

제 34회 국제기능올림픽 밀링/CNC 과제의 개요

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1. 시간

일감 전체의 프로그래밍 및 가공 제한시간은 22시간이 주어졌으나 특이한 사항은 부품①은 따로 6시간의 제한시간을 주어 대개의 선수들이 시간이 부족하여 ①번 부품을 완성하지 못하였다. 나머지 ②, ③, ④의 부품은 통합적으로 16시간을 주어 대체로 무난하게 프로그래밍 및 가공을 진행할 수가 있었다.

2. 난이도

전체적으로 과제의 난이도는 평이했으나 ①번 부품은 제한시간에 비하면 난이도가 예상외로 높은 편이었다. 프로그래밍도 하이덴하임 컨트롤러에 의하면 쉽게 할 수가 있어 큰 어려움은 없었다.

3 공차

국내 대회와 과제는 대체적으로 중요 공차범위가 0.02mm 정도인데 본 과제에서는 거의 모든 공차가 이보다는 더커서 (0.05mm 이상) 공차를 맞추는 데는 별 어려움이 없을 것 같다.

4. 재료

①번 과제의 재료가 CK 45이고 나머지 ②, ③, ④번 과제는 알루미늄 합금으로 절삭성이 좋아 가공은 쉬운 편이었다.

5. 기계

스위스 미크론사의 머시닝 센터로 정밀도가 높고 절삭력이 좋아 가공에 걸리는 시간을 단축시킬 수 있을 뿐만 아니라 정도 높은 가공물을 얻을 수 있다.

6. 대회운영

16개국의 선수가 2개조로 나누어 가공과 프로그래밍을 교대로 실시하였고 ①번 과제만은 도면을 받고 바로 6시간동안 프로그래밍 및 가공을 끝내도록 대회가 진행되었다. 때문에 따로 과제 분석을 할 시간이 없어서 상당한 어려움을 겪었다.

부품 ①

①의 C면

사용공구

1. 센터드릴
2. $\phi 7.2$ 드릴
3. 11드릴
4. 5드릴
5. M8 탭
6. 5엔드밀 황삭
7. 10엔드밀 황삭
8. 12 (-)엔드밀
9. 12리이머
10. 20엔드밀 황삭
11. 5엔드밀 정삭
12. 10엔드밀 정삭
13. 20엔드밀 정삭

작업순서

1. 외곽 및 윗면
2. 육각형
3. 센터드릴, 드릴, 탭, 리이머.
4. 12 장공
5. 36보링

프로그램

PO1000
 G40 G49 G80
 G91 G28 X0 Y0 Z0
 G90 G92
 G91 G30 Z0 T01($\phi 30$ 셀 황삭엔드밀) M06
 G90 G00 G43 X-80 Y-80 Z20 H01 S800 M03
 G01 G41 X-105 Z-12 D01 F1000
 M98 P1001
 G90 G00 Y55
 X50
 G01 Z-46 F1000
 M98 P1004
 G90 G00 G40 G49 Z200 M05
 G91 G30 Z0 T02 (센터드릴) M06
 G90 G00 G43 X-68.5 Y37.239 Z20 H02
 S2000 M03
 G81 G99 Z-2.5 R-7 F150 M08

X-40 Y40
 X-47 Y0
 X-40 Y-40
 X40 Y-40 R3
 Y40

G00 G49 Z200 M09
 M05
 G91 G30 Z0 T03(5황삭엔드밀) M06
 G90 G00 G43 X-19.445 Y19.445 Z10 H03
 S1200 M03
 G01 Z-5 F100 M08
 G91 G41 X2.121 Y-2.121 F150
 M98 P1002
 G00 G40 G49 Z200 M05
 G91 G30 Z0 T04 ($\phi 10$ 황삭 엔드밀) M06
 G90 G00 G43 X-58.5 Y37.239 Z20 H04
 S1000 M03
 G01 Z-9 F100 M08
 G91 G41 X3 Y-5.196 F150
 M98 P1003
 G00 G40 G49 Z200 M05
 G91 G30 Z0 T08 ($\phi 20$ 황삭엔드밀) M06
 G90 G00 G43 X0 Y0 Z30 H08 S800 M03
 G01 Z-24 F100 M08
 M98 P1005
 G90 G00 G49 Z200 M05
 G91 G30 Z0 T05($\phi 11$ 드릴) M06
 G90 G00 G43 X-47 Y0 Z20 H05 S1000 M03
 G73 G99 Z-55 R3 Q3 F150 M08
 X0 Z-23.9
 M09
 G00 G49 Z200 M05
 G91 G30 Z0 T06(12-엔드밀) M06
 G90 G00 G43 X-47 Z20 H06 S1000 M03
 G81 G99 Z-38 R-7 Q3 F150 M08
 M09
 G00 G49 Z200 M05
 G91 G30 Z0 T07($\phi 12$ 리이머) M06
 G90 G00 G43 Z20 H06 S200 M03
 G81 G99 Z-35 R-7 Q3 F150 M08
 M09
 G00 G49 Z200 M05
 G91 G30 Z0 T09 ($\phi 30$ 셀 정삭엔드밀) M06
 G90 G00 G43 X-80 Y-80 Z20 H09 S800 M03

