HEIDENHAIN

TNC 320 / TNC 620 / TNC 640

Solutions
Programming Station Exercises

HIT Learning Package
Milling – 3+2-Axis Machining

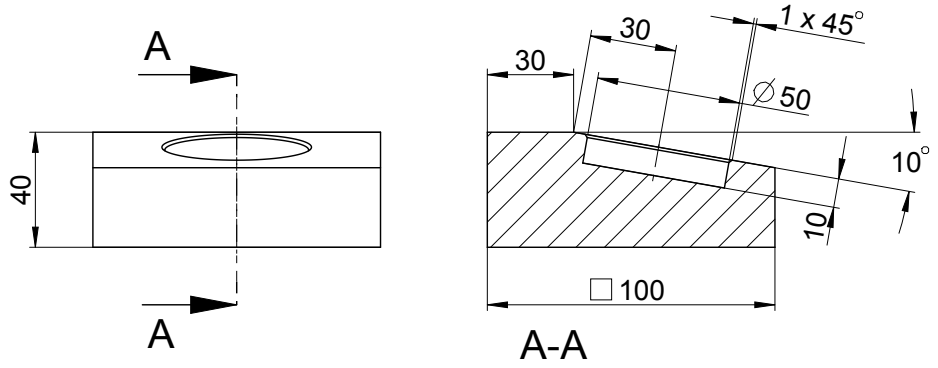
English (en)
8/2019

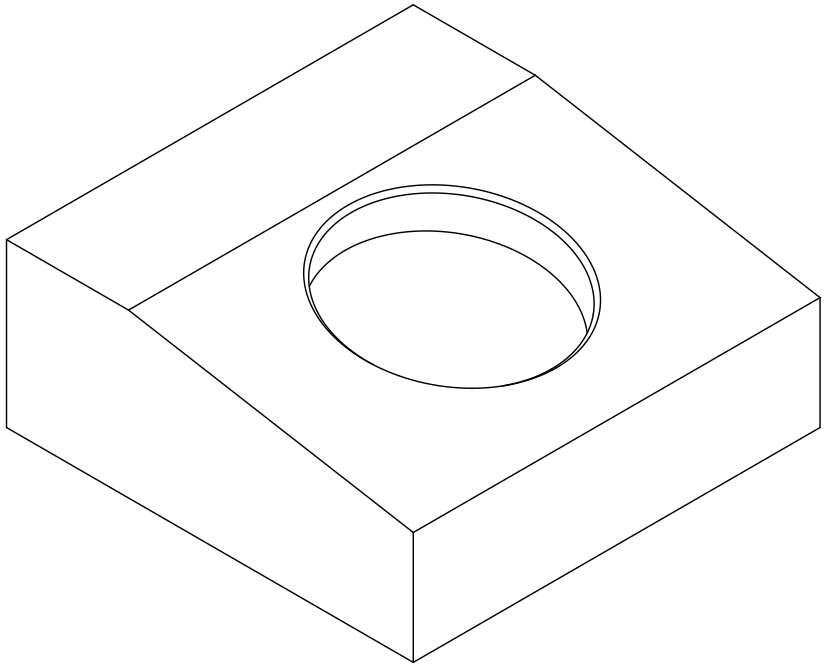
Contents

1

Fundamentals of tilted machining

1.1 Programming one spatial angle – 1277121





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1:1

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Maße in mm / Dimensions in mm				
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3		Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	Tolerierung nach ISO 8015 Tolerances as per ISO 8015	Oberflächen nach ISO 1302 Surfaces as per ISO 1302
			Oberflächenbehandlung: Surface treatment:	

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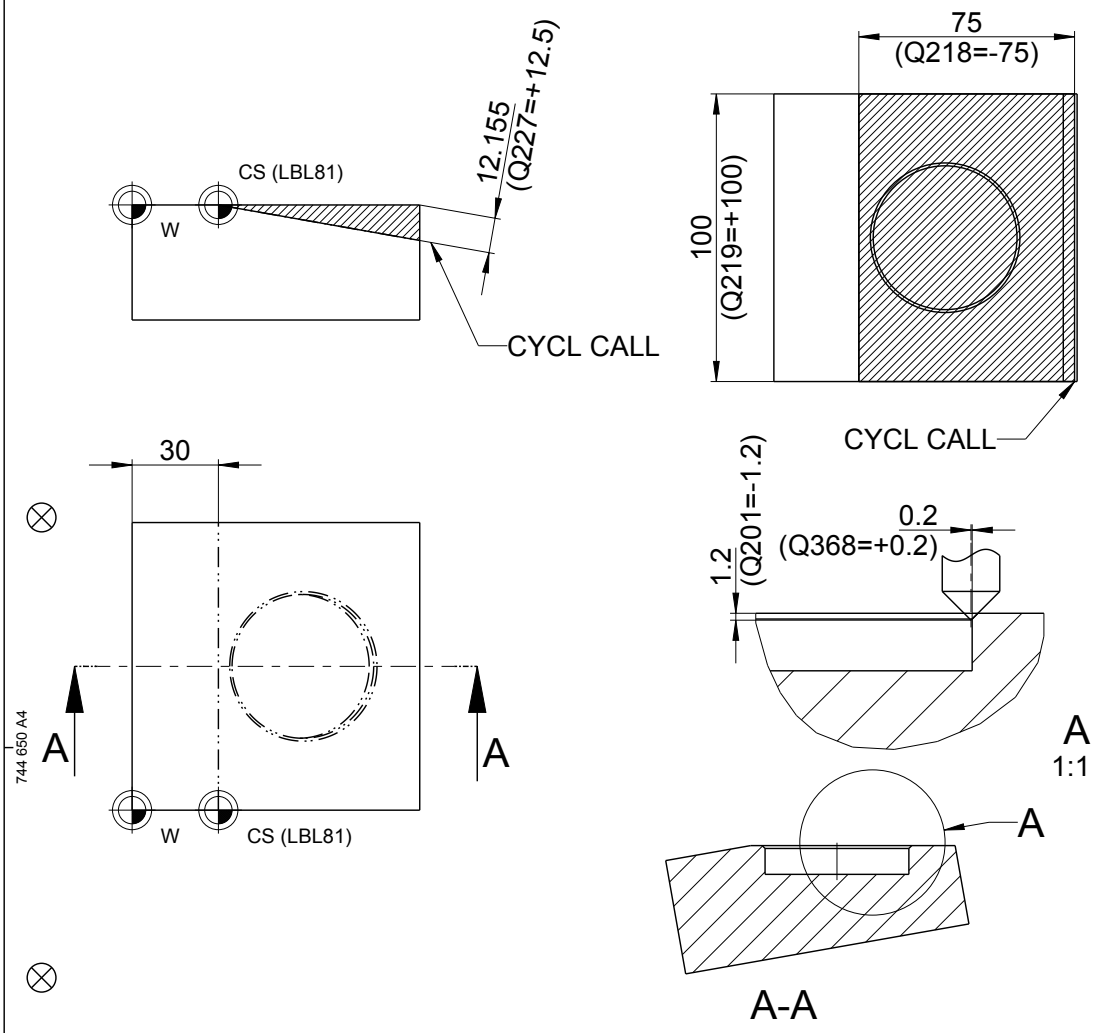
	11.01.2019			Document number			



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RoHS	1:2 / A4		
Maße in mm / Dimensions in mm		Einzelteilzeichnung / Component Drawing	●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	Tolerierung nach ISO 8015 Tolerances as per ISO 8015	Oberflächen nach ISO 1302 Surfaces as per ISO 1302
		Oberflächenbehandlung: Surface treatment:	

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Working plan

- Workpiece blank definition
- Tool call
- Safe tilting position
- Shift datum to tilting edge
- Tilt the working plane
- Mill the inclined surface (10°)
- Mill the circular pocket
- Tool call
- Safe tilting position
- Shift datum to tilting edge
- Tilt the working plane
- Mill the chamfer on the circular pocket
- Reset tilting
- Reset datum shift

Program parameters

Face milling (roughing)	**Parameters**	**X**	**Y**	**Z**
Milling plan	2, climb milling			
Milling direction	1, parallel to X axis			
Feed rate for pre-positioning	Maximum feed rate			
Circular pocket milling (roughing)	**Parameters**	**X**	**Y**	**Z**
Pre-position		+30	+50	-
Machining direction	Climb milling			
Plunging motion	Helical			
Milling of chamfer on circular pocket (finishing)	**Parameters**	**X**	**Y**	**Z**
Pre-position		+30	+50	-
Machining direction	Climb milling			
Plunging motion	Helical			
General parameters	**Parameters**	**X**	**Y**	**Z**
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	T	S	F_1	DZ	IZ	DL	DR
	20	10	5000	1000	-10	5	-	-
	10	172	4300	730	-10	5	-2.5	-2.5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining depth
IZ) Infeed
DL) Tool oversize: delta value for length
DR) Tool oversize: delta value for radius

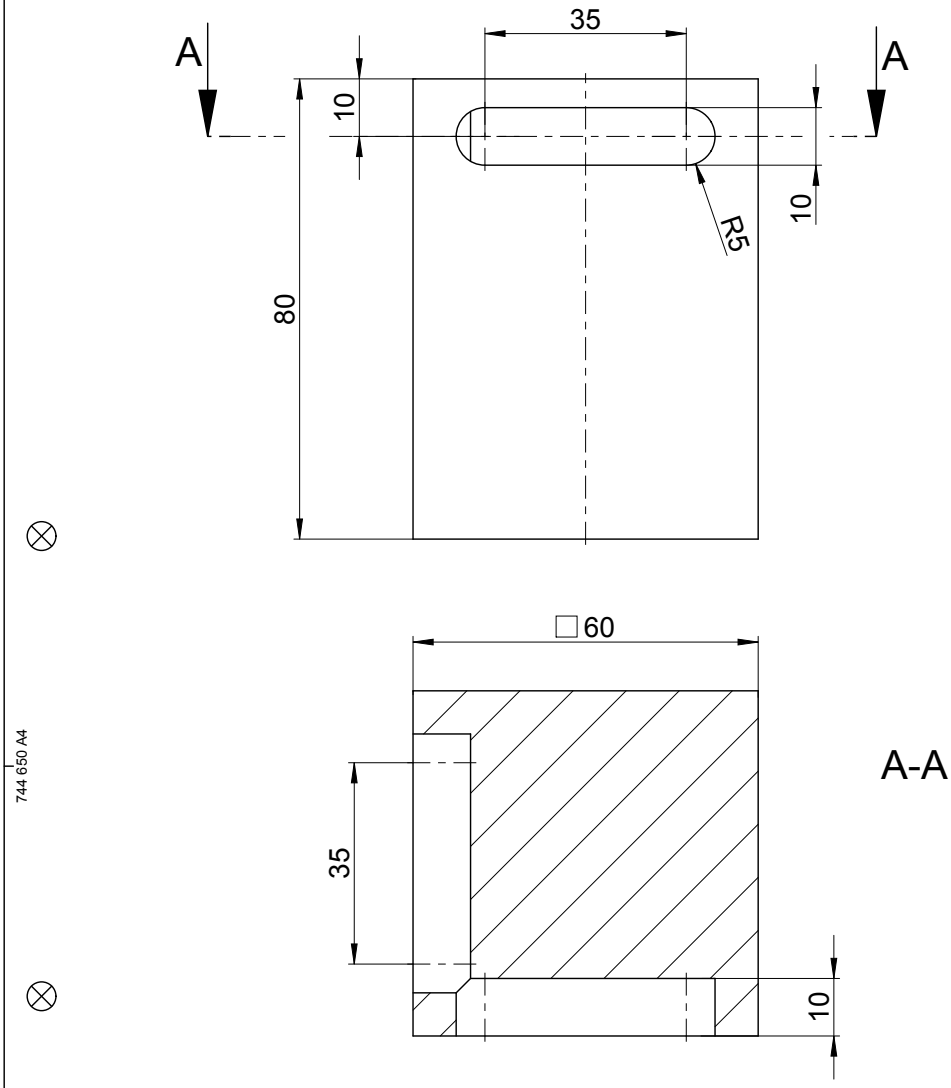
Solution

```
0  BEGIN PGM 1277121 MM
1  BLK FORM 0.1 Z X+0 Y+0 Z-40
2  BLK FORM 0.2  X+100  Y+100  Z+0
3  TOOL CALL 10 Z S5000 F1000
4 L  Z+300 R0 FMAX M3 M91
5 L  X+300  Y-300 R0 FMAX M91
6 CYCL DEF 7.0 DATUM SHIFT
7 CYCL DEF 7.1  X+30
8 PLANE SPATIAL SPA+0 SPB+10 SPC+0 TURN FMAX
9 CYCL DEF 233 FACE MILLING ~
    Q215=+1          ;MACHINING OPERATION ~
    Q389=+2          ;MILLING STRATEGY ~
    Q350=+1          ;MILLING DIRECTION ~
    Q218=-75         ;FIRST SIDE LENGTH ~
    Q219=+100        ;2ND SIDE LENGTH ~
    Q227=+12.5       ;STARTNG PNT 3RD AXIS ~
    Q386=+0          ;END POINT 3RD AXIS ~
    Q369=+0          ;ALLOWANCE FOR FLOOR ~
    Q202=+5          ;MAX. PLUNGING DEPTH ~
    Q370=+1          ;TOOL PATH OVERLAP ~
    Q207= AUTO       ;FEED RATE MILLING ~
    Q385=+500        ;FINISHING FEED RATE ~
    Q253= MAX        ;F PRE-POSITIONING ~
    Q357=+2          ;CLEARANCE TO SIDE ~
    Q200=+2          ;SET-UP CLEARANCE ~
    Q204=+50         ;2ND SET-UP CLEARANCE ~
    Q347=+0          ;1ST LIMIT ~
    Q348=+0          ;2ND LIMIT ~
    Q349=+0          ;3RD LIMIT ~
    Q220=+0          ;CORNER RADIUS ~
    Q368=+0          ;ALLOWANCE FOR SIDE ~
    Q338=+0          ;INFEED FOR FINISHING ~
10 L  X+75  Y+0  Z+50 R0 FMAX M99
11 CYCL DEF 252 CIRCULAR POCKET ~
    Q215=+1          ;MACHINING OPERATION ~
    Q223=+50         ;CIRCLE DIAMETER ~
    Q368=+0          ;ALLOWANCE FOR SIDE ~
    Q207= AUTO       ;FEED RATE MILLING ~
    Q351=+1          ;CLIMB OR UP-CUT ~
    Q201=-10         ;DEPTH ~
    Q202=+5          ;PLUNGING DEPTH ~
    Q369=+0          ;ALLOWANCE FOR FLOOR ~
```

```
    Q206= AUTO          ;FEED RATE FOR PLNGNG ~
    Q338=+0             ;INFEED FOR FINISHING ~
    Q200=+2             ;SET-UP CLEARANCE ~
    Q203=+0             ;SURFACE COORDINATE ~
    Q204=+50            ;2ND SET-UP CLEARANCE ~
    Q370=+1             ;TOOL PATH OVERLAP ~
    Q366=+1             ;PLUNGE ~
    Q385=+500           ;FINISHING FEED RATE ~
    Q439=+0             ;FEED RATE REFERENCE
12 L  X+30  Y+50  Z+50 R0 FMAX M99
13 PLANE RESET TURN FMAX
14 CYCL DEF 7.0 DATUM SHIFT
15 CYCL DEF 7.1  X+0
16 CYCL DEF 7.2  Y+0
17 CYCL DEF 7.3  Z+0
18  TOOL CALL 172 Z S4300 F7300 DL-2.5 DR-2.5
19 L  Z+300 R0 FMAX M3 M91
20 L  X+300  Y-300 R0 FMAX M91
21 CYCL DEF 7.0 DATUM SHIFT
22 CYCL DEF 7.1  X+30
23 PLANE SPATIAL SPA+0 SPB+10 SPC+0 TURN FMAX
24 CYCL DEF 252 CIRCULAR POCKET ~
    Q215=+2             ;MACHINING OPERATION ~
    Q223=+50            ;CIRCLE DIAMETER ~
    Q368=+0.2           ;ALLOWANCE FOR SIDE ~
    Q207= AUTO          ;FEED RATE MILLING ~
    Q351=+1             ;CLIMB OR UP-CUT ~
    Q201=-1.2           ;DEPTH ~
    Q202=+5             ;PLUNGING DEPTH ~
    Q369=+0             ;ALLOWANCE FOR FLOOR ~
    Q206= AUTO          ;FEED RATE FOR PLNGNG ~
    Q338=+0             ;INFEED FOR FINISHING ~
    Q200=+2             ;SET-UP CLEARANCE ~
    Q203=+0             ;SURFACE COORDINATE ~
    Q204=+50            ;2ND SET-UP CLEARANCE ~
    Q370=+1             ;TOOL PATH OVERLAP ~
    Q366=+1             ;PLUNGE ~
    Q385=+500           ;FINISHING FEED RATE ~
    Q439=+0             ;FEED RATE REFERENCE
25 L  X+30  Y+50  Z+50 R0 FMAX M99
26 PLANE RESET TURN FMAX
27 CYCL DEF 7.0 DATUM SHIFT
28 CYCL DEF 7.1  X+0
```

```
29 CYCL DEF 7.2  Y+0
30 CYCL DEF 7.3  Z+0
31 M30
32 END PGM 1277121 MM
```

