Tea Light Holder

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Christmas Tea Light Holder:

Our Christmas workpiece for 2019 is a decorative candle holder for standard tea lights with a diameter of 39 mm and a height of 16 mm. A special feature of this workpiece is the curved bottom running out to the edge. Thanks to the arched bottom, the tea light rests comfortably in the hand and is easy on sensitive furniture surfaces. As the edge of the curved bottom does not sit flush on the surface beneath, it casts a shadow that creates a greater contrast with the engraving around the edge, which can then be easily read by candlelight.

The workpiece is a turned part made of low-silica aluminum. Before being engraved, it is colored, by anodizing for example.

All information required for machining, including the set of drawings, tool data, work plan and NC programs, is given below.

1. Safety note

The use of machinery always entails wide-ranging hazards. It is therefore essential that you also strictly observe the customary and statutory safety regulations when manufacturing the tea light holder.

2. Preliminary remarks

The following description is intended for operators of CNC machines who have experience with or knowledge of the SINUMERIK CNC. All technology data listed here correspond to the machines, tools, materials, work plans, and drawings used in the manufacture of the sample. For remanufacturing purposes, they only serve as a model, on account of the diverse conditions prevailing in other workshops. Trouble-free machining should nevertheless be possible in most cases.

The program was generated and tested on a CNC turning machine with a counterspindle. The machine was equipped with a SINUMERIK 840D sl and a SINUMERIK Operate V4.7 SP6 user interface. As a rule, the program can be easily adapted to other turning machines (e.g. without counterspindle) or to other SINUMERIK and software versions. Simulations and any necessary modifications, such as zero point adjustments, should always be carried out.

All CAD drawings, programs, and manufacturing descriptions for the workpieces can be downloaded free of charge at **www.siemens.com/cnc4you**.

We offer you the following files and formats:
ShopTurn NC programs

3. Workpiece material/bill of materials

- Low-silica aluminum as round material Ø 70 mm

  Rod length for 6 parts approx. 530 mm
- Purchased parts: commercially available tea lights measuring 39 mm x 16 mm

  Tea lights higher than 16 mm can also be used.

4. Turning machine and work plans

CNC turning machine:

- DOOSAN PUMA 2600SY
- SINUMERIK 840D with SINUMERIK Operate V4.7 SP6

ShopTurn work plan:

- TEELICHTHALTER_V2_1.MPF

5. Tools used

5.1 Tools for turning machine with counterspindle

Tool/short name	Description
SCHRUPP_HS	Roughing turning tool, main spindle
SCHL35_HS	Finishing turning tool, main spindle
FRAESER_D12_HS	Milling cutter with three cutting edges, 12 mm in diameter, driven tool, face machining, main spindle
FRAESER_D4_HS	Milling cutter with three cutting edges, 4 mm in diameter, driven tool, face machining, main spindle
FASER_D6_HS	Chamfer cutter, 6 mm in diameter, driven tool, main spindle
ROUGHING_CS	Roughing turning tool, counterspindle
FINISHING_CS	Finishing turning tool, counterspindle
BALL_END_CYL_D1	Ball end cutter, 1 mm in diameter, driven tool, cylinder surface machining, counterspindle
EINSTECH_3MM_HS	Parting tool, main spindle

6. Turning the workpiece

6.1 Work steps at the turning machine with counterspindle

1. Approach the reference point of the machine.
2. Read-in the work plan: TEELICHTHALTER_V2_1.MPF.
3. Import the tool list and/or the work offsets TEELICHTHALTER_V2_1_TMZ.INI.
4. Measure the tools and enter them in the tool list.
5. Insert the tools in the magazine.
6. Clamp the (first) workpiece, extension length depends on the machine and the tool. Shorter extension lengths are possible with a parting tool that allows you to work close to the chuck of the main spindle. The extension length was 90 mm for the DOOSAN PUMA 2600SY used for the sample piece. In the simulation of the TEELICHTHALTER_V2_1.MPF part program offered for download, the extension length was 60 mm
7. Set tool zero point by scraping.
8. Program zero offsets
9. If necessary, alter the text for the engraving in the engraving cycle.
10. Perform simulation
11. Start production, process work plan
12. Remove the workpiece

Coloring or anodizing: before engraving!

