient and precise machining of geared workpieces.

The MONO head with its “turret technology” (continuous head swivel range of $\pm 105^\circ$) has the advantage that workpieces are skived and deburred in a single clamping. Possible reference diameters and surfaces are finished with a turning tool. This yields not only highly complex gearing qualities, but also high overall component quality in terms of the shape and position tolerances.

In addition, the MONO head enables the optional use of an in-process probe. This allows measurement of the workpieces during the machining process. It ensures that specifications such as the spherical dimension and flank line of the gearing are performed efficiently. The probe also has a positive effect on the setup process after a tool change. The user interface developed by Pittler supports monitoring of the component quality.

Moreover, a sensor can also be implemented for finding the tooth gap for hard peeling. This enables precise and fully automatic control of the process when machining tempered workpieces.

The combination of all of these equipment options enables efficient processing and a high workpiece quality level. The familiar smart operation renders the pSkive skiving machine a versatile solution for rotationally symmetrical components with internal and external gears.



ADVANTAGES OF THE MONO HEAD

- Skiving and finishing turning
- Up to four fixed mounts
- Use of a measuring probe or sensor for hard peeling

pSkive with DUO head

The DUO head offers numerous advantages for ring gear production in the pSkive. With its innovative design and versatile features, the DUO head improves the efficiency and precision of the production process.

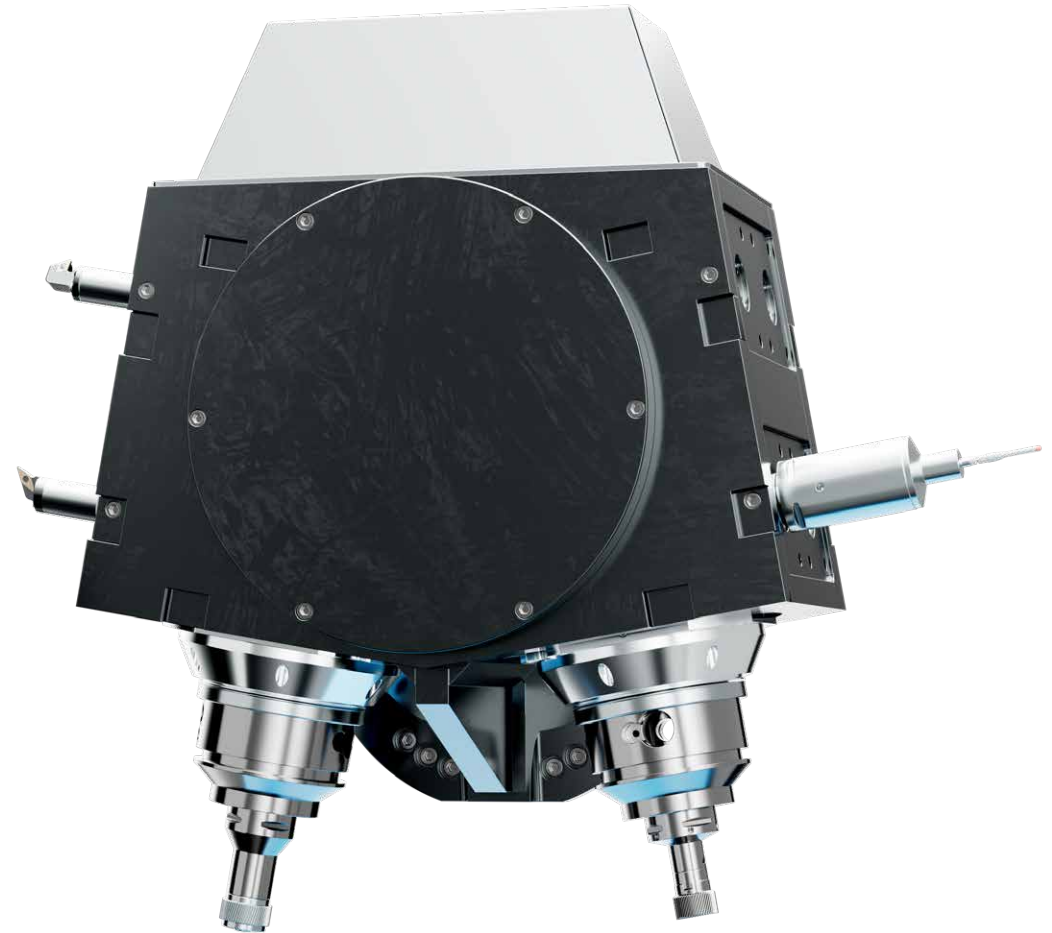
A major advantage of the DUO head are two driven workpiece spindles. This means that two skiving wheels can be mounted, which significantly increases productivity. For example, while a roughing tool (larger modules) is used on one spindle for efficient material removal, the finishing peeling wheel can be mounted on the second spindle in order to reduce component costs and protect the expensive finishing tool.

