Special tools for customer applications
Your competent partner in the area of metal chip removal

At our two company locations in Nuremberg und Zorbau (Germany) we design and manufacture precision tooling for highest quality demands on state-of-the-art CNC-turning / milling / grinding and EDM machines.

All activities in our enterprise are based on our corporate quality and environmental policy and aim to contribute to a permanent increase in our customers productivity while observing all applicable legal and governmental regulations.

Additionally we strive to achieve a leading position in our sector with our products and services and to continuously improve this position by means of a high level of quality as well as an adequate environmental policy.

All processes in our enterprise are mainly based on our customers demands and are always supervised by the management team and adapted to the changing general conditions by continuous improvement processes (CIP). In order to achieve our targets we maintain a certificated quality and environmental system according to DIN EN ISO 9001 : 2008 and DIN EN ISO 14001 : 2004.

The perfect composition of highly qualified staff and most modern production methods constitutes the basis for fully developed products on a high quality standard.

The easy handling and the adjustability of our milling cutters are the basis for savings in the area of tool presetting as well as for achieving tight tolerances.

Our standard program constitutes the basis for a huge number of innovative special tooling solutions which get used and appreciated at our customers globally. In many cases it is the customers specific solution which opens up the full potential of our tooling systems and thus contributes to savings and increases in productivity.

We would be happy to advise you in selecting the right tooling solution for your specific application and to stay on your side as your competent partner from the start of process planning until the effective use of our tools.

Challenge us with your requirements!

precise | flexible innovative
We always appreciate your confidence in us.
A reliable partner

HOLLFELDER-GÜHRING CUTTING TOOLS has achieved a leading position as a reliable partner in the metal cutting industry. Innovative tooling solutions in standard tools as well as in tools made to customers specifications constitute the basis for cost optimised production.

Competence

Individual solutions for complex machining problems, tailor-made to the individual requirements are part of the self-image of our technicians and engineers. With a high qualification and an innovative thinking combined with a lot of experience, we design and manufacture in close contact with our customers tooling systems of highest precision for the μm-accurate machining of complex contours.

Profitability

HOLLFELDER-GÜHRING CUTTING TOOLS offers profitable solutions. The easy adjustment of our tools reduces non-productive times. We achieve a reduction in machining times due to our intelligent combined tools, the high number of effective teeth and the selection of the optimal cutting grade. The advantages are the utmost flexibility, productivity and certainty in process.

Our service

Depending on the technical requirements we analyse the machining processes and suggest tooling solutions which satisfy the high demands of our customers. With the proven tooling solutions of HOLLFELDER-GÜHRING CUTTING TOOLS our customers use highly precise and reliable systems which have achieved an excellent reputation worldwide.

Our service spectrum includes among others:
• In-house machining tests
• Application training also on-site at the customer’s premises
• Complete CAD-layouts according to customer specifications
• Technical support

Our targets...

…are to steadily increase the efficiency of our precision tools as well as their operational possibilities. Thus our customers are leading obtain a competitive advantage due to the more efficient production with a high certainty in process.

For further information
visit our website
www.hollfelder-guehring.de
Customer specific tools for machining the workpieces mentioned below:

6 Adjustment systems
Adjustment systems for our tools

10 Cylinder head
Pre- and finish-machining, fire face, bearing passage, bearing width, axial grooving, spring seat, spark plug bore, relief bore, induction port

24 Cylinder crankcase
Pre- and finish-machining, bearing width, sealing surface, ventilation bore, connecting bore, balance shaft bore, bearing cap, crankshaft bore, cylinder bore, cylinder liner, clearance cut for the honing tool, crankshaft bearing passage

46 Gearbox components
Valve body, gearbox case, pre-machining, shoulder machining, connecting shank, bearing seats, valve plate

56 Electric motor
Stator bore
Contents

60  **Pumps**
    Oil pump, injection pump, stainless steel pump

74  **Further components for automotive industry**
    Starter housing, camshaft, crankshaft, frame, gearshift fork, axle carrier,
    steering housing, drive flange, balance shaft housing, brake caliper,
    control housing, gearbox case, balance shaft, connecting rod

92  **Components of general engineering**
    Power tools, hydraulic industry, wind power industry,
    end machining, compressor construction industry

108 **Turbocharger housing**
    Pre- and finish-machining, V-band

118 **Aviation technology**
    Fuel manifold, aircraft components

122 **Turning**
    Camshaft regulator, case, profil shaft, bearing bracket, shaft

128 **Enquiry forms**
The adjustment systems in the tools constitute the basis for highly precise production results in the most different materials. They are the basis for innovative tooling designs which contribute enormously to the productivity of our customers. The application is simple and saves time.

- Eccentric pin for µm-accurate adjustment
- Many design options thanks to open construction
- Design of the clamping system doesn’t require any support on the side of the pocket seat
- Triangular machining is possible
- Insert can be adjusted in 2 directions
Adjustment systems

Radial screw adjustment and adjustment with tapered screw

- Radial screw adjustment for µm-accurate diameter adjustment
- Large range of adjustment → up to 2 mm in diameter
- Easy handling thanks to robust design

Large chip flute

Adjustable up to 2 mm

Adjustment element (pushing screw)

Set screw

Thrust transmitting piece

Central position of the insert

- µm-accurate diameter adjustment with tapered screw
- Adjustment possible from the front and from the top
- Can be flexibly combined and used

Adjustment element (tapered screw / torx or hexagon socket)

Ø µm-accurate adjustable

Adjustment from the front

Adjustment from the top
The micro-adjustment can be considered as the logical next step in the development of the tapered screw adjustment from the front. A built-in adjustment cartridge in the holder enables the user to achieve an extremely precise adjustment of the machining measures.

- Adjustment element can be integrated even for small bore diameters
- Advantageous adjustment relation 1 revolution 0.02 mm in Ø
- µm-accurate adjustment directly in the machining center
- Low machine downtime
Adjustment systems

SMART SETTING MOTION TOOLS adjustment

Smart Setting Motion Tools

Pre-setting and re-adjusting of inserts within seconds

- Individual fine adjustment of all finishing inserts.
  One graduation line equals 0.002 mm in diameter
- Diameter adjustment in both directions, plus and minus
- No special equipment required for pre-setting (i.e. magnetic V-gauges)
- Cartridges available with eccentric adjustment, also available with standard ISO insert
- Option: retraction of the inserts via drawbar
  → no workpiece adjustment required
- Option: mechanical operation, using either compressed air or machine coolant
- Time saving of more than 90% per setting cycle

Central adjustment

- Simple pre-setting without special equipment
- Cartridges available with eccentric adjustment, also available with standard ISO insert
- Diameter adjustment in both directions, plus and minus via central adjustment screw
- Automatic readjustment if required. One rotation equals 0.03 mm on radius
- Retracting of the finishing cartridge by means of compressed air
- Expanding of the finishing cartridge inside the honing undercut

Different adjustment screws
Cylinder head
**Requirements**
Reduction of cycle times

**Solution**
HPC rough milling cutter Ø 163 / L = 232 mm / HSK80-A / Teeth = 18

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) AlSi10Mg(Cu) heat-treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD 30</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 3,000</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.14</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm -6</td>
</tr>
</tbody>
</table>

**Result**
50% faster than competitors
Longer tool life
Lower power consumption

**Customer benefits**
Reduced tooling costs per component
Almost chip-free components, lower cleaning costs
Increased productivity and energy efficiency
Cylinder head
Finish-machining

HPC milling cutter with closed chip flutes / Ø 250 reduced weight

Teeth = 21 + 3 mixture of inserts / Use of wiper inserts

Requirements
Chip-free components

Solution
HPC milling cutter with closed chip flutes

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) AlSi10Mg(Cu) heat-treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD 30</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 3,500</td>
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<tr>
<td>Feed rate per tooth</td>
<td>mm 0.12</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.5</td>
</tr>
</tbody>
</table>

Result
50% faster than competitors
Longer tool life
Higher surface finish quality

Customer benefits
Reduced tooling costs per component
Almost chip-free components, lower cleaning costs
Increased productivity and energy efficiency
Requirements
Combustion chamber milling, required cutter diameter 315 mm
R<sub>6.3</sub> - R<sub>7</sub> - Wt<sub>3</sub> - PMr → 65 %
Critical capability index Cmk 2.74
Maximum permissible tool diameter 250 mm

Solution
HPC bar cutter Ø315 with HSK-A100 / Teeth = 4 + 4 / Teeth<sub>eff.</sub> = 8

Cutting data
Material (DIN) □ GD-AlSi9Cu3
Cutting grade PCD
Cutting speed m/min 2,177
Feed rate per tooth mm 0.13
Cutting depth mm 0.28

Result
Uniform surface
R<sub>z1.4</sub> - R<sub>7.167</sub> - Wt1,28 - PMr 100 %

Customer benefits
High-precision machining can be carried out on a standard machining center
(no special machine required)
Almost chip-free components, lower cleaning costs
**Requirements**

Clearance milling, face run-out and milling cutters are adjustable towards each other

