HEIDENHAIN

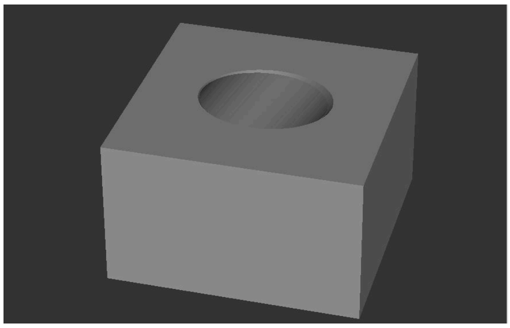
NC Solutions

Description of NC Program 5100

English (en)
3/2020

1 Description of NC program 5100_en.h

NC program for deburring an oblique hole on the surface with a forming tool.



Requirement

Machine a hole in a tilted working plane. Subsequently, deburr the upper wall of the hole with a forming tool. The contour at the surface is an ellipse. The lengths of the semiaxes of this ellipse depend on the hole diameter and on the angle of the hole to the surface.

i	This NC program was written for a hole that is tilted by an SPA spatial angle.

i	The path contour for deburring is defined with the X, Y, and Z axes. Additional rotary axes are required for machining of the hole.

NC program 5100_en.h

At program start, define the blank form and the parameters required of the machining process. Then the control calls the NC program 51001_en.h. With this NC program, the control machines the hole in a tilted working plane.

After running the called NC program, the control calls the forming tool for deburring. Then the control positions the tool at clearance height in the tool axis. Then it positions the circle center point at the center of the hole. Subsequently, it pre-positions the tool to the starting point in the X/Y plane first and then to the defined safe position in the Z axis.

In the next program step, the control calls the **LBL 10** subprogram. The calculation and movement for the machining process take place in this subprogram. When the subprogram has been executed, the control retracts the tool and ends the NC program.

After the defined **M2** program end, the **LBL 10** subprogram is defined. In this subprogram, the control first shifts the datum into the center of the hole and to the upper surface of the machining operation. Then it rotates the coordinate system by the defined value.

Some calculations follow. First, the control sets the current angle to equal the defined starting angle. Then it calculates the opening angle between the starting angle and stopping angle. In order to calculate the stepping angle, the control divides the opening angle by the subdivision. In the next two NC blocks, the control calculates the semiaxis of the ellipse in Y direction from the inclination angle of the hole and the hole diameter. In the last step of these calculations, the control sets the counter to zero.

Then the control calls the **LBL 2** subprogram. In this subprogram, it calculates the X and Y coordinates for the tool path. After jumping back from the subprogram, the control moves to the calculated coordinates in the X/Y plane. Then it moves the tool to the milling depth in the Z axis.

Subsequently, the **LBL 1** jump label is defined. Then the control increments the current angle by the stepping angle and increments the counter by one. In order to calculate the coordinates for the next point, the control calls the **LBL 2** subprogram again. When the subprogram is completed, the tool moves to the calculated coordinates.

Then the control checks whether the counter has reached the value of the subdivision.

- If the counter value is smaller than the subdivision value, the control jumps to the **LBL 1** jump label and repeats the program part.
- If the counter value equals the subdivision value, the NC program continues to run.

After the comparison, the control resets first the rotation and then the datum shift. Subsequently, it ends the **LBL 10** subprogram.

Then the **LBL 2** subprogram is defined. In this subprogram, the control calculates the X and Y coordinates for the end point of the tool path from the current angle and the semiaxes of the ellipse. Then it sets the Z coordinate to equal the milling depth. Then it ends the subprogram.

> The control moves along the calculated tool path without radius compensation. If you want to shift the tool closer to or farther from the contour, you must take this into account when defining the radius.

Parameter	Name	Meaning
Q1	HOLE RADIUS	Radius of the hole. The control calculates the midpoint path of the forming tool. If you want to shift the tool path closer to or farther from the contour, you must take this offset into account in this parameter.
Q3	STARTING ANGLE	Angle at which the tool path begins in relation to the positive X axis.
Q4	STOPPING ANGLE	Angle at which the tool path ends in relation to the positive X axis.
Q7	HOLE CENTER IN X	X coordinate of the hole center
Q8	HOLE CENTER IN Y	Y coordinate of the hole center
Q9	COORDINATE SURFACE	Difference between the surface and the Z datum
Q11	INCLINED ANGLE ABOUT A	Angle by which the hole is tilted in relation to the workpiece coordinate system
Q12	MILLING DEPTH	Depth of the tool tip in relation to the upper surface
Q13	ROTATION	Rotation of the contour in the X/Y plane
Q20	FEED RATE FOR PLUNGING	Traversing speed of the tool in the Z axis
Q21	FEED RATE FOR MILLING	Traversing speed of the tool in the X/Y plane
Q26	SAFE POSITION Z	Coordinate of the Z axis to which the control pre-positions the tool in rapid traverse
Q26	SUBDIVISION	The number of linear elements into which the control divides the tool path

