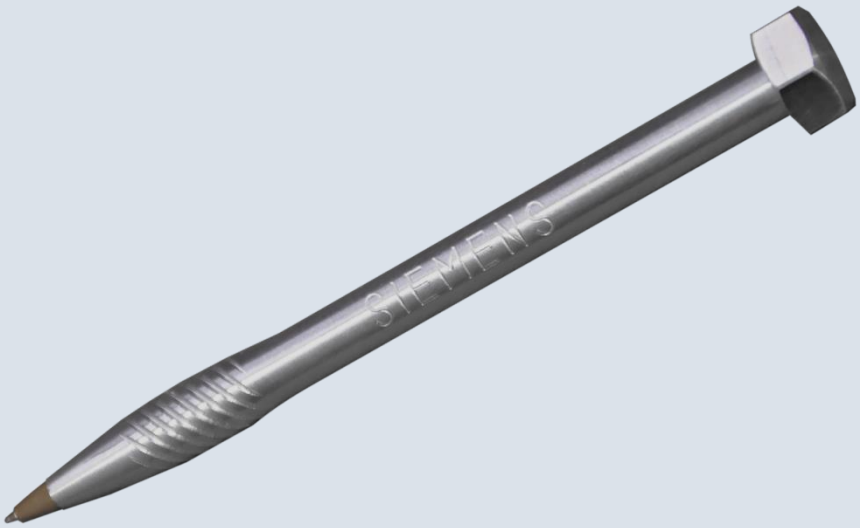
Screw as ball-point pen



Ball-point pen

The ball-point pen - a writing utensil that is an indispensable part of every day life - especially at school. With some basic CNC knowledge, this ordinary device can become a personalized writing implement.

Thus, at the vocational school for handicrafts and industry in Bozen, the idea of designing an M10 hexagonal screw as a ball-point pen was born. The result was a light-weight, ergonomic writing instrument, which can be personalized with an engraving.

The goal was to give the students realistic exposure to CNC programming with the SINUMERIK controller from Siemens.

The ball-point pen consists of 3 parts. Two parts are manufactured using CNC turning with ShopTurn. One part, the ball-point pen refill, is taken from a commercially available ball-point pen.

All of the information required for production, 3D design data and derivations of drawings (Autodesk Inventor 2015), tool data and workplans are compiled in the following. The 3D design data and derivations of drawings for the required clamping aids are also available for download.

www.siemens.com/cnc4you

Contents

1. Safety Note

Working with machines is always associated with numerous hazards. It is therefore imperative that the legal and company safety regulations are also observed during the production of the ball-point pen.

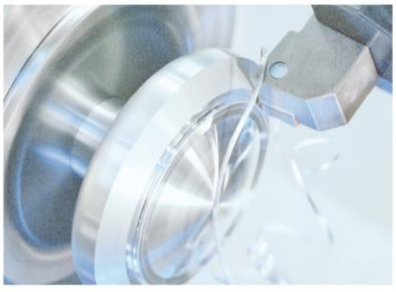
2. Preliminary remark

The following description is intended for persons acquainted with CNC machines and who have experience with or knowledge of SINUMERIK CNCs. All the technical data listed here corresponds to the machines, tools, materials, machining plans and drawings used to produce the prototype. Because of the widely varying conditions in other workshops, this data is only of exemplary character for a reproduction. Nevertheless, a problem-free reproduction should be possible in most cases.

The programs were created and tested on the machines. These are equipped with ShopTurn Version 06.04. As a rule, the program can easily be adapted to other SINUMERIK versions, e.g. other SINUMERIK Operate SW versions. A simulation and necessary changes, such as zero points, should be carried out in any case.

You can download all the CAD drawings, programs and machining descriptions for the workpieces free of at **www.siemens.com/cnc4you**.

The following files and formats are available there:
NC programs ShopTurn, drawings PDF, 3D data, pictures