**Solution**

Gang milling cutter / Teeth\textsubscript{eff.} = 2

**Cutting data**

<table>
<thead>
<tr>
<th>Material (DIN)</th>
<th>G-AlSi9Cu</th>
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<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 220</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.07</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.7 - 0.8</td>
</tr>
</tbody>
</table>

**Result**

- PCD inserts regrindable and renewable
- Narrow tolerances of bearing spacings achievable
- Minimal effort for insert change

**Customer benefits**

- Reduced tooling costs per component
- Low non-productive times
Cylinder head
Bearing width

**Gang milling cutter / Teeth = 2 x 4**

**Requirements**
Gang milling cutter for milling the bearing width with chamfering
Bearing width and chamfer sizes µm-accurate adjustable

**Solution**
Gang milling cutter / Teeth = 2 x 4

**Cutting data**

<table>
<thead>
<tr>
<th>Material (DIN)</th>
<th>GKAISi7Mg</th>
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<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
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<tr>
<td>Cutting speed</td>
<td>m/min 1,200</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.1</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 2.5</td>
</tr>
</tbody>
</table>

**Result**
PCD inserts regrindable and renewable
Narrow tolerances of bearing spacings achievable
Minimal effort for insert change
Reduced machining time thanks to combination tool

**Customer benefits**
Reduced tooling costs per component
Low non-productive times
Cylinder head
Axial grooving

Reaming tool / Teeth = 1

Requirements
Fine machining with PCD guide pads

Solution
Reaming tool / Teeth = 1

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) Al</th>
</tr>
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<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 800</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.1</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.3</td>
</tr>
</tbody>
</table>

Result
Narrow form and position tolerances are maintained
Surface finish quality $R_a 0.5$

Customer benefits
Higher process reliability
Easy adjustment of the inserts
**Requirements**
Complete machining of the hole including the spring support

**Solution**
Drilling and countersinking tool / Teeth = 2
Profile inserts adjustable and separately replaceable

**Cutting data**
- Material: (DIN) AlSi10Mg(Cu)
- Cutting grade: PCD 10
- Cutting speed: m/min 590
- Feed rate per tooth: mm 0.075

**Result**
- Tool life 85,000 drilled holes
- SC-drill regrindable several times

**Customer benefits**
Lower tool costs per part compared to brazed tools
**Requirements**
Machining of the complete workpiece contour with one tool

**Solution**
Form countersinking tool with PCD inserts and integrated SC-drill / Teeth=2

**Cutting data**
- **Material** (DIN): AlSi9Cu
- **Cutting grade**: PCD
- **Cutting speed**: m/min 850
- **Feed rate per tooth**: mm 0.15
- **Cutting depth**: mm 4.3

**Result**
High tool life (>70,000 drilled holes) with simultaneous compliance of tolerances and surface requirements

**Customer benefits**
- Short processing time
- Lower costs per workpiece
Cylinder head
Spring seat

Multi-step fine boring tool / Teeth = 2 per Ø

Requirements
Drilling and fine boring of the spring seat
Drill length adjustable, fine boring diameters adjustable

Solution
Multi-step fine boring tool / Teeth = 2 per Ø

Cutting data
Material (DIN) ■ GG25
Cutting grade carbide coated
Cutting speed m/min (Ø 11) 88 / (Ø 33.9) 258
Feed rate per tooth mm 0.07
Cutting depth mm -5

Result
SC-drill regrindable several times
Inserts adjustable and separately replaceable

Customer benefits
Reduced tooling costs per component compared to solid carbide tools
Requirements
Pre-machining, form inserts for special profile
All inserts adjustable

Solution
Multi-step fine boring tool / Teeth_{eff.} = 1

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GG-Cr</th>
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</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed m/min</td>
<td>220</td>
</tr>
<tr>
<td>Feed rate per tooth mm</td>
<td>0.07</td>
</tr>
<tr>
<td>Cutting depth mm</td>
<td>0.2-0.8</td>
</tr>
</tbody>
</table>

Result
Inserts adjustable and separately replaceable

Customer benefits
Reduced tooling costs per component compared to solid carbide tools
Cylinder head
Broaching of relief groove

**Broaching tool / Teeth = 1**

Requirements
Reduction of tool costs and machining time
Elimination of expensive special milling cutters

Solution
Broaching tool / Teeth = 1

Cutting data
- Material (DIN) AlSi10Mg(Cu)
- Cutting grade PCD
- Cutting speed m/min 25
- Cutting depth mm 0.5 per stroke

Result
- Long tool life thanks to constant cut
- Low tooling costs
- Significant reduction in machining time

Customer benefits
- Lower machine investment - no expensive milling spindle (high-speed)
- Reduced tooling costs per component
Requirements
Complete machining of the in-and outlet ducts

Solution
Induction port milling tool / Teeth = 2
PCD inserts adjustable and replaceable

Cutting data
Material (DIN) AISI10
Cutting grade PCD 10
Cutting speed m/min 1.357
Feed rate per tooth mm 0.35
Cutting depth mm 3 forward and backward

Result
High feed rates
Consistent surface finish

Customer benefits
Lower tool costs thanks to interchangeable inserts
Cylinder crankcase
Cylinder crankcase
Pre-machining

HPC rough milling cutter / Teeth = 15 / up to 8 mm cutting depth

Requirements
Increase tool life
Minimization of edge breakouts on the component

Solution
HPC rough milling cutter / Teeth = 15

Cutting data
Material (DIN) AlSi17Cu4 T5/T6
Cutting grade PCD 30
Cutting speed m/min 685
Feed rate per tooth mm 0.14
Cutting depth mm ~1.5

Result
Tool life improvement by factor 4 to 5
Lower power consumption
No edge breakouts on the component

Customer benefits
Reduced tooling costs per component
Almost chip-free components, lower cleaning costs
Increased productivity and energy efficiency
**Requirements**

Milling of the bearing width

Face run-out and milling cutters adjustable to each other

**Solution**

Gang milling cutter / Teeth = 5 per milling cutter

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GD-AlSi9</th>
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<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD/K10</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 500</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.07</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm -5</td>
</tr>
</tbody>
</table>

**Result**

Quick and easy changing of the inserts

Excellent surface finish

PCD inserts usable on both sides

**Customer benefits**

Reduced non-productive times

Half of the costs thanks to double-used PCD inserts
**Requirements**

Milling of the sealing surface, Aluminium crankcase

All inserts adjustable

**Solution**

Face milling cutter / Teeth = 52

Cartridge solution

**Cutting data**

<table>
<thead>
<tr>
<th>Material (DIN)</th>
<th>GD-AlSi9</th>
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</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm</td>
</tr>
</tbody>
</table>

**Result**

Outstanding tool life

Easy adjustment of the inserts

**Customer benefits**

Low costs per component

Reduced non-productive times
### Requirements
Milling the bearing clearances for the crankshaft

### Solution
Milling cutter with vibration damper / Teeth = 16 / Teeth\(_{\text{eff.}} = 8\)

### Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN)</th>
<th>AlSi9Cu3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
<td></td>
</tr>
<tr>
<td>Cutting speed</td>
<td>\text{m/min}</td>
<td>516</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>\text{mm}</td>
<td>0.08</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>\text{mm}</td>
<td>1.5 - 8</td>
</tr>
</tbody>
</table>

### Result
Absolutely vibration-free and high quality surface finish

### Customer benefits
High tool life of PCD inserts thanks to smooth cutting performance
Cylinder crankcase
Milling thrust bearing seat

Milling cutter with integrated vibration damper / Teeth = 16 (8 + 8)

Requirements
Maximum number of cutting edges, vibration damped for high surface quality

Solution
Milling cutter / Teeth = 16 (8 + 8)

Cutting data
<table>
<thead>
<tr>
<th>Material (DIN)</th>
<th>AlSi12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
</tr>
</tbody>
</table>

Result
Stable milling operation, surfaces free of vibrations

Customer benefits
Cycle time reduction thanks to high number of cutting edges
Excellent surface finish
**Requirements**
Milling a slot in the bearing diameter
Extreme protrusion length

**Solution**
Milling cutter with vibration damper / Teeth_{eff.} = 3

**Cutting data**
- Material: (DIN) GG25
- Cutting grade: carbide coated
- Cutting speed: m/min 345
- Feed rate per tooth: mm 0.03
- Cutting depth: mm 3.5

**Result**
Smooth cutting performance and good surface quality thanks to the use of a vibration damper

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**Customer benefits**
High quality components
Cylinder crankcase
Ventilation bore

Drilling and fine boring tool / Teeth (drilling) = Teeth_{eff} = 1 / (counterboring) = 2

Requirements
Pilot tool with guide pads (drilling into solid - 1. web)
Finish tool with guide pads (drilling into solid)

Solution
Drilling and fine boring tool / Teeth (drilling) = Teeth_{eff} = 1 / (counterboring) = 2

Cutting data
- Material (DIN) ▪ GK-AlSi17Cu4Mg
- Cutting grade K10/PCD
- Cutting speed m/min 320
- Feed rate per tooth mm 0.07
- Cutting depth mm into solid/0.5