NC program 51001_en.h

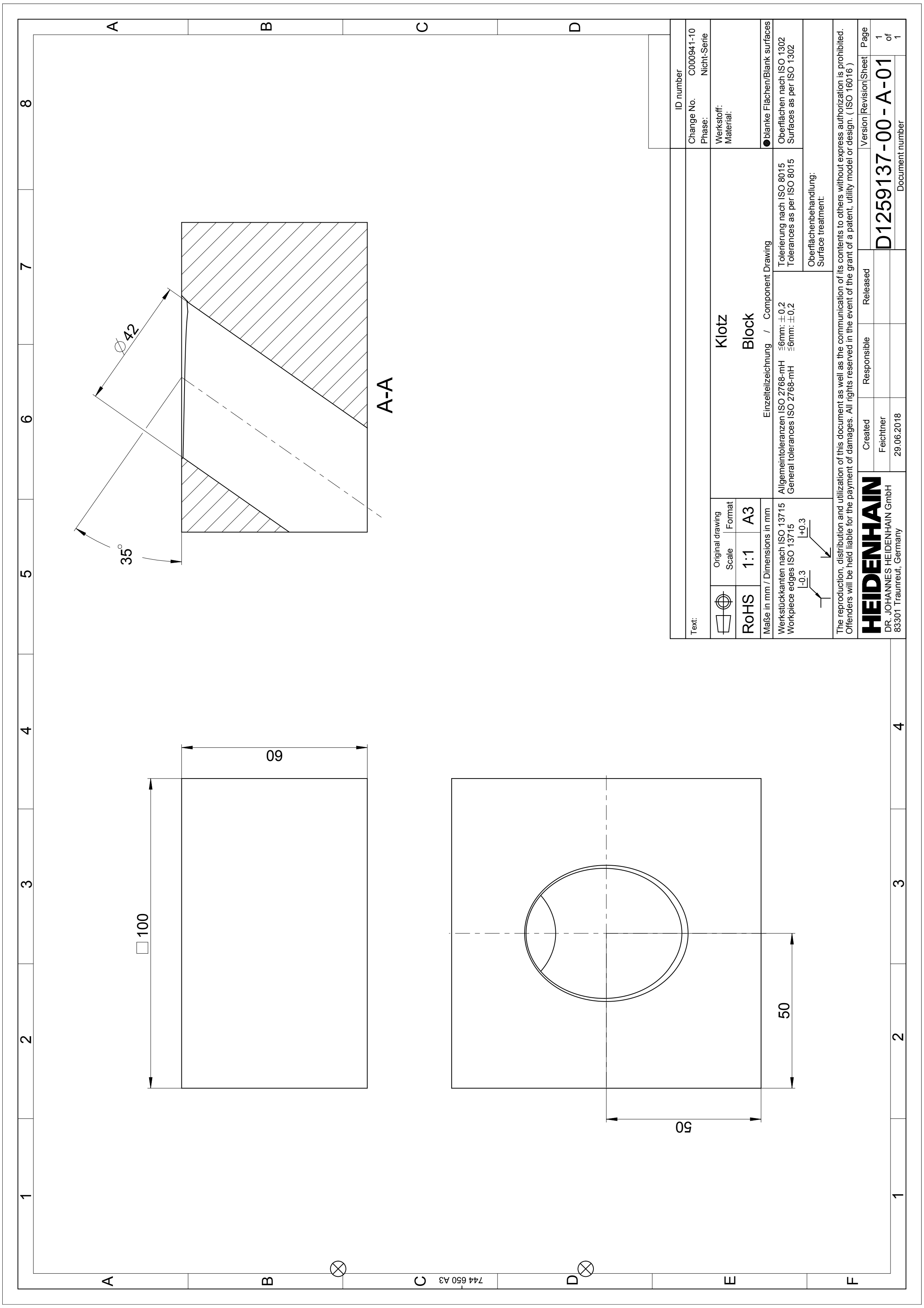
With this NC program, the control machines a hole in a tilted working plane.

At the beginning of the program, define the tool. Then the control moves the tool to a safe position in the Z axis. Subsequently, it positions the tool in the center of the hole. The control uses the coordinates from the NC program 5100_en.h.

In the next step, the control shifts the datum into the center of the hole and to the Z surface. Then it tilts the working plane by the angle defined in the NC program 5100_en.h. Then the control positions the rotary axes to the axis angles calculated with Cycle 19.

Subsequently, Cycle 252 CIRCULAR POCKET is defined. In this cycle, you must define the parameters for the machining process. Then the control positions the tool in the hole center and calls the cycle.

After machining the hole, the control retracts the tool in the tool axis. Then it resets the tilting the working plane function. Subsequently, the control moves the rotary axes to the starting position. After that, the control resets the datum shift and ends the program.