G01 G41 X-105 Z-12 D09 F1000
 M98 P1001
 G90 G00 Y55
 X50
 G01 Z-46 F1000
 M98 P1004
 G90 G00 G40 G49 Z200 M05
 G91 G30 Z0 T10(φ10 엔드밀) M06
 G90 G00 G43 X-58.5 Y37.239 Z10 H10
 S1000 M03
 G01 Z-9 F100 M08
 G91 G41 X3 Y-5.196 F150
 M98 P1003
 G90 G00 G40 G49 Z200 M05
 G91 G30 Z0 T11(φ5엔드밀) M06
 G90 G00 G43 X-19.445 Y 19.445 Z10 H11
 S1500 M03
 G01 Z-5 F100 M08
 G91 G41 X2.121 Y-2.121 D11 F150 M08
 M98 P1002
 G90 G00 G40 G49 Z200 M05
 G91 G30 Z0 T12(φ20엔드밀) M06
 G90 G00 G43 X0 Y0 Z20 H12 S800 M03
 G01 Z-24 F100 M08
 M98 P1005
 G90 G40 G49 Z200 M05
 G91 G30 Z0 T13(M8탭) M06
 G90 G00 G43 X-40 Y40 Z30 H13 S300 M03
 G84 G99 Z-15 R3 F360 M08
 Y-40
 X40
 Y40
 G00 G49 Z200 M09
 M05
 G91 G30 Z0
 M02

 PO1001
 G90 G01 Y60
 X-80
 Y-60
 X-32
 Y-25
 G91 G03 Y50 R25

G90 G01 Y0
 X-40.145
 X-21.939 Y32
 G02 X-16.743 Y35 R6
 G01 X16.743
 G02 X21.939 Y32 R6
 G01 X34.196 Y3
 G02 Y-6 R6
 G01 X21.939 Y-32
 G02 X16.743 Y-35 R6
 G01 X-16.743
 G02 X-21.939 Y-32 R6
 G01 X-40.415 Y0
 Z5 F1000 M09
 M99

 PO1002
 G90 G02 Y-17.325 R24.5 F150
 G91 G03 X-4.242 Y-4.242 R3
 G90 G03X-21.566 Y21.566 R30.5
 G91 G03 X4.242 Y -4.242 R3
 G90 G40 X19.445 Y19.445 M09
 Z5 F1000
 M99

 PO1003
 G90 G03 Y-42.435 R49
 G91 G03 X6 Y10.392 R6
 G90 G02 Y32.043 R37
 G91 G40 X-3 Y5.196 M09
 Z5F1000
 M99

 PO1004
 G90 G01 Y-50 F200
 X-100
 Y50
 X60
 Z5 F1000 M09
 M99

 PO1005
 G90 G41 G01 X17.5
 G03 X0 Y18 R18
 J-18
 X0 Y-17.5 R18

G40 X0 Y0 M09
Z5 F1000 M05
M99

부품① 의 뒷면

사용공구

1. 센터드릴
2. φ6-엔드밀
3. φ 리이머
4. φ5드릴
5. M6 탭
6. φ5 황삭엔드밀
7. φ30 셀 황삭엔드밀
8. φ5 정삭엔드밀
9. φ30 셀 정삭엔드밀
10. φ16엔드밀