Result
Longer tool life

Customer benefits
Process reliable production processes
Drilling and fine boring tool / Teeth = 2 + 2 + 1

Requirements
Combination tool with solid carbide drill for boring and adjustable inserts for fine boring and chamfering

Solution
Drilling and fine boring tool / Teeth = 2 + 2 + 1

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) Al</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td></td>
</tr>
<tr>
<td>Drilling</td>
<td>m/min</td>
</tr>
<tr>
<td>193</td>
<td></td>
</tr>
<tr>
<td>Fine boring</td>
<td></td>
</tr>
<tr>
<td>470</td>
<td></td>
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<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
</tr>
<tr>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm</td>
</tr>
<tr>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>into solid</td>
<td></td>
</tr>
</tbody>
</table>

Result
Conventional solid carbide drill, regrindable several times
Insert diameter µm-accurate adjustable

Customer benefits
Cost-efficient solution
Cylinder crankcase

Balance shaft bore

Line boring with cartridges and PCD-equipped pilot

Heavy metal holder with carbide guide pads for stabilisation

Requirements
Semi-finish machining with counter bearing in the component
All inserts adjustable

Solution
Line boring with cartridges and PCD-equipped pilot
Heavy metal holder with carbide guide pads for stabilisation

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) AlSi9Cu3</th>
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<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 280</td>
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<tr>
<td>Feed rate per tooth</td>
<td>mm 0.12</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.5</td>
</tr>
</tbody>
</table>

Result
High concentricity of bearing diameters
Simple tool handling

Customer benefits
High process reliability
**Requirements**
Form milling cutter for machining bearing caps

**Solution**
Form milling cutter / Teeth = 2 x 6  
Transition of the insert profile adjustable

**Cutting data**
- **Material** (DIN) GGG40
- **Cutting grade** carbide coated
- **Cutting speed** m/min 240
- **Feed rate per tooth** mm 0.1
- **Cutting depth** mm 1

**Result**
Low cutting forces thanks to cutting division

**Customer benefits**
Cost-effective interchangeable inserts solution
**Operation 1: counterboring tool / Teeth = 2**

- Diameter: Ø 52.5
- Teeth: 2
- Length: 215

**Operation 2: fine boring tool / Teeth = 1**

- Diameter: Ø 52.7
- Teeth: 1
- Length: 105

**Requirements**
- Operation 1: pre-machining from 2 sides
- Operation 2: pilot bore

**Solution**
- Operation 1: counterboring tool / Teeth = 2
- Operation 2: fine boring tool / Teeth = 1

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>Operation 1</th>
<th>Operation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DIN) GG</td>
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<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
<td></td>
</tr>
<tr>
<td>Cutting speed</td>
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<td>150</td>
<td>135</td>
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<tr>
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<td>mm</td>
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</tr>
<tr>
<td></td>
<td>2.5</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Result**
- Simple tool handling thanks to eccentric pin adjustment
- Guide pads easily replaceable

**Customer benefits**
- Reduced non-productive times
- High quality components
Operation 3: fine boring tool / Teeth = 1 + 1

**Requirements**
Operation 3: finish-machining

**Solution**
Operation 3: fine boring tool / Teeth = 1 + 1

**Cutting data**
- Material: (DIN) GG
- Cutting grade: carbide coated
- Cutting speed: m/min 238
- Feed rate per tooth: mm 0.1
- Cutting depth: mm 0.1

**Result**
- Simple tool handling thanks to eccentric pin adjustment
- Guide pads easily replaceable

**Customer benefits**
- Reduced non-productive times
- High quality components
**Cylinder crankcase**

**Cylinder bore**

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**Boring tool with integrated vibration damper, adjustable cartridges and ISO indexable inserts / Teeth = 5**

KV400 KKH
axially adjustable

---

**Requirements**

Roughing operation
Ø 74±0.01

**Solution**

Boring tool with adjustable cartridges and ISO indexable inserts / Teeth = 5

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GG25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 150</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.2</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm Ø1 - 1.5</td>
</tr>
</tbody>
</table>

**Result**

Very good tool life
Stable machining process

---

**Customer benefits**

Low costs per component
Requirements
Roughing operation
Ø 72.5±0.2  Rz 100

Solution
GA 200 Vario / Teeth = 2

Cutting data
Material (DIN) GG
Cutting grade CBN
Cutting speed m/min 649
Feed rate per tooth mm 0.2
Cutting depth mm Ø1.5 - 2

Result
Increased tool life
Simple tool handling

Customer benefit
Low cost per component
Requirements
Circular milling a clearance cut for the honing tool into the cylinder bore
Mixed machining Aluminium and Cast Iron

Solution
Circular milling cutter with fixed insert seat
Double positive cutting geometry

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>AISI9 / GG25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD / PROTON coated carbide</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 242</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.18</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 6-7</td>
</tr>
</tbody>
</table>

Result
Short machining time with high cutting depth

Customer benefits
Solid solution → high feeds possible
Inserts can be changed individually
→ lower costs per component
Requirements
Simple tool handling

Solution
Automatically adjustable tool / Teeth = 1
SMART SETTING MOTION TOOLS concept

Cutting data
- Material (DIN) GG25
- Cutting grade CBN
- Cutting speed m/min 750
- Feed rate per tooth mm 0.28
- Cutting depth mm 0.3

Result
Fully automatic diameter adjustment

Customer benefits
- Increase in tool life quantity
- Very easy handling and very precise adjustment
**Requirements**
Reduction of processing costs

**Solution**
Automatically adjustable tool / Teeth = 3 + 2
SMART SETTING MOTION TOOLS concept
Control of the drawbar via compressed air

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>CBN</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 700</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.18</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.3</td>
</tr>
</tbody>
</table>

**Result**
Semi-finish and finishing machining in one tool
No retraction marks thanks to retractable inserts

**Customer benefits**
High process reliability
Simple tool handling
**Line boring bar / Teeth = 5 + 5 / Teeth\textsubscript{eff.} = 1 + 1**

**SMART SETTING MOTION TOOLS concept**

---

### Requirements
- Reduced non-productive time and cycle time
- Defined surface R\textsubscript{a} 12 - 20

### Solution
- Line boring bar / Teeth = 5 + 5 / Teeth\textsubscript{eff.} = 1 + 1
- SMART SETTING MOTION TOOLS concept

### Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GG25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>solid carbide</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 185</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.27 / 0.2</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.5</td>
</tr>
</tbody>
</table>

### Result
- Non-productive times for re-adjusting reduced from 20 minutes to 2 minutes
- Simple handling

### Customer benefits
- High process reliability
- Dramatic reduction of non-productive time
Cylinder crankcase

Crankshaft bearing passage

Bearing position 2

$|l| = 0.002 \text{ mm in } \varnothing$

Finish-machining

Semi-finish-machining

Machining direction
Gearbox components
Gearbox components
Valve body

**HPC gang milling cutter Ø 380 mm / Teeth = 2 x 33**

**Adjustable distance between milling cutters (Dimension 280 mm)**

---

**Requirements**
- Machining of the sealing surface
- Chip free components
- Simultaneous machining of two components

**Solution**
- HPC gang milling cutter Ø 380 mm / Teeth = 2 x 33
- Adjustable distance between milling cutters (Dimension 280 mm)

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) AlSi7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed m/min</td>
<td>780</td>
</tr>
<tr>
<td>Feed rate per tooth mm</td>
<td>0.07</td>
</tr>
<tr>
<td>Cutting depth mm</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Result**
- Excellent surface finish
- Very good tool life

---

**Customer benefits**
- Almost chip-free components, lower cleaning costs
- Reduced tooling costs per component

---
**Gearbox case**

**Pre-machining**

**Stepped countersinking tool Ø206 mm + Ø209 mm + Ø285 mm / Teeth = 2 + 2 + 2**

**Basic tool body in steel and aluminium with cartridges**

---

**Requirements**
Minimization of tool weight and tool dimensions

**Solution**
Stepped countersinking tool / Teeth = 2 + 2
Basic tool body in steel and aluminium with cartridges

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN)</th>
<th>AlADC10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
<td></td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
<td>1,200</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**Result**
Reduced tool weight

---

**Customer benefits**

Slim design saves space within the tool magazine of the machine
Low costs thanks to standard cartridges and ISO inserts
**Gearbox case**

**Pre-machining**

Stepped countersinking tool Ø 219 mm + Ø 220 mm / Teeth = 2 + 4

Basic tool body in steel and aluminium with cartridges

**Requirements**
Minimization of tool weight and tool dimensions

**Solution**
Stepped countersinking tool / Teeth = 4 + 2
Basic tool body in steel and aluminium with cartridges

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) AIADC10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 1,200</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.1</td>
</tr>
</tbody>
</table>

**Result**
Reduced tool weight

**Customer benefits**
Reduced machining times
Low costs thanks to standard cartridges and ISO inserts
Requirements
High surface quality on face and shoulder surface

Solution
Multi tooth cutter / Teeth = 36 / Teeth_{eff.} = 12

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) AlSi9Cu3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD 10</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 2,500</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.12</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.8</td>
</tr>
</tbody>
</table>