A-A
⌀42
35°
60
□100
50
50
Klotz
Block
Einzelteilzeichnung / Component Drawing
Maße in mm / Dimensions in mm
Original drawing
Scale 1:1
Format A3
RoHS
Werkstückkanten nach ISO 13715
Workpiece edges ISO 13715
Allgemeintoleranzen ISO 2768-mH
General tolerances ISO 2768-mH
Tolerierung nach ISO 8015
Tolerances as per ISO 8015
Oberflächenbehandlung:
Surface treatment:
Oberflächen nach ISO 1302
Surfaces as per ISO 1302
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Werkstoff:
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ID number
Text:
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HEIDENHAIN
DR. JOHANNES HEIDENHAIN GmbH
83301 Traunreut, Germany
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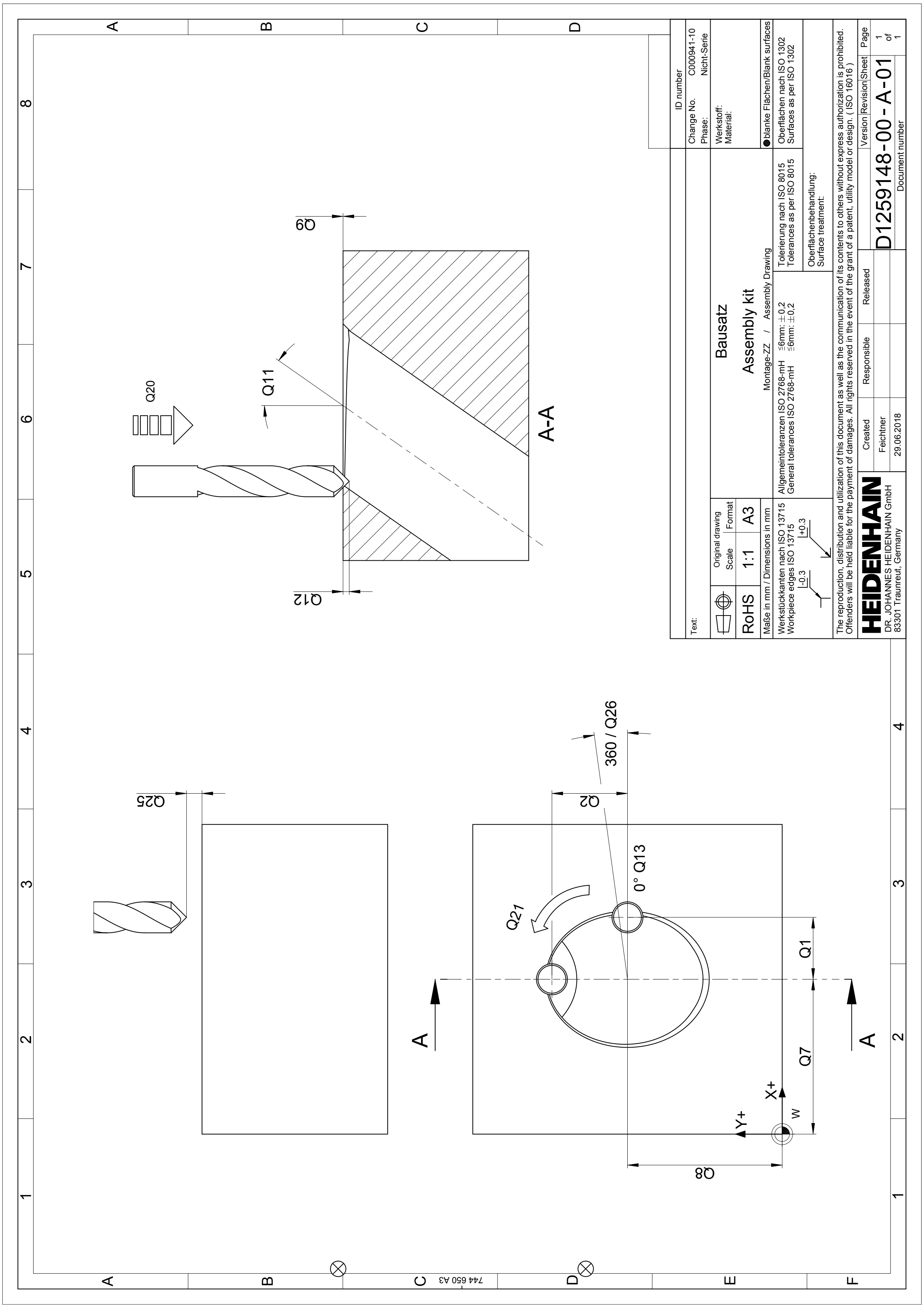
Q20
Q11
Q9
Q12
A-A
Q25
Q2
360 / Q26
0° Q13
Q21
Q1
Q7
Q8
X+
Y+
W
A
A
Bausatz
Assembly kit
Montage-ZZ / Assembly Drawing
Maße in mm / Dimensions in mm
RoHS
1:1
A3
Original drawing
Scale
Format
Werkstückkanten nach ISO 13715
Workpiece edges ISO 13715
Allgemeintoleranzen ISO 2768-mH
General tolerances ISO 2768-mH
Tolerierung nach ISO 8015
Tolerances as per ISO 8015
Oberflächen nach ISO 1302
Surfaces as per ISO 1302
Oberflächenbehandlung:
Surface treatment:
blanke Flächen/Blank surfaces
Werkstoff:
Material:
Change No. C000941-10
Phase: Nicht-Serie
ID number
Text:
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