If you want to paint or anodize the workpiece, it is advisable to carry out the engraving after coloring. To do so, clamp the colored workpiece using soft jaws or a collet chuck on the cylindrical edge of the candleholder flush with the star (make sure of concentricity) and start the part program from the engraving cycle. The text specified in the engraving cycle can be customized.

Machines without counterspindle

If the machine you are using does not have a counterspindle, use the optional program stop (M01) before the counterspindle transfer for manual reclamping. In this case, the workpiece has to be clamped after parting with the machined side onto the main spindle using soft jaws or a collet chuck. Concentricity must be ensured in this 2nd clamping.

Star contour is stored in the program

The contour used to mill the star was created in ShopMill and imported into the part program by a DXF file. This means a DXF reader is not required for executing the part program.

6.2 Executing the "TEELICHTHALTER_V2_1.MPF" ShopTurn work plan

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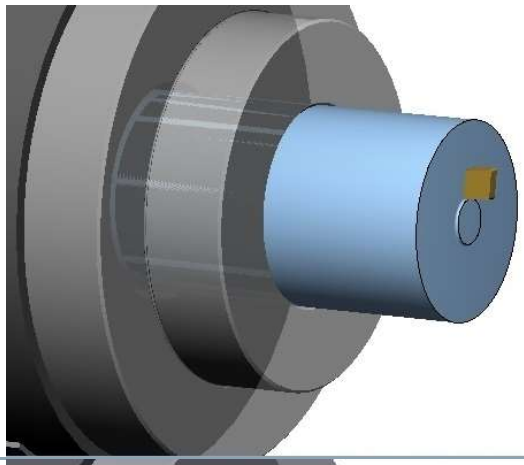
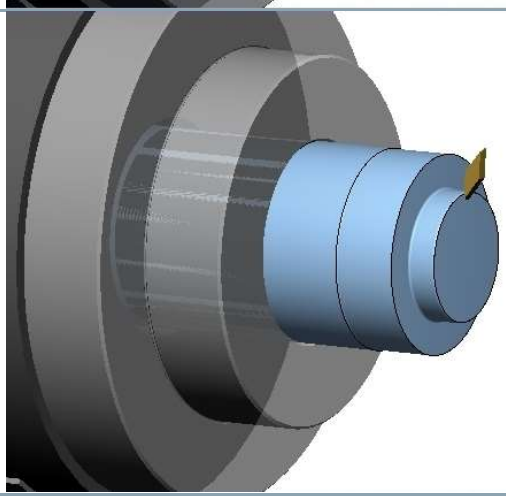
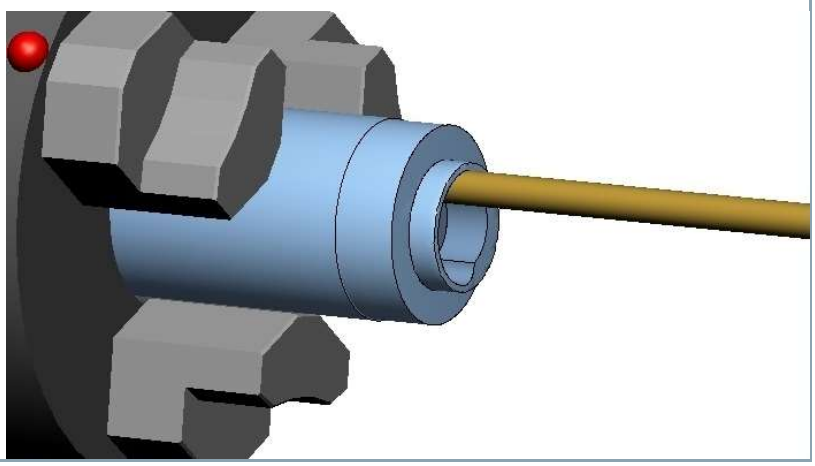
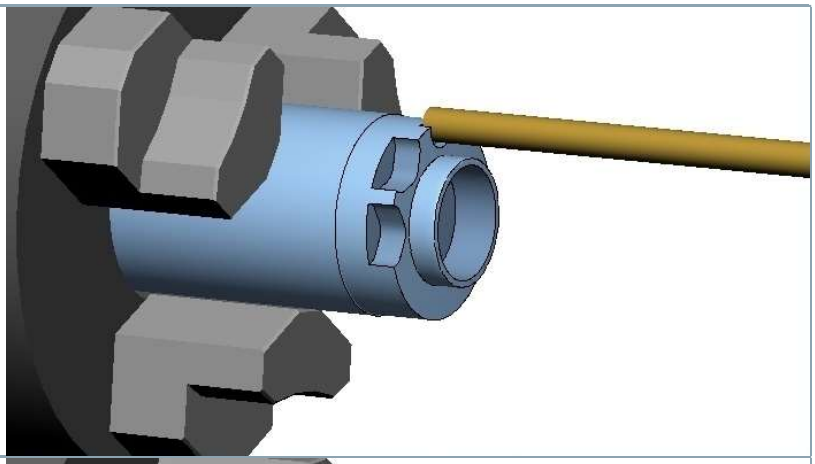
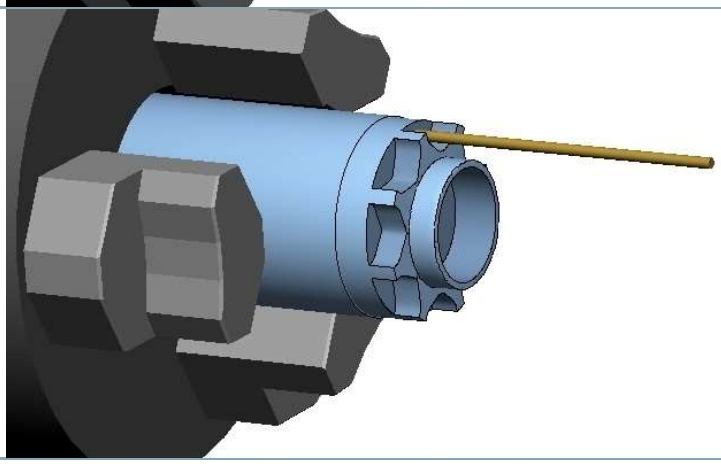
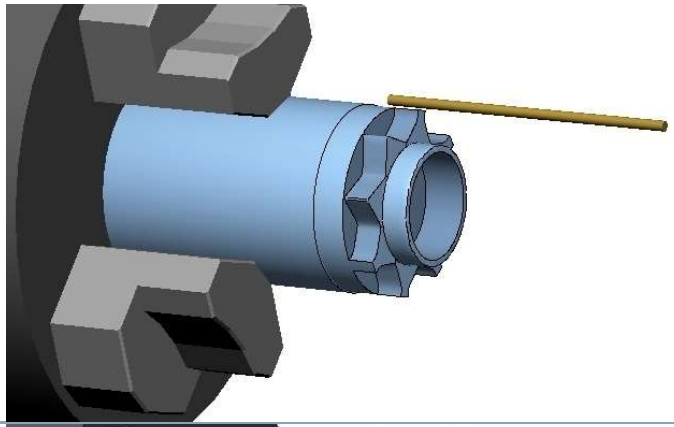