1.2 Programming one spatial angle – 1157579



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RoHS	1:1	A4			
Maße in mm / Dimensions in mm			Einzelteilzeichnung / Component Drawing		●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3			Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	Tolerierung nach ISO 8015 Tolerances as per ISO 8015	Oberflächen nach ISO 1302 Surfaces as per ISO 1302
				Oberflächenbehandlung: Surface treatment:	

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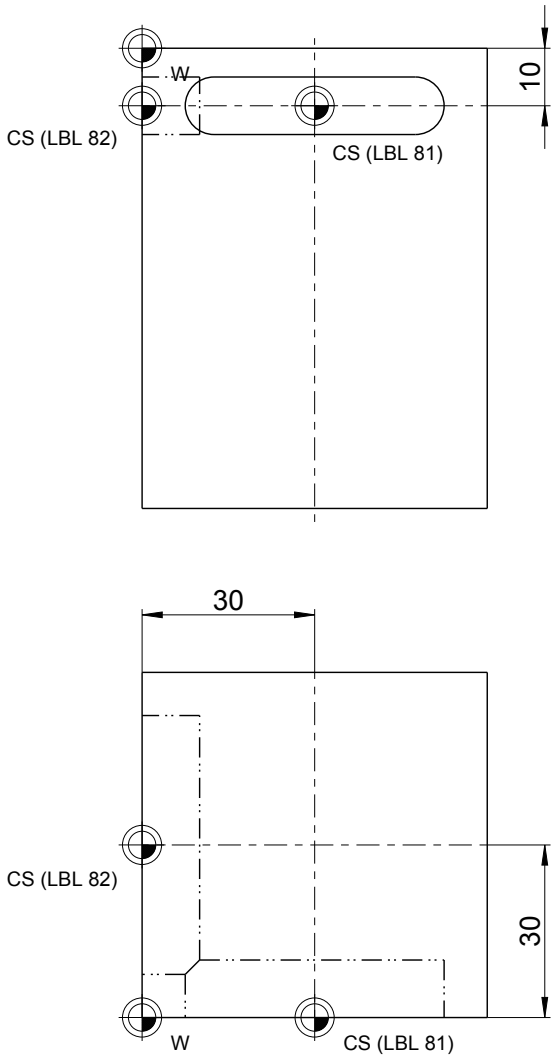
	09.11.2015			Document number			



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RoHS	1:1 / A4		●blanke Flächen/Blank surfaces	
Maße in mm / Dimensions in mm				
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	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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	09.11.2015			Document number			

Working plan

- Workpiece blank definition
- Tool call
- Safe tilting position
- Shift datum to tilting edge
- Tilt the working plane
- Mill the front slot
- Reset transformations mathematically
- Shift datum to tilting edge
- Tilt the working plane
- Mill the left-hand slot
- Reset tilting
- Reset datum shift

Program parameters

Slot milling (roughing)	Parameters	X	Y	Z
Machining direction	Climb milling			
Plunging motion	Reciprocating			

General parameters	Parameters	X	Y	Z
Safe position		-	-	+50
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	T	S	F_1	DZ	IZ
	8	4	12000	950	-10	5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining depth
IZ) Infeed

Solution

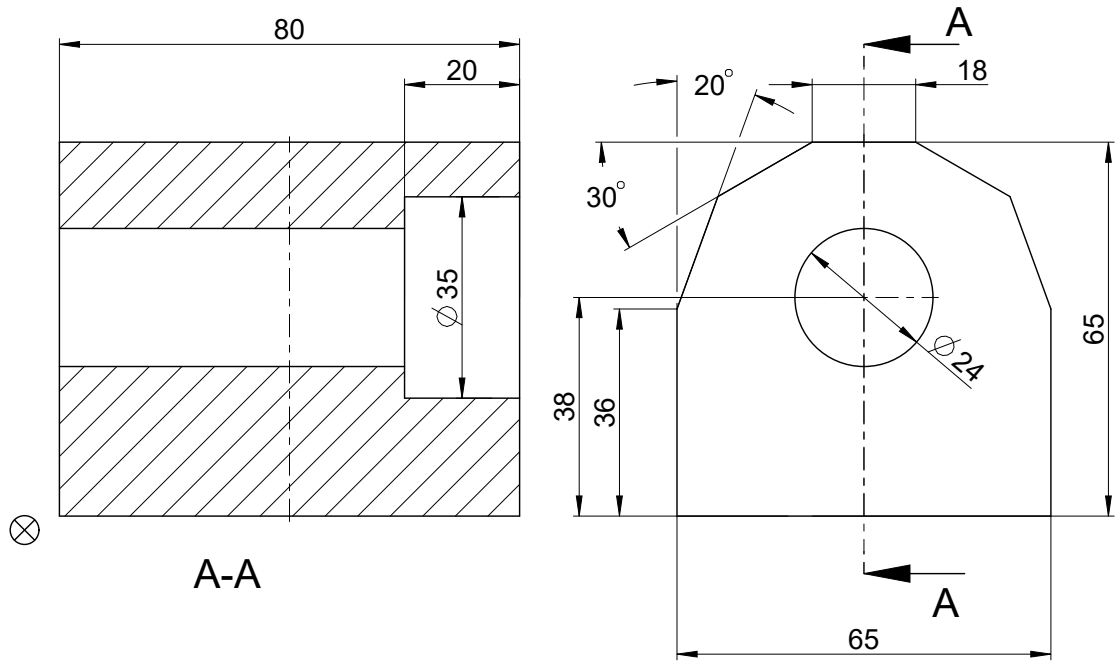
```
0  BEGIN PGM 1157579 MM
1  BLK FORM 0.1 Z X+0 Y+0 Z-80
2  BLK FORM 0.2  X+60  Y+60  Z+0
3  TOOL CALL 4 Z S12000 F950
4 L  Z+300 R0 FMAX M3 M91
5 L  X+300  Y-300 R0 FMAX M91
6 CYCL DEF 7.0 DATUM SHIFT
7 CYCL DEF 7.2  X+30
8 CYCL DEF 7.3  Z-10
9 PLANE SPATIAL SPA+90 SPB+0 SPC+0 TURN FMAX
10 CYCL DEF 253 SLOT MILLING ~
    Q215=+1          ;MACHINING OPERATION ~
    Q218=+45         ;SLOT LENGTH ~
    Q219=+10         ;SLOT WIDTH ~
    Q368=+0          ;ALLOWANCE FOR SIDE ~
    Q374=+0          ;ANGLE OF ROTATION ~
    Q367=+0          ;SLOT POSITION ~
    Q207= AUTO       ;FEED RATE MILLING ~
    Q351=+1          ;CLIMB OR UP-CUT ~
    Q201=-10         ;DEPTH ~
    Q202=+5          ;PLUNGING DEPTH ~
    Q369=+0          ;ALLOWANCE FOR FLOOR ~
    Q206= AUTO       ;FEED RATE FOR PLNGNG ~
    Q338=+0          ;INFEED FOR FINISHING ~
    Q200=+2          ;SET-UP CLEARANCE ~
    Q203=+0          ;SURFACE COORDINATE ~
    Q204=+50         ;2ND SET-UP CLEARANCE ~
    Q366=+2          ;PLUNGE ~
    Q385=+500        ;FINISHING FEED RATE ~
    Q439=+3          ;FEED RATE REFERENCE
11 L  X+0  Y+0  Z+50 R0 FMAX M99
12 PLANE RESET TURN FMAX
13 CYCL DEF 7.0 DATUM SHIFT
14 CYCL DEF 7.1  X+0
15 CYCL DEF 7.2  Y+0
16 CYCL DEF 7.3  Z+0
17 CYCL DEF 7.0 DATUM SHIFT
18 CYCL DEF 7.1  Y+30
19 CYCL DEF 7.3  Z-10
20 PLANE SPATIAL SPA+0 SPB-90 SPC+0 TURN FMAX
21 CYCL DEF 253 SLOT MILLING ~
    Q215=+1          ;MACHINING OPERATION ~
```

Q218=+45 ;SLOT LENGTH ~	
Q219=+10 ;SLOT WIDTH ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q374=+90 ;ANGLE OF ROTATION ~	
Q367=+0 ;SLOT POSITION ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q351=+1 ;CLIMB OR UP-CUT ~	
Q201=-10 ;DEPTH ~	
Q202=+5 ;PLUNGING DEPTH ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q206= AUTO ;FEED RATE FOR PLNGNG ~	
Q338=+0 ;INFEED FOR FINISHING ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q203=+0 ;SURFACE COORDINATE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q366=+2 ;PLUNGE ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q439=+3 ;FEED RATE REFERENCE	
22 L X+0 Y+0 Z+50 R0 FMAX M99	
23 PLANE RESET TURN FMAX	
24 CYCL DEF 7.0 DATUM SHIFT	
25 CYCL DEF 7.1 X+0	
26 CYCL DEF 7.3 Y+0	
27 CYCL DEF 7.3 Z+0	
28 M 30	SAFE
29 END PGM 1157579 MM	

2

Advanced topics of tilted machining

2.1 Programming one spatial angle – 1277117



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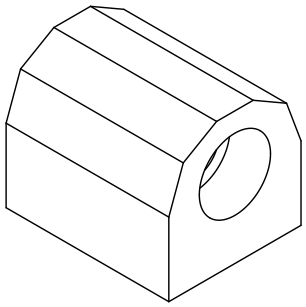

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RoHS	1:1 / A4	Einzelteilzeichnung / Component Drawing		●blanke Flächen/Blank surfaces
Maße in mm / Dimensions in mm				
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3		Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	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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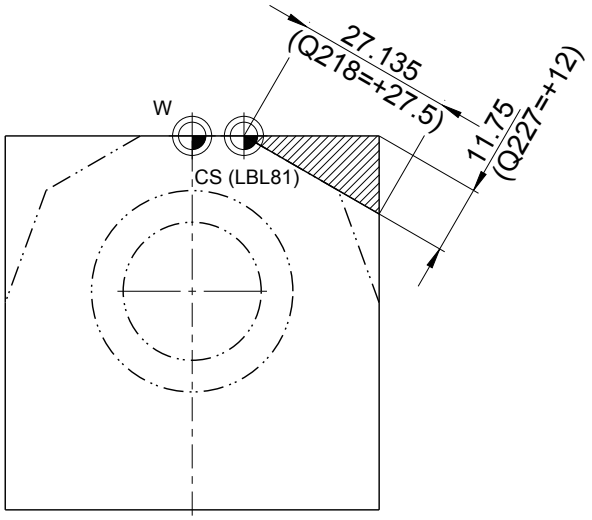

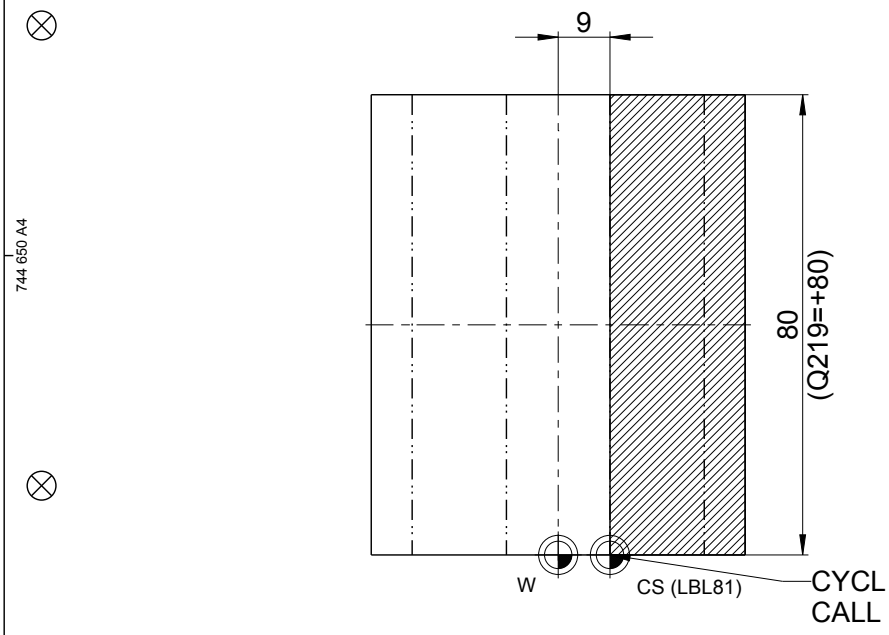

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Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3			Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	Tolerierung nach ISO 8015 Tolerances as per ISO 8015 Oberflächenbehandlung: Surface treatment:
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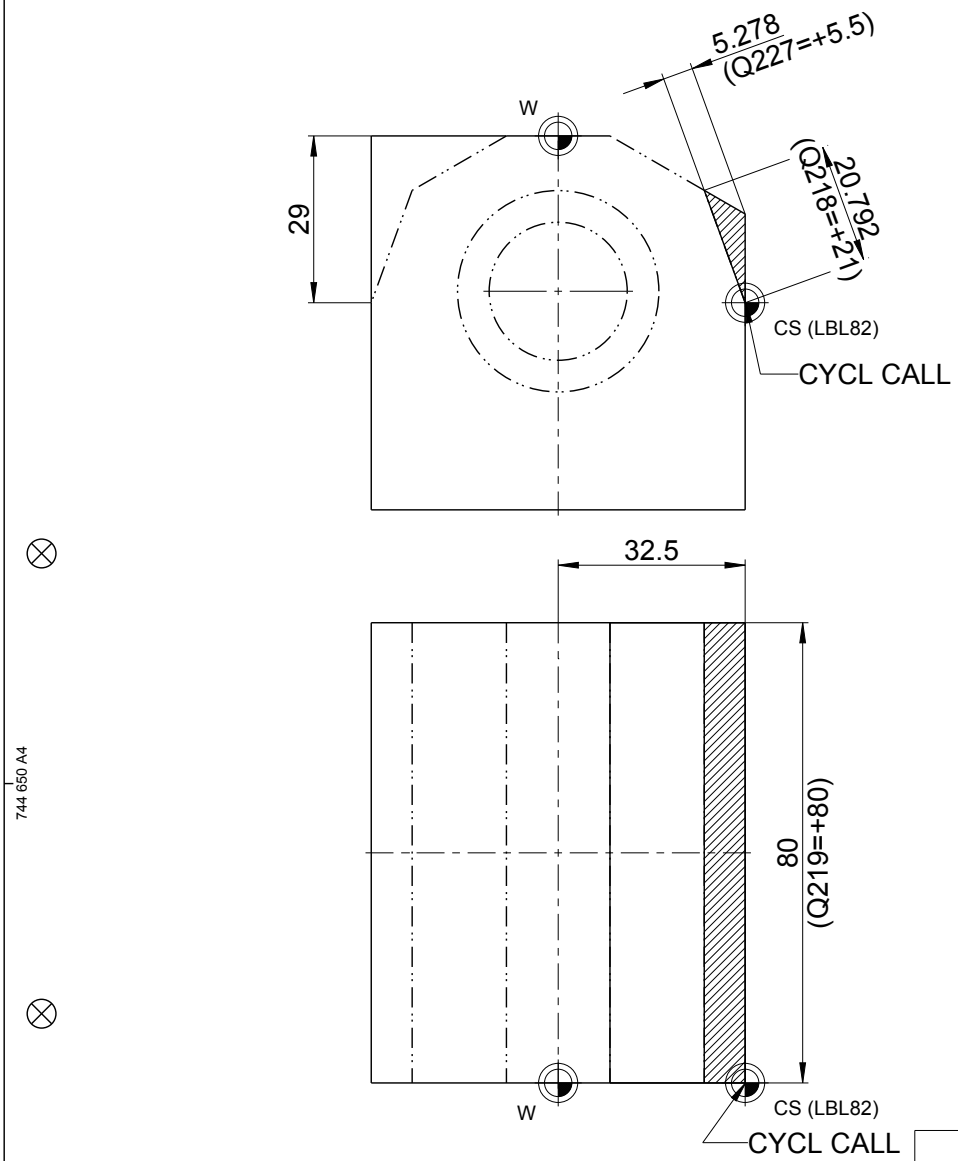

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Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2		Tolerierung nach ISO 8015 Tolerances as per ISO 8015 Oberflächenbehandlung: Surface treatment:	Oberflächen nach ISO 1302 Surfaces as per ISO 1302

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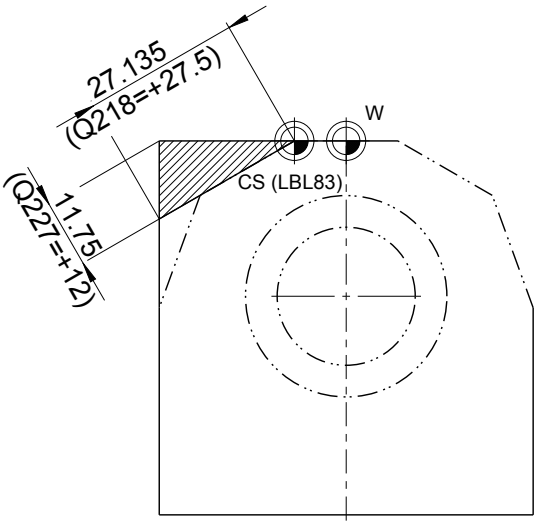