프로그램

PO1020
G40 G49 G80
G91 G28 X0 Y0 Z0
G90 G92
G91 G30 Z0 T01(φ16황삭엔드밀) M06
G90 G00 G43 X0 Y0 Z20 H01 S800 M03
G01 Z-20 F150 M08
G41 Y-9.5 D01
M98 P1014
G40 Y0 M09
Z5 M05 F1000
G00 G40 Z200
G91 G30 Z0 T02(φ30 셀황삭엔드밀) M06
G90 G00 G43 X-80 Y-80 Z10 H02 S800 M03
G01 G42 Y-40 Z-12 D02 F1000
M98 P1011
G90 G00 G40 X120 Y0
G01 G41 Y-24 Z-7 D02 F1000
M98 P1012
G90 G00 G40 X120 Y-40
G01 G41 Y-50 Z-41 D02 F1000
M98 P1013
G90 G00 G40 X0 Y0
G01 Z-15 F100 M08
G41 Y-34 D14(보정량을 달리하거나 공구
경을 달리한다)

M98 P1011

G90 G00 G40 G49 Z200 M05
G91 G30 Z0 T3(φ30 셀 정삭엔드밀) M06
G90 G00 G43 X-80 Y-80 Z10 H02 S800 M03
G01 G42 Y-40 Z-12 D03 F1000
M98 P1011
G90 G00 G40 X120 Y0
G01 G41 Y-24 Z-7 D03 F1000
M98 P1012
G90 G00 G40 X120 Y-40
G01 G41 Y-50 Z-41 D03 F1000
M98 P1013
G90 G00 G40 X0 Y0
G01 Z-15 F100 M08
G41 Y-34 D14(보정량을 달리하거나 공구
경을 달리한다)

M98 P1011

G90 G00 G40 G49 Z200 M05
G91 G30 Z0 T4(φ16정삭엔드밀) M06
G90 G00 G43 X0 Y0 Z10 H04 S1000 M03
G01 Z-20 F150 M08
G91 G41 Y-9.5 D04
M98 P1014
G90 G00 G49 Z200 M05
G91 G30 Z0 T06 (센터드릴) M06
G90 G00 G43 X0 Y0 Z10 H06 S2000 M03
G16
G81 G99 X25 Y20 Z-2.5 F200 M08
M98 P1015
M98P1016
G15
G90 G00 G49 Z200 M19
G91 G30 Z0 T07(φ5드릴) M06
G90 G00 G43 X0 Y0 Z10 H07 S1000 M03
G16
G73 G99 X25 Y20 Z-30 F200 M08
M98 P1015
G15
G90 G00 G49 Z200 M19
G91 G30 Z0 T08(M6탭) M06
G90 G00 G43 X0 Y0 Z10 H08 S300 M03
G16
G84 G99 X25 Y20 Z-27 F300 M08
M98 P1015

G90 G00 G49 Z200 M19
 G91 G30 Z0 T09(φ7.5드릴) M06
 G90 G00 G43 X65 Y0 Z10 H09 S800 M03
 G81 G99 Z-27 R-5 F150 M08
 M98 P1016
 G90 G00 G49 Z200 M19
 G91 G30 Z0 T10 (φ8-엔드밀) M06
 G90 G00 G43 X65 Y0 Z10 H10 S1000 M03
 G81 G99 Z-27 R-5 F150 M08
 M98 P1016
 G90 G00 G49 Z200 M19
 G91 G30 Z0 T11 (φ8리아머) M06
 G90 G00 G43 X65 Y0 Z10 H11 S200 M03
 G81 G99 Z-27 R-5 F150 M08
 M98 P1016
 G90 G00 G49 Z200 M19
 G91 G30 Z0 T12 (φ5황삭) M06
 G90 G00 G43 X27 Y24 Z10 H11 S200 M03
 G01 Z-25 F100 M08
 G91 G41 X-1.928 Y-2.298 D12
 M98 P1017
 G90 G01 G40 X27 Y24 M09
 G00 Z200 M19
 G91 G30 Z0 T13 (φ5정삭) M06
 G90 G00 G43 X27 Y24 Z10 H11 S200 M03
 G01 Z-25 F100 M08
 G91 G41 X-1.928 Y-2.298 D13
 M98 P1017
 G90 G01 G40 X27 Y24 M09
 G00 Z200 M19
 M02
 P 1012
 G90 G01 X16 F150
 G03 X32.45 Y30.055 R21
 G02 X44.982 Y24
 G01 X59
 G91 G03 X21 Y21 R21
 G01 Y10
 G90 G03 X64.158 Y26.563 R20
 G01 X55.842 Y28.365
 G02 X47.037 Y 32.559 R20
 G03 X32 Y41 R23.5