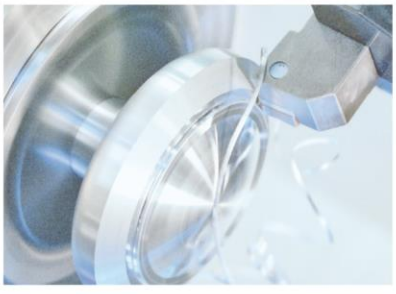


3. Workpiece blanks

- AlCu4PbMg, round stock Ø 14 mm
- AlCu4PbMg, round stock Ø 20 mm

4. Turning machine and machining plan

- CNC turning machine MaxxTurn 65 from EMCO, Siemens 840D - SINUMERIK 06.04
- CNC turning machine EmcoTurn 45 from EMCO, Siemens 810D - SINUMERIK 06.04
- ShopTurn machining plan body: Side 1 — SCHREIBER_KOERPER_01.MPF, SCHREIBER_KOERPER_01_TMZ.INI
- ShopTurn machining plan body: Side 2 — SCHREIBER_KOERPER_02.MPF, SCHREIBER_KOERPER_02_TMZ.INI
- ShopTurn machining plan hexagon: Side 1 — SCHREIBER_6_KANT_01.MPF, SCHREIBER_6_KANT_01_TMZ.INI
- ShopTurn machining plan hexagon: Side 2 — SCHREIBER_6_KANT_02.MPF, SCHREIBER_6_KANT_02_TMZ.INI

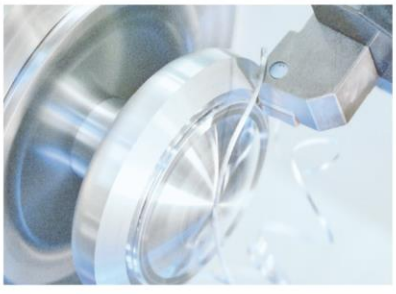



5. Tools used

Turning, drilling and milling tools for machining both sides of the parts.

Tools for turning machine

Tool name in the machining plan	Designation
SCHRUPPER-A-80	Turning chisel for outside with one roughing disk, disk radius R0.8, corner angle 80°
SCHLICHTER-A-55	Turning chisel for outside with one finishing disk, disk radius R0.4, corner angle 55°
SCHLICHTER-A-35	Turning chisel for outside with one finishing disk, disk radius R0.4, corner angle 35°
NC-ANBOHRER-H	NC spotdrill, ø10mm, tip angle 90°, axial
BOHRER-3.9-H	Drill HSS, ø3.9mm, axial
ZIEHER	Rod gripper
GRAVIERER-V	Engraving unit VHM, driven tool, radial
BOHRER-1.5-V	Drill HSS, ø1.5mm, driven tool, radial
ABSTECHER-3	Cutoff tool HM, plate width 3mm
BOHRER-6.8-LANG-H	Drill HSS, ø6.8mm, long version, axial
GEW-BOHRER-M8-H	Machine screw tap HSS, M8, axial
GEWINDESTAHL-1.25	Threaded turning chisel HM, full profile, pitch 1.25 mm
FRAESER-10-V	End mill VHM, ø10 mm, 4 cutting edges

6. Turning the parts

The ball-point pen consists of two individual parts.

Ball-point pen body

The body of the ball-point pen forms the base.

Machining SCHREIBER_KOERPER_01 (Side 1)

For this machining, the raw part is clamped ø14 mm short (15 mm) in the chuck. Now, this side is machined by means of face turning (chipping), or by centering and drilling ø3.9 mm (centered drilling).

The raw part is moved to the next position with the aid of a rod gripper. Since the part was first clamped short and is extracted using the rod gripper, the operator must work with two zero offsets. The second zero offset is activated.

The tailstock with the revolving center point (RÖHM type 614 FLEX) and the in-house manufactured insert, is approached and supports the part for the subsequent machining.

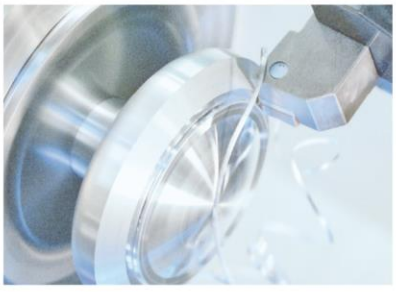
The exterior contour is created in the contour editor and is roughed and finished with the aid of the "chipping" cycle. The engravings (Siemens and LBS Bozen) are programmed with the "Engraving" cycle and are milled at the perimeter.

> ATTENTION
> A maximum of 10 characters are possible for each engraving.

The "thread" is machined via a milling contour, which is worked into the volume with the "path milling" cycle and by further turning of the C-axle or by repeating a subprogram 8 times at the perimeter.

The ø1.5 mm drill-hole, which serves to ventilate the refill, is produced at the right position at the perimeter with the "Deep drilling" cycle or with the "Hole circle" cycle. The tailstock has fulfilled its task and is retracted. The part is slightly beveled, cut off and caught by the part catcher and then discharged.

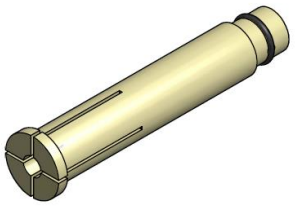
The zero offset is reset and the machining can start again.