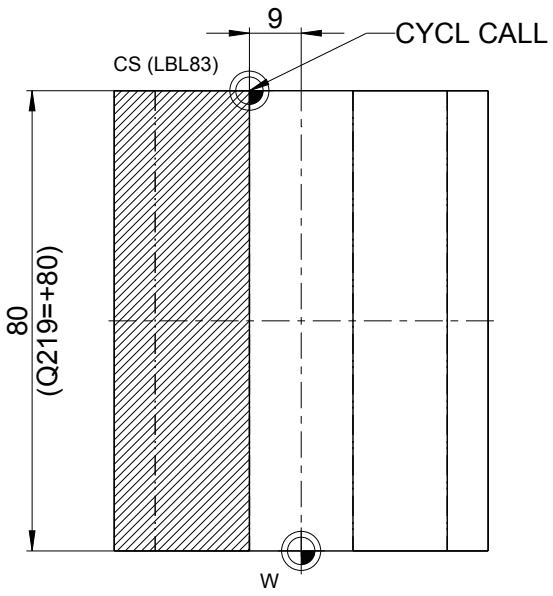

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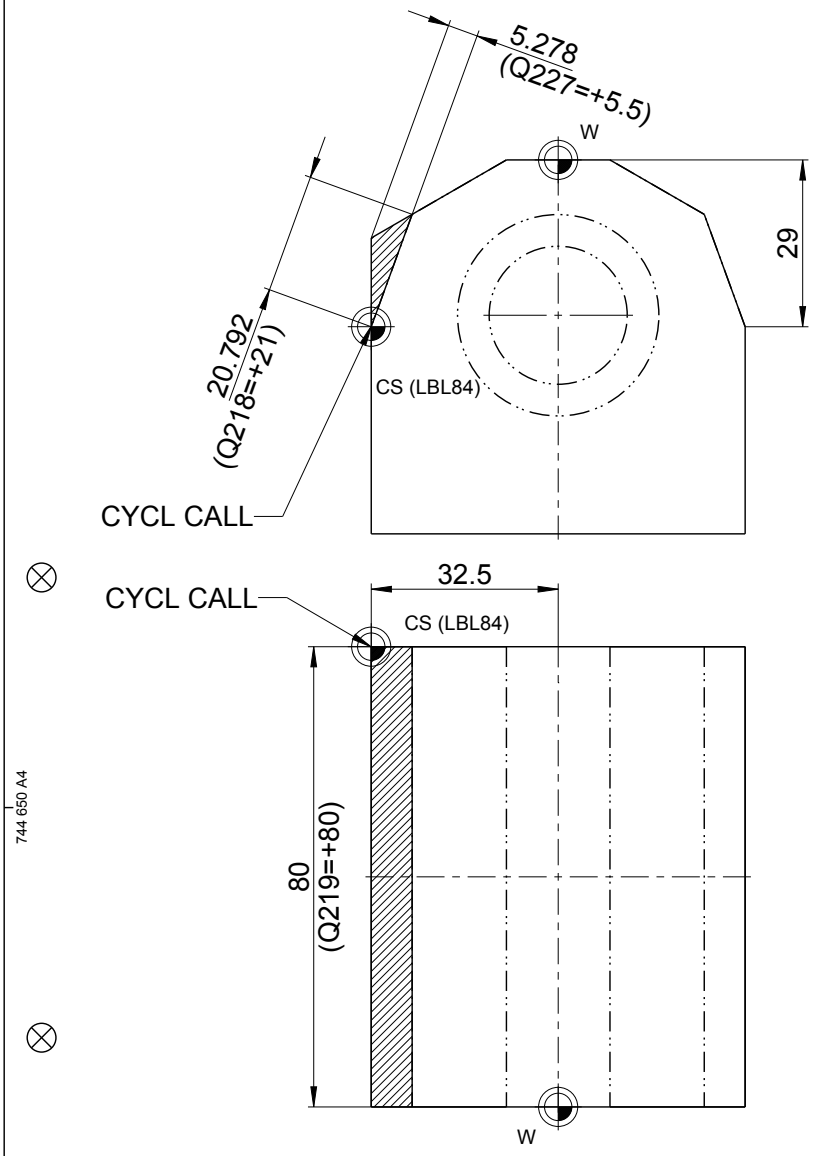

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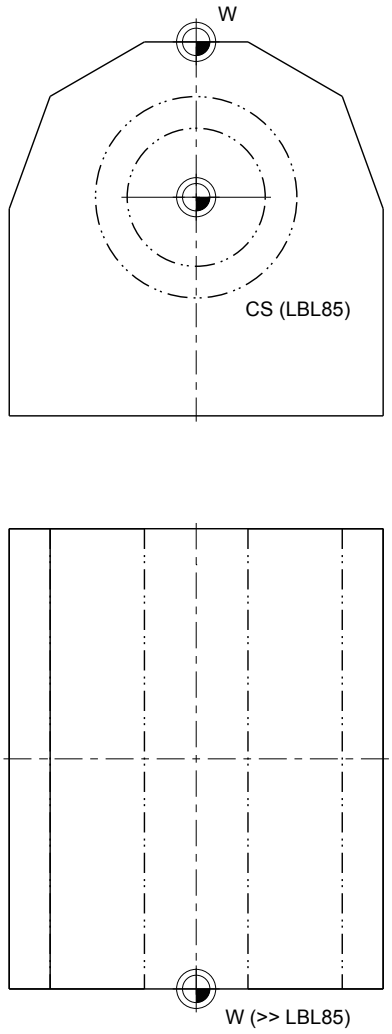

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Maße in mm / Dimensions in mm		Einzelteilzeichnung / Component Drawing	●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	Tolerierung nach ISO 8015 Tolerances as per ISO 8015	Oberflächen nach ISO 1302 Surfaces as per ISO 1302
		Oberflächenbehandlung: Surface treatment:	

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DR. JOHANNES HEIDENHAIN GmbH 83301 Traunreut, Germany	M-TS			D1277117-00-A-02			5 of 5
	11.01.2019			Document number			

Working plan

- Workpiece blank definition
- Tool call
- Mill the inclined surfaces
- Mill the circle (Ø 24)
- Mill the circle (Ø 35)
- End the NC program
- Define subprograms

Program parameters

Face milling (roughing)	**Parameters**	**X**	**Y**	**Z**
Milling plan	2, climb milling			
Milling direction	2, parallel to Y axis			
Feed rate for pre-positioning	Maximum feed rate			
Bore milling	**Parameters**	**X**	**Y**	**Z**
Machining direction	Climb milling			
Plunging depth	1			
General parameters	**Parameters**	**X**	**Y**	**Z**
Safe position		-	-	+50
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	T	S	F_1	DZ	IZ
	20	10	5000	1000	-81	5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining depth
IZ) Infeed

Solution

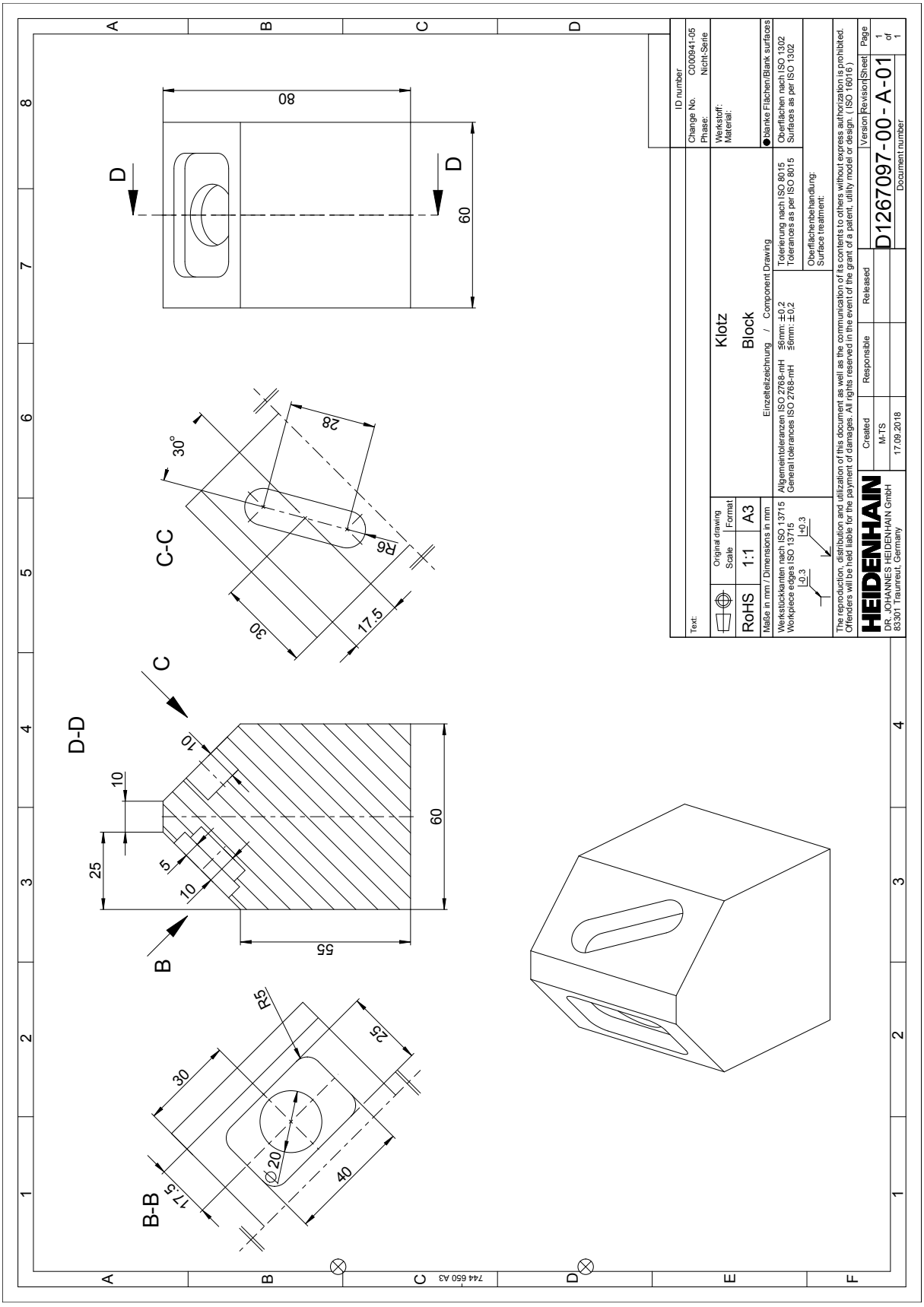
0 BEGIN PGM 1277117 MM	
1 BLK FORM 0.1 Z X-32.5 Y+0 Z-65	
2 BLK FORM 0.2 X+32.5 Y+80 Z+0	
3 TOOL CALL 10 Z S5000 F1000	
4 CALL LBL 99	RESET
5 CALL LBL 81	PLANE_1
6 CALL LBL 51	MACHINING_1
7 CALL LBL 98	RESET_COORD. TRANS.
8 CALL LBL 82	PLANE_2
9 CALL LBL 52	MACHINING_2
10 CALL LBL 98	RESET_COORD. TRANS.
11 CALL LBL 83	PLANE_3
12 CALL LBL 51	MACHINING_1
13 CALL LBL 98	RESET_COORD. TRANS.
14 CALL LBL 84	PLANE_4
15 CALL LBL 52	MACHINING_2
16 CALL LBL 98	RESET_COORD. TRANS.
17 CALL LBL 85	PLANE_6
18 CALL LBL 53	MACHINING_3
19 CALL LBL 98	RESET_COORD. TRANS.
20 CALL LBL 85	PLANE_6
21 CALL LBL 54	MACHINING_4
22 CALL LBL 99	RESET
23 M30	
24 LBL 51	MACHINING_1
25 CYCL DEF 233 FACE MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	
Q389=+2 ;MILLING STRATEGY ~	
Q350=+2 ;MILLING DIRECTION ~	
Q218=+27.5 ;FIRST SIDE LENGTH ~	
Q219=+80 ;2ND SIDE LENGTH ~	
Q227=+12 ;STARTNG PNT 3RD AXIS ~	
Q386=+0 ;END POINT 3RD AXIS ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q202=+5 ;MAX. PLUNGING DEPTH ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q253= MAX ;F PRE-POSITIONING ~	
Q357=+2 ;CLEARANCE TO SIDE ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	

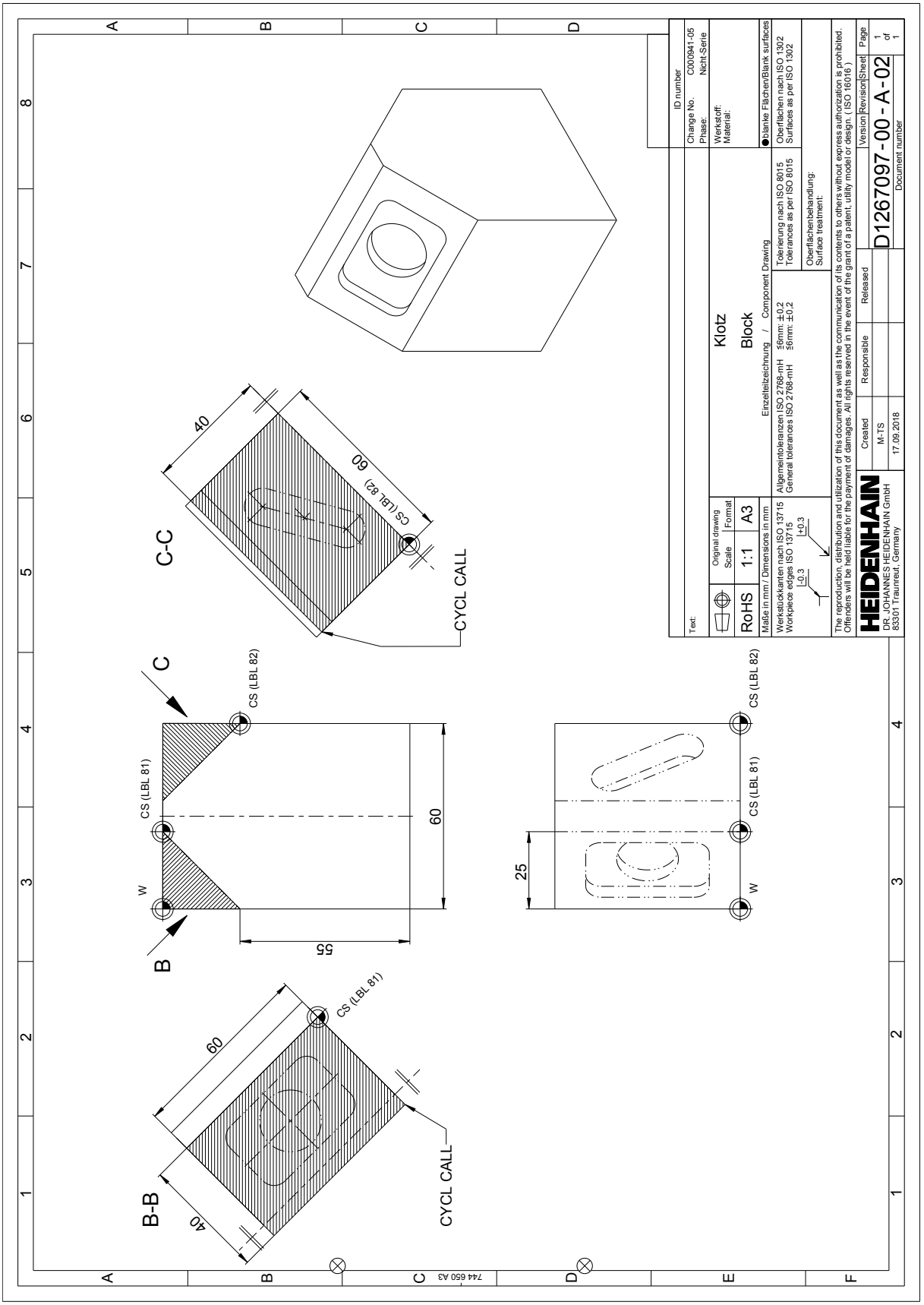
Q347=+0 ;1ST LIMIT ~	
Q348=+0 ;2ND LIMIT ~	
Q349=+0 ;3RD LIMIT ~	
Q220=+0 ;CORNER RADIUS ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q338=+0 ;INFEED FOR FINISHING ~	
26 L X+0 Y+0 Z+50 R0 FMAX M99	
27 LBL 0	
28 LBL 52	MACHINING_2
29 CYCL DEF 233 FACE MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	
Q389=+2 ;MILLING STRATEGY ~	
Q350=+2 ;MILLING DIRECTION ~	
Q218=+21 ;FIRST SIDE LENGTH ~	
Q219=+80 ;2ND SIDE LENGTH ~	
Q227=+5.5 ;STARTNG PNT 3RD AXIS ~	
Q386=+0 ;END POINT 3RD AXIS ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q202=+5 ;MAX. PLUNGING DEPTH ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q253= MAX ;F PRE-POSITIONING ~	
Q357=+2 ;CLEARANCE TO SIDE ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q347=+0 ;1ST LIMIT ~	
Q348=+0 ;2ND LIMIT ~	
Q349=+0 ;3RD LIMIT ~	
Q220=+0 ;CORNER RADIUS ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q338=+0 ;INFEED FOR FINISHING ~	
30 L X+0 Y+0 Z+50 R0 FMAX M99	
31 LBL 0	
32 LBL 53	MACHINING_3
33 CYCL DEF 208 BORE MILLING ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q201=-81 ;DEPTH ~	
Q206= AUTO ;FEED RATE FOR PLNGNG ~	
Q334=+1 ;PLUNGING DEPTH ~	
Q203=+0 ;SURFACE COORDINATE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q335=+24 ;NOMINAL DIAMETER ~	

