



APPLICATION EXAMPLES

GROOVING SYSTEMS

Application example 1 – Drive shaft

Contents

Component information page 3

Machining

1. Boring of internal contour page 4

2. Gear milling page 5

3. Multi contour grooving page 6

4. Broaching of keyway page 7

5. Parting off into bore page 8



Drive shaft

Component information

Component



- Material:
42CrMo4
- Field of applications:
see industries

Industries

- Automotive, automotive suppliers
- Powertrain applications
- Machines, engineering equipment

Machining

- Machine:
turnmill machining centre
- Coolant:
water soluble, 40 bar through
the spindle
- Serial production:
500-800 pieces per month

Specifications

- Tight tolerance for grooving:
 $\pm 0.015 \text{ mm}$
- Required surface roughness:
 $r_z = 6 \text{ }\mu\text{m}$
- Required tolerance for broaching:
P9



Drive shaft

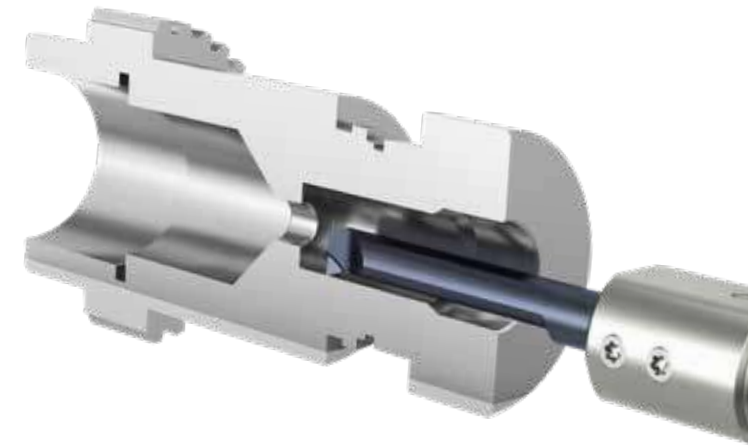
1. Machining – Boring of internal contour

Initial situation

- Long cycle time:
 $f = 0.06 \text{ mm}$
- Inconsistent surface roughness:
 $r_z = 5\text{-}10 \text{ }\mu\text{m}$

Tool selection

System: 110
Insert: special tool
Tool holder: standard item
Coating: TiAlN nanoA
Geometry: Wiper



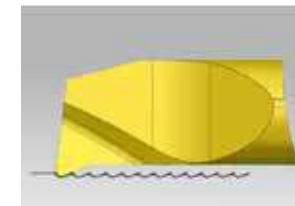
Cutting parameter

Cutting speed: 100 m/min
Feedrate: 0.10 mm/rev.
Depth of cut: 0.20 mm

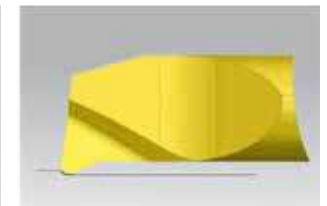
Customer benefit

- ✓ Reduction of cycle time by increasing feedrate to 0.10 mm
- ✓ Better chip forming/chip breakage
- ✓ Consistent tool life
- ✓ Consistent surface finish of
 $r_z = 2\text{-}4 \text{ }\mu\text{m}$

without Wiper geometry



with Wiper geometry



Rigid solution for difficult tasks: No matter if long overhangs, large width of cuts or deep contouring. System 110 offers lots of options.