Work steps at the turning machine

1. Approach the reference point of the machine
2. Read-in the workplan: SCHREIBER_KOERPER_01.MPF
3. Read-in the tool list or zero offsets SCHREIBER_KOERPER_01_TMZ.INI
4. Measure tools and enter them in the tool list
5. Insert tools in magazine
6. Clamp the workpiece
7. Set tool zero point, by scraping
8. Program zero offsets
9. Teach in tailstock
10. Perform simulation
11. Start production, process workplan

Machining SCHREIBER_KOERPER 02 (Side1)



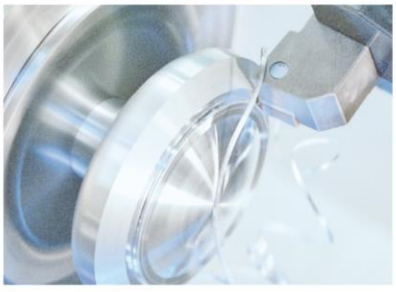
For machining the second side, the body of the ball-point pen must be inserted into an in-house manufactured clamping device made of plastic. A stop pin is inserted and secured with an O-ring. The part to be machined must be moved to the stop pin and clamped into the chuck of the machine using the clamping device.

Now, this side is face turned by means of "chipping" or the edge is provided with a small bevel.

The center drill-hole (center drilling) and the ø6.8 mm drill-hole (center drilling) are worked in. The center drill-hole is dimensioned in such a way that subsequent thread is also correctly beveled. The M8 thread is drilled via the "Center tapping" cycle.

Work steps at the turning machine

1. Approach the reference point of the machine
2. Read-in the workplan: SCHREIBER_KOERPER_02.MPF
3. Read-in the tool list or zero offsets SCHREIBER_KOERPER_02_TMZ.INI
4. Measure tools and enter them in the tool list
5. Insert tools in magazine
6. Correctly clamp the clamping device, complete with the tool

7. Set tool zero point, by scraping
8. Perform simulation
9. Start production, process workplan

Ball-point pen hexagon

The ball-point pen hexagon forms the end of the ball-point pen and seals it.

Description SCHREIBER_SECHSKANT_01 (Side 1)

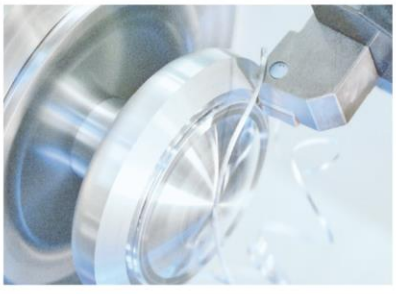
The ø20 mm raw part is clamped 65 mm from the chuck. Now this side is face turned (chipping).

In the contour editor, the external contour is created, which is roughed and finished with the "Chipping" cycle. The thread undercut Din 76-B is made with the aid of the "Undercut DIN" cycle. The M8 thread is turned by means of "Thread longitudinal". The hexagon SW 17 mm at the perimeter is roughed and finished with the aid of the "multi-edge" milling cycle.

The part is cut off, the zero point is moved in the direction of negative Z. The program is executed again by means of the programmed repetitions. Two additional parts are manufactured.

Work steps at the turning machine

1. Approach the reference point of the machine
2. Read-in of the workplan SCHREIBER_6_KANT_01.MPF
3. Read-in of the tool list or zero offsets SCHREIBER_6_KANT_01_TMZ.INI
4. Measure tools and enter them in the tool list
5. Insert tools in magazine
6. Clamp the workpiece
7. Set tool zero point, by scraping
8. Perform simulation
9. Start production, process workplan

Machining PEN_HEXAGON_02 (Side2)

The ø20 mm raw part is clamped 65 mm from the chuck. Now, this side is face turned (chipping). For the machining of the second side of the hexagon, it must be screwed into an in-house manufactured clamping device, which is clamped in the chuck of the turning machine.

For the subsequent machining, it must be noted that the position of the turning chisel cutting edges and the directions of rotation must be selected in such a way that the part does not become unscrewed during the machining.

With the aid of the "Chipping" cycle, this side is face turned and the 30° bevel is produced.

The clamping device is securely clamped in.