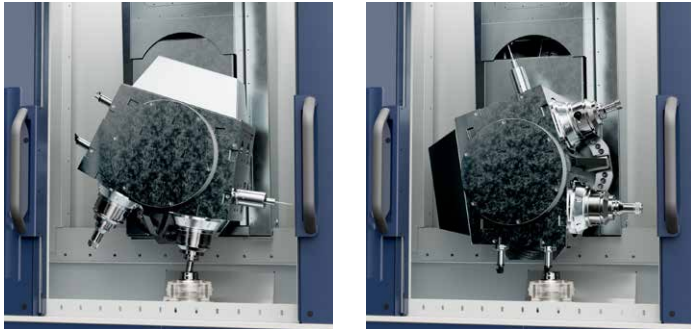
Another option for two peeling spindles is the use of sister tools or two different peeling wheels, which, for example, are required for a stepped planetary gear.

As with the pSkive with MONO head, up to four fixed mounts can be mounted on the DUO head. Further processing or component testing using a measuring probe or finding tooth gaps using a sensor are possible. This opens up a wide range of possible applications in the production of complex ring gears.

In summary, the DUO head enables efficient, precise, and versatile production in the pSkive.

With its ability to swivel to a second skiving wheel in just seconds and thus make the process even more flexible and time-saving, it is the skiving machine of the modern manufacturing industry.





ADVANTAGES OF THE DUO HEAD

Tool carrier

- Two powered tool spindles
- Up to four fixed mounts
- Integration of optional drilling spindle or grinding spindle

Possible equipment options

- Roughing and finishing peeling tools
- Separate peeling of the left and right flanks
- Two identical peeling tools (sister tools)
- Skiving in combination with drilling or grinding