Drive shaft

2. Machining – Gear Milling (according to DIN 5482)

Initial situation

Customer requirement:
reducing machining time through
maximum number of teeth

$v_c = 70 \text{ m/min}$

$f_z = 0.04 \text{ mm}$

Tool selection

System: 305

Insert: special tool

Width: 6 mm

Tool holder: special tool

Coating: FIRE

Milling cutter with internal coolant

Cutting parameter

Cutting speed: 100 m/min

Feed per tooth: 0.10 mm

Depth of cut: 2.20 mm

Number of cuts: 1

Customer benefit

- ✓ Reduced cycle time:
 $z3 \rightarrow z4$
 $v_c = +40\%$
 $f_z = +50\%$
- ✓ thereby increase of productivity
- ✓ Improved surface finish from
 $r_z = 6 \mu\text{m}$ to $r_z = 4 \mu\text{m}$



Drive shaft

3. Machining – Multi contour grooving

Initial situation

- Customer is using 2 tools
- Inconsistent tolerances caused by tool change
- Burrs occur at contour transition

Tool selection

System: 128
Insert: special tool
Width: 24 mm
Tool holder: special tool
Coating: FIRE

The insert covers the complete contour including chamfering

Cutting parameter

Cutting speed: 70 m/min
Feedrate: 0.05 mm/rev.

Customer benefit

- ✓ Time saving of approx 20 sec. per component = increase of productivity
- ✓ Burr free contour



- Insert can be reground
- Rigid M6 clamping screw in combination with the dovetail insert seat offers good rigidity

Drive shaft

4. Machining – Broaching of keyway

Initial situation

- Poor and inconsistent surface finish caused by vibrations
- Burrs occur at the exit of the keyway, time consuming manual deburring is required

Tool selection

System: 128
Insert: special tool
Tool holder: special tool
Coating: FIRE
Width: 12P9

Special design with internal coolant

Cutting parameter

Feedrate: 6,000 mm/min
Depth of cut per stroke: 0.06 mm

Customer benefit

- ✓ Big improvement in chip removal due to approaching the cutting edge with the coolant right from the front
- ✓ Special tool body designed for maximum rigidity
- ✓ Significant reduction of manual deburring



Innovative design of special "coolant flaps" to direct the coolant right onto the cutting edge.

Drive shaft

5. Machining – Parting off into bore

Initial situation

- Inconsistent tool life:
500-800 cuts
- Inconsistent surface finish:
 $r_z = 8-15 \mu\text{m}$
- Poor chip forming

Tool selection

System: 222
Insert: standard item
Blade: standard item
Coating: FIRE

Cutting parameter

Cutting speed: 170 m/min
Feedrate: 0.05 mm/rev.

Customer benefit

- ✓ Consistent tool life:
900-950 cuts
- ✓ Very good chip forming
- ✓ Improved surface finish:
 $r_z = 3-6 \mu\text{m}$



- Standard program available
- Parting off blade: width 3 mm

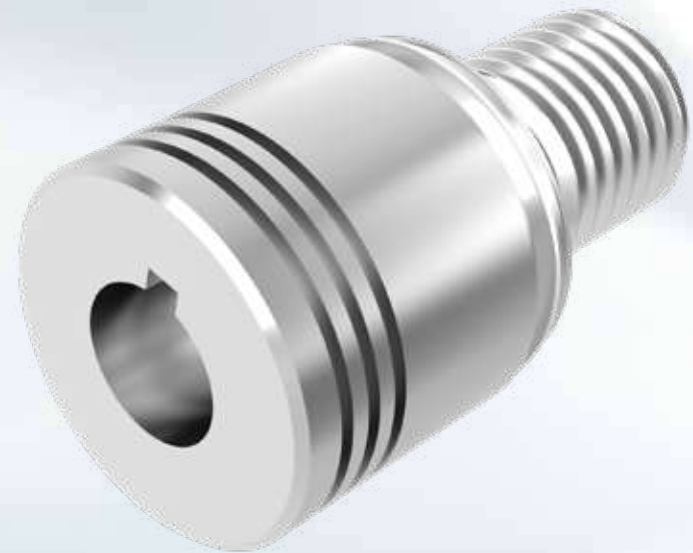
Application example 2 – Connector

Contents

Component information page 10

Machining

- 1. Internal boring page 11
- 2. External thread turning page 12
- 3. External profile grooving page 13
- 4. External grooving page 14
- 5. Keyway broaching page 15