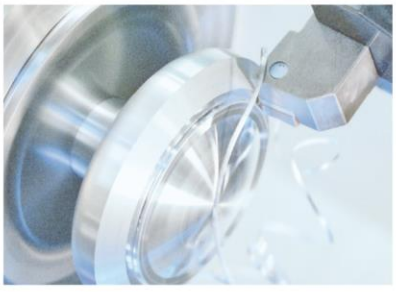
Work steps at the turning machine

1. Approach the reference point of the machine
2. Read-in of the workplan SCHREIBER_6_KANT_02.MPF
3. Read-in of the tool list or zero offsets SCHREIBER_6_KANT_02_TMZ.INI
4. Measure tools and enter them in the tool list
5. Screw the workpiece into the clamping device
6. Insert tools in magazine
7. Set tool zero point, by scraping
8. Perform simulation
9. Start production, process workplan

Assembly

The individual parts of the ball-point pen can simply be put together. The hexagon is screwed onto the ball-point pen body.

The refill is taken from a commercially available "BIC ball-point pen" and is pressed into the ø3.9 mm drill-hole from the front. This drill-hole is somewhat smaller, so that the refill cannot fall out on its own. If the refill of the pen runs out of ink, it can be removed from the hole with very little effort and easily be replaced with a new one.

7. Information on the Internet

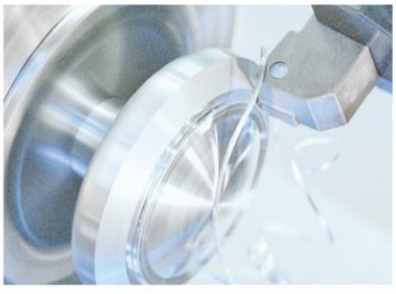
Design of the parts, creation of the drawings, development of the machining plans for machining

Landesberufsschule für Handwerk und Industrie
Romstr. 20
39100 Bozen

Internet: http://www.bozen.berufsschule.it/

Details of the tool machine and tools to be used

EMCO CNC-turning machine
Internet: http://www.emco-world.com/

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- DOConWEB (www.automation.siemens.com/doconweb)
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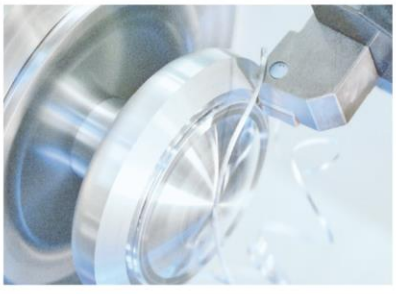
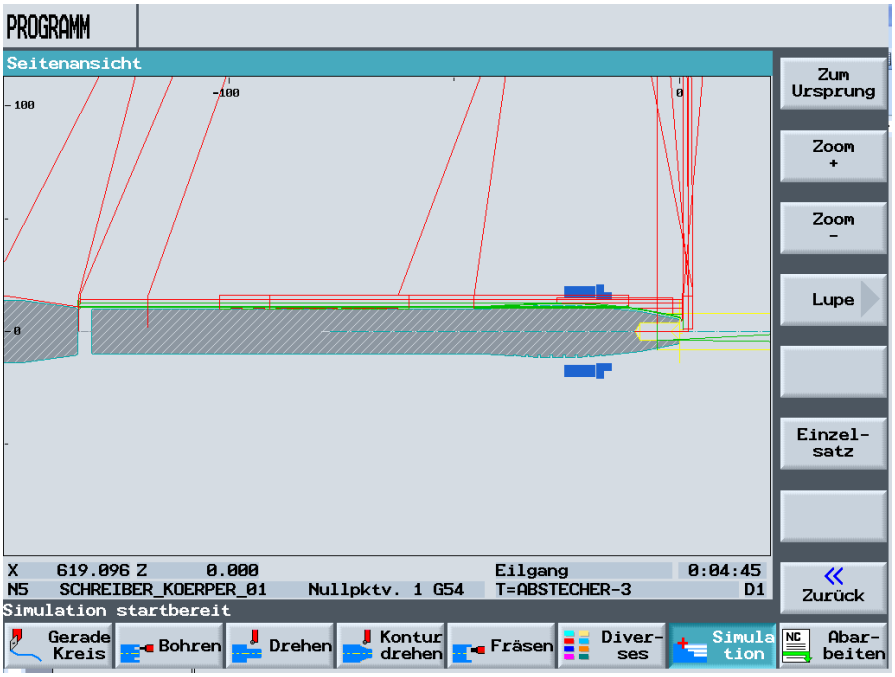
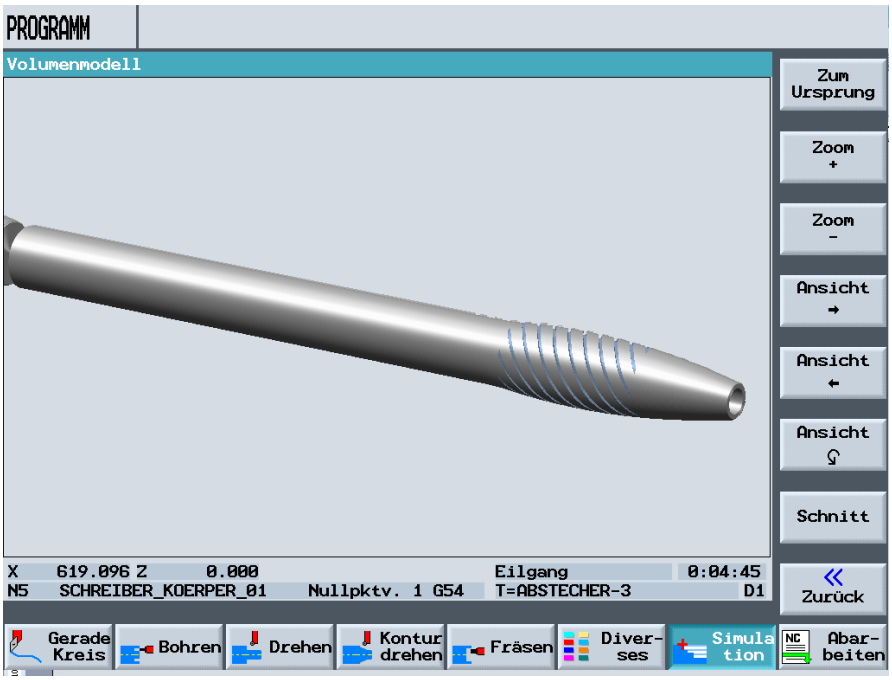
- SINUMERIK website (www.siemens.com/sinumerik)