Result
Almost uninterrupted shoulder thanks to high concentricity

Customer benefits
- Inserts separately replaceable
- Increased productivity and energy-efficiency
Combination tool with adjustable inserts - eccentric pin adjustment / Teeth = 5 / Teeth_{eff.} = 1

---

**Requirements**
High concentricity requirements and concentricity of the individual diameters to each other
Adjustability of inserts

**Solution**
Combination tool with adjustable inserts - eccentric pin adjustment / Teeth = 5 / Teeth_{eff.} = 1

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN)</th>
<th>AlSi9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
<td></td>
</tr>
<tr>
<td>Cutting speed m/min</td>
<td>1,380</td>
<td></td>
</tr>
<tr>
<td>Feed rate per tooth mm</td>
<td>0.15</td>
<td></td>
</tr>
</tbody>
</table>

**Result**
Easy readjustment of the inserts

---

**Customer benefits**
Reduced non-productive times
Cost-effective interchangeable inserts solution
Gearbox case

Bearing seats

**Fine boring and circular milling tool / Teeth = 3 per Ø**

**Requirements**
Combination tool for fine boring and circular milling

**Solution**
Fine boring and circular milling tool / Teeth = 3 per Ø

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN)</th>
<th>AISI9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cutting speed</th>
<th>m/min</th>
<th>450</th>
<th>517</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
<td>0.08</td>
<td>0.12</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm</td>
<td>-4</td>
<td>-4</td>
</tr>
</tbody>
</table>

**Result**
Inserts separately replaceable

**Customer benefits**
Reduced tooling costs per component
**Requirements**
Combination tool for forward and backward fine boring and for over turning of outside diameter

**Solution**
Fine boring tool / Teeth = 5 / Teeth_{eff.} = 1

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN)</th>
<th>AlSi9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td></td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
<td>(Ø 85) 450</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**Result**
Inserts separately replaceable

**Customer benefits**
Reduced machining times
Reduced tooling costs per component
Gearbox case
Valve plate

Face milling cutter Ø 49 mm with heavy metal shank (anti-vibration effect) / Teeth = 8

Requirements
Axial plunging into the component, face milling of the surface through the clamping device
PMr(3) > 50% - Rₜ 8 - Rₘₚ₈ 10 and axially adjustable

Solution
Face milling cutter with heavy metal shank (anti-vibration effect) / Teeth = 8

Cutting data
Material (DIN) GD-AlSi9Cu3
Cutting grade PCD
Cutting speed m/min 2,700
Feed rate per tooth mm 0.034 - 0.069 - 0.086
Cutting depth mm 0.6

Result
Excellent surface finish
PMr(3) 100% - Rₜ 2.2 - Rₘₚ₈ 2.6

Customer benefits
Very high tool life quantity
Excellent surface finish quality
**Requirements**
Precise diameter and high coaxiality

**Solution**
Fine machining tool with heavy metal shank and twisted guide shank / Teeth = 1

**Cutting data**

<table>
<thead>
<tr>
<th>Material (DIN)</th>
<th>Al</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 449</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.056</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm -8</td>
</tr>
</tbody>
</table>

**Result**
Excellent surface finish quality

---

**Customer benefits**
Fewer tools required for machining
Electric motor
Requirements
Strongly fluctuating allowances and machining several steps reliably
Safety cut required for bottom surface over 28 mm width

Solution
Light-weight stepped countersinking tool / Teeth = 4 + 4 + 4
Tangential inserts with underhand grip installed in the cartridge, thus very stable embedding

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>AlSi10MgCu-T6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>600 m/min</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>0.15 mm</td>
</tr>
</tbody>
</table>

Result
Process reliable machining combined with high feed rates
Long tool life thanks to a stable tool

Customer benefits
Roughing with only one tool
Reduced cycle times
Electric motor

Semi-finish machining stator bore

Adjustable pre-machining tool / Teeth = 4 + 4 + 2 + 2 + 2

Light-weight tool concept with cartridges and PCD guide pads

Requirements
Exact premachining for finishing tool

Solution
Adjustable ISO indexable inserts combined with different diameters
Light-weight construction with aluminium base body

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>AlSi10MgCu-T6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 820</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.12</td>
</tr>
</tbody>
</table>

Result
Stable machining process

Customer benefits
Pre-machining and finishing of several steps
Low cycle time thanks to multi-teeth tool
Electric motor
Finish-machining stator bore

Multi-teeth fine boring tool / Teeth = 6 + 2 + 2 + 2

Light-weight tool concept with cartridges and PCD guide pads

Requirements
Fitting Ø with high surface quality and short cycle time

Solution
6-fluted tool with mixture of inserts
Light-weight construction with aluminium base body

Cutting data
Material: AlSi10MgCu-T6
Cutting grade: PCD
Cutting speed: m/min 1,000
Feed rate per tooth: mm 0.18

Result
Compliance with all tolerances and surface requirements

Customer benefits
Low cycle time thanks to a high feed rate
Excellent surface finish quality
Multi-step fine boring tool / Teeth = 4 / Teeth_{eff.} = 1

Requirements
Combination tool, all diameters adjustable

Solution
Multi-step fine boring tool / Teeth = 4 / Teeth_{eff.} = 1

Cutting data
Material (DIN) GGG40
Cutting grade carbide coated
Cutting speed \( \text{m/min} \) (Ø 41.35) 197
Feed rate per tooth mm 0.15
Cutting depth mm -3

Result
Flexible tool design
Inserts separately adjustable

Customer benefits
High flexibility of diameter offsets
Operation 1: multi-step fine boring tool / Teeth = 3 + 5

Operation 2: step milling cutter / Teeth = 4 + 8

Operation 3: multi-step fine boring tool / Teeth = 1 + 1 / 3

Requirements

Operation 1: fine boring tool for rough machining of the pump cavity
Operation 2: step milling cutter for simultaneous milling of the sealing surfaces, distance (dim. 49) μm-accurate adjustable
Operation 3: fine machining of both diameters with CBN

Solution

Operation 1: multi-step fine boring tool / Teeth = 3 + 5
Operation 2: step milling cutter / Teeth = 4 + 8
Operation 3: multi-step fine boring tool / Teeth = 1 + 1 / 3

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>Operation 1</th>
<th>Operation 2</th>
<th>Operation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DIN) GG25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
<td>carbide coated</td>
<td>CBN</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>(Ø 27.6) 108 (Ø 62.6) 242</td>
<td>(Ø 23) 92 (Ø 63) 250</td>
<td>240</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>(Ø 27.6) 0.15 (Ø 62.6) 0.09</td>
<td>(Ø 23) 0.12 (Ø 63) 0.06</td>
<td>0.1</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>-3</td>
<td>-2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Result

Reduced machining time

Customer benefits

Low costs per component
Higher process reliability
Operation 3: fine machining of both diameters with CBN

Oil pump

Pump cavity

Operation 2

Operation 3

HSK 63-A

HSK 63-A

Ø 63

Ø 23

z = 8

z = 4

49 adjustable

7.8

129 adjustable

129.2 adjustable

Ø 63.1 H8 adjustable

Ø 28 H6 adjustable

z = 1

z = 1

77

129

7.849 adjustable

129 adjustable
**Requirements**

Combination tool for 6 machining steps  
All inserts adjustable

**Solution**

Forward and backward fine boring tool / Teeth = 7 / Teeth<sub>eff.</sub> = 1

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) AlSi9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
</tr>
<tr>
<td>(Ø 62) 467</td>
<td></td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.12</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.5</td>
</tr>
</tbody>
</table>

**Result**

Short processing time  
Inserts can be changed separately

**Customer benefits**

Low costs per component
Requirements
Multi-step machining with one tool

Solution
Multi-step fine boring tool / Teeth_{eff.} = 2

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) ENAC-AlSi12CuNiMg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD 10</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 1,500</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.13</td>
</tr>
</tbody>
</table>

Result
Short machining time
Very good surface quality and dimensional accuracy
Inserts can be changed separately depending on wear

Customer benefits
Cycle time reduction thanks to combination of several machining steps
Low costs per component
Requirements
Combination tool for 6 machining steps, cartridges for different types of workpieces
Inserts adjustable in diameter

Solution
Modular designed fine boring tool
Angular position of inserts for sealing surface adjustable

Cutting data
Material (DIN) GD-AlSi12Cu
Cutting grade PCD
Cutting speed m/min (Ø 68) 641
Feed rate per tooth mm 0.12
Cutting depth mm -4

Result
Flexible tool design for high requirements

Customer benefits
High process reliability
**Micro-adjustment**

allows the precise adjustment of the tool diameter directly in the machine without using any devices, this leads to a reduction of non-productive times in continuously running processes e.g. mass production of automotive components.
Injection pump

Axial grooving

Axial grooving tool with heavy metal shank / Teeth = 2 / Teeth_{eff.} = 1

Replaceable head design

Requirements
Grooving tool with adjustable inserts

Solution
Axial grooving tool with heavy metal shank / Teeth = 2 / Teeth_{eff.} = 1
Replaceable head design