Q342=+0 ;ROUGHING DIAMETER ~	
Q351=+1 ;CLIMB OR UP-CUT	
34 L X+0 Y+0 Z+50 R0 FMAX M99	
35 LBL 0	
36 LBL 54	MACHINING_4
37 CYCL DEF 208 BORE MILLING ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q201=-20 ;DEPTH ~	
Q206= AUTO ;FEED RATE FOR PLNGNG ~	
Q334=+1 ;PLUNGING DEPTH ~	
Q203=+0 ;SURFACE COORDINATE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q335=+35 ;NOMINAL DIAMETER ~	
Q342=+24 ;ROUGHING DIAMETER ~	
Q351=+1 ;CLIMB OR UP-CUT	
38 L X+0 Y+0 Z+50 R0 FMAX M99	
39 LBL 0	
40 LBL 81	PLANE_1
41 CALL LBL 100	SAFE
42 CYCL DEF 7.0 DATUM SHIFT	
43 CYCL DEF 7.1 X+9	
44 PLANE SPATIAL SPA+0 SPB+30 SPC+0 TURN FMAX	
45 LBL 0	
46 LBL 82	PLANE_2
47 CALL LBL 100	SAFE
48 CYCL DEF 7.0 DATUM SHIFT	
49 CYCL DEF 7.1 X+32.5	
50 CYCL DEF 7.3 Z-29	
51 PLANE SPATIAL SPA+0 SPB+70 SPC+0 TURN FMAX	
52 LBL 0	
53 LBL 83	PLANE_3
54 CALL LBL 100	SAFE
55 CYCL DEF 7.0 DATUM SHIFT	
56 CYCL DEF 7.1 X-9	
57 CYCL DEF 7.2 Y+80	
58 PLANE SPATIAL SPA+0 SPB+30 SPC+180 TURN FMAX	
59 LBL 0	
60 LBL 84	PLANE_4
61 CALL LBL 100	SAFE
62 CYCL DEF 7.0 DATUM SHIFT	
63 CYCL DEF 7.1 X-32.5	
64 CYCL DEF 7.2 Y+80	
65 CYCL DEF 7.3 Z-29	

66 PLANE SPATIAL SPA+0 SPB+70 SPC+180 TURN FMAX	
67 LBL 0	
68 LBL 85	PLANE_5
69 CALL LBL 100	SAFE
70 CYCL DEF 7.0 DATUM SHIFT	
71 CYCL DEF 7.3 Z-27	
72 PLANE SPATIAL SPA+90 SPB+0 SPC+0 TURN FMAX	
73 LBL 0	
74 LBL 98	RESET_COORD. TRANS.
75 PLANE RESET STAY	
76 CYCL DEF 7.0 DATUM SHIFT	
77 CYCL DEF 7.1 X+0	
78 CYCL DEF 7.2 Y+0	
79 CYCL DEF 7.3 Z+0	
80 LBL 0	
81 LBL 99	RESET
82 CALL LBL 100	SAFE
83 PLANE RESET TURN FMAX	
84 CYCL DEF 7.0 DATUM SHIFT	
85 CYCL DEF 7.1 X+0	
86 CYCL DEF 7.2 Y+0	
87 CYCL DEF 7.3 Z+0	
88 LBL 0	
89 LBL 100	SAFE
90 L Z+300 R0 FMAX M3 M91	
91 L X+300 Y-300 R0 FMAX M91	
92 LBL 0	
93 END PGM 1277117 MM	

2.2 Programming one spatial angle – 1267097




C-C
40
60
CS (LBL 82)
CYCL CALL
C
B
CS (LBL 82)
CS (LBL 81)
60
55
W
25
B-B
60
40
CS (LBL 81)
CYCL CALL
ID number
Change No. C000941-05
Phase: Nicht-Serie
Werkstoff:
Material:
Klotz
Block
Einzelteilzeichnung / Component Drawing
Original drawing
Scale 1:1
Format A3
RoHS
Maße in mm / Dimensions in mm
Werkstückkanten nach ISO 13715
Workpiece edges ISO 13715
Allgemeintoleranzen ISO 2768-mH
General tolerances ISO 2768-mH
≤6mm: ±0.2
≤6mm: ±0.2
Tolerierung nach ISO 8015
Tolerances as per ISO 8015
Oberflächenbehandlung:
Surface treatment:
blanke Flächen/Blank surfaces
Oberflächen nach ISO 1302
Surfaces as per ISO 1302
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HEIDENHAIN
DR. JOHANNES HEIDENHAIN GmbH
83301 Traunreut, Germany
Created
M-TS
17.09.2018
Responsible
Released
Version Revision Sheet Page
D1267097-00-A-02
Document number
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Working plan

- Workpiece blank definition
- Tool call
- Mill the left-hand inclined surface (45°)
- Mill the right-hand inclined surface (45°)
- Tool call
- Mill the circular pocket
- Mill rectangular pocket
- Slot milling
- End the NC program
- Define subprograms

Program parameters

Face milling (roughing)	**Parameters**	**X**	**Y**	**Z**
Milling plan	2, climb milling			
Milling direction	2, parallel to Y axis			
Feed rate for pre-positioning	Maximum feed rate			
Milling of circular pocket and rectangular pocket (roughing)	**Parameters**	**X**	**Y**	**Z**
Machining direction	Climb milling			
Plunging motion	Helical			
Slot milling (roughing)	**Parameters**	**X**	**Y**	**Z**
Machining direction	Climb milling			
Plunging motion	Reciprocating			
General parameters	**Parameters**	**X**	**Y**	**Z**
Safe position		-	-	+50
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	T	S	F_1	DZ	IZ
	20	10	5000	1000	-5	5
	8	4	12000	950	-10	5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining depth
IZ) Infeed

Solution

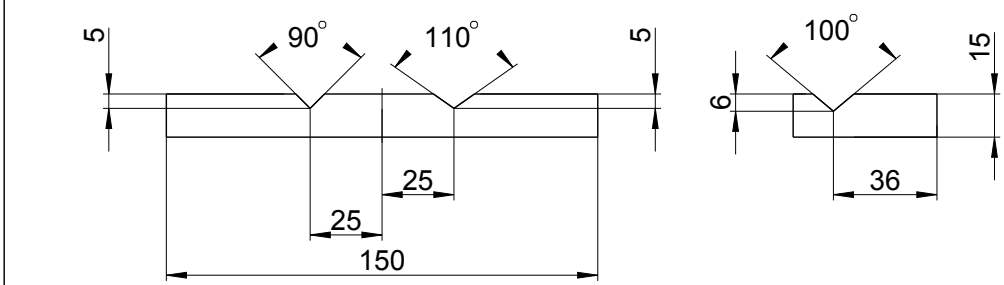
0 BEGIN PGM 1267097 MM	
1 BLK FORM 0.1 Z X+0 Y+0 Z-80	
2 BLK FORM 0.2 X+60 Y+60 Z+0	
3 TOOL CALL 10 Z S5000 F1000	
4 CALL LBL 99	RESET
5 CALL LBL 81	PLANE_1
6 CALL LBL 51	MACHINING_1
7 CALL LBL 98	RESET
8 CALL LBL 82	PLANE_2
9 CALL LBL 51	MACHINING_1
10 CALL LBL 99	RESET
11 TOOL CALL 4 Z S12000 F950	
12 CALL LBL 99	RESET
13 CALL LBL 81	PLANE_1
14 CALL LBL 52	MACHINING_2
15 CALL LBL 53	MACHINING_3
16 CALL LBL 98	RESET
17 CALL LBL 82	PLANE_2
18 CALL LBL 54	MACHINING_4
19 CALL LBL 99	RESET
20 M30	
21 LBL 51	MACHINING_1
22 CYCL DEF 233 FACE MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	
Q389=+2 ;MILLING STRATEGY ~	
Q350=+2 ;MILLING DIRECTION ~	
Q218=+40 ;FIRST SIDE LENGTH ~	
Q219=+60 ;2ND SIDE LENGTH ~	
Q227=+25 ;STARTNG PNT 3RD AXIS ~	
Q386=+0 ;END POINT 3RD AXIS ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q202=+5 ;MAX. PLUNGING DEPTH ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q253= MAX ;F PRE-POSITIONING ~	
Q357=+2 ;CLEARANCE TO SIDE ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q347=+0 ;1ST LIMIT ~	
Q348=+0 ;2ND LIMIT ~	
Q349=+0 ;3RD LIMIT ~	

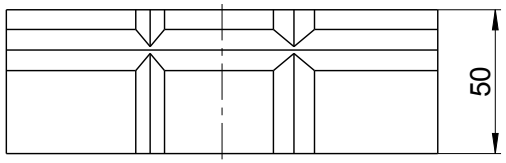
Q220=+0 ;CORNER RADIUS ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q338=+0 ;INFEED FOR FINISHING ~	
23 L X-40 Y+0 Z+50 R0 FMAX M99	
24 LBL 0	
25 LBL 52	MACHINING_2
26 CYCL DEF 252 CIRCULAR POCKET ~	
Q215=+1 ;MACHINING OPERATION ~	
Q223=+20 ;CIRCLE DIAMETER ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q351=+1 ;CLIMB OR UP-CUT ~	
Q201=-10 ;DEPTH ~	
Q202=+5 ;PLUNGING DEPTH ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q206= AUTO ;FEED RATE FOR PLNGNG ~	
Q338=+0 ;INFEED FOR FINISHING ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q203=+0 ;SURFACE COORDINATE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q366=+1 ;PLUNGE ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q439=+0 ;FEED RATE REFERENCE	
27 L X-17.5 Y+30 Z+50 R0 FMAX M99	
28 LBL 0	
29 LBL 53	MACHINING_3
30 CYCL DEF 251 RECTANGULAR POCKET ~	
Q215=+1 ;MACHINING OPERATION ~	
Q218=+25 ;FIRST SIDE LENGTH ~	
Q219=+40 ;2ND SIDE LENGTH ~	
Q220=+5 ;CORNER RADIUS ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q224=+0 ;ANGLE OF ROTATION ~	
Q367=+0 ;POCKET POSITION ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q351=+1 ;CLIMB OR UP-CUT ~	
Q201=-5 ;DEPTH ~	
Q202=+5 ;PLUNGING DEPTH ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q206= AUTO ;FEED RATE FOR PLNGNG . ~	
Q338=+0 ;INFEED FOR FINISHING ~	
Q200=+2 ;SET-UP CLEARANCE ~	

Q203=+0 ;SURFACE COORDINATE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q366=+1 ;PLUNGE ~	
Q385=+500 ;FINISHING FEED RATE	
31 L X-17.5 Y+30 Z+50 R0 FMAX M99	
32 LBL 0	
33 LBL 54	MACHINING_4
34 CYCL DEF 253 SLOT MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	
Q218=+40 ;SLOT LENGTH ~	
Q219=+12 ;SLOT WIDTH ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q374=+120 ;ANGLE OF ROTATION ~	
Q367=+0 ;SLOT POSITION ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q351=+1 ;CLIMB OR UP-CUT ~	
Q201=-10 ;DEPTH ~	
Q202=+8 ;PLUNGING DEPTH ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q206= AUTO ;FEED RATE FOR PLNGNG ~	
Q338=+0 ;INFEED FOR FINISHING ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q203=+0 ;SURFACE COORDINATE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q366=+2 ;PLUNGE ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q439=+3 ;FEED RATE REFERENCE	
35 L X-17.5 Y+30 Z+50 R0 FMAX M99	
36 LBL 0	
37 LBL 81	PLANE_1
38 CALL LBL 100	SAFE
39 CYCL DEF 7.0 DATUM SHIFT	
40 CYCL DEF 7.1 X+25	
41 PLANE SPATIAL SPA+0 SPB-45 SPC+0 TURN FMAX	
42 LBL 0	
43 LBL 82	PLANE_2
44 CALL LBL 100	SAFE
45 CYCL DEF 7.0 DATUM SHIFT	
46 CYCL DEF 7.1 X+60	
47 CYCL DEF 7.3 Z-25	
48 PLANE SPATIAL SPA+0 SPB+45 SPC+0 TURN FMAX	
49 LBL 0	

50 LBL 98	RESET_COORD. TRANS.
51 PLANE RESET STAY	
52 CYCL DEF 7.0 DATUM SHIFT	
53 CYCL DEF 7.1 X+0	
54 CYCL DEF 7.2 Y+0	
55 CYCL DEF 7.3 Z+0	
56 LBL 0	
57 LBL 99	RESET
58 CALL LBL 100	SAFE
59 PLANE RESET TURN FMAX	
60 CYCL DEF 7.0 DATUM SHIFT	
61 CYCL DEF 7.1 X+0	
62 CYCL DEF 7.2 Y+0	
63 CYCL DEF 7.3 Z+0	
64 LBL 0	
65 LBL 100	SAFE
66 L Z+300 R0 FMAX M3 M91	
67 L X+300 Y-300 R0 FMAX M91	
68 LBL 0	
69 END PGM 1267097 MM	

2.3 Programming more than one spatial angle – 1277110





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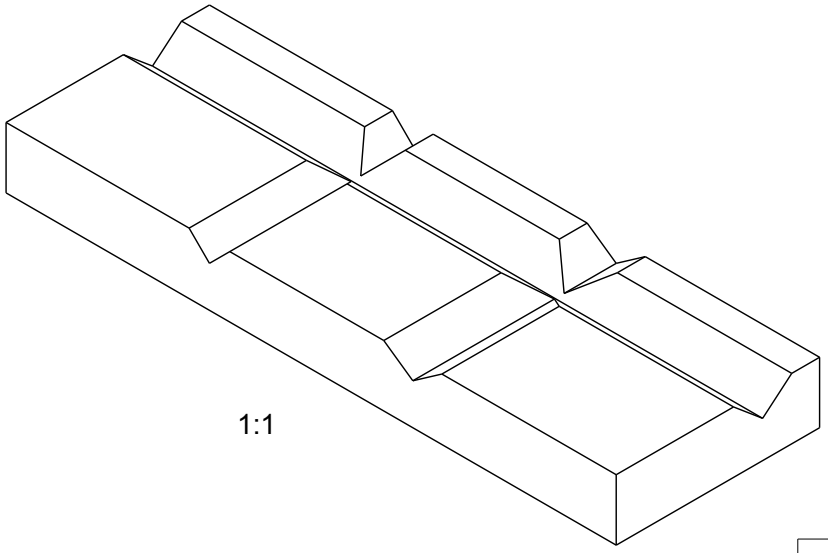

1:1

				ID number
Text:				Change No. C000941-05 Phase: Nicht-Serie
	Original drawing Scale: 1:2 / Format: A4	Spannbacke clamping jaw Einzelteilzeichnung / Component Drawing		Werkstoff: 3.1645 Material:
RoHS				●blanke Flächen/Blank surfaces
Maße in mm / Dimensions in mm				
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3		Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	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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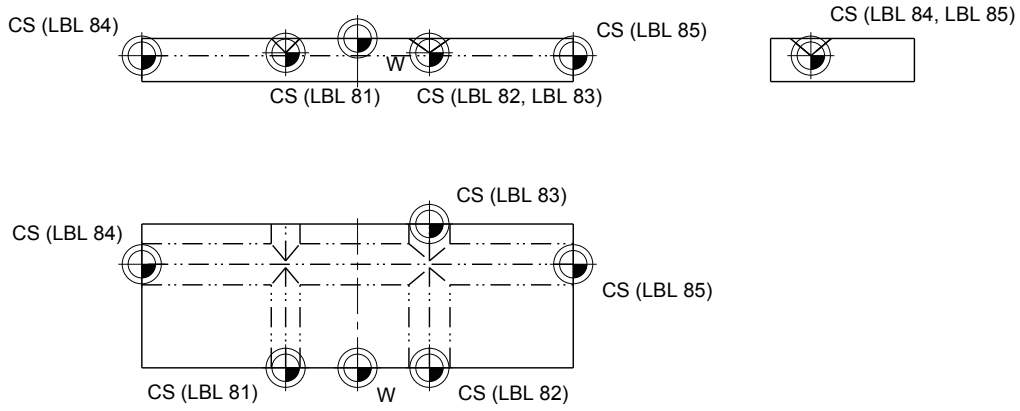
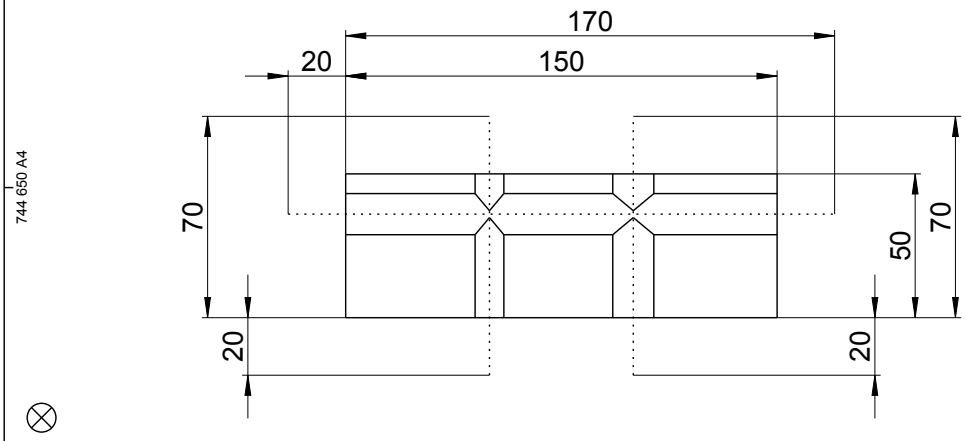
	11.01.2019			Document number			