pSkive DUO head in detail

Integration of grinding or drilling spindle

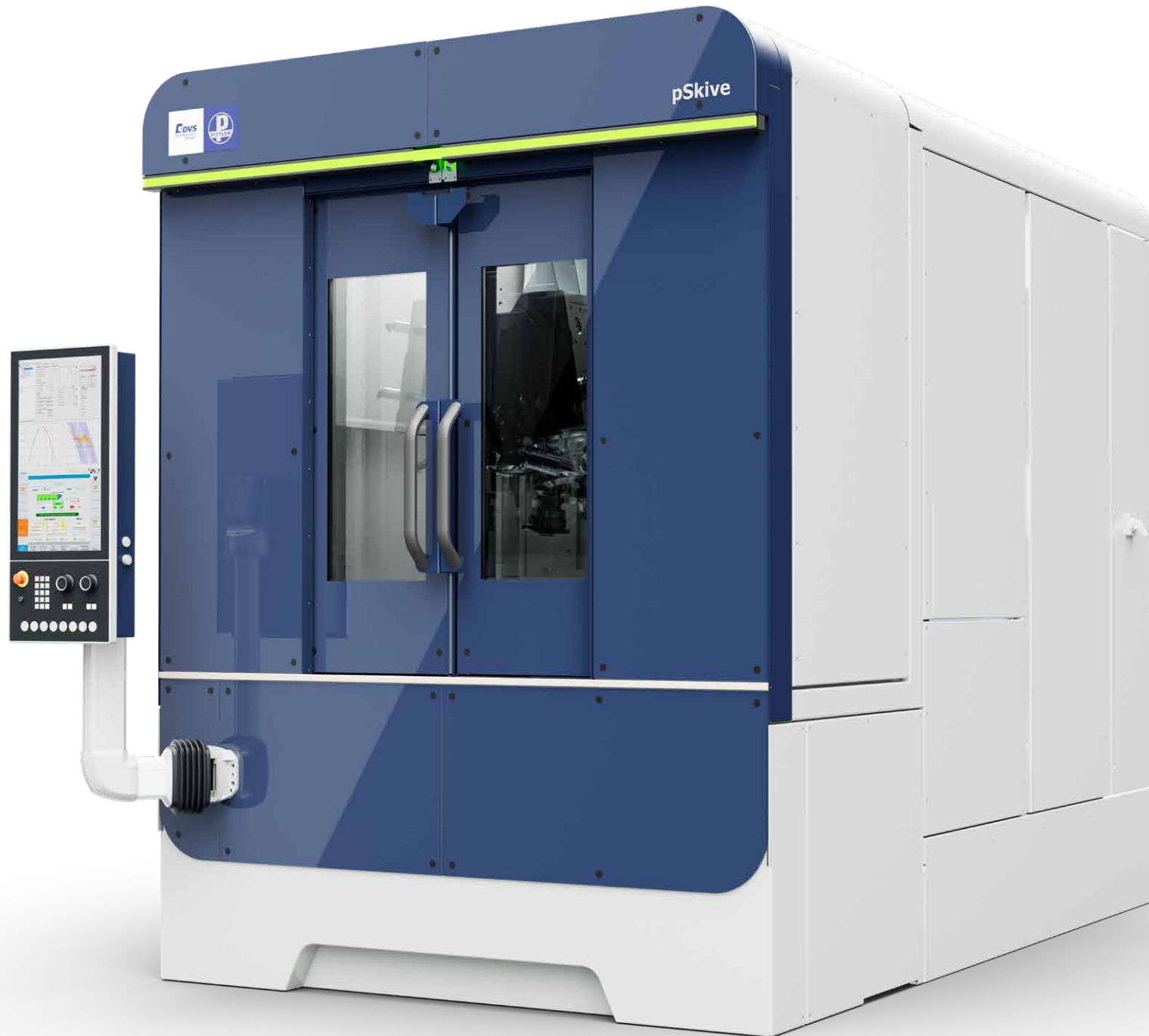


Up to four fixed mounts for turning tools and measuring probes

Two SKIVING spindles

Technical Data

	pSkive MONO head	pSkive DUO head		pSkive MONO head	pSkive DUO head
WORKPIECE			B-AXIS AS CLAMPED SPUR GEAR UNIT		
Max. diameter (mm)	315		Holding torque (Nm)	1200	
Max. circumferential diameter (mm)	400		Swivel speed max. (rpm)	40	
Module range (Mn)	0.3 – 5		Swivel range (o)	105	
TOOL			SKIVING SPINDLE	1x	2x
Max. diameter (mm)	150		Tool system	C5x	
Capto mount	C5x		Drive power (kW at 100% duty cycle)	36	
Swivel range (o)	+/- 105		Torque (Nm at 100% duty cycle)	120	
			Speed (rpm)	0 – 6000	
			ATTACHMENT TOOL CARRIER FOR UP TO FOUR TURNING TOOLS		
			Capto interface	C5	
			Manual	manuell	
			Other		Use of separate drilling/grinding spindle possible





Large image: cylindrical peeling tool

Small image: Roughing tool with V-inserts

PITTLER tool engineering

Intelligent, individual, and cost-saving

Another important factor for rolling formwork is the tools and their cutting geometry. These are designed individually for each gearing (module and number of teeth). Roughing tools that are used for gears with a module greater than 3 are equipped with standard indexable inserts. They have a significant impact in terms of reducing wear on the skiving tools.

The finishing process is carried out by means of cylindrically or conically shaped, powder-metallurgical coated tools or carbide tools. At the end of their service life, these can be stripped, sanded, and re-coated. PITTLER offers turnkey tooling services from a single source, from tool design to finishing.