G01 X0
 G03 Y-38 R38
 G91 G01 X10 Y-1 Z10 F1000 M09
 M99
 P 1011
 G90 G01 X47.977 F150
 G91 G03 X-5.314 Y-11.314 R16
 G90 G01 X36.977 Y-51
 X-22
 X-54 Y-19
 Y19
 X22 Y51
 X 30.268
 X50.399 Y39.412
 G03 X59.339 Y37 R18
 G01 X80
 G91 X18 Y-18
 G90 Y19
 G91 X-40 Y-40
 G90 Z5 M09 F1000
 M99
 P1013
 G90 G01 X-53
 Y50
 X97
 Y-60
 Z5 F1000 M09
 M99
 P1014
 G90 G03 X10 Y9.5 R10
 I-10
 X-10 Y9.5.
 G40 X0 Y0 M09
 Z10 F1000
 M99
 P1015
 G90 Y65
 Y110
 Y160

Y205

Y250

Y295

Y340

G15

G01 G90 Z30 M09

M99

P1016

G91 X-5.657 Y5.657

X-5.657 Y5.657

X-5.657 Y-5.657

X-5.657 Y-5.657

X5.657 Y-5.657

X5.657 Y-5.657

X5.657 Y5.657

X-5.657 Y5.657

G90 G01 Z10 F1000 M09

M99

부품 ②

· 사용공구

- 1 센터드릴
- 2 $\phi 9$ 드릴
- 3 $\phi 15$ 정삭 엔드밀
- 4 $\phi 3$ 정삭 엔드밀
- 5 $\phi 20$ 정삭 엔드밀
- 6 모따기 엔드밀

· 작업순서

1. 외곽황삭
2. 드릴
3. 정삭
4. 3mm홈
5. $\phi 15$
6. $\phi 36$ 및 내부 황삭
7. 정삭

프로그램

PO2000 (부품 ②의 A면)

G40 G49 G80

G91 G28 X0 Y0 Z0

G90 G92

G91 G30 Z0 T05($\phi 20$ 황정삭 엔드밀) M6

G90 G00 G43 X60 Y-80 Z30 H05

G01 G41 Y-62 Z-31 D05 F500 S1000 M3

X-50 M08

Y35

X50

Y-70

Z10 M09 F2000

G00 G49 G40 Z200 M05

G91 G30 Z0 T01(센터드릴) M06

G90 G00 G43 X40 Y40 Z30 H01 S2000 M3

G81 G99 Z-2.5 R3 F150 M8

X-40

Y-40

X40

G00 G49 Z200 M09

M05

G91 G30 Z0 T02(드릴) M6

G90 G00 G43 X40 Y40 Z30 H02 S800 M03

G73 G99 Z-35 R3 F150 M08

X-40

Y-40

X40

G00 G49 Z200 M09

M05

G91 G30 Z0 T03(15mm엔드밀) M06

G90 G00 G43 X40 Y40 Z30 H03 S1000 M03

G81 G99 Z-9 R3 F150 M08

X-40

Y-40

X40

G00 G49 Z200 M09

M05

G91 G30 Z0 T04(3mm 정삭엔드밀) M06

G52 X-29.5 Y-44.5

G90 G00 G43 X0 Y0 Z10 H04 S2000 M03

G01 Z-1 F100 M08

Y17

Z5 F2000

X56

Z-1 F100

X63 F150

X56 Y0

Z5 F2000

X19 Y17

Z-1 F100

X23.5 Y0 F150

X28 Y17

X32.5 Y0

X37 Y17

Z5 F2000

X43 Y3.5
 G01 Z-1 F150
 G03 X50 R3.5
 G01 Y13.5
 G03 I-3.5
 G01 Z5 F2000
 X9.5 Y0
 Z-1 F100
 G02 J3.5 F150
 G01 X5 Y0
 Y17
 X9.5
 G02 J-3.5
 G01 Z10 F2000 M09
 G90 G52 X0 Y0
 G90 G00 X0 Y28.5
 G01 Z-5 F100 M09
 G02 I-28.5
 G01 Z5 F1000
 X23.5 Y0
 Z-5 F100
 X-23.5
 Z5 F1000
 X0 Y-23.5
 Z-5 F100
 Y23.5
 Z5 F1000
 X-22 Y-7.96
 G03 X22 R48.5
 G01 Z5 F1000
 Y7.96
 Z-5 F100
 G03 X-22 R48.5
 G01 Z5 F1000
 X-7.96 Y22
 Z-5 F100
 G03 Y-22 R48.5
 G01 Z5 F1000
 X7.96
 Z-5 F1000
 G03 Y22 R48.5
 G01 Z5 M09
 G00 G49 Z200 M05
 M02