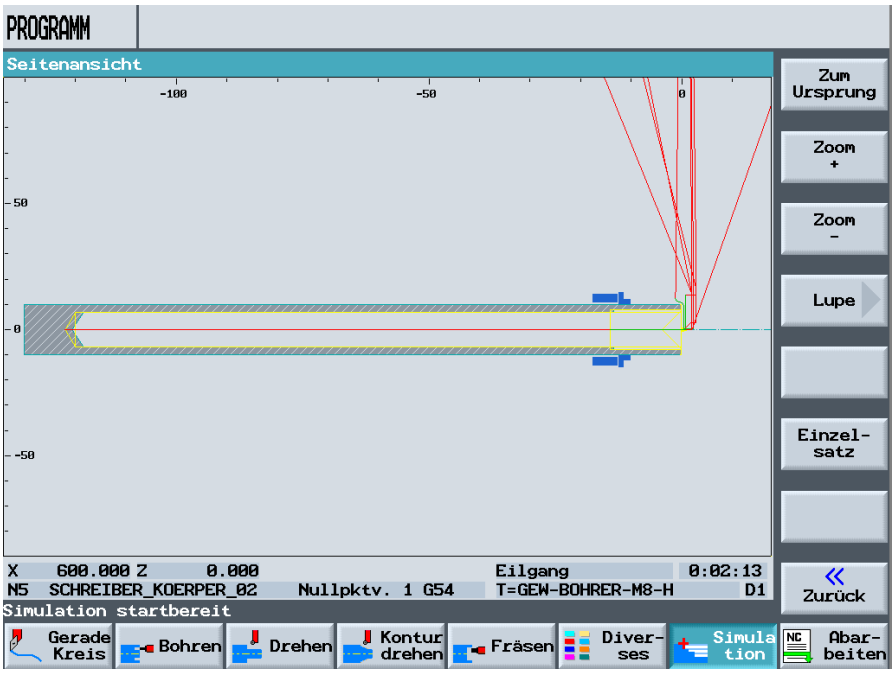
8. Figures

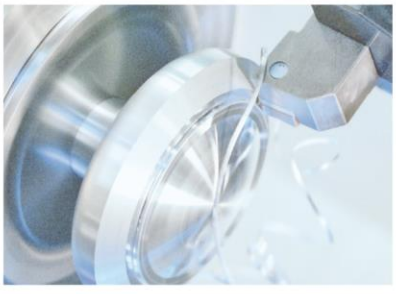
Simulation base body side 1



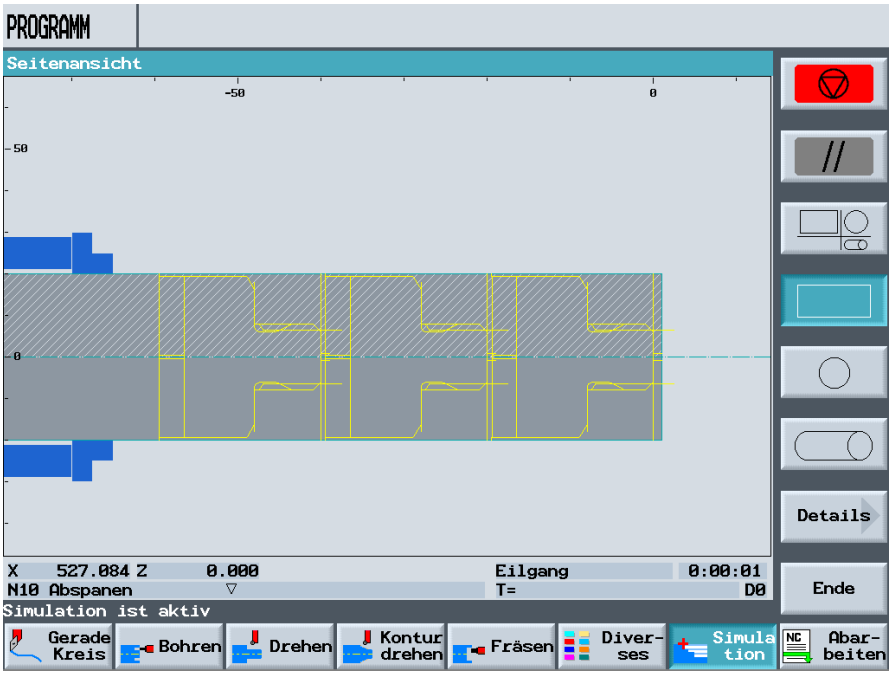