CONICAL SHAPED SKIVING TOOL

- Symmetrical profile
- Easy positioning and technology guidance
- High flexibility

CYLINDRICALLY SHAPED SKIVING TOOL

- Significantly longer service life due to larger usable width
- Profile consistency through regrinding
- Complex profiles possible (e.g., protuberance)

Pittler Indexable Inserts

The Solution for High Demands



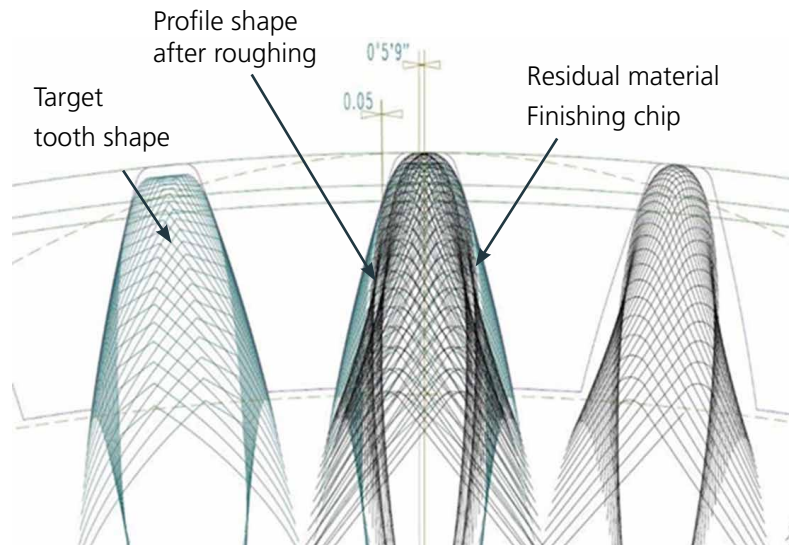
The use of PITTLER indexable inserts from module 4 opens up new possibilities in production. Here, the “large modules” are considered standard. At least one roughing tool and one finishing tool are used. But for special quality requirements, even two finishing tools with a single-flank cut can be used. However, previous approaches with V-shaped indexable inserts led to unfavorable results.

The V-shaped indexable inserts have suboptimal service lives in roughing machining due to their poor profile shape for skiving. The flank allowances are uneven and jagged flank profiles arise. These defects lead to a shorter service life of the expensive finishing tools. Furthermore, the full gap depth cannot be reached due to the limited insert height.

The answer to these challenges comes in the form of the PITTLER standard indexable insert. It features a near-evolute insert profile, which results in near-evolute workpiece profiles. A particularly uniform flank allowance is achieved, which in turn results in a longer service life of the finishing tools. These optimized inserts are ideal for roughing modules 4 to 10.

The innovation is that specific inserts have been developed for modules 4 – 6 and 6 – 10 respectively. This not only enables targeted adaptation to the different requirements of the modules, but also leads to faster cycle times compared to previous V plates. This is due, among other things, to the larger head radius. The cost structure is also optimized by these indexable inserts: The improved cycle times and downtime make the new solutions more attractive in terms of pricing.

Overall, the PITTLER standard indexable inserts are a groundbreaking innovation that skilfully overcomes the weak points of conventional V-shaped indexable inserts. They not only enable more efficient production, but also improved cost efficiency and product quality.



YOUR ADVANTAGE OVER SOLID TOOLS

- No regrinding process
- No large amount of capital tied up
- Does not require new setup with WKZ preset or profile correction
- No risk of transport damage
- No logistic organization
- Significantly less damage if a tooth breaks in the process

CHALLENGE

- At PITTLER, anything above module 4 is considered a 'large module'.
- Generally speaking, at least one roughing tool and one finishing tool are used.
- Two finishing tools with single-flank cut for special quality requirements
- Previously, V-shaped inserts were often used for rough machining

DISADVANTAGES OF V-SHAPED INSERTS

- Poor service life due to unfavorable profile shape for skiving
- Uneven flank dimensions and jagged flank profiles
- Shorter service life of expensive finishing tools
- In some cases the full gap depth cannot be achieved due to the limited insert height

SOLUTION: PITTLER STANDARD INDEXABLE INSERTS

- Near-involute indexable insert profile
 - Leads to near-involute workpiece profiles
 - Very even flank measurement
 - Cost savings due to longer service life of the finishing tools
- Roughing from modules 4 to 10
 - Two different indexable inserts for modules 4–6 and modules 6–10
- Faster cycle times than with V-plates
 - Due to larger head radius
- Lower cost due to better cycle times and downtime