PO2010 (부품② 의 B면)
 G40 G49 G80
 G91 G28 X0 Y0 Z0
 G90 G92
 G91 G30 Z0 T01(ϕ 120 페이스커터) M06
 G90 G00 G43 X-120 Y0 Z10 H01
 G01 Z0 F1000 S1500 M03
 X50 F200
 Z10 F1000 M05
 G00 G49 Z200
 G91 G30 Z0 T02(ϕ 7 엔드밀) M06
 G90 G00 G43 X-35 Y60 Z10 H02 S1000 M03
 G01 G41 Y-55 Z-22 F1000
 X-28.66 Y50
 X-22 Y46.155M08
 G02 X-20 Y42.691 R5
 G01 Y31.177
 G02 X-22 Y27.713 R5
 G01 X-32.5 Y21.651
 G03 X-35 Y17.321 R5
 G01 Y-17.321
 G03 X-32.5 Y-21.651 R5
 G01 X-22 Y-27.713
 G02 X-20 Y-31.177 R5
 G01 Y-35
 G03 X-15 Y-40 R5
 G01 X15
 G03 X20 Y-35 R5

 G01 Y-31.177
 G02 X24 Y-27.713 R 4.
 G01 X32.5 Y-21.651
 G03 X35 Y-17.321 R5
 G01 Y17.321
 G03 X32.5 Y21.651 R5
 G01 X22 Y27.713
 G02 X20 Y31.177 R4
 G01 Y42.691
 G02 X22 Y46.155 R4
 G01 X28.66 Y50
 G91 X10 Y4 M09
 G00 G40 G49 Z200 M05
 G91 G30 Z0 T03(ϕ 15엔드밀) M06
 G90 G00 G43 X0 Y60 Z10 H03 S1000 M03

G01 G41 X-18 Z-22 D03 F1000

Y18 F200 M08

X0

G02 J-18

G01X18

Y60

Z5 M09

G00 G40 G49 Z200 M05

M02

부품 ③

사용공구

1. φ20황삭엔드밀
2. φ8황삭엔드밀
3. 센터드릴
4. φ12 - 엔드밀
5. φ12리이머
6. φ60페이스 커터
7. φ 20정삭엔드밀
8. φ8정삭엔드밀

프로그램

PO3000
 G40 G49 G80
 G91 G28 X0 Y0 Z0
 G90 G92
 G91 G30 Z0 T05 (φ 20mm황삭) M06
 G90 G00 G43 Z30 H05
 X100 Y-40 S600 M03
 G01 Z-12 F1000
 G41 Y-7.5 D05
 M98P3001
 G00 G40 G49 Z200
 G91 G30 Z0 T06 (φ 8mm 황삭) M06
 G90 G00 G43 Z30 H06
 X100 Y-30 S1000 M03
 G01 Z-25 F1000
 G41 Y-11 D06
 M98 P3002
 G00 G40 G49 Z200
 G91 G30 Z0 T01(센터드릴)
 G90 G00 G43 Z30 H01
 X0 Y0 S1500 M3
 G81 G99 Z-2.5 R3 F100 M8

X43
 M09
 91 G30 Z0 T03(φ12-엔드밀) M06
 G00 G49 Z200 M19
 G91 G30 Z0 T02(φ10드릴)M06
 G90 G00 G43 Z30 H02
 X43 Y0 S1000 M03
 G73 G99 Z-30 R3 Q2 F150 M8
 X0
 M9
 G00 G49 Z200 M19
 G91 G30 Z0 T03(φ12 -엔드밀) M06
 G90 G00 G43 Z20 H03
 X0 Y0 S1000 M03
 G81 G99 Z-30 R-7 F100 M08
 X43 R5
 M05
 G90 G00 G80 G49 Z200 M09
 G91 G30 Z0 T04(φ12H7리이머) M06
 G90 G00 G43 Z30 H04
 X0 Y0 S100 M03
 G81 G99 Z-28 R-7 F100 M08
 X43 R5
 G90 G00 G49 G80 Z200 M09
 M05
 G91 G30 Z0 T10 (φ60 페이스 커터) M06
 G90 G00 G43 Z20 H10
 G00 X-60 Y0
 G01 Z0 F1000
 X120
 G00 G49 Z200 M05
 G91 G30 Z0 T07(φ20 정삭엔드밀) M06
 G90 G00 G43 Z30 H07
 X100 Y-40
 G01 G41 Y-7.5 Z-12 D07 F800 S800 M03