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) 20MnCr5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min (Ø 21.2) 121</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.08</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm into solid</td>
</tr>
</tbody>
</table>

Result
Good chip control thanks to cutting division
Excellent surface finish

Customer benefits
High process reliability
Requirements
Hard machining of the sealing surface
Angular position of inserts on tool holder adjustable

Solution
Fine boring tool / Teeth = 1

Cutting data
Material 60 - 62 HRC (DIN) 20MnCr5
Cutting grade CBN
Cutting speed m/min 195
Feed rate per tooth mm 0.025
Cutting depth mm 0.2

Result
Excellent surface finish quality
Very good tool life
Regrindable CBN inserts

Customer benefits
Low costs per component
**Requirements**
Combination tool for 5 machining steps

**Solution**
Multi-step fine boring tool / Teeth = 7 / Teeth\(_{\text{eff.}}\) = 1 / (Ø 66.5 + Ø 63.3) Teeth = 2

**Cutting data**
- **Material**: (DIN) 20MnCr5
- **Cutting grade**: carbide coated
- **Cutting speed**: m/min (Ø 13.7) 37 (Ø 66.5) 180
- **Feed rate per tooth**: mm (Ø 13.7) 0.15 (Ø 66.5) 0.075
- **Cutting depth**: mm (Ø 13.7) 0.5 (Ø 66.5) 0.5 - 1.5

**Result**
Inserts separately adjustable and replaceable

**Customer benefits**
Low costs per component
**Requirements**
Inside and outside diameter adjustable

**Solution**
Fine boring/grooving tool / Teeth = 2 + 2

**Cutting data**
- **Material** (DIN) GG25
- **Cutting grade** carbide coated
- **Cutting speed** m/min 220
- **Feed rate per tooth** mm 0.1
- **Cutting depth** mm ~ 12, entire cutting width

**Result**
Very good tool life

**Customer benefits**
- Low costs per component
- High process reliability
- Simple tool handling
**Injection pump**

**Pre-machining connecting flange**

---

**Requirements**
Reduction of cycle times

**Solution**
OD turning tool, stationary tool (turning machine) / Teeth\_net. = 2 / 1

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) X17CrNi16 / 1.4057</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 200</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.125</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 4</td>
</tr>
</tbody>
</table>

**Result**
Faster machining with consistent quality

---

**Customer benefits**
Reduced cycle times up to 66 %
Stainless steel pump

Multi-step fine boring tool / Teeth = 2 + 2 + 2 + 1 + 1 + 1 + 1

Requirements
Combination tool, all diameters adjustable

Solution
Multi-step fine boring tool / Teeth = 2 + 2 + 2 + 1 + 1 + 1 + 1

Cutting data
Material (DIN) X2CrNi19-11
Cutting grade carbide coated
Cutting speed m/min 25 - 100
Feed rate per tooth mm 0.025
Cutting depth mm 0.4

Result
Flexible tool design

Customer benefits
Short machining time
Low costs per component
Various automotive components
Requirements
Milling and overturning of a stud with one tool
Face runout of the milling cutter and diameter of the fine boring tool are adjustable

Solution
Milling and overturning tool / Teeth = 8 (milling), 2 (fine boring)

Cutting data
Material (DIN) GDAISi12
Cutting grade PCD
Cutting speed m/min (Ø 63) 1.800 (Ø 19) 543
Feed rate per tooth mm 0.12 0.12
Cutting depth mm 0.8 0.8

Result
Reduced machining time thanks to combination tool

Customer benefits
Low costs per component
Increased productivity
Requirements
Machining of two types of camshafts with only one tool

Solution
Gang milling cutter / Teeth = 18/14

Cutting data
Material (DIN) GGG40
Cutting grade carbide coated
Cutting speed m/min 80
Feed rate per tooth mm 0.06
Cutting depth mm Teeth = 18/16 Teeth = 14/7

Result
Reduced non-productive times
Reduced machining stations

Customer benefits
Increased productivity
**Requirements**
Fine boring tool with carbide guide pads for machining of the flange bore

**Solution**
Fine boring and chamfer tool / Teeth = 1 + 1

**Cutting data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material (DIN)</td>
<td>GGG60</td>
</tr>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed m/min</td>
<td>80</td>
</tr>
<tr>
<td>Feed rate per tooth mm</td>
<td>0.12</td>
</tr>
<tr>
<td>Cutting depth mm</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**Result**
High dimensional accuracy thanks to tool concept with guide pads

**Customer benefits**
Higher process reliability
Requirements
Milling of the sealing surface with a defined surface roughness
All inserts axially adjustable

Solution
Special face milling cutter / Teeth = 8
Equipped with standard PCD inserts

Cutting data
Material (DIN) □ AlSi12Cu
Cutting grade PCD
Cutting speed m/min 3560
Feed rate per tooth mm 0.16

Result
High machining speed thanks to special insert geometry
Constant wear - all inserts set to same height

Customer benefits
Low costs per component
Increased productivity
**Requirements**

Very unstable component, requires low cutting forces of the tool

Machining of the two ring surfaces in one cut

**Solution**

Gang milling cutter (monoblock) / Teeth = 10 / Teeth\textsubscript{eff.} = 5

Inserts interchangeable among each other, thus both cutting edges of the inserts can be used

All inserts adjustable (dim. 5 mm)

**Cutting data**

- **Material** (DIN) C35-520N/mm\(^2\)
- **Cutting grade** carbide coated
- **Cutting speed** m/min 120
- **Feed rate per tooth** mm 0.1
- **Cutting depth** mm both sides 0.6

**Result**

Short machining time

Inserts usable on both sides

**Customer benefits**

Low costs per component
Large radii can be achieved
Tangential inserts with PCD cutting edges

Requirements
Milling connection taps in a single step

Solution
Gang milling cutter for double-sided milling of two taps

Cutting data
Material: AlSi9
Cutting grade: PCD
Cutting speed: m/min 1,250
Feed rate per tooth: mm 0.1
Cutting depth: mm 3-12!

Result
Process reliable machining of combined work steps

Customer benefit
Long tool life thanks to PCD-coated cutting inserts
Short machining times as a result of multiple operations being combined in one tool
Steering housing

Reaming tool / Teeth = 13

Adjustment range 60 μm for diameter → 5 μm per turn

Interchangeable inserts

- Diameter μm-accurate adjustable
- Adjustment to both directions
- Adjustment range 60 μm for diameter → 5 μm per turn
- Interchangeable inserts

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>DIN</th>
<th>GGG50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
<td></td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
<td>160</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
<td>0.2</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Result

Reduced non-productive time thanks to adjustment options on the machine

Customer benefits

- High process reliability
- High productivity

Requirements

- Diameter μm-accurate adjustable in both directions

Solution

- Reaming tool / Teeth = 13
- Adjustment range 60 μm for diameter → 5 μm per turn
- Freely selectable and exchangeable inserts
Drive flange

Combination tool for the complete component contour

Ø 18,5 H8 adjustable by means of eccentric pin adjustment

Requirements
Combination tool for the complete component contour

Solution
Drilling and fine boring tool / Teeth = 2
Ø 18,5 H8 adjustable by means of eccentric pin adjustment

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) Ck45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td></td>
<td>drilling</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm into solid</td>
</tr>
</tbody>
</table>

Result
Reduction of machining time thanks to combination tool

Customer benefits
Low costs per component
Increased productivity
Requirements
Machining of both ring surfaces in one cut

Solution
All inserts adjustable (dim. 5 mm)

Cutting data
Material (DIN) GG25
Cutting grade carbide coated
Cutting speed m/min 270
Feed rate per tooth mm 0.15
Cutting depth mm 0.2

Result
Short machining time
Inserts usable on both sides

Customer benefits
Low costs per component
**Requirements**
Circular milling cutter for the machining of grooves

**Solution**
Circular milling cutter / Teeth = 2 + 2 + 2 + 2 + 2

**Cutting data**
- **Material** (DIN) Al
- **Cutting grade** PCD
- **Cutting speed** m/min 490
- **Feed rate per tooth** mm 0.1
- **Cutting depth** mm 0.5 - 1.0

**Result**
Tool life tripled

**Customer benefits**
- Reduced tooling costs
- Reduced handling costs
Brake caliper

Interpolation turning tool / Teeth = 4 + 1

1. Step ➔ positioning 1.25 mm ex centre
2. Step ➔ entering by interpolation to nominal diameter
3. Step ➔ countersinking Ø37 mm

Requirements
Combination tool for Ø37 mm plus seal grooves

Solution
Interpolation turning tool / Teeth = 4 + 1

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GGG45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 70</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.12</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.75</td>
</tr>
</tbody>
</table>

Result
Reduction of machining time thanks to combination tool
Long tool life thanks to constant cut (interpolation turning process)