				ID number
Text:				Change No. C000941-05 Phase: Nicht-Serie
	Original drawing Scale / Format	Spannbacke clamping jaw		Werkstoff: 3.1645 Material:
RoHS	1:2 / A4			
Maße in mm / Dimensions in mm		Einzelteilzeichnung / Component Drawing		●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2		Tolerierung nach ISO 8015 Tolerances as per ISO 8015	Oberflächen nach ISO 1302 Surfaces as per ISO 1302
			Oberflächenbehandlung: Surface treatment:	

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	11.01.2019			Document number			

Working plan

- Workpiece blank definition
- Tool call
- Mill the inclined surface (90°)
- Mill the inclined surface (110°)
- Mill the inclined surface (100°)
- End the NC program
- Define subprograms

Program parameters

General parameters	Parameters	X	Y	Z
Safety clearance		-	-	+5
Safe position		-	-	+50
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	T	S	F_1	DZ	IZ
	20	10	5000	1000	-10	5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining depth
IZ) Infeed

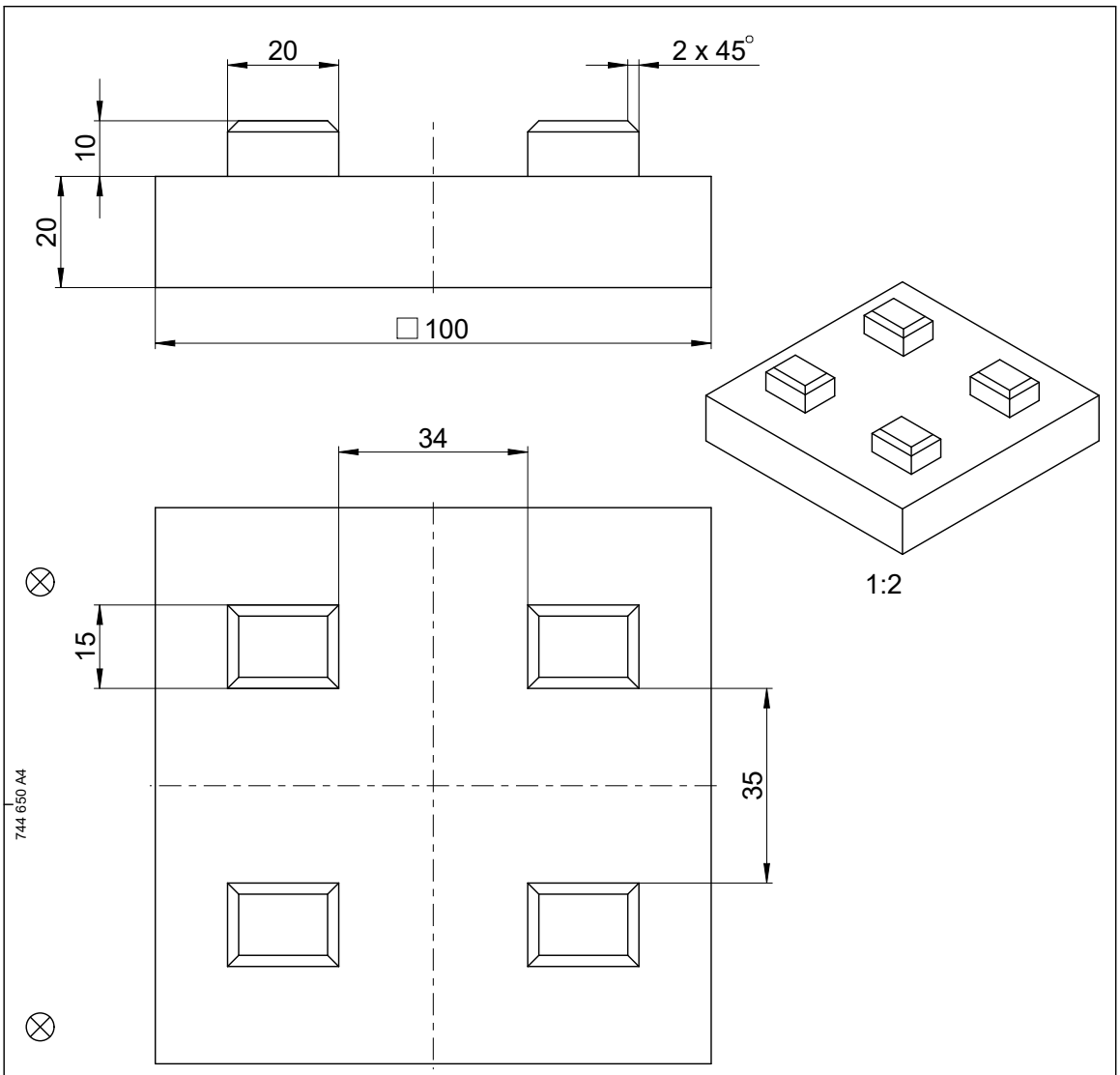
Solution

0 BEGIN PGM 1277110 MM	
1 BLK FORM 0.1 Z X-75 Y+0 Z-15	
2 BLK FORM 0.2 X+75 Y+50 Z+0	
3 TOOL CALL 10 Z S5000 F1000	
4 CALL LBL 99	RESET
5 CALL LBL 81	PLANE_1
6 CALL LBL 51	MACHINING_1
7 CALL LBL 98	RESET_COORD. TRANS.
8 CALL LBL 82	PLANE_2
9 CALL LBL 51	MACHINING_1
10 CALL LBL 98	RESET_COORD. TRANS.
11 CALL LBL 83	PLANE_3
12 CALL LBL 51	MACHINING_1
13 CALL LBL 98	RESET_COORD. TRANS.
14 CALL LBL 84	PLANE_4
15 CALL LBL 52	MACHINING_2
16 CALL LBL 98	RESET_COORD. TRANS.
17 CALL LBL 85	PLANE_5
18 CALL LBL 52	MACHINING_2
19 CALL LBL 99	RESET
20 M30	
21 LBL 51	MACHINING_1
22 L X+0 Y-20 Z+50 R0 FMAX	
23 L Z+5 R0 FMAX	
24 L Z+0 R0 F AUTO	
25 APPR LT X+0 Y+0 LEN20 RL F AUTO	
26 L Y+50	
27 DEP LT LEN20	
28 L Z+50 R0 FMAX	
29 LBL 0	
30 LBL 52	MACHINING_2
31 L X-20 Y+0 Z+50 R0 FMAX	
32 L Z+5 R0 FMAX	
33 L Z+0 R0 F AUTO	
34 APPR LT X+0 Y+0 LEN20 RL F AUTO	
35 L Y+150	
36 DEP LT LEN20	
37 L Z+50 R0 FMAX	
38 LBL 0	
39 LBL 81	PLANE_1
40 CALL LBL 100	SAFE
41 CYCL DEF 7.0 DATUM SHIFT	

42 CYCL DEF 7.1 X-25	
43 CYCL DEF 7.3 Z-5	
44 PLANE SPATIAL SPA+0 SPB+45 SPC+0 TURN FMAX	
45 LBL 0	
46 LBL 82	PLANE_2
47 CALL LBL 100	SAFE
48 CYCL DEF 7.0 DATUM SHIFT	
49 CYCL DEF 7.1 X+25	
50 CYCL DEF 7.3 Z-5	
51 PLANE SPATIAL SPA+0 SPB+55 SPC+0 TURN FMAX	
52 LBL 0	
53 LBL 83	PLANE_3
54 CALL LBL 100	SAFE
55 CYCL DEF 7.0 DATUM SHIFT	
56 CYCL DEF 7.1 X+25	
57 CYCL DEF 7.2 Y+50	
58 CYCL DEF 7.3 Z-5	
59 PLANE SPATIAL SPA+0 SPB+55 SPC+180 TURN FMAX	
60 LBL 0	
61 LBL 84	PLANE_4
62 CALL LBL 100	SAFE
63 CYCL DEF 7.0 DATUM SHIFT	
64 CYCL DEF 7.1 X-75	
65 CYCL DEF 7.2 Y+36	
66 CYCL DEF 7.3 Z-6	
67 PLANE SPATIAL SPA+0 SPB+50 SPC-90 TURN FMAX	
68 LBL 0	
69 LBL 85	PLANE_5
70 CALL LBL 100	SAFE
71 CYCL DEF 7.0 DATUM SHIFT	
72 CYCL DEF 7.1 X+75	
73 CYCL DEF 7.2 Y+36	
74 CYCL DEF 7.3 Z-6	
75 PLANE SPATIAL SPA+0 SPB+50 SPC+90 TURN FMAX	
76 LBL 0	
77 LBL 98	RESET_COORD. TRANS.
78 PLANE RESET STAY	
79 CYCL DEF 7.0 DATUM SHIFT	
80 CYCL DEF 7.1 X+0	
81 CYCL DEF 7.2 Y+0	
82 CYCL DEF 7.3 Z+0	
83 LBL 0	
84 LBL 99	RESET

85 CALL LBL 100	SAFE
86 PLANE RESET TURN FMAX	
87 CYCL DEF 7.0 DATUM SHIFT	
88 CYCL DEF 7.1 X+0	
89 CYCL DEF 7.2 Y+0	
90 CYCL DEF 7.3 Z+0	
91 LBL 0	
92 LBL 100	SAFE
93 L Z+300 R0 FMAX M3 M91	
94 L X+300 Y-300 R0 FMAX M91	
95 LBL 0	
96 END PGM 1277110 MM	

2.4 Programming more than one spatial angle – 1277113



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	Original drawing Scale / Format	Platte plate Einzelteilzeichnung / Component Drawing		Werkstoff: 3.1645 Material:
RoHS	1:1 / A4			●blanke Flächen/Blank surfaces
Maße in mm / Dimensions in mm				
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715		Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	Tolerierung nach ISO 8015 Tolerances as per ISO 8015	Oberflächen nach ISO 1302 Surfaces as per ISO 1302
-0.3 +0.3			Oberflächenbehandlung: Surface treatment:	

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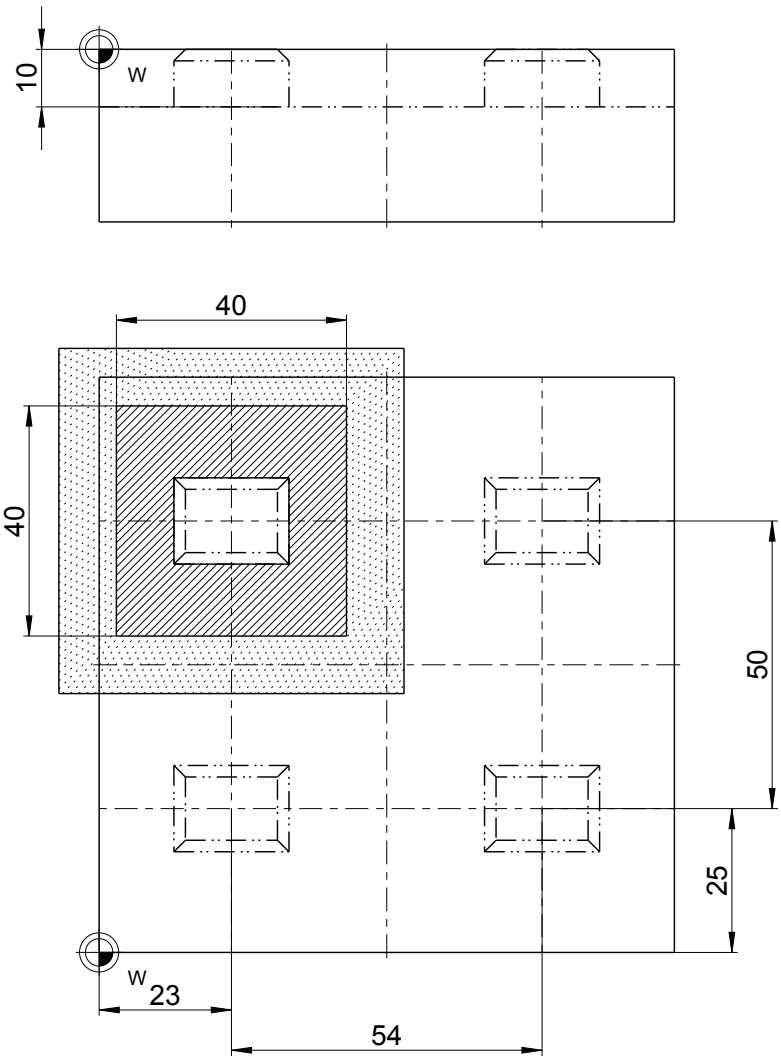
DR. JOHANNES HEIDENHAIN GmbH 83301 Traunreut, Germany	M-TS 11.01.2019			D1277113-00-A-01 Document number			1 of 1



744 650 A4

			ID number
Text:			Change No. C000941-05 Phase: Nicht-Serie
	Original drawing Scale: 1:1 / Format: A4	Platte plate Einzelteilzeichnung / Component Drawing	Werkstoff: 3.1645 Material:
RoHS			●blanke Flächen/Blank surfaces
Maße in mm / Dimensions in mm			
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	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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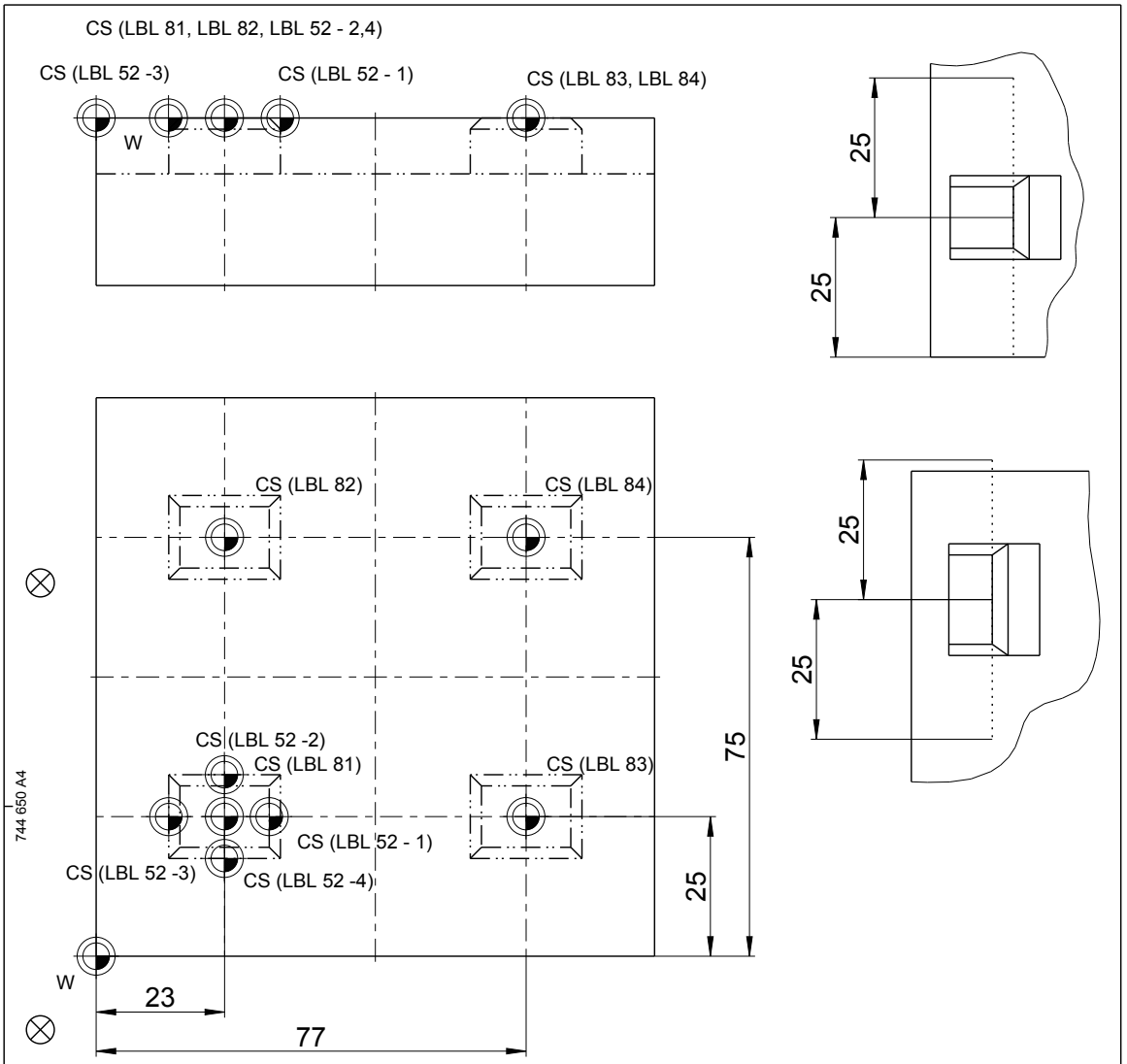
DR. JOHANNES HEIDENHAIN GmbH 83301 Traunreut, Germany	M-TS 11.01.2019			D1277113-00-A-02 Document number			1 of 2