<p>M98 P3001</p> <p>G90 G00 G40 G49 Z200</p> <p>G91 G30 Z0 T08 (φ8 정삭엔드밀) M06</p> <p>G90 G00 G43 Z20 H08</p> <p style="padding-left: 40px;">X100 Y-40</p> <p>G01 G41 Y-11 Z-25 D08 F800 S1200 M03</p> <p>M98 P3002</p> <p>G90 G00 G40 G49 Z200</p> <p>G91 G30 Z0 T10(페이스커터) M06</p> <p>G90 G00 G43 Z30 H10</p> <p style="padding-left: 40px;">X-60 Y0</p> <p style="padding-left: 40px;">G01 Z0 F2000</p> <p style="padding-left: 80px;">X120 F150</p> <p>G00 G49 Z200 M19</p> <p>M02</p>	<p><u>P3002 (부품③의 외곽)</u></p> <p>G90 G01 X19.209 Y-11 F500 M8</p> <p style="padding-left: 40px;">G03 X17.96 Y-12.8</p> <p style="padding-left: 40px;">G02 Y12.84 R-20</p> <p style="padding-left: 40px;">G03 X19.209 Y11</p> <p style="padding-left: 80px;">X71</p> <p>G91 G02 X8 Y-8 R8</p> <p>G90 G01 Y-3</p> <p>G91 G02 X-8 Y-8 R8</p> <p style="padding-left: 40px;">G1 X-10 Y-1 M9</p> <p>M05</p> <p>M99</p>
<p><u>P3001(부품 ③의 윗면)</u></p> <p>G90 G01 X30.5 F500</p> <p>G91 G02 X-5 Y5 R5</p> <p style="padding-left: 40px;">G01 Y5</p> <p style="padding-left: 40px;">G02 X5 Y5 R5</p> <p style="padding-left: 40px;">G01 X40</p> <p style="padding-left: 40px;">G02 X5 Y-5 R5</p> <p style="padding-left: 40px;">G01 Y-5</p> <p style="padding-left: 40px;">G02 X-5 Y-5 R5</p> <p>G40 G01 Y-40 F1000</p> <p>G41 X-5 F500</p> <p style="padding-left: 40px;">Y5</p> <p style="padding-left: 40px;">X-7</p> <p style="padding-left: 40px;">Y-25</p> <p style="padding-left: 80px;">Z5 F1000 M09</p> <p>M05</p> <p>M99</p>	

부품 ④

공구목록

1. 센터드릴
2. $\phi 16$ 드릴
3. $\phi 8$ 드릴
4. $\phi 20$ 엔드밀
5. $\phi 8$ 엔드밀
6. $\phi 50$ 셸 엔드밀
7. 페이스커터
8. $\phi 2.5$ 드릴
9. $\phi 7.2$ 드릴
10. M8 탭

작업순서

1. 엔드밀 황삭
2. 드릴
3. 엔드밀 정삭

프로그램

PO4200
 G40 G49 G80
 G91 G28 X0 Y0 Z0
 G90 G92
 G91 G30 Z0 T01 M06
 G90 G00 G43 X100 Y-60 Z30 H01 S800 M03
 G01 G41 Y-47.5 Z-31 F1000
 M98 P4201
 G00 G49 Z200 M05
 G91 G30 Z0 T01(센터드릴) M06
 G90 G00 G43 X0 Y0 S2000 M03
 G81 G99 Z-2.5 R3 F150 M8
 X-42 Y-27
 X45 Y27.5
 X31.113 Y-31.113
 X-22.925 Y35
 M09
 G00 G49 Z200 M19
 G91 G30 Z0 T02 (16드릴) M06
 G90 G00 G43 X0 Y0 Z30 H02 S800 M03
 G73 G99 Z-31 R3 Q2.5 F150 M8
 X-42 Y27
 X45 Y27.5
 M09
 G00 G49 Z200 M19