Connector

Component information

Component



- Material:
1.4301
- Field of applications:
see industries

Industries

- Automotive, automotive suppliers
- Machines, engineering equipment
- Electrical-/electronical industry
- General installation applications

Machining

- Machines:
multi spindle machines
- Coolant:
60 bar internal coolant with oil
- Serial production:
10,000 pieces per month

Specifications

- Reduction of cycle time
- Improving chip forming in
grooving operations
- Burr free
- Improving the surface finish
of the thread



Connector

1. Machining – Internal boring (combination tool boring into solid and turning)

Initial situation

- Inconsistent tool life
- Tool breakage caused by chip clogging
- Current tool is also capable of boring and turning

Tool selection

System: 108
Insert: special tool with internal coolant
Tool holder: special tool with internal coolant
Coating: TiAlN nanoA
Optimised shape and position of the coolant supply

Cutting parameter boring

Cutting speed: 120 m/min
Feedrate: 0.03 mm/rev.

Cutting parameter contouring

Cutting speed: 120 m/min
Feedrate: 0.08 mm/rev.
Depth of cut: 1.00 mm

Customer benefit

- ✓ Very good chip removal
- ✓ No longer tool breakage
- ✓ Very effective coolant supply benefits surface finish
- ✓ 10% Increase of tool life



Connector

2. Machining – External thread turning (pitch = 1.5 mm)

Initial situation

- Customer is using ISO inserts
- Burrs occur during machining
- Poor surface finish

Tool selection

System: 305
Insert: standard item
Tool holder: standard item with
internal coolant
Coating: FIRE
Full ground thread turning insert

Cutting parameter

Cutting speed: 80 m/min
Feed = pitch
Depth of cut per stroke: 0.06 mm

Customer benefit

- ✓ 50% Improved surface finish due to full ground insert
- ✓ Less burrs
- ✓ Optimised chip removal due to the adjustable coolant supply
→ **exclusively at Gühring**



Connector

3. Machining – External profile grooving

Initial situation

- Currently customer is machining the complex contour with various tools
- This leads into long machining time with high production costs involved

Tool selection

System:	308
Insert:	special tool
Tool holder:	special tool with internal coolant
Coating:	FIRE

Cutting parameter roughing

Cutting speed:	150 m/min
Feedrate:	0.09 mm/rev.

Cutting parameter finishing

Cutting speed:	200 m/min
Feedrate:	0.04 mm/rev.

Customer benefit

- ✓ Pre-grooving and finish grooving with one tool means no tool change needed
- ✓ Chamfering included in the ground contour means no burrs
- ✓ Reduced machining costs due to significantly reduced machining time



Connector

4. Machining – External grooving (3 grooves width 1.5 mm)

Initial situation

- Customer unhappy because of poor chip removal what occasionally leads to insert breakage
- Inconsistent surface finish

Tool selection

System:	305
Insert:	special tool with suitable chip breaker
Tool holder:	standard item with internal coolant
Coating:	FIRE

Cutting parameter

Cutting speed:	180 m/min
Feedrate:	0.08 mm/rev.
Depth of groove:	5.00 mm

Customer benefit

- ✓ High process reliability due to save chip removal
- ✓ Occasionally insert breakage stopped
- ✓ Good surface finish:
 $r_z = 3-5 \mu\text{m}$



Connector

5. Machining – Keyway broaching (width = 5C11, depth = 5 mm)

Initial situation

- Current tool is a standard item
- Very limited space available

Tool selection

System:	106
Insert:	special item
Tool holder:	standard item with internal coolant
Coating:	TiAlN nanoA

Cutting parameter

Feedrate:	7,000 mm/min
Depth of cut per stroke:	0.07 mm

Customer benefit

- ✓ Individually designed special insert with optimised rigidity
- ✓ Rigid insert allows high feed rate
- ✓ Improved tool life





MANY THANKS
FOR YOUR ATTENTION