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Text:			Change No. C000941-05 Phase: Nicht-Serie
	Original drawing Scale: 1:1 / Format: A4	Platte plate Einzelteilzeichnung / Component Drawing	Werkstoff: 3.1645 Material:
RoHS			●blanke Flächen/Blank surfaces
Maße in mm / Dimensions in mm			
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	Tolerierung nach ISO 8015 Tolerances as per ISO 8015	Oberflächen nach ISO 1302 Surfaces as per ISO 1302
		Oberflächenbehandlung: Surface treatment:	

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DR. JOHANNES HEIDENHAIN GmbH 83301 Traunreut, Germany	M-TS			D1277113-00	A	02	2 of 2
	11.01.2019			Document number			

Working plan

- Workpiece blank definition
- Tool call
- Mill islands
  - Rectangular stud
  - Pattern definition
- Mill the chamfer on the islands
- End the NC program
- Define subprograms

Program parameters

Slot milling (roughing)	Parameters	X	Y	Z
Pre-position		0	0	-
Machining direction	Climb milling			
Plunging motion	Reciprocating			

General parameters	Parameters	X	Y	Z
Set-up clearance		-	-	+5
Safe position		-	-	+50
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	T	S	F_1	DZ	IZ
	20	10	5000	1000	-10	5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining depth
IZ) Infeed

Solution

0 BEGIN PGM 1277113 MM	
1 BLK FORM 0.1 Z X+0 Y+0 Z-20	
2 BLK FORM 0.2 X+100 Y+100 Z+0	
3 TOOL CALL 10 Z S5000 F1000	
4 CALL LBL 99	RESET
5 CALL LBL 51	MACHINING_1
6 CALL LBL 99	RESET
7 CALL LBL 81	PLANE_1
8 CALL LBL 52	MACHINING_2
9 CALL LBL 99	RESET
10 CALL LBL 82	PLANE_2
11 CALL LBL 52	MACHINING_2
12 CALL LBL 99	RESET
13 CALL LBL 83	PLANE_3
14 CALL LBL 52	MACHINING_3
15 CALL LBL 99	RESET
16 CALL LBL 84	PLANE_4
17 CALL LBL 52	MACHINING_4
18 CALL LBL 99	RESET
19 M30	
20 LBL 51	MACHINING_1
21 CYCL DEF 256 RECTANGULAR STUD ~	
Q218=+20 ;FIRST SIDE LENGTH ~	
Q424=+40 ;WORKPC. BLANK SIDE 1 ~	
Q219=+15 ;2ND SIDE LENGTH ~	
Q425=+40 ;WORKPC. BLANK SIDE 2 ~	
Q220=+0 ;RADIUS / CHAMFER ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q224=+0 ;ANGLE OF ROTATION ~	
Q367=+0 ;STUD POSITION ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q351=+1 ;CLIMB OR UP-CUT ~	
Q201=-10 ;DEPTH ~	
Q202=+5 ;PLUNGING DEPTH ~	
Q206=+250 ;FEED RATE FOR PLNGNG ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q203=+0 ;SURFACE COORDINATE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q437=+0 ;APPROACH POSITION ~	
Q215=+1 ;MACHINING OPERATION ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	

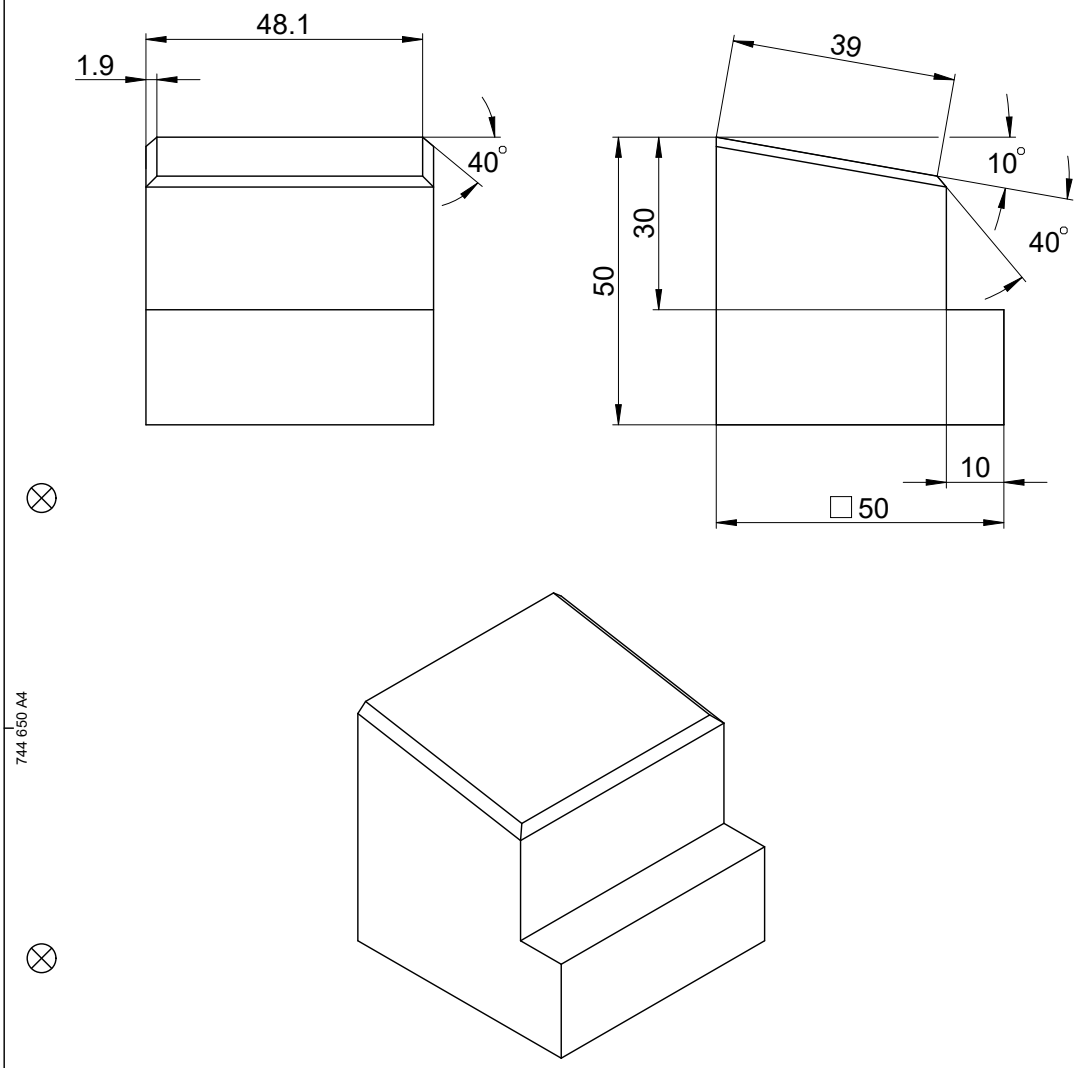
Q338=+0 ;INFEED FOR FINISHING ~	
Q385=+500 ;FINISHING FEED RATE	
22 PATTERN DEF ~	
FRAME1(X+23 Y+25 DX+54 DY+50 NUMX2 NUMY2 ROT+0 ROTX+0 ROTY+0 Z+0)	
23 L X+0 Y+0 Z+50 R0 FMAX	
24 CYCL CALL PAT FMAX	
25 LBL 0	
26 LBL 52	MACHINING_2
27 CALL LBL 100	SAFE
28 CYCL DEF 7.0 DATUM SHIFT	
29 CYCL DEF 7.1 IX+8	
30 PLANE SPATIAL SPA+0 SPB+45 SPC+0 MOVE	
31 CALL LBL 10	
32 PLANE RESET STAY	
33 CYCL DEF 7.0 DATUM SHIFT	
34 CYCL DEF 7.1 IX-8	
35 CYCL DEF 7.2 IY+5.5	
36 PLANE SPATIAL SPA+0 SPB+45 SPC+90 MOVE	
37 CALL LBL 10	
38 PLANE RESET STAY	
39 CYCL DEF 7.0 DATUM SHIFT	
40 CYCL DEF 7.1 IX-8	
41 CYCL DEF 7.2 IY-5.5	
42 PLANE SPATIAL SPA+0 SPB+45 SPC+180 MOVE	
43 CALL LBL 10	
44 PLANE RESET STAY	
45 CYCL DEF 7.0 DATUM SHIFT	
46 CYCL DEF 7.1 IX+8	
47 CYCL DEF 7.2 IY-5.5	
48 PLANE SPATIAL SPA+0 SPB+45 SPC+270 MOVE	
49 CALL LBL 10	
50 LBL 0	
51 LBL 10	MILLING PATH
52 L X+0 Y-25 Z+50 R0 FMAX	
53 L Z+5 R0 FMAX	
54 L Z+0 R0 F AUTO	
55 L Y+25	
56 LBL 0	
57 LBL 81	PLANE_1
58 CYCL DEF 7.0 DATUM SHIFT	
59 CYCL DEF 7.1 X+23	
60 CYCL DEF 7.2 Y+25	

61 LBL 0	
62 LBL 82	PLANE_2
63 CYCL DEF 7.0 DATUM SHIFT	
64 CYCL DEF 7.1 X+23	
65 CYCL DEF 7.2 Y+75	
66 LBL 0	
67 LBL 83	PLANE_3
68 CYCL DEF 7.0 DATUM SHIFT	
69 CYCL DEF 7.1 X+77	
70 CYCL DEF 7.2 Y+25	
71 LBL 0	
72 LBL 84	PLANE_4
73 CYCL DEF 7.0 DATUM SHIFT	
74 CYCL DEF 7.1 X+77	
75 CYCL DEF 7.2 Y+75	
76 LBL 0	
77 LBL 98	RESET_COORD. TRANS.
78 PLANE RESET STAY	
79 CYCL DEF 7.0 DATUM SHIFT	
80 CYCL DEF 7.1 X+0	
81 CYCL DEF 7.2 Y+0	
82 CYCL DEF 7.3 Z+0	
83 LBL 0	
84 LBL 99	RESET
85 CALL LBL 100	SAFE
86 PLANE RESET TURN FMAX	
87 CYCL DEF 7.0 DATUM SHIFT	
88 CYCL DEF 7.1 X+0	
89 CYCL DEF 7.2 Y+0	
90 CYCL DEF 7.3 Z+0	
91 LBL 0	
92 LBL 100	SAFE
93 L Z+300 R0 FMAX M3 M91	
94 L X+300 Y-300 R0 FMAX M91	
95 LBL 0	
96 END PGM 1277113 MM	

3

Related and further topics

3.1 Programming more than one transformation – 1277115



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RoHS	1:1 / A4			
Maße in mm / Dimensions in mm		Einzelteilzeichnung / Component Drawing		●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3		Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	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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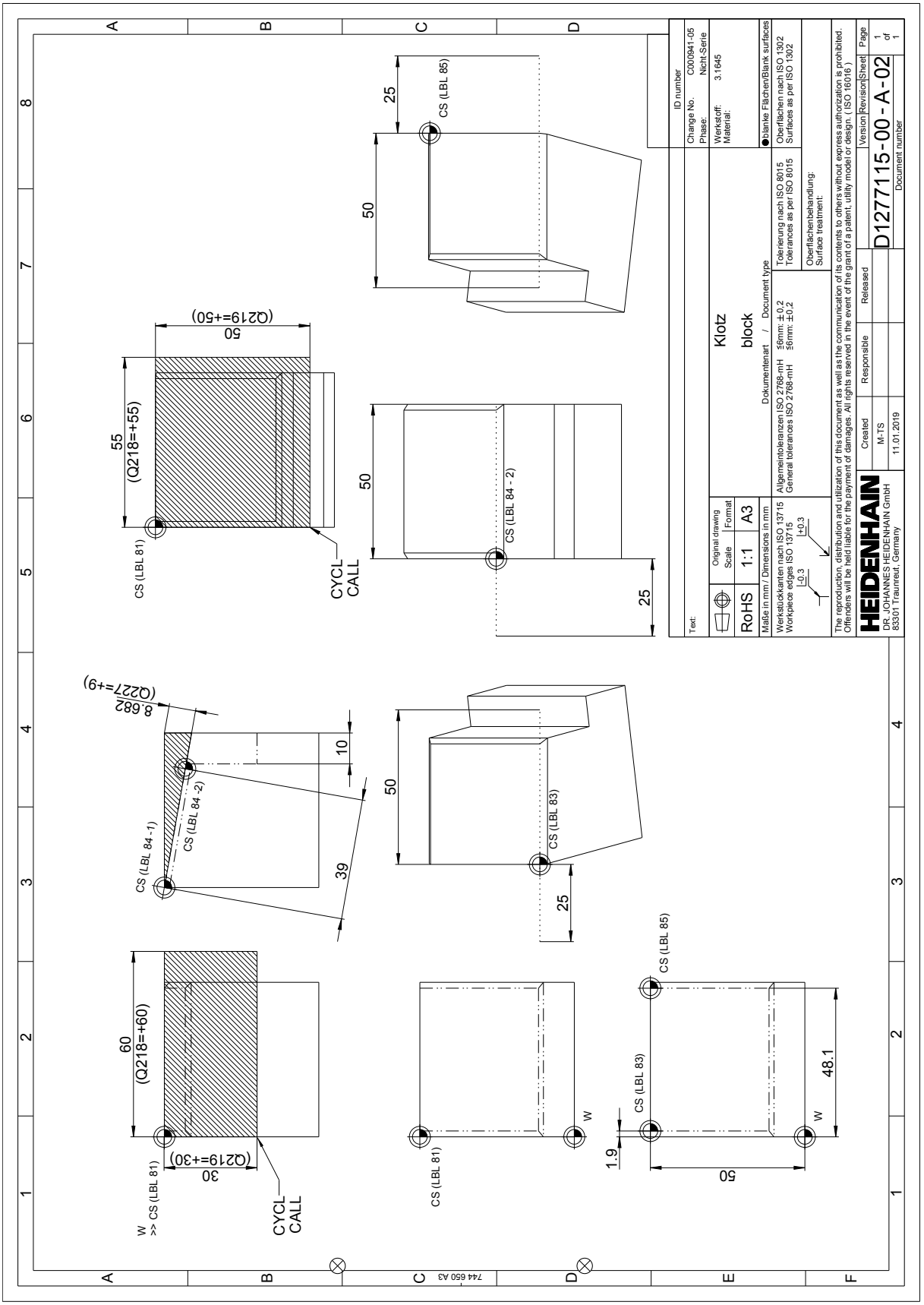
	11.01.2019			Document number			


Klotz
block
HEIDENHAIN
DR. JOHANNES HEIDENHAIN GmbH
83301 Traunreut, Germany
D1277115-00 - A-02
CS (LBL 85)
CS (LBL 84 - 2)
CS (LBL 81)
CS (LBL 83)
CS (LBL 84 -1)
CYCL CALL
(Q219=+50)
(Q218=+55)
(Q227=+9)
(Q218=+60)
(Q219=+30)

Working plan

- Workpiece blank definition
- Tool call
- Mill the inclined surface (10°)
- Mill the inclined surface (90°)
- Mill the chamfer
- End the NC program
- Define subprograms

Program parameters

Face milling (roughing)	Parameters	X	Y	Z
Milling plan	2, climb milling			
Milling direction	2, parallel to Y axis			
Feed rate for pre-positioning	Maximum feed rate			
Limitation at A+90°	-2, negative minor axis			

General parameters	Parameters	X	Y	Z
Set-up clearance		-	-	+5
Safe position		-	-	+50
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	T	S	F_1	DZ	IZ
	20	10	5000	1000	-10	5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining depth
IZ) Infeed