G91 G30 Z0 T03 (8드릴) M06
 G90 G0 G43 X-22.925 Y35 Z30 H03 S1000M3
 G73 G99 Z-5 R3 Q2 F150 M8
 X31.113 Y-31.113
 M09
 G00 G49 Z200 M19
 G91 G30 Z0 T04(20 엔드밀) M06
 G90 G00 G43 X0 Y0 Z30 H04 S1000 M03
 G01 Z-31 F150 M08
 G41 Y20 D04
 M98 P4203
 G00 X45 Y27.5
 G01 Z-31 F150 M08
 G41 X15.5
 M98 P4202
 G00 X-42 Y -27
 G01 Z-31 F150 M08
 G41 X15.5
 G00 G49 Z200 M19
 G91 G30 Z0 T05(8엔드밀) M06
 G90 G00 G43 X41.535 Y-11.192 Z10 H05
 S1500 M03
 G01 Z-5 F150 M08
 G41 X36.705 Y-9.835 D05
 M98 P4204
 G90 G00 X-22.925 Y35
 G01 Z-5 F150 M08
 G41 Y40 D05
 M98 P4205
 G00 G49 Z200 M19

부품 ④의 A면

G40 G49 G80
 G91 G28 X0 Y0 Z0
 G90 G92
 G91 G30 Z0 T06(셸 엔드밀 50) M06
 G90 G00 G43 X110 Y0 Z10 H06 S800 M03
 G01 G42 Y25 Z-10 D06 F150 M08
 (보정을 5더 크게 함)
 X0 Y25
 M98 P4203
 G00 G49 Z200 M19

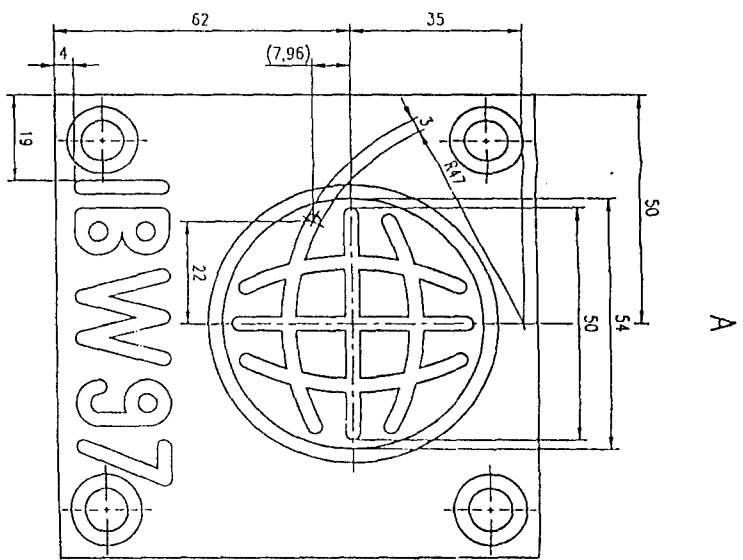
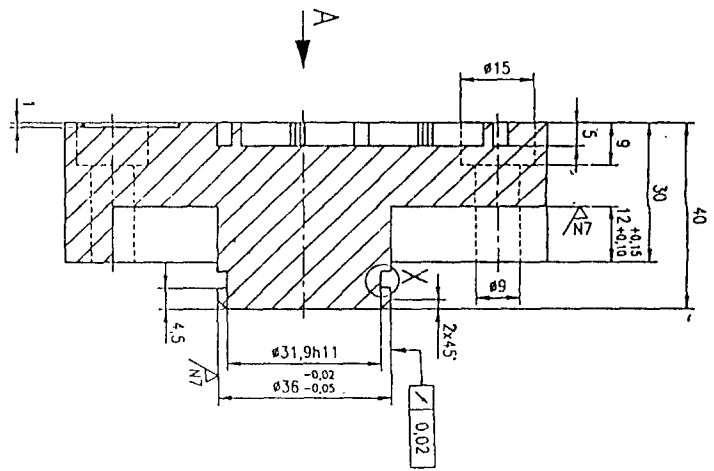
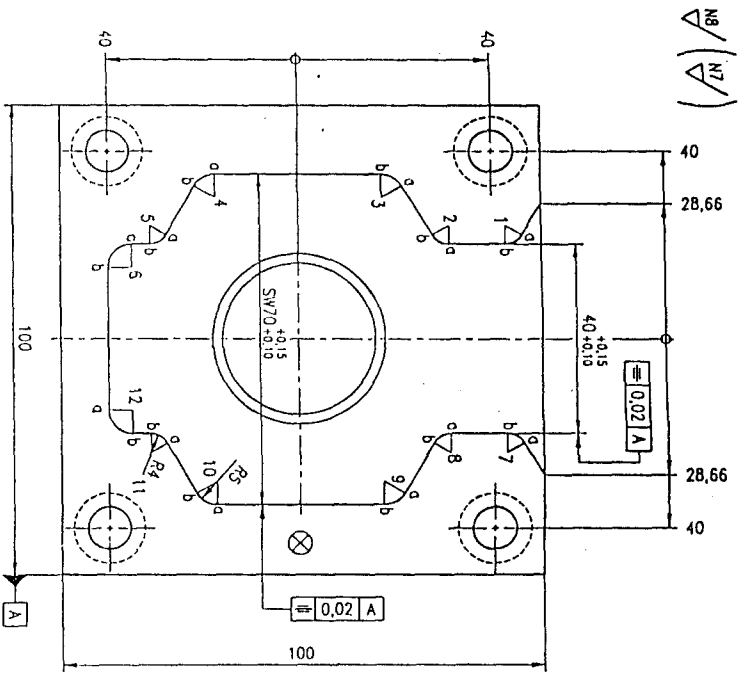
G91 930 Z0 T07(ϕ 100 페이스 커터) M06
 G90 G00 G43 X-100 Y0 Z30 H07 S1500 M03
 G01 Z0 F1000
 X0 F150
 M05
 Z10 F1000
 G00 G49 Z200
 G91 G30 Z0 T08(2.5드릴) M06
 G90 G00 G43 X-23 Y38 H08 S2000 M03
 G73 G99 Z-10 R3 Q2 F150 M08
 X27
 G80 Z10 M09 F1000
 G00 G49 Z200 M05
 G91 G30 Z0 T09(7.2드릴) M06
 G90 G00 G43 X-45 Y-35 Z30 H09 S1000 M03
 G73 G99 Z-26 R3 Q2 F150 M08
 G80 G01 Z10 M09
 G00 G49 Z200 M05
 G91 G30 Z0 T10 (M8 탭) M06
 G90 G00 G43 Z30 H10 S450 M03
 G84 G99 Z-21.5 R3 M08
 G80 G01 Z10 M09
 G00 G49 Z200 M05
 M02
 PO4201 - B(외곽)
 G90 G01 X51.962 Y-47.5 F150 M08
 G02 X-56.65 Y-45.244 R6
 G02 X-68.618 Y-23.404 R72.5
 X -65.381 Y-5.986 R6
 G03 X55 Y0 R17.5
 X-65.381 Y15.986 R17.5
 G02 X-68.618 Y23.404 R6
 X-56.65 Y45.244 R72.5
 X-51.961 Y47.5 R6
 G01 X51.961
 G02 X56.65 Y45.244 R6
 X68.618 Y23.404 R72.5