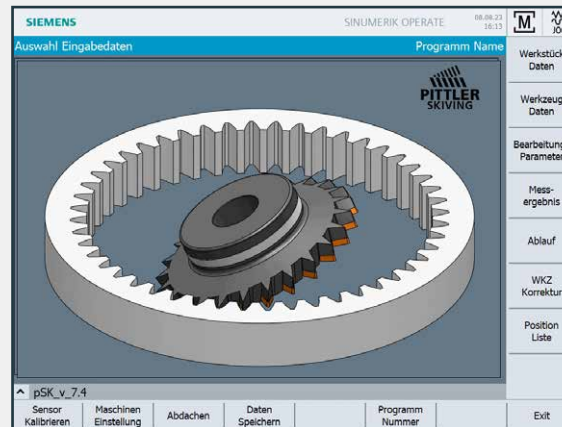


to adapt and optimize it perfectly for each component. With these versatile functions, the PITTLER skiving software offers an outstanding solution for high-quality and demanding gear cutting applications.

YOUR ADVANTAGE

- Workshop-oriented user interface for internal and external gears
- Integrated plausibility check of entered values
- Optional roughing-finishing strategy
- Automatic NC program generation, no gear expert required
- Pittler SkiveExpert with cutting strategy suggestion

Call up the PITTLER SKIVING software

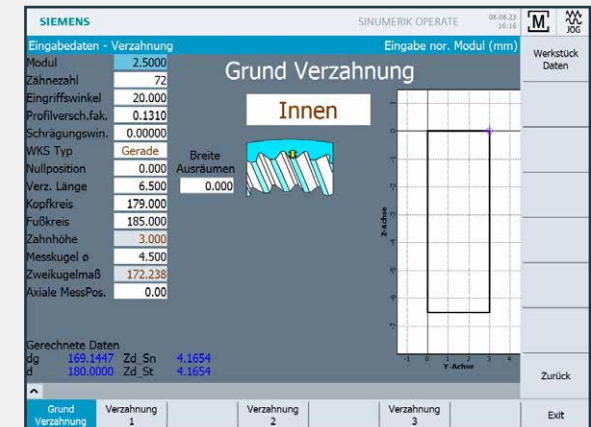


The screenshot displays the 'Übersicht - Werkzeugdaten 1 - 6' screen. It contains a table with columns for tool types (WKZ 1 to WKZ 6) and their parameters. The table is organized into sections for 'Ein' (Internal) and 'Aus' (External) gears.

	WKZ 1	WKZ 2	WKZ 3	WKZ 4	WKZ 5	WKZ 6
Wkz Name	MODUL075	M450 SR	M450 SL			
Durchmesser	66.626	135.540	147.000	0.000	0.000	150.500
Zähnezahl	84	26	29	0	0	0
Einlaufweg	5.000	10.000	10.000	0.000	0.000	0.000
Auslaufweg	1.500	4.000	4.000	0.000	0.000	0.000
Wkz Typ	Rechts	Rechts	Rechts	Rechts	Rechts	Links
Position	Hinten	Hinten	Hinten	Hinten	Hinten	Hinten
Technologie	Mitte	Mitte	Mitte	Mitte	Aussermitte	Mitte
Achskreuzwinkel						
Start	15.000	20.000	20.000	0.000	0.000	0.000
Ende	15.000	20.000	20.000	0.000	0.000	0.000
Winkel Kappa						
Start	28.000	0.000	23.200	0.000	0.000	0.000
Ende	28.000	0.000	23.200	0.000	0.000	0.000

Enter the geometry data of the tools

Enter the geometry data of the workpiece



The screenshot displays the 'Bearbeitungs Parameter' (Processing Parameters) screen. It contains a table with columns for processing steps (1 to 4) and their parameters, including 'Zustellung', 'Anz.ap', 'F mm/U', 'U/min', and 'm/min'.

Step	Zustellung	Anz.ap	F mm/U	U/min	U/min	m/min
1. Ja	0.555	1	0.500	530	2952	159
2. Ja	0.325	1	0.500	530	2952	159
3. Nein	0.000	0	0.000	0	0	0
4. Ja	0.125	1	0.000	0.400	530	2952

Enter the processing parameters

SkivingExpert

Bearbeitungs Parameter

Step	Zustellung	Anz.ap	F mm/U	U/min	U/min	m/min
1.	Ja	0.175	2	0.377	397	2215
2.	Ja	0.245	1	0.330	397	2215
3.	Ja	0.105	1	0.320	397	2215
4.	Ja	0.149	1	0.000	0.160	397