Solution

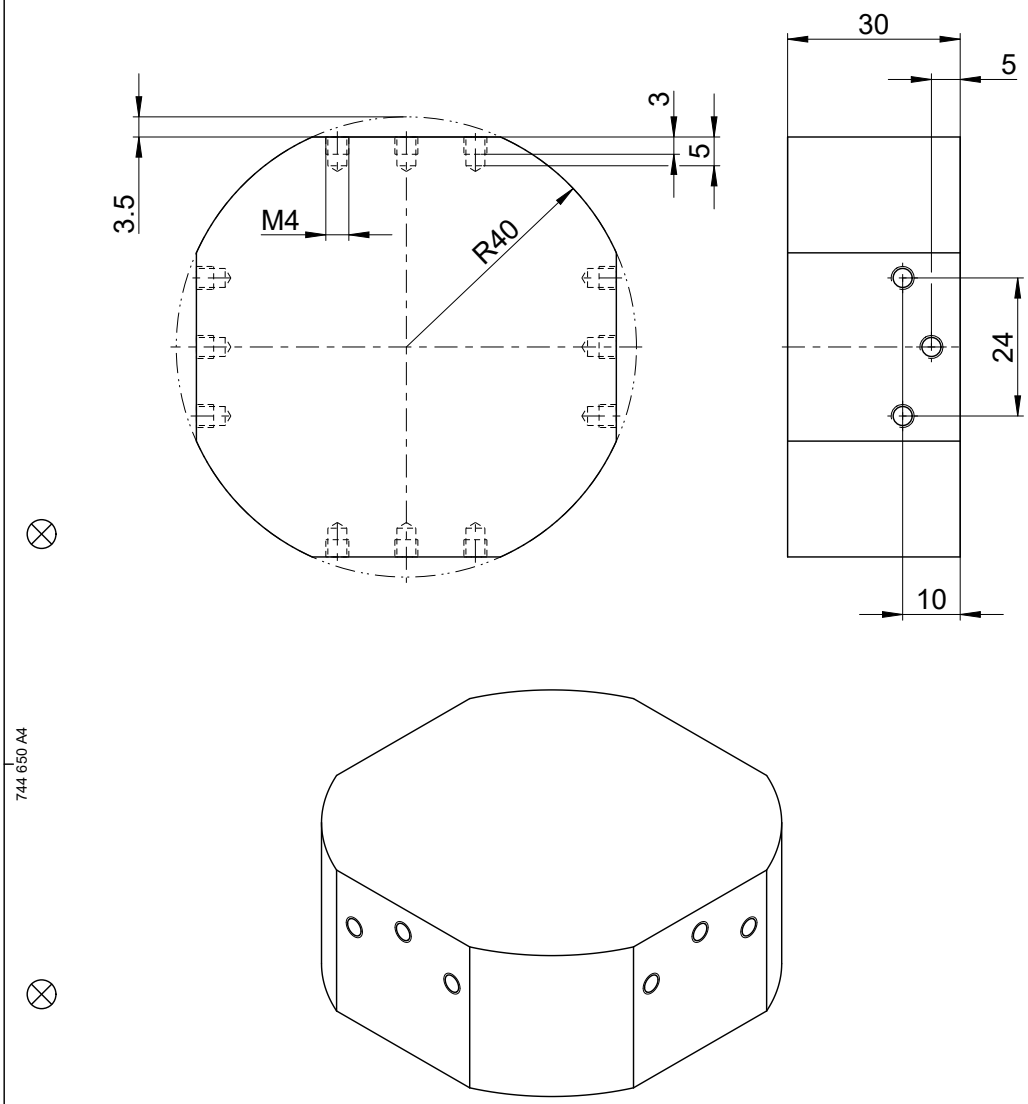
0 BEGIN PGM 1277115 MM	
1 BLK FORM 0.1 Z X+0 Y+0 Z-50	
2 BLK FORM 0.2 X+50 Y+50 Z+0	
3 TOOL CALL 10 Z S5000 F1000	
4 CALL LBL 99	RESET
5 CALL LBL 81	PLANE_1
6 CALL LBL 51	MACHINING_1
7 CALL LBL 99	RESET
8 CALL LBL 82	PLANE_2
9 CALL LBL 52	MACHINING_2
10 CALL LBL 99	RESET
11 CALL LBL 83	PLANE_3
12 CALL LBL 53	MACHINING_3
13 CALL LBL 98	RESET_COORD. TRANS.
14 CALL LBL 84	PLANE_4
15 CALL LBL 53	MACHINING_3
16 CALL LBL 98	RESET_COORD. TRANS.
17 CALL LBL 85	PLANE_5
18 CALL LBL 53	MACHINING_3
19 CALL LBL 99	RESET
20 M30	
21 LBL 51	MACHINING_1
22 CYCL DEF 233 FACE MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	
Q389=+2 ;MILLING STRATEGY ~	
Q350=+2 ;MILLING DIRECTION ~	
Q218=+55 ;FIRST SIDE LENGTH ~	
Q219=+50 ;2ND SIDE LENGTH ~	
Q227=+9 ;STARTNG PNT 3RD AXIS ~	
Q386=+0 ;END POINT 3RD AXIS ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q202=+5 ;MAX. PLUNGING DEPTH ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q253= MAX ;F PRE-POSITIONING ~	
Q357=+2 ;CLEARANCE TO SIDE ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q347=+0 ;1ST LIMIT ~	
Q348=+0 ;2ND LIMIT ~	
Q349=+0 ;3RD LIMIT ~	

Q220=+0 ;CORNER RADIUS ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q338=+0 ;INFEED FOR FINISHING ~	
23 L X+0 Y-50 Z+50 R0 FMAX M99	
24 LBL 0	
25 LBL 52	MACHINING_2
26 CYCL DEF 233 FACE MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	
Q389=+2 ;MILLING STRATEGY ~	
Q350=+2 ;MILLING DIRECTION ~	
Q218=+60 ;FIRST SIDE LENGTH ~	
Q219=+30 ;2ND SIDE LENGTH ~	
Q227=+0 ;STARTNG PNT 3RD AXIS ~	
Q386=-10 ;END POINT 3RD AXIS ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q202=+5 ;MAX. PLUNGING DEPTH ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q253= MAX ;F PRE-POSITIONING ~	
Q357=+2 ;CLEARANCE TO SIDE ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q347=-2 ;1ST LIMIT ~	
Q348=+0 ;2ND LIMIT ~	
Q349=+0 ;3RD LIMIT ~	
Q220=+0 ;CORNER RADIUS ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q338=+0 ;INFEED FOR FINISHING ~	
27 L X+0 Y-30 Z+50 R0 FMAX M99	
28 LBL 0	
29 LBL 53	MACHINING_3
30 L X-25 Y+0 Z+50 R0 FMAX	
31 L Z+5 R0 FMAX	
32 L Z+0 R0 F AUTO	
33 L X+50	
34 L Z+50 R0 FMAX	
35 LBL 0	
36 LBL 81	PLANE_1
37 CALL LBL 100	SAFE
38 CYCL DEF 7.0 DATUM SHIFT	
39 CYCL DEF 7.2 Y+50	
40 PLANE SPATIAL SPA+10 SPB+0 SPC+0 TURN FMAX	

41 LBL 0	
42 LBL 82	PLANE_2
43 CALL LBL 100	SAFE
44 PLANE SPATIAL SPA+90 SPB+0 SPC+0 TURN FMAX	
45 LBL 0	
46 LBL 83	PLANE_3
47 CALL LBL 100	SAFE
48 CYCL DEF 7.0 DATUM SHIFT	
49 CYCL DEF 7.1 Y+50	
50 CYCL DEF 7.2 X+1.9	
51 PLANE SPATIAL SPA+40 SPB+10 SPC-90 TURN FMAX	
52 LBL 0	
53 LBL 84	PLANE_4
54 CALL LBL 100	SAFE
55 CYCL DEF 7.0 DATUM SHIFT	
56 CYCL DEF 7.1 Y+50	
57 PLANE SPATIAL SPA+10 SPB+0 SPC+0 TURN FMAX	
58 CYCL DEF 7.0 DATUM SHIFT	
59 CYCL DEF 7.1 IY-39	
60 PLANE RELATIV SPA+40 TURN FMAX	
61 LBL 0	
62 LBL 85	PLANE_5
63 CALL LBL 100	SAFE
64 CYCL DEF 7.0 DATUM SHIFT	
65 CYCL DEF 7.1 X+48.1	
66 CYCL DEF 7.2 Y+50	
67 PLANE SPATIAL SPA-40 SPB+10 SPC-90 TURN FMAX	
68 LBL 0	
69 LBL 98	RESET_COORD. TRANS.
70 PLANE RESET STAY	
71 CYCL DEF 7.0 DATUM SHIFT	
72 CYCL DEF 7.1 X+0	
73 CYCL DEF 7.2 Y+0	
74 CYCL DEF 7.3 Z+0	
75 LBL 0	
76 LBL 99	RESET
77 CALL LBL 100	SAFE
78 PLANE RESET TURN FMAX	
79 CYCL DEF 7.0 DATUM SHIFT	
80 CYCL DEF 7.1 X+0	
81 CYCL DEF 7.2 Y+0	
82 CYCL DEF 7.3 Z+0	
83 LBL 0	

84 LBL 100	SAFE
85 L Z+300 R0 FMAX M3 M91	
86 L X+300 Y-300 R0 FMAX M91	
87 LBL 0	
88 END PGM 1277115 MM	

3.2 Programming more than one transformation – 1277120



					ID number
Text:					Change No. C000941-05 Phase: Nicht-Serie
	Original drawing Scale / Format		Platte plate		Werkstoff: 3.1645 Material:
RoHS	1:1	A4			
Maße in mm / Dimensions in mm			Einzelteilzeichnung / Component Drawing		●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3			Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	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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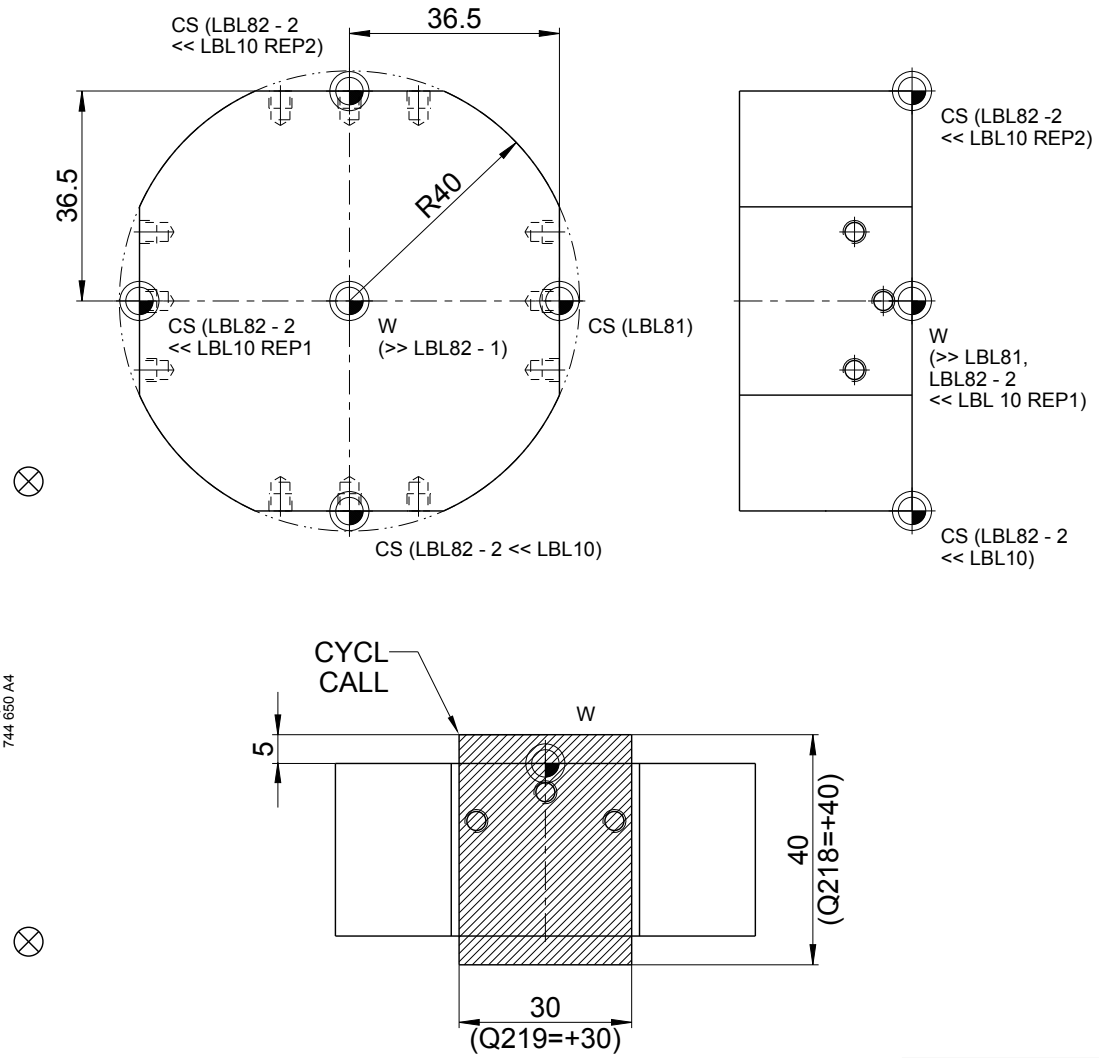

			ID number
Text:			Change No. C000941-05 Phase: Nicht-Serie
	Original drawing Scale / Format	Platte plate Einzelteilzeichnung / Component Drawing	Werkstoff: 3.1645 Material:
RoHS	1:1 / A4		
Maße in mm / Dimensions in mm			●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	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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Working plan

- Workpiece blank definition
- Tool call
- Face milling
  - **PLANE SPATIAL**
  - Shift datum to tilting edge
- Mill the other plane surfaces
  - Program section repeat
  - **PLANE RELATIV**
- Tool call
- Drill the holes
- End the NC program
- Define subprograms

Program parameters

Face milling (roughing)	**Parameters**	**X**	**Y**	**Z**
Milling plan	2, climb milling			
Milling direction	2, parallel to Y axis			
Feed rate for pre-positioning	Maximum feed rate			
Centering / drilling / thread cutting	**Parameters**	**X**	**Y**	**Z**
Diameter of counterbore	-5			
Reference for depth	To cylindrical part of the drill (without tool tip)			
Thread pitch	0.7			
General parameters	**Parameters**	**X**	**Y**	**Z**
Safe position		-	-	+50
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	T	S	F_1	DZ	IZ
	20	10	1000	5000	-10	5
	10	203	43000	730	-10	5
	3.3	224	3000	800	-10	5
	4	261	1250	-	-10	5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining / drilling depth
IZ) Infeed

Solution

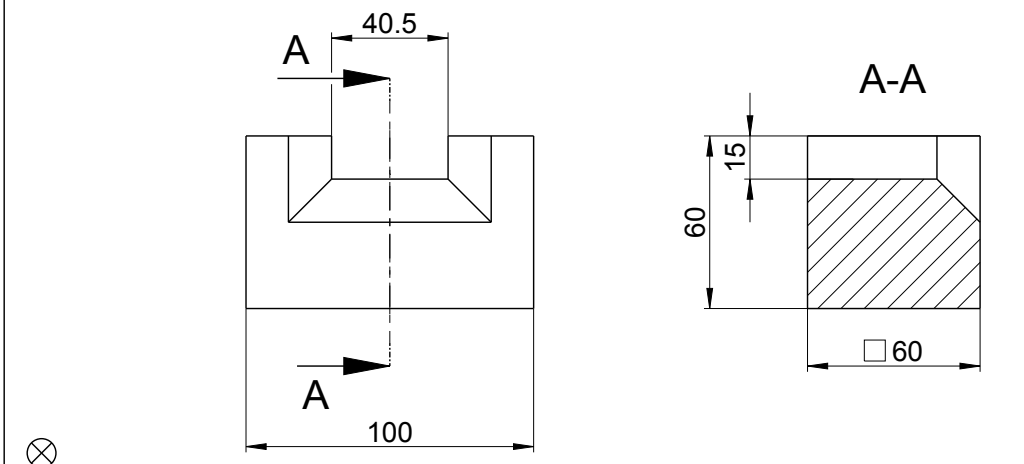
0 BEGIN PGM 1277120 MM	
1 BLK FORM CYLINDER Z R40 L30	
2 TOOL CALL 10 Z S5000 F1000	
3 CALL LBL 99	RESET
4 CALL LBL 81	PLANE_1
5 CALL LBL 51	MACHINING_1
6 LBL 10	PROGRAM SECTION REPEAT
7 CALL LBL 82	PLANE_2
8 CALL LBL 51	MACHINING_1
9 CALL LBL 10 REP2	TWO REPETITIONS
10 CALL LBL 99	RESET
11 TOOL CALL 203 Z S1000 F800	
12 CALL LBL 99	RESET
13 CALL LBL 81	PLANE_1
14 CALL LBL 52	MACHINING_2
15 LBL 11	PROGRAM SECTION REPEAT
16 CALL LBL 82	PLANE_2
17 CALL LBL 52	MACHINING_2
18 CALL LBL 11 REP2	TWO REPETITIONS
19 CALL LBL 99	RESET
20 TOOL CALL 224 Z S3000 F800	
21 CALL LBL 99	RESET
22 CALL LBL 81	PLANE_1
23 CALL LBL 53	MACHINING_3
24 LBL 12	PROGRAM SECTION REPEAT
25 CALL LBL 82	PLANE_2
26 CALL LBL 53	MACHINING_3
27 CALL LBL 12 REP2	TWO REPETITIONS
28 CALL LBL 99	RESET
29 TOOL CALL 261 Z S1250	
30 CALL LBL 99	RESET
31 CALL LBL 81	PLANE_1
32 CALL LBL 54	MACHINING_4
33 LBL 13	PROGRAM SECTION REPEAT
34 CALL LBL 82	PLANE_2
35 CALL LBL 54	MACHINING_4
36 CALL LBL 13 REP2	TWO REPETITIONS
37 CALL LBL 99	RESET
38 M30	
39 LBL 51	MACHINING_1
40 CYCL DEF 233 FACE MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	