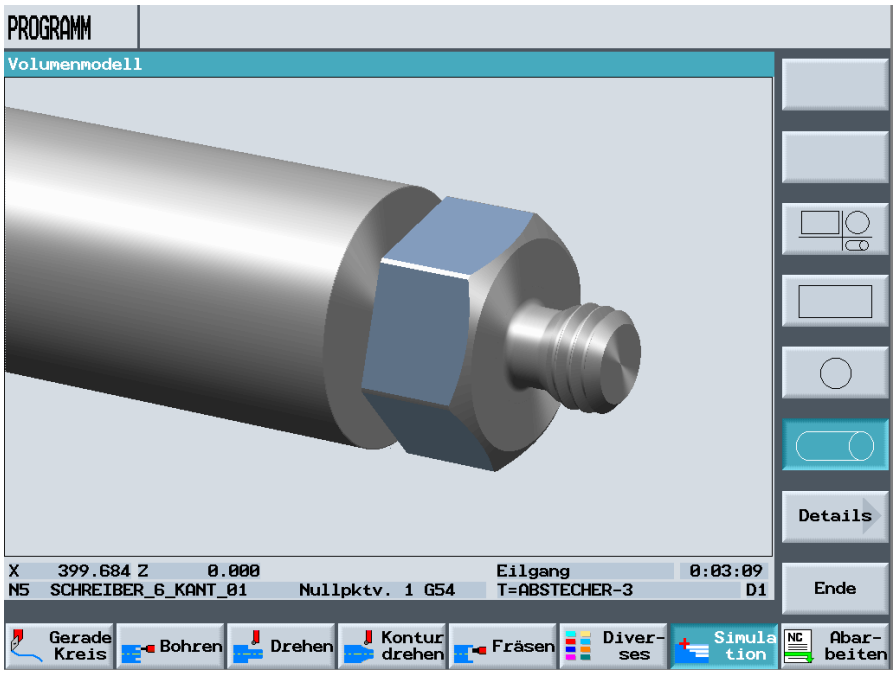
Simulation base body side 2



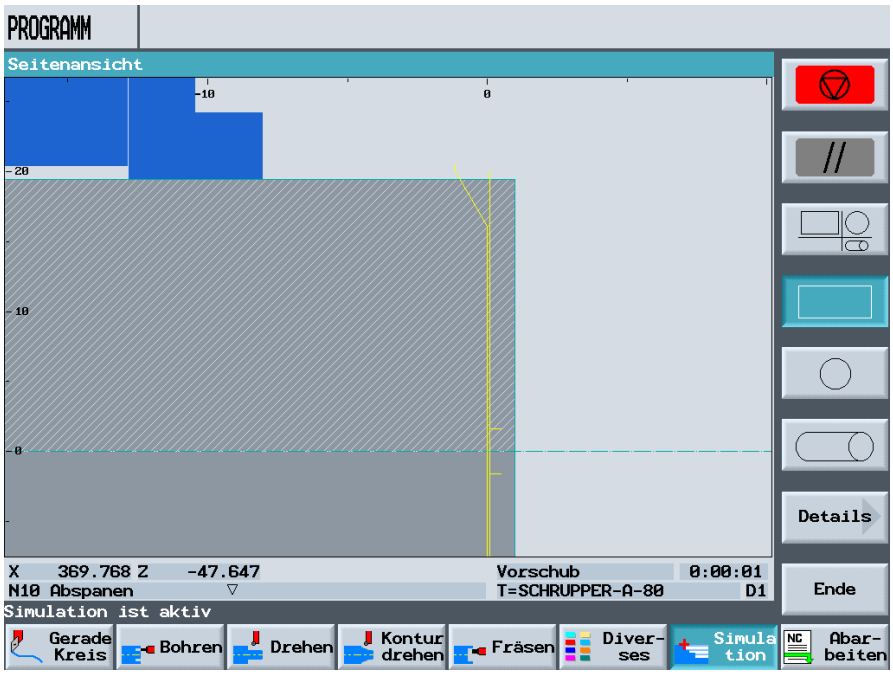


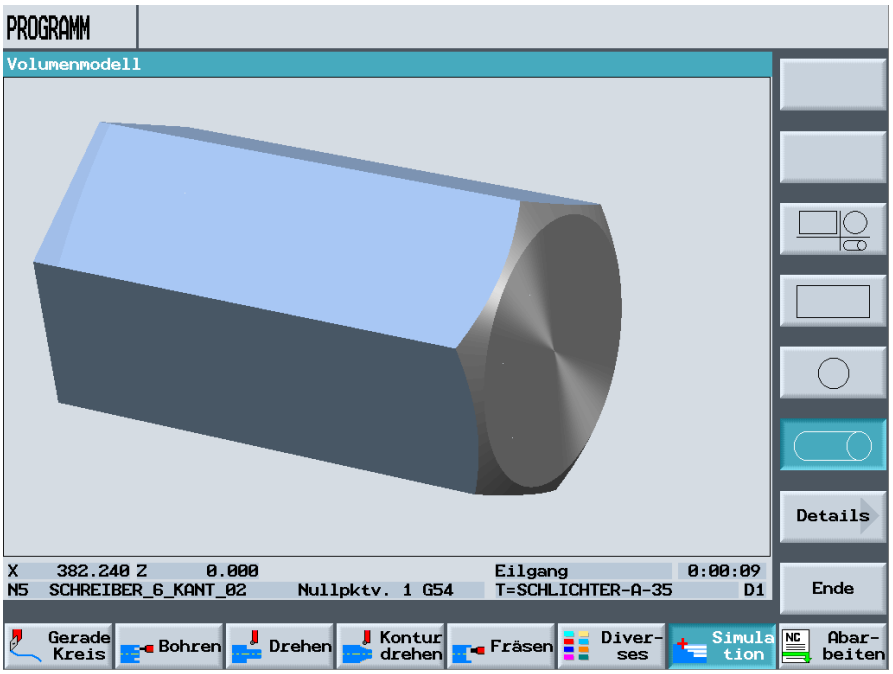