Werkzeugdaten
 Durchmesser: 66.626
 Achskreuzwinkel: 15.000
 Zahnzahl: 84

Auswahl Werkzeug
 Werkzeug 1
 WKZ - Werkstoff: PM
 Zugfestigkeit Werkstück: 1300 N/mm²

Zeit: 1.14 min
 Ist Tiefe: 0.850 mm
 Hz [WKS]: 0.850 mm

YOUR ADVANTAGE

- Ideal for skiving beginners
- Self-explanatory user interface
- With just five parameters for gearing:
 - Specification from the tool manufacturer
 - Workpiece-specific information
- Subsequent optimization of the cutting strategy suggestion is possible

Simple corrections

Eingabe - Werkzeugkorrektur Radiale Werkzeugzustellung (über Y-Achse)

Links: $f_{H\beta}$ 0.000 Y

Rechts: $f_{H\beta}$ 0.000 Y

Diagram parameters: L_{Ce} 0.000, C_{β} 0.000, L_{Ce} 0.000, C_{β} 0.000, L_{Ce} 0.000, C_{β} 0.000, L_{Ce} 0.000, C_{β} 0.000

19.000 C_e 0.000 Zwei - Flankig 0.000 C_e 19.000

Flankenlinie Soll. Verz. 1, Flankenlinie Korr. Verz. 1, Flankenlinie Soll. Verz. 2, Flankenlinie Korr. Verz. 2, Flankenlinie Soll. Verz. 3, Flankenlinie Korr. Verz. 3

Werkzeugkorrektur - Verzahnung

	1.	2.	3.
Mdk Soll	353.101	308.890	198.497
Mdk Ist	353.101	308.890	198.497
Mdk Abw.	0.000	0.000	0.000
Mdk Korrektur	0.085	-0.306	0.000

Istmaß Abweichung, Flankenlinie $f_{H\beta}$, Profiwinkel $f_{H\alpha}$, Mdk Korrektur, Meßtaster Korrektur

YOUR ADVANTAGE

- Simple operation possible without in-depth programming know-how
- Symmetrical/asymmetrical correction Flank line corrections
- Correction of diametrical two-ball measurement
- Targeted corrections of flank line angle such as end retracts possible
- Crowning corrections of flanks possible
- Preservation of dimensional deviations before a subsequent heat treatment

Operating software extensions

Measuring:

- In-process measurement of gearing
- Simple control and evaluation of integrated measurement processes
- Measuring of:
 - MDK, two-ball measure
 - Angle of the flank line or helix angle
- Automatic correction of measurement characteristics

SIEMENS SINUMERIK OPERATE 08.08.23 16:28

Ergebnisse - Verzahnung 1 Anzahl der Zähne Messen (Max 4)

mn:	0.7500	an:	35.0000	dg:	287.5224	x:	-0.6788	Anzahl	4	D-Nr	1
z:	468	β:	0.0000	d:	351.0000	b:	19.00	Offset Nr.	1		

Links Rechts

0.0000	0.0000	0.0000	0.0000	fHB	0.0000	0.0000	0.0000	0.0000			
5.073	5.077	5.081	5.073	Zd	233.318	233.299	233.309	233.317			

Pos.Oben 15.00 Mittelpunkt 0.00 Pos. Lücke 0.0420 R859 Messkreis 350.000

Pos.Unten 15.00 soll ist Abw. Tol - Tol + Ver.Ber. Win.Abw. Offset

Zahndicke: 4.996 5.073 0.077

Kugelmaß: 353.101 233.317 -0.180 -0.165 0.000 0.000

Sollwert fHB 0.000 0.001 0.001 0.000 0.000 0.000 0.001

Einstellung 1 Verzahnung 1 Korr MDK Ein / Aus Korr Flanke Ein / Aus Exit

SIEMENS SINUMERIK OPERATE 08.08.23 16:28

Auswahl Verzahnung 1 oder 2

Verzahnung 1 Verzahnung 2 Verzahnung 3 Messen Hinterlegung Exit

Alignment with sensor:

- Easier setup
- Reduction of setup time for skiving with multiple tools
- Subsequent corrections of the tooth positions possible



SIEMENS SINUMERIK OPERATE 08.08.23 16:30

Werkzeugeinstellen - Innenverzahnung

Werkzeug 1	Ein	✓	4.937
Werkzeug 2	Ein	✓	1.770
Werkzeug 3	Aus	⊗	0.000
Werkzeug 4	Aus	⊗	0.000
Werkzeug 5	Aus	⊗	0.000
Werkzeug 6	Aus	⊗	0.000

WKZ Messen ⊗

Werkzeug Messen Lücke Position Exit

ProAC Software

Profile Angle Correction



ProAC is a software program from PITTLER that was specifically developed to calculate the machine parameters to reduce profile angle errors when skiving (PITTLER SKIVING).