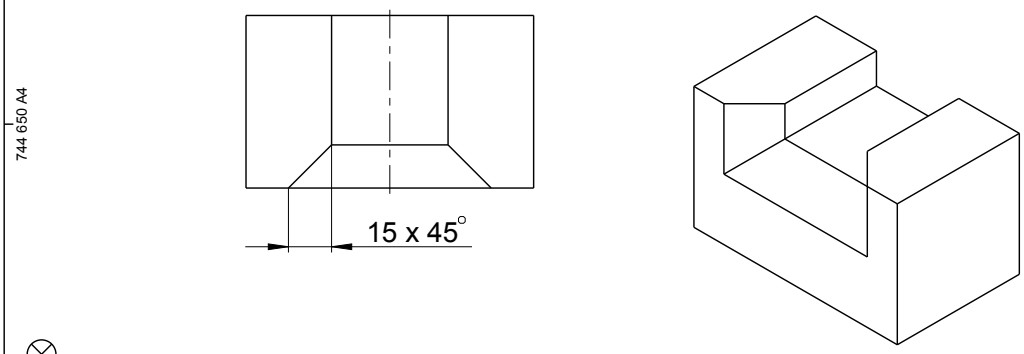
Q389=+2	;MILLING STRATEGY ~	
Q350=+2	;MILLING DIRECTION ~	
Q218=+40	;FIRST SIDE LENGTH ~	
Q219=+30	;2ND SIDE LENGTH ~	
Q227=+3.5	;STARTNG PNT 3RD AXIS ~	
Q386=+0	;END POINT 3RD AXIS ~	
Q369=+0	;ALLOWANCE FOR FLOOR ~	
Q202=+5	;MAX. PLUNGING DEPTH ~	
Q370=+1	;TOOL PATH OVERLAP ~	
Q207= AUTO	;FEED RATE MILLING ~	
Q385=+500	;FINISHING FEED RATE ~	
Q253= MAX	;F PRE-POSITIONING ~	
Q357=+2	;CLEARANCE TO SIDE ~	
Q200=+2	;SET-UP CLEARANCE ~	
Q204=+50	;2ND SET-UP CLEARANCE ~	
Q347=+0	;1ST LIMIT ~	
Q348=+0	;2ND LIMIT ~	
Q349=+0	;3RD LIMIT ~	
Q220=+0	;CORNER RADIUS ~	
Q368=+0	;ALLOWANCE FOR SIDE ~	
Q338=+0	;INFEED FOR FINISHING ~	
41 L X+0 Y-15 Z+50 R0 FMAX M99		
42 LBL 0		
43 LBL 52		MACHINING_2
44 CYCL DEF 240 CENTERING ~		
Q200=+2	;SET-UP CLEARANCE ~	
Q343=+1	;SELECT DIA./DEPTH ~	
Q201=-2	;DEPTH ~	
Q344=-5	;DIAMETER ~	
Q206= AUTO	;FEED RATE FOR PLNGNG ~	
Q211=+0	;DWELL TIME AT DEPTH ~	
Q203=+0	;SURFACE COORDINATE ~	
Q204=+50	;2ND SET-UP CLEARANCE	
45 CALL LBL 20		
46 LBL 0		
47 LBL 53		MACHINING_3
48 CYCL DEF 200 DRILLING ~		
Q200=+2	;SET-UP CLEARANCE ~	
Q201=-5	;DEPTH ~	
Q206= AUTO	;FEED RATE FOR PLNGNG ~	
Q202=+5	;PLUNGING DEPTH ~	
Q210=+0	;DWELL TIME AT TOP ~	
Q203=+0	;SURFACE COORDINATE ~	

Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q211=+0 ;DWELL TIME AT DEPTH ~	
Q395=+1 ;DEPTH REFERENCE	
49 CALL LBL 20	
50 LBL 0	
51 LBL 54	MACHINING_4
52 CYCL DEF 207 RIGID TAPPING ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q201=-3 ;DEPTH OF THREAD ~	
Q239=+0.7 ;THREAD PITCH ~	
Q203=+0 ;SURFACE COORDINATE ~	
Q204=+50 ;2ND SET-UP CLEARANCE	
53 CALL LBL 20	
54 LBL 0	
55 LBL 20	MACHINING POSITIONS
56 L X+10 Y-12 Z+50 R0 FMAX M99	
57 L X+5 Y+0 Z+50 R0 FMAX M99	
58 L X+10 Y+12 Z+50 R0 FMAX M99	
59 LBL 0	
60 LBL 81	PLANE_1
61 CALL LBL 100	SAFE
62 PLANE SPATIAL SPA+0 SPB+90 SPC+0 TURN FMAX	
63 CYCL DEF 7.0 DATUM SHIFT	
64 CYCL DEF 7.1 Z+36.5	
65 LBL 0	
66 LBL 82	PLANE_2
67 CALL LBL 100	SAFE
68 CYCL DEF 7.0 DATUM SHIFT	
69 CYCL DEF 7.1 Z+0	
70 PLANE RELATIV SPA+90 TURN FMAX	
71 CYCL DEF 7.0 DATUM SHIFT	
72 CYCL DEF 7.1 Z+36.5	
73 LBL 0	
74 LBL 99	RESET
75 CALL LBL 100	SAFE
76 PLANE RESET TURN FMAX	
77 CYCL DEF 7.0 DATUM SHIFT	
78 CYCL DEF 7.1 X+0	
79 CYCL DEF 7.2 Y+0	
80 CYCL DEF 7.3 Z+0	
81 LBL 0	
82 LBL 100	SAFE
83 L Z+300 R0 FMAX M3 M91	

```
84 L  X+300  Y-300 R0 FMAX M91
85 LBL 0
86 END PGM 1277120 MM
```

3.3 Programming more than one transformation – 1277112





744 650 A4

				ID number
Text:				Change No. C000941-05 Phase: Nicht-Serie
	Original drawing Scale / Format	Klotz block		Werkstoff: 3.1645 Material:
RoHS	1:2 / A4			
Maße in mm / Dimensions in mm		Einzelteilzeichnung / Component Drawing		●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3		Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	Tolerierung nach ISO 8015 Tolerances as per ISO 8015 Oberflächenbehandlung: Surface treatment:	Oberflächen nach ISO 1302 Surfaces as per ISO 1302

HEIDENHAIN DR. JOHANNES HEIDENHAIN GmbH 83301 Traunreut, Germany	Created	Responsible	Released	Version	Revision	Sheet	Page
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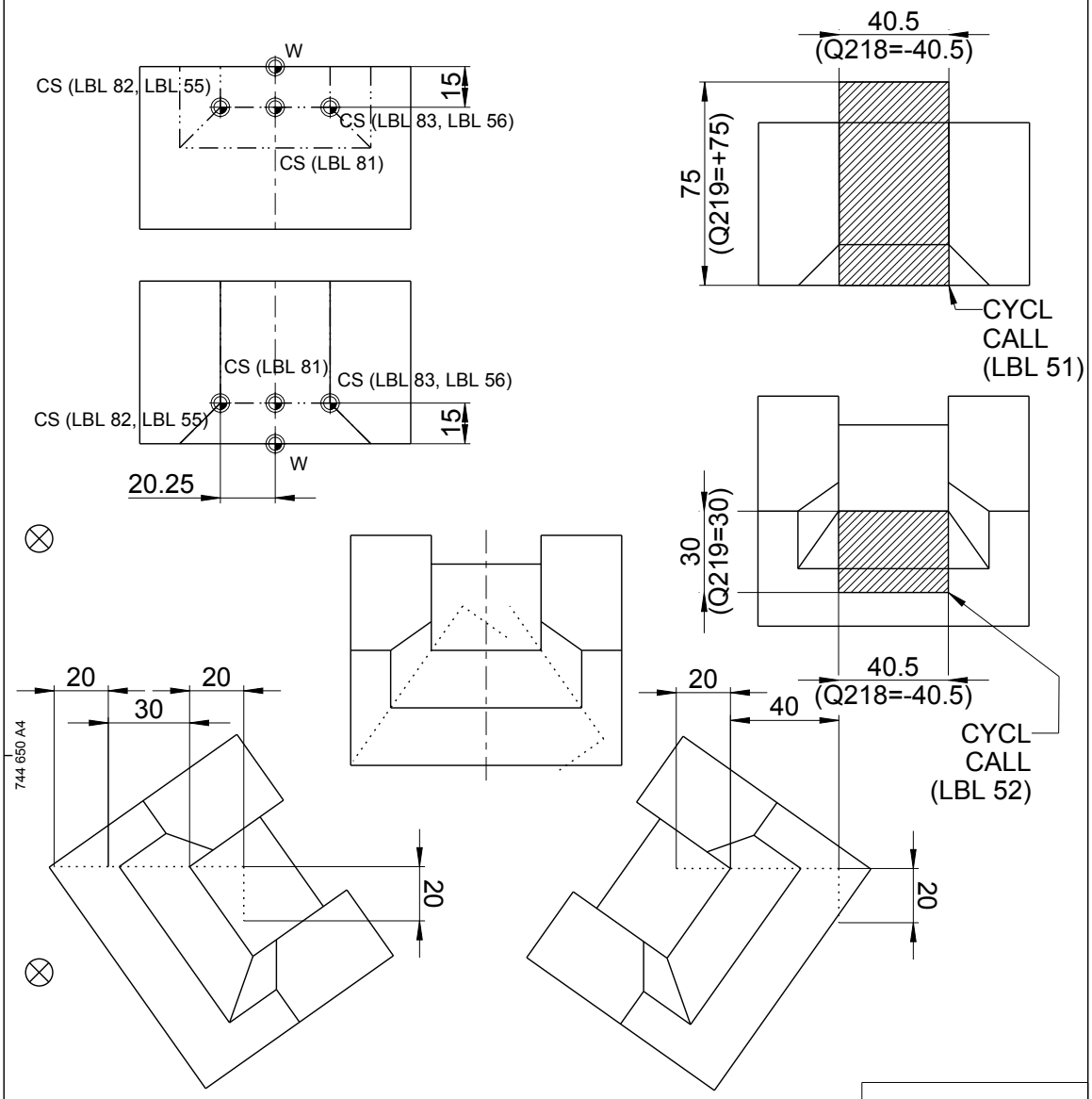
	11.01.2019			Document number			



			ID number
Text:			Change No. C000941-05 Phase: Nicht-Serie
	Original drawing Scale / Format	Klotz block Dokumentenart / Document type	Werkstoff: 3.1645 Material:
RoHS	1:2 / A4		
Maße in mm / Dimensions in mm			●blanke Flächen/Blank surfaces
Werkstückkanten nach ISO 13715 Workpiece edges ISO 13715 -0.3 +0.3	Allgemeintoleranzen ISO 2768-mH ≦6mm: ±0,2 General tolerances ISO 2768-mH ≦6mm: ±0,2	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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Working plan

- Workpiece blank definition
- Tool call
- Mill the slot
- Pre-rough the inclined surface (45°)
  - **PLANE SPATIAL**
- Mill the left-hand inclined surface
  - **PLANE SPATIAL**
- Mill the right-hand inclined surface
- Finish milling of the inclined surface (45°)
  - **PLANE SPATIAL**
  - **PLANE RELATIV**
- End the NC program
- Define subprograms

Program parameters

Face milling (roughing)	**Parameters**	**X**	**Y**	**Z**
Milling plan	2, climb milling			
Milling direction	1, parallel to X axis			
Feed rate for pre-positioning	Maximum feed rate			
Limits	+1, positive principal axis -1, negative principal axis			

General parameters	**Parameters**	**X**	**Y**	**Z**
Set-up clearance		-	-	+5
Safe position		-	-	+50
Safe tilting position	Relative to the machine datum	+300	-300	+300

Tool parameters

	Ø	**T**	**S**	**F_1**	**DZ**	**IZ**
	20	10	5000	1000	-10	5

Ø) Diameter
T) Tool number
S) Speed
F_1) Machining feed rate
DZ) Max. machining depth
IZ) Infeed

Solution

0 BEGIN PGM 1277112 MM	
1 BLK FORM 0.1 Z X-50 Y+0 Z-60	
2 BLK FORM 0.2 X+50 Y+60 Z+0	
3 TOOL CALL 10 Z S5000 F1000	
4 CALL LBL 99	RESET
5 CALL LBL 51	MACHINING_1
6 CALL LBL 81	PLANE_1
7 CALL LBL 52	MACHINING_2
8 CALL LBL 99	RESET
9 CALL LBL 82	PLANE_2
10 CALL LBL 53	MACHINING_3
11 CALL LBL 99	RESET
12 CALL LBL 83	PLANE_3
13 CALL LBL 54	MACHINING_4
14 CALL LBL 99	RESET
15 CALL LBL 81	PLANE_1
16 CALL LBL 55	MACHINING_5
17 CALL LBL 99	RESET
18 CALL LBL 81	PLANE_1
19 CALL LBL 56	MACHINING_6
20 CALL LBL 99	RESET
21 M30	
22 LBL 51	MACHINING_1
23 CYCL DEF 233 FACE MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	
Q389=+2 ;MILLING STRATEGY ~	
Q350=+1 ;MILLING DIRECTION ~	
Q218=-40.5 ;FIRST SIDE LENGTH ~	
Q219=+75 ;2ND SIDE LENGTH ~	
Q227=+0 ;STARTNG PNT 3RD AXIS ~	
Q386=-15 ;END POINT 3RD AXIS ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q202=+5 ;MAX. PLUNGING DEPTH ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q253= MAX ;F PRE-POSITIONING ~	
Q357=+2 ;CLEARANCE TO SIDE ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q347=+1 ;1ST LIMIT ~	
Q348=-1 ;2ND LIMIT ~	

Q349=+0 ;3RD LIMIT ~	
Q220=+0 ;CORNER RADIUS ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q338=+0 ;INFEED FOR FINISHING ~	
24 L X+20.25 Y+0 Z+50 R0 FMAX M99	
25 LBL 0	
26 LBL 52	MACHINING_2
27 CYCL DEF 233 FACE MILLING ~	
Q215=+1 ;MACHINING OPERATION ~	
Q389=+2 ;MILLING STRATEGY ~	
Q350=+1 ;MILLING DIRECTION ~	
Q218=-40.5 ;FIRST SIDE LENGTH ~	
Q219=+40 ;2ND SIDE LENGTH ~	
Q227=+15 ;STARTNG PNT 3RD AXIS ~	
Q386=+0 ;END POINT 3RD AXIS ~	
Q369=+0 ;ALLOWANCE FOR FLOOR ~	
Q202=+5 ;MAX. PLUNGING DEPTH ~	
Q370=+1 ;TOOL PATH OVERLAP ~	
Q207= AUTO ;FEED RATE MILLING ~	
Q385=+500 ;FINISHING FEED RATE ~	
Q253= MAX ;F PRE-POSITIONING ~	
Q357=+2 ;CLEARANCE TO SIDE ~	
Q200=+2 ;SET-UP CLEARANCE ~	
Q204=+50 ;2ND SET-UP CLEARANCE ~	
Q347=+1 ;1ST LIMIT ~	
Q348=-1 ;2ND LIMIT ~	
Q349=+0 ;3RD LIMIT ~	
Q220=+0 ;CORNER RADIUS ~	
Q368=+0 ;ALLOWANCE FOR SIDE ~	
Q338=+0 ;INFEED FOR FINISHING ~	
28 L X+20.25 Y-30 Z+50 R0 FMAX M99	
29 LBL 0	
30 LBL 53	MACHINING_3
31 L X+20 Y+20 Z+50 R0 FMAX	
32 L Z+5 R0 FMAX	
33 L Z+0 R0 F AUTO	
34 APPR LT X+0 Y+0 LEN20 RL F AUTO	
35 L Y-30	
36 DEP LT LEN20	
37 L Z+50 R0 FMAX	
38 LBL 0	
39 LBL 54	MACHINING_4
40 L X-20 Y+20 Z+50 R0 FMAX	

41 L Z+5 R0 FMAX	
42 L Z+0 R0 F AUTO	
43 APPR LT X+0 Y-40 LEN20 RL F AUTO	
44 L Y0	
45 DEP LT LEN20	
46 L Z+50 R0 FMAX	
47 LBL 0	
48 LBL 55	MACHINING_5
49 CYCL DEF 7.0 DATUM SHIFT	
50 CYCL DEF 7.1 IX-20.25	
51 PLANE RELATIV SPC-35.2644 STAY	
52 CALL LBL 53	MACHINING_3
53 LBL 0	
54 LBL 56	MACHINING_6
55 CYCL DEF 7.0 DATUM SHIFT	
56 CYCL DEF 7.1 IX+20.25	
57 PLANE RELATIV SPC+35.2644 STAY	
58 CALL LBL 54	MACHINING_4
59 LBL 0	
60 LBL 81	PLANE_1
61 CALL LBL 100	SAFE
62 CYCL DEF 7.0 DATUM SHIFT	
63 CYCL DEF 7.2 Y+15	
64 CYCL DEF 7.3 Z-15	
65 PLANE SPATIAL SPA+45 SPB+0 SPC+0 TURN FMAX	
66 LBL 0	
67 LBL 82	PLANE_2
68 CALL LBL 100	SAFE
69 CYCL DEF 7.0 DATUM SHIFT	
70 CYCL DEF 7.1 X-20.5	
71 CYCL DEF 7.2 Y+15	
72 CYCL DEF 7.3 Z-15	
73 PLANE SPATIAL SPA+35.2644 SPB+0 SPC-45 TURN FMAX	
74 LBL 0	
75 LBL 83	PLANE_3
76 CALL LBL 100	SAFE
77 CYCL DEF 7.0 DATUM SHIFT	
78 CYCL DEF 7.1 X+20.5	
79 CYCL DEF 7.2 Y+15	
80 CYCL DEF 7.3 Z-15	
81 PLANE SPATIAL SPA+35.2644 SPB+0 SPC+45 TURN FMAX	

82 LBL 0	
83 LBL 99	RESET
84 CALL LBL 100	SAFE
85 PLANE RESET TURN FMAX	
86 CYCL DEF 7.0 DATUM SHIFT	
87 CYCL DEF 7.1 X+0	
88 CYCL DEF 7.2 Y+0	
89 CYCL DEF 7.3 Z+0	
90 LBL 0	
91 LBL 100	SAFE
92 L Z+300 R0 FMAX M3 M91	
93 L X+300 Y-300 R0 FMAX M91	
94 LBL 0	
95 END PGM 1277112 MM	