Simulation hexagon side 1

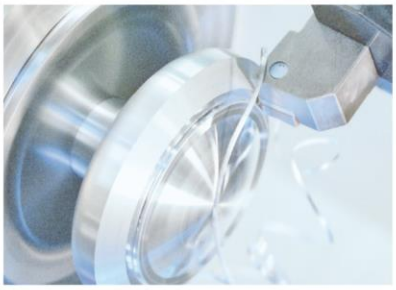




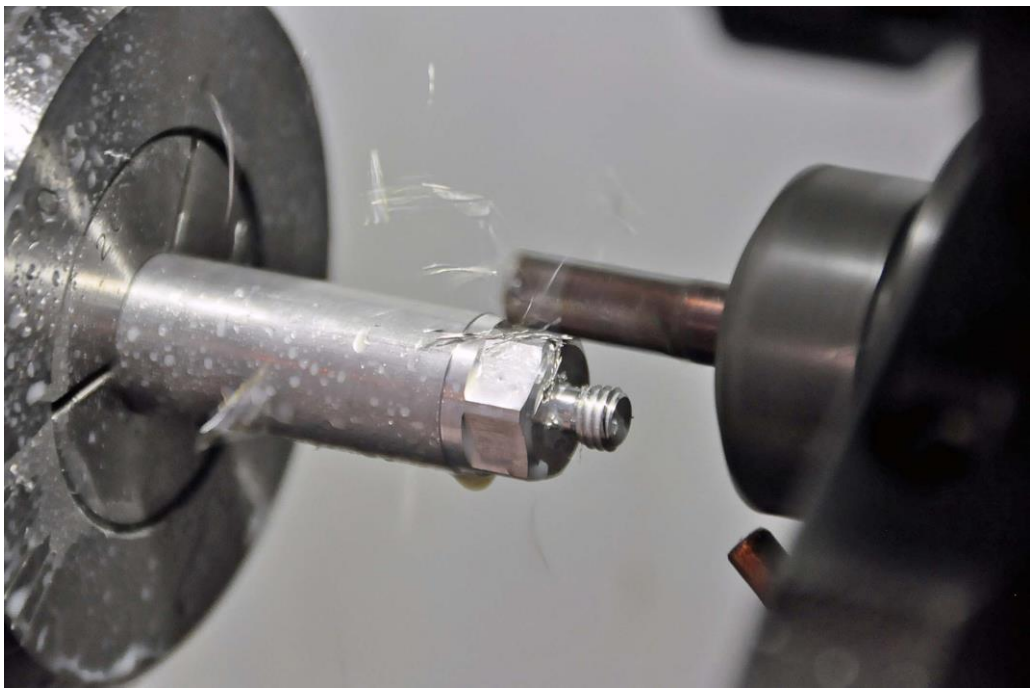
Simulation hexagon side 2