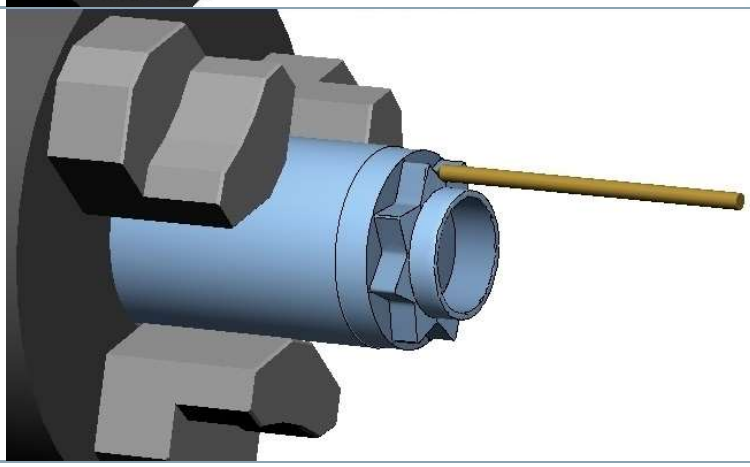
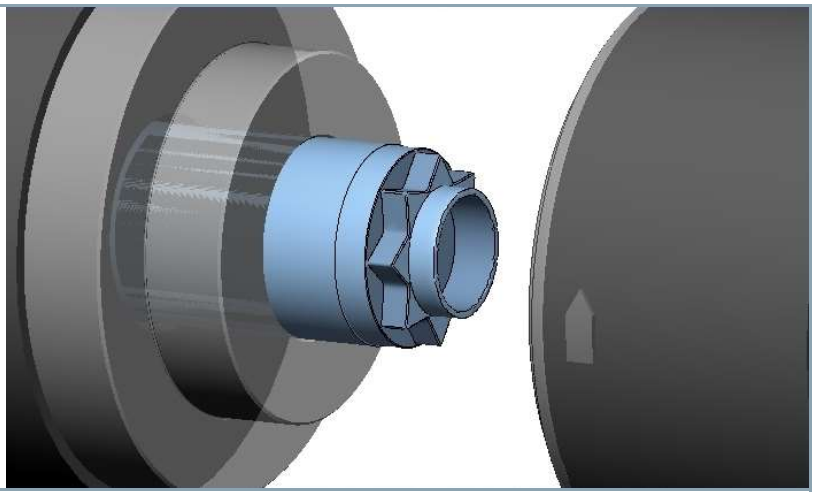
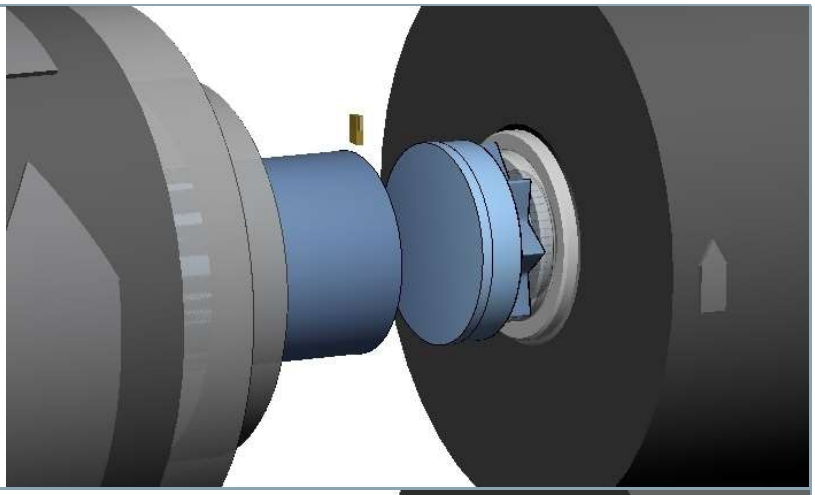
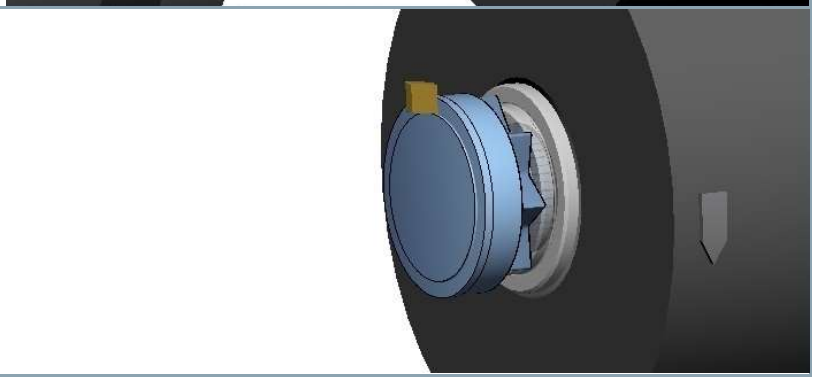
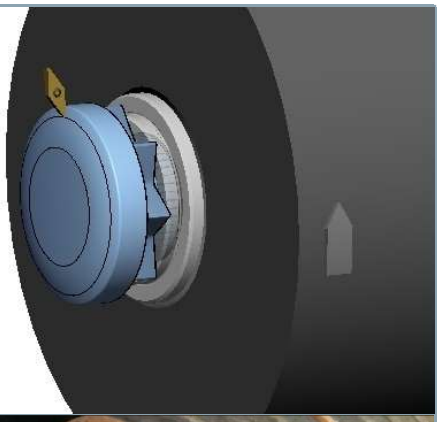
Machining step	Diagram
Clamp the aluminum blank, extension length depends on the machine and tool (on the DOOSAN PUMA 2600SY: 90 mm), load TEELICHTHALTER_V2_1.MPF, complete preparations (see section "6.1 Work steps at the turning machine with counterspindle"). Start the program, first machining step: Face turning	
Rough and finish the outside contour	
Machine the pocket for the tea light (12 mm end milling cutter with 3 cutting edges)	