To access ProAC, the DVS Connect portal is used. This requires either a computer or a mobile device, such as a cell phone or tablet. In the future it will also be possible to call up ProAC directly on the machine tool. This is made possible by the DVS Edge through a separate IPC that is connected to the Internet.

A big advantage of direct installation is that ProAC directly accesses the machine's gearing and tool data. The operator only has to enter the measured error of the profile angle. This simplifies operation and reduces potential sources of error.

For a calculation with PITTLER ProAC, it does not matter whether cylindrical or conical tools are used. It is also irrelevant whether the profile angle error comes from tool production or is caused by the regrinding of the conical tools. ProAC can handle both variants and delivers reliable results.

Thanks to ProAC, companies can benefit from more precise profile angle calculation, resulting in improved quality of the workpieces produced. The software simplifies the process, saves time, and minimizes potential sources of error, which ultimately contributes to more efficient and economical production.

Function

ProAC is based on the concept of approximation through iterative calculation. Various variable parameters, such as the axis crossing angle (sigma angle) and the kappa angle, are varied according to a specific logic. The intersection points of the two profile lines are then compared with a zero degree profile angle error. In the ideal case, these three surfaces meet at one point, which theoretically results in a profile angle error of 0°.

Additionally, limit values are monitored to ensure that the tool does not collide with the workpiece if there is too much change in sigma or kappa.



GEMESSENE DATEN

Verwendeter ARW Σ [°]: Verwendeter Kappa κ [°]:

Auswertebereich Kopf (mm): Auswertebereich Fuß (mm):

fHa links [μm]: fHa rechts [μm]:

Flankenkorrektur: beide

KORREKTURPARAMETER

Achsenwinkel Σ [°]: Kappa κ [°]:

Erwarteter fHa links [μm]: Erwarteter fHa rechts [μm]:

Veränderung Auslaufweg [mm]:

MACHINING EXAMPLE

- Measurement result of the first component
- Quality profile angle error **fHa 7**

DIN 3961/62	Q	[.]	x	#63	#42	#22	#1	Zahn	#1	#22	#42	#63	x	[.]	Q	
I=6	I=8	6	0/20	8.2	7.1	8.2	8.0	9.4	Fa	4.0	2.6	4.9	5.5	4.4	0/20	5
=7	=5	5	0/16	5.3	5.3	5.1	5.1	5.5	fHa	4.3	2.8	3.5	3.9	3.6	0/16	5

- Measurement result of the second component after calculation with ProAC
- Quality profile angle error **fHa 4**

DIN 3961/62	Q	[.]	x	#63	#42	#22	#1	Zahn	#1	#22	#42	#63	x	[.]	Q	
I=7	I=7	5	0/14	5.1	4.7	5.0	5.7	5.1	Fa	4.5	4.0	3.5	3.9	4.0	0/14	4
=5	=5	5	0/11	4.9	4.3	4.9	5.3	5.0	fHa	4.2	3.7	2.3	4.1	3.6	0/11	5

PITTLER SKIVING and PITTLER ProAC reduce waiting times, avoid unnecessary calculations, and good parts can be used from the second workpiece and tools despite fHa errors.

YOUR ADVANTAGE

- Easy to use (through the use of actual values)
- No complex calculations by operators necessary
- No more trial and error, operator errors are reduced
- Visual display for the operator or message if no improvement in the profile angle error is possible
- Reduction in the number of setup parts
- Reduces setup time
- Tool errors are compensated for and service life can be increased
- Both conical and cylindrical tools can be compensated
- Increasing machine availability through reduction in waiting time
- Can be used flexibly, i.e., machine-independently

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Members of the DVS TECHNOLOGY GROUP

DVS MACHINE



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DVS PRODUCTION



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