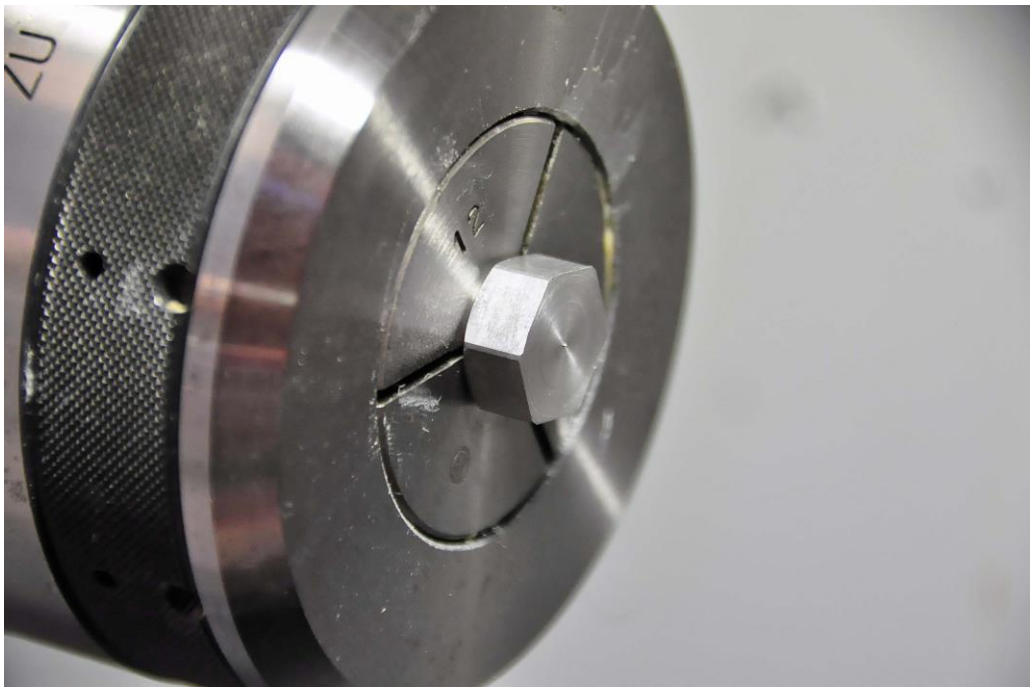


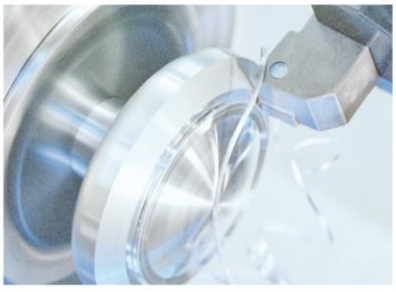




Figures production hexagon







Figures production base body