Pre-roughing of the cutouts for the star	
Removal of the residual material with 4 mm end milling cutter	
Finish the tips of the star for the contour	
Deburring using a 6 mm chamfer cutter, set so that really only the edges to be deburred are reached.	

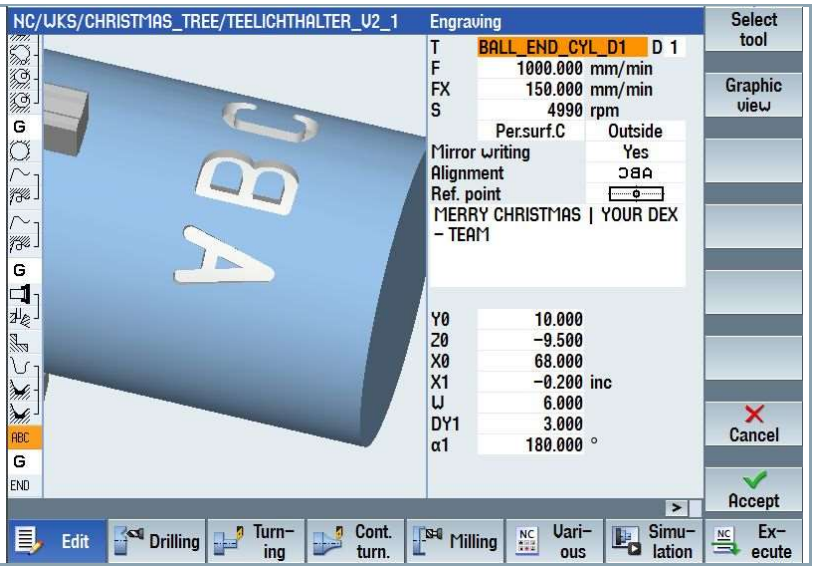
Counterspindle transfer (with retightening of material for any following parts) or programmed program stop for manual parting and reclamping on soft jaws or collet	

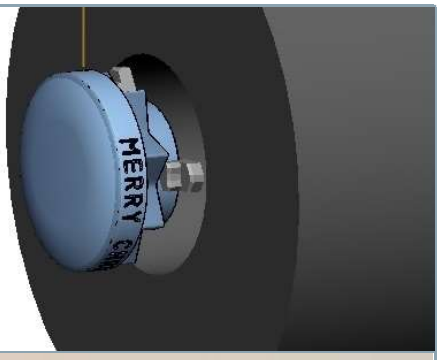
With the "complete" programmed spindle transfer, all the following work steps are automatically carried out in a mirrored fashion – corresponding to the "Machining on the counterspindle" clamping situation.
If the counterspindle transfer is not used because reclamping is done manually and machining continues on the main spindle, no adjustments to the part program are required (the program-controlled mirroring is not carried out).

Parting and disengagement with program-controlled transfer to the counterspindle	
Face turning the rear	

Contour cycle for machining the rounded bottom (roughing and finishing)	
At this point, the workpiece should be removed if the tea light holder is to be colored before engraving.	

After coloring, clamp the workpiece flush to the star using soft jaws for the engraving process, make sure of concentricity.

Optional alteration of the engraved text (before starting the program)	

Engraving with 1mm ball end cutter	
Remove the finished workpiece	

7. Information on the Internet

Published by

Digital Experience and Application Center (DEX)
Frauenauracher Strasse 80
91056 Erlangen, Germany

Design of parts, creation of drawings, development of work plans for machining:

Digital Experience and Application Center (DEX)
Frauenauracher Strasse 80
91056 Erlangen, Germany

Information on the machine tools/tools used:

DOOSAN turning machine:

Internet: http://www.doosan.com

Manuals and information issued by Siemens AG

Manuals and detailed information about our products can be found on the following websites:

- DOConWEB (https://support.industry.siemens.com/cs/ww/en/view/109476679)
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