Customer benefits
Low costs per component
High productivity
Brake caliper

4. Step → Positioning

5. Step → Interpolation turning of 3 slots / grooves
Timing housing

Drilling and countersinking tool with interchangeable inserts

Requirements
Machining of the complete workpiece contour with one tool

Solution
Step tool with interchangeable inserts

Cutting data
- Material: (DIN) GGG40
- Cutting grade: carbide coated
- Cutting speed: m/min 52 (Ø27.7)
- Feed rate per tooth: mm 0.28
- Cutting depth: mm into solid

Result
Tool life tripled

Customer benefits
Reduced tooling costs
Reduced handling costs
Gearbox case

**Circular milling cutter with form inserts / Teeth = 4 + 4**

Requirements
Grouping of several groove machining operations

Solution
Circular milling cutters with form inserts / Teeth = 4 + 4

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GD-AlSi9Cu3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 1,060</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.13</td>
</tr>
</tbody>
</table>

Result
High positional accuracy of the grooves and edge outlines in relation to each other
Several grooves can be produced with one tool

Customer benefits
High process reliability
High productivity
Balance shaft

Multi-fluted OD tool / Teeth = 3 + 1

Coolant outlet at front for 1-channel MQL system

Requirements
Reduction of costs per component

Solution
Multi-fluted OD tool / Teeth = 3 + 1

Cutting data
<table>
<thead>
<tr>
<th>Material (DIN)</th>
<th>C56E2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 160</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.2</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 6 mm in Ø</td>
</tr>
</tbody>
</table>

Result
Increased tool life by 60 %
Low cutting forces
Very good chip control

Customer benefits
Significant reduced costs per component
Automatic adjustment tool / Teeth = 2 + 1

SMART SETTING MOTION TOOLS concept

Machining diameter can be set μm-accurately larger and smaller by means of a central adjusting screw

Requirements
Reduction of non-productive times

Solution
 Automatically adjustable tool / Teeth = 2 + 1
SMART SETTING MOTION TOOLS concept
Machining diameter can be set μm-accurately larger and smaller by means of a central adjusting screw

Cutting data
Material: (DIN) 36MnVS4
Cutting grade: carbide coated
Cutting speed: m/min 138
Feed rate per tooth: mm 0.1/0.2

Result
High tool life quantity (it is re-adjusted approx. 2x per tool life)
Easy handling by readjusting the machining diameter directly in the machine spindle

Customer benefits
High productivity
General engineering
**Requirements**
Combination tool for fine boring, chamfering and milling

**Solution**
Fine boring, chamfering and circular milling tool / Teeth = 8 / Teeth<sub>eff</sub> = 1 je Ø (fine boring) / Teeth = 8 / Teeth<sub>eff</sub> = 2 je Ø (milling)
Middle part exchangeable for different types of components
All inserts adjustable

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GD-AlSi9Cu3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm (milling)</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm</td>
</tr>
</tbody>
</table>

**Result**
Short machining time
High dimensional accuracy

**Customer benefits**
Low costs per component
Reduced non-productive times
Gearbox case
for angle grinders

Fine boring, chamfering and face tool / Teeth = 6 eff. 1 per Ø
All inserts adjustable
Exchangeable cartridges for different types of housings

Requirements
Combination tool for 6 machining steps

Solution
Fine boring, chamfering and face tool / Teeth = 6 eff. 1 per Ø
All inserts adjustable
Exchangeable cartridges for different types of housings

Cutting data
- Material (DIN): GD-AlSi9Cu3
- Cutting grade: PCD
- Cutting speed: m/min 800
- Feed rate per tooth: mm -0.15
- Cutting depth: mm 0.5

Result
- Short machining time
- High dimensional accuracy

Customer benefits
- Low costs per component
- Reduced non-productive times
Gearbox case for hand drills

Drilling and fine boring tool

Inserts adjustable

Operation 1
drilling and fine boring

Operation 2
circular chamfering

Requirements
Combination tool for 5 machining steps
Diameter of the chamfer and the facegroove adjustable

Solution
Drilling and fine boring tool
Inserts adjustable

Cutting data
Material (DIN) AlSi12
Cutting grade carbide coated
Cutting speed m/min (Ø 14.5) 160 (Ø 30) 331
Feed rate per tooth mm 0.15 0.07
Cutting depth mm 7.25 4.9

Result
Short machining time
High dimensional accuracy

Customer benefits
Low costs per component
Reduced non-productive times
Requirements
Drilling, chamfering and fine boring in one tool

Solution
Drilling and fine boring tool

Cutting data
Material (DIN) Al
Cutting grade K10

<table>
<thead>
<tr>
<th></th>
<th>drilling</th>
<th>fine boring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
<td>374</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
<td>0.38</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm into solid</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Result
Short machining time
High dimensional accuracy
Solid carbide drill regrindable for several times

Customer benefits
Low costs per component
Reduced non-productive times
Hydraulic industry

Connection holes

Fine boring and chamfering tool with indexable inserts

PCD-form inserts with 5 steps, all diameters adjustable

Requirements
Multi-step fine boring tool for hydraulic connection

Solution
Fine boring and chamfering tool with indexable inserts
PCD-form inserts with 5 steps, all diameters adjustable

Cutting data
Material (DIN) GDAHSi9
Cutting grade PCD
Cutting speed m/min (Ø 21.34) 700
Feed rate per tooth mm 0.1
Cutting depth mm -5

Result
Simple correction of diameters by means of taper screw or eccentric pin adjustment
Inserts separately replaceable

Customer benefits
Low costs per component
Brake component
for wind mill

Circular milling cutter / Teeth = 16 / Teeth_{eff.} = 4

Requirements
Multi-step circular milling cutter for machining grooves

Solution
Circular milling cutter / Teeth = 16 / Teeth_{eff.} = 4

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GGG40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed m/min</td>
<td>95</td>
</tr>
<tr>
<td>Feed rate per tooth mm</td>
<td>0.11</td>
</tr>
<tr>
<td>Cutting depth mm</td>
<td>4</td>
</tr>
</tbody>
</table>

Result
Short machining time
High dimensional accuracy

Customer benefits
Low costs per component
Reduced non-productive times
Bearing bracket
Housing

Stepped fine boring tool with clamped PCD guide pads / Teeth = 4 / Teeth_{eff.} = 1

All inserts adjustable

Requirements
Multi-step fine boring tool

Solution
Stepped fine boring tool with clamped PCD guide pads / Teeth = 4 / Teeth_{eff.} = 1
All inserts adjustable

Cutting data

<table>
<thead>
<tr>
<th>Material (DIN)</th>
<th>AlSi11Cu2(Fe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed m/min</td>
<td>600</td>
</tr>
<tr>
<td>Feed rate per tooth mm</td>
<td>0.1</td>
</tr>
<tr>
<td>Cutting depth mm</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Result
Excellent surface finish
Simple tool handling

Customer benefits
Higher process reliability
Low costs for replacing the PCD guide pads, if necessary
Compressor housing

Put on milling cutter Ø 80 mm / Teeth = 8 + 3

Mixed assembly: semi finish inserts (Teeth = 8) and wiper inserts (Teeth = 3)

Requirements
Surface finish $R_z$ max. 20 µm
Flatness 0.05 mm

Solution
Put on milling cutter Ø 80 mm / Teeth = 8 + 3
Mixed assembly: semi finish inserts (Teeth = 8) and wiper inserts (Teeth = 3)

Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) GG25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>CBN</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 1,200</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.140</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.10</td>
</tr>
</tbody>
</table>

Result
Increased tool life by 300 - 400 %

Customer benefits
Dramatically reduced costs per component
Rotor shaft
Rotor for turbine

Side milling cutter Ø350mm / Teeth = 12 + 12
Width 5.6mm adjustable

Requirements
Milling of the rotor grooves

Solution
Side milling cutter Ø350mm / Teeth = 12 + 12
Width 5.6mm adjustable

Cutting data
Material (DIN) GGG50
Cutting grade carbide coated
Cutting speed m/min 80
Feed rate per tooth mm 0.05
Cutting depth mm 140

Result
Finish machining of slots in one cut
Therefore dramatic shortening of processing time compared to the grinding process

Customer benefits
Dramatically reduced costs per component
Requirements
Tool for hydraulic connection
All diameters adjustable

Solution
Multi-step fine boring tool with adjustable inserts / Teeth = 8 / Teeth_{eff.} = 2

Cutting data
Material (DIN) GGG50
Cutting grade carbide coated
Cutting speed m/min (Ø 47) 180
Feed rate per tooth mm (Ø 47 / Ø 41) 0.1
Cutting depth mm -5

Result
Short machining time
Stable machining process

Customer benefits
Low costs per component
Milling tool with fixed insert seat / Teeth = 3

Machining of different sizes with one holder and different interchangeable inserts

Requirements
- Geometric shape accuracy
- Mixed machining (Steel unhardened / hardened)
- Faster machining

Solution
Milling tool with fixed insert seat / Teeth = 3

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) Toolox 33</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>CBN / carbide</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min CBN 250 / carbide 140</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm CBN 0.03 / carbide 0.03</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 4.8 resp. 6.65</td>
</tr>
</tbody>
</table>

Result
- Higher surface finish quality
- Reduced tooling costs

Customer benefits
- Cycle time reduction with higher surface quality
- Only one tool required for different workpiece geometries
- Reduced tooling costs
Requirements
Manufacturing of fitting diameters
High surface finish quality

Solution
Countersinking tool with guide pads / Teeth = 1 + 1

Cutting data
Material (DIN) GG25
Cutting grade carbide coated
Cutting speed m/min 88
Feed rate per tooth mm 0.075
Cutting depth mm 0.2

Result
Very good coaxiality despite the long distance to be bridged
Diameter can be set with micrometre precision

Customer benefits
Reduction of the number of tools
Long tool life
**Requirements**
Increasing the process reliability

**Solution**
Drilling and countersinking tool (HT 800 + 14 steps) / Teeth = 16

**Cutting data**
- **Material**: (DIN) GGG40
- **Cutting grade**: carbide
- **Cutting speed**: m/min 120
- **Feed rate per tooth**: mm 0.4
- **Cutting depth**: mm into solid

**Result**
Faster machining time

**Customer benefits**
- High process reliability
- Longer tool life
**Requirements**
Alternative solution to a ground carbide tool

**Solution**
Fine boring tool with adjustable form inserts / Teeth = 2 + 1

**Cutting data**
- Material (DIN) CuZn39Pb3R500
- Cutting grade carbide uncoated
- Cutting speed m/min 76
- Feed rate per tooth mm 0.065
- Cutting depth mm into solid

**Result**
Tool life: 1,000,000 plug contacts
µm-accurate adjustability of diameters

**Customer benefits**
- No regrinding of the entire tool necessary
- Reduced storage costs
**Requirements**
Reduction of machining time

**Solution**
GA200 Vario special solution (roughing/finishing combination) / Teeth = 1 + 1

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>CuZn35Pb2Al</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide/PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
</tr>
<tr>
<td></td>
<td>300</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>0.06</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

**Result**
Reduction of required tools from 2 to 1

**Customer benefits**
Cycle time reduction machining with consistent quality
Reduced tooling costs
Turbocharger housing
**Requirements**
Machining of a V-contour despite limited space conditions

**Solution**
Interpolation turning tool / Teeth = 1

**Cutting data**
- Material (DIN): GX40NiCrSiNb38-19
- Cutting grade: carbide coated
- Cutting speed: m/min 100
- Feed rate per tooth: mm 0.1

**Result**
- Very short machining time
- Flexible and stable tool concept with cartridge
- Long tool life

**Customer benefits**
Low costs per component
Turbocharger housing

Pre-machining

Requirements
Several machining steps in one tool

Solution
Stepped countersinking tool
Various inserts adjustable

Cutting data
Material (DIN) GX40NiCrSiNb38-19
Cutting grade carbide coated
Cutting speed m/min 95
Feed rate per tooth mm 0.1

Result
Very short machining time thanks to maximum possible number of teeth
Thanks to the division of the chip spaces, it is possible
to combine several machining steps

Customer benefits
Lower tool costs by using ISO inserts
Reduced cycle times
Requirements
Step tool for finishing operation

Solution
Countersinking tool / Teeth = 1 + 1
Adjustment of the diameter by means of thread wedge adjustment

Cutting data
Material (DIN) ■ GX40NiCrSiNb38-19
Cutting grade carbide coated
Cutting speed m/min 120
Feed rate per tooth mm 0.075

Result
Short machining time

Customer benefits
Lower tool costs by using ISO inserts
μm accurate adjustment directly at the spindle → low machine downtime
Turbocharger housing
Finish-machining

Requirements
Different machining processes in one tool

Solution
Countersinking and interpolation tool in one Ø 182.4 mm → Finishing
Plane surface from 182.4 to 155.698 mm → Interpolation process

Cutting data
Material (DIN) GX40NiCrSiNb38-19
Cutting grade carbide coated
Cutting speed m/min 100
Feed rate per tooth mm 0.1

Result
2 machining processes in one tool
Adjustment of the diameter by means of thread wedge adjustment

Customer benefits
Lower tool costs by using ISO inserts
Turbocharger housing
Pre-machining

Axial grooving tool / Teeth = 2 + 2

Division of the contour into two different cutting insert geometries

Compact tool concept

Requirements
Pre-machining of a complex contour

Solution
Axial grooving tool / Teeth = 2 + 2
Division of the contour into two different cutting insert geometries
Compact tool concept

Cutting data
Material (DIN) GX40NiCrSiNb38-19
Cutting grade carbide coated
Cutting speed m/min 110
Feed rate per tooth mm 0.125

Result
Simple tool handling

Customer benefits
Low costs per component thanks to multi-fluted insert
**Requirements**
Finishing of a complex contour

**Solution**
Axial grooving tool with profile insert / Teeth = 1

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN)</th>
<th>GX40NiCrSiNb38-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td></td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
<td>100</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Result**
Very good surface quality and dimensional accuracy
µm-accurate adjustability of diameter

**Customer benefits**
Low costs per component
Requirements
Pre-machining of a complex contour

Solution
Axial grooving tool, adjustable diameter / Teeth = 1 + 1
Division of the contour on two different inserts
Compact tool concept

Cutting data
- Material (DIN): GX40NiCrSiNb38-19
- Cutting grade: carbide coated
- Cutting speed: m/min 95
- Feed rate per tooth: mm 0.09

Result
Simple tool handling
Inserts μm-accurate adjustable

Customer benefits
Low costs per component thanks to long tool life
Turbocharger housing

Pre-machining

Axial grooving tool, adjustable diameter / Teeth = 1 + 1
Division of the contour into two different cutting inserts
Compact tool concept with cartridges

Requirements
Pre-machining of a complex contour

Solution
Axial grooving tool, adjustable diameter / Teeth = 1 + 1
Division of the contour into two different cutting inserts
Compact tool concept with cartridges

Cutting data
Material (DIN) ▶ GX40NiCrSiNb38-19
Cutting grade carbide coated
Cutting speed m/min 110
Feed rate per tooth mm 0.15

Result
Simple tool handling

Customer benefits
Low costs per component thanks to multi-edge insert
Turbocharger housing
V-contour

Interpolation turning tool / Teeth = 1

Requirements
Machining of a V-contour despite limited space conditions

Solution
Interpolation turning tool / Teeth = 1

Cutting data
Material (DIN) ➤ GX40NiCrSiNb38-19
Cutting grade carbide coated
Cutting speed m/min 110
Feed rate per tooth mm 0.15

Result
Very short machining time
Flexible and stable tool concept with cartridge
Long tool life

Customer benefits
Low costs per component
Aviation technology
### Requirements
Machining of various outside diameters
with high requirements for diameter tolerance and roundness
Reduction of machining time

### Solution
Axial grooving tool / Teeth = 2

### Cutting data

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) TiAl6V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 48</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.03</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.25</td>
</tr>
</tbody>
</table>

### Result
Significantly shorter machining time due to double fluted tool
Uniform distribution of cutting forces compared to a single-fluted tool - resulting in very high roundness and uniform wall thickness

### Customer benefits
High process reliability
**Aircraft wing**

**Side milling cutter with distribution of cut**

*Teeth = 10 / Teeth\textsubscript{eff} = 5*

---

**Requirements**
- Increase in process reliability
- Reduction of delamination with so called mesh material

**Solution**
- Side milling cutter with distribution of cut / Teeth = 10 / Teeth\textsubscript{eff} = 5

**Cutting data**

<table>
<thead>
<tr>
<th>Material (DIN)</th>
<th>Composite / CFK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>PCD</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm</td>
</tr>
<tr>
<td>Cutting width</td>
<td>mm</td>
</tr>
</tbody>
</table>

| Cutting speed | 370 |
| Feed rate per tooth | 0.08 |
| Cutting width | 0   |

**Result**
- Increase in tool life quantity

---

**Customer benefits**
- Higher quality, therefore lower costs for re-work
Aircraft components

Drilling and countersinking tool with interchangeable inserts / Teeth = 1

Insert diameter μm-accurate adjustable

Requirements
Machining of rivet holes
Burr-free transition from holes to chamfer

Solution
Drilling and countersinking tool with interchangeable inserts / Teeth = 1
Insert diameter μm-accurate adjustable

Cutting data
Material (DIN) • CFK/titanium
Cutting grade PCD
Cutting speed m/min 380
Feed rate per tooth mm 0.11
Cutting depth mm into solid

Result
High quality of chamfer or transition thanks to PCD cutting insert
High concentricity accuracy of the solid carbide drill due to use of hydraulic chuck

Customer benefits
High process reliability
Low costs per component
Turning tools
Requirements
Narrow tolerances of the grooves to each other
Reduction of machining time

Solution
Plunging tool for turning machines / Teeth = 2 / Teeth_{eff.} = 1
Grooving inserts adjustable towards each other

Cutting data
Material (DIN)  ■ Sind D 11 (sintered metal)
Cutting grade  carbide coated
Cutting speed  m/min  (Ø 29.1) 220
Feed rate per tooth  mm  0.1
Cutting depth  mm  ~ 4.5

Result
Reduced machining time thanks to combination tool

Customer benefits
Low costs per component
Reduced non-productive times thanks to simple tool handling
Turning tools

Case

Requirements
Finish machining chamfer 30° and Ø 11.4 + 0.05

Solution
Grooving tool / Teeth = 1

Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) 9Sm28K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min (Ø 11.4) 95</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 0.12</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm -1</td>
</tr>
</tbody>
</table>

Result
High dimensional accuracy thanks to precision-ground cutting insert

Customer benefits
High process reliability thanks to stable insert clamping
Requirements
Groove turning - profil recess
Recesses adjustable towards each other

Solution
Grooving tool / Teeth = 2 / Teeth_{eff.} = 1

Cutting data
Material (DIN) 9SMn28K
Cutting grade carbide coated
Cutting speed m/min 120
Feed rate per tooth mm 0.1
Cutting depth mm 2

Result
Complete machining with one tool

Customer benefits
Cycle time reduction
**Requirements**
Reduction of cycle time

**Solution**
Combi turning tool (finishing/grooving) / Teeth = 3 / $\text{Teeth}_{\text{eff.}} = 1 + 1$

**Cutting data**

<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) AlSi12Cu1(Fe) EN-AC47100/11SMn30+C1,0715</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated/uncoated</td>
</tr>
<tr>
<td></td>
<td>grooving / finishing</td>
</tr>
<tr>
<td>Cutting speed m/min</td>
<td>240 320</td>
</tr>
<tr>
<td>Feed rate per tooth mm</td>
<td>0.12 0.1</td>
</tr>
</tbody>
</table>

**Result**
Reduced machining times

**Customer benefits**
Saving of tool places on turret
## Requirements
Very high surface quality  
Reduction of machining time

## Solution
Holder for skiving operations / Teeth = 1

## Cutting data
<table>
<thead>
<tr>
<th>Material</th>
<th>(DIN) steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting grade</td>
<td>carbide coated</td>
</tr>
<tr>
<td>Cutting speed</td>
<td>m/min 225</td>
</tr>
<tr>
<td>Feed rate per tooth</td>
<td>mm 1.5</td>
</tr>
<tr>
<td>Cutting depth</td>
<td>mm 0.4</td>
</tr>
</tbody>
</table>

## Result
Very fast machining time  
Excellent surface finish quality

## Customer benefits
Cycle time reduction  
Up to 10x faster than conventional turning  
Saving of one work step (grinding)
### Enquiry form for special tools

**Customer**

**Contact person**

**Street**

**Town/post code**

**Workpiece**

**Material**

**Hardness/tensile strength**

**Telephone**

**Fax**

**E-Mail**

**Drawing number**

<table>
<thead>
<tr>
<th>Machining</th>
<th>Into solid</th>
<th>Pre cast</th>
<th>Pre bored</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Blind hole</td>
<td>Through hole</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuous cut</td>
<td>Interrupted cut</td>
<td>Highly interrupted cut</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Required surface finish**

<table>
<thead>
<tr>
<th>R_s =</th>
<th>R_x =</th>
<th>Others</th>
</tr>
</thead>
</table>

**Stock**

<table>
<thead>
<tr>
<th>mm</th>
<th>In Radius</th>
<th>In diameter</th>
<th>a_p</th>
<th>a_s</th>
</tr>
</thead>
</table>

**Fixture**

<table>
<thead>
<tr>
<th>Stable</th>
<th>Instable</th>
<th>Very instable</th>
</tr>
</thead>
</table>

**Interference**

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
<th>mm</th>
</tr>
</thead>
</table>

**Machine**

<table>
<thead>
<tr>
<th>MC</th>
<th>Transferline</th>
<th>Lathe</th>
<th>Turn / milling centre</th>
<th>Boring head</th>
<th>Multi-spindle</th>
</tr>
</thead>
</table>

**Spindle**

<table>
<thead>
<tr>
<th>Steep taper</th>
<th>DIN</th>
<th>Size</th>
<th>30</th>
<th>40</th>
<th>45</th>
<th>50</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>HSK</th>
<th>DIN</th>
<th>Size</th>
<th>32</th>
<th>40</th>
<th>50</th>
<th>63</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Others</th>
<th>Internal coolant</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>max. Rpm</th>
<th>Power</th>
<th>kW</th>
</tr>
</thead>
</table>

**Tool**

<table>
<thead>
<tr>
<th>Right-hand cutting</th>
<th>Left-hand cutting</th>
<th>Non-Rotating</th>
<th>Rotating</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Face milling cutter</th>
<th>Groove/end milling cutter</th>
<th>Disc milling cutter</th>
<th>Power</th>
</tr>
</thead>
</table>

**Shank style/Form**

<table>
<thead>
<tr>
<th>Size</th>
</tr>
</thead>
</table>

**Tool balanced**

<table>
<thead>
<tr>
<th>No</th>
<th>Yes</th>
<th>Balancing grade G</th>
<th>at</th>
<th>1/min</th>
</tr>
</thead>
</table>

**Necessary cutting data**

<table>
<thead>
<tr>
<th>v_c =</th>
<th>m/min</th>
<th>f =</th>
<th>mm/U</th>
<th>mm/teeth</th>
<th>mm/min</th>
</tr>
</thead>
</table>

**Coolant**

<table>
<thead>
<tr>
<th>Internal</th>
<th>External</th>
<th>Without</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Emulsion</th>
<th>Oil</th>
<th>MQL</th>
<th>Dry</th>
</tr>
</thead>
</table>

**Remarks**

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Please complete the enquiry form and fax to: +49 (0) 911 / 64 19 22-10 or scan and send e-mail to info@hollfelder-guehring.de. An online enquiry can be found at www.hollfelder-guehring.de

Company name/no. if available

Contact person

Street

Town/post code

Telephone

e-mail address

Date

Signature

Enquiry form for HPC special milling cutter

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>Width of cut (a₀)</th>
<th>Maximum no. of teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>IC (bar)</td>
<td>Reduced no. of teeth</td>
</tr>
<tr>
<td>Allowance (aₚ)</td>
<td>MQL 1 channel</td>
<td>Maximum tool weight</td>
</tr>
<tr>
<td>Surface finish Rₐ</td>
<td>MQL 2 channel</td>
<td></td>
</tr>
</tbody>
</table>
### Enquiry form

for automatically adjustable tools

<table>
<thead>
<tr>
<th><strong>Customer</strong></th>
<th><strong>Date</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Contact person</strong></th>
<th><strong>Telephone</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Street</strong></th>
<th><strong>Fax</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Town/post code</strong></th>
<th><strong>e-mail</strong></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Workpiece</strong></th>
<th><strong>Drawing number</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Material</strong></th>
<th><strong>Hardness/tensile strength</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Designation workpiece / 3D model required!**

<table>
<thead>
<tr>
<th><strong>Machining</strong></th>
<th><strong>Crankshaft bearing passage</strong></th>
<th><strong>Balance shaft</strong></th>
<th><strong>Cylinder liner</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Required surface finish</strong></th>
<th><strong>R_a</strong></th>
<th><strong>R_t</strong></th>
<th><strong>Others</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Stock</strong></th>
<th><strong>mm</strong></th>
<th><strong>in radius</strong></th>
<th><strong>in Diameter</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Machine</strong></th>
<th><strong>MC</strong></th>
<th><strong>Transferline</strong></th>
<th><strong>Multi-spindle machining</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Machine manufacturer</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Machine type</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Spindle</strong></th>
<th><strong>Steep taper DIN</strong></th>
<th><strong>Size</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>HSK DIN</strong></th>
<th><strong>Size</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Others</strong></th>
<th><strong>max. Rpm</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>With Internal coolant</strong></th>
<th><strong>Without internal coolant</strong></th>
<th><strong>Power</strong></th>
<th><strong>KW</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Retraction of the inserts required (drawbar)?</strong></th>
<th><strong>Yes</strong></th>
<th><strong>Air</strong></th>
<th><strong>Emulsion</strong></th>
<th><strong>Mechanical</strong></th>
<th><strong>No</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Hubmechanismus</strong></th>
<th><strong>Yes</strong></th>
<th><strong>No</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Lagerung</strong></th>
<th><strong>Intermediate bearing</strong></th>
<th><strong>Counter bearing</strong></th>
<th><strong>drawing required!</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Tool</strong></th>
<th><strong>Right-hand cutting</strong></th>
<th><strong>Left-hand cutting</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Cutting data (current process)</strong></th>
<th><strong>v_c</strong> =</th>
<th><strong>f</strong> =</th>
<th><strong>mm/teeth</strong></th>
<th><strong>mm/min</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Coolant</strong></th>
<th><strong>Emulsion</strong></th>
<th><strong>MQL</strong></th>
<th><strong>Air (dry)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Description of machining strategy (e.g., machining direction? roughing/finishing?)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Our innovative tooling systems are used all over the world in many areas in the metal cutting industry. Both the highly precise standard tools which can be used flexibly as well as our customer specific innovative tooling solutions qualify us as a reliable partner in the metal machining industry. Thanks to many years of experience and our specific know-how we will increase your productivity.

Challenge us with your requirements!