G02 X65.38 Y15.986 R6
 G03 X55 Y0 R17.5
 X65.381 Y-15.986 R17.5
 G02 X68.618 Y-23.404 R6
 X56.65 Y-45.244 R17.5
 X51.961 Y-47.5 R6
 G01 G40 Y-55 F1000 M09
 Z5 F2000
 M99
 PO4202 - B (ϕ 32 H7)
 G91 G03 X-15.5 Y16 R16 F150 M08
 J-16
 X-15.5 Y-16 R16 M09
 G01 G40 X15.5 F500
 G90 Z5 F2000
 M99
 PO203 - B (중앙의 타원)
 G90 G03 X-20 Y19.64 R40
 X-27.009 Y7.5 R14.09
 X-7.01 Y-27.141 R40
 X7.01 R14.019
 X27.009 Y7.5 R40
 X20 Y19.64 R14.019
 X0 Y25 R40 M09
 G40 G01 Y0 F500
 Z5 F2000
 M99
 PO4204 - B(창공)
 G90 G02 X26.87 Y-26.87 R38 F150
 G03 X35.355 Y-35.355 R6
 X48.296 Y-12.941 R50
 X44.761 Y-6.817 R5
 G01 X42.829 Y-6.362
 G03 X36.705 Y-9.835 R5 M09
 G01 G40 X41.535 Y-11.192 F500

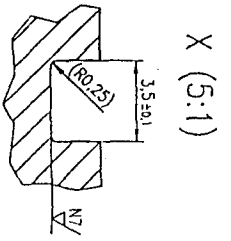
Z5 F2000
M99

PO4205 - B(좌측상단)

G90 G01 X-48.734 Y40 F150
G03 X-52.795 Y37.917 R5
X-58.821 Y27.661 R65
X-59.375 Y21.277 R5
G02 X-47.822 Y4 R25
G03 X-43.777 Y0 R4
G01 X-40.896
G03 X-36.896 Y4 R4
G02 X-37.009 Y7.5 R50
X-25 Y28.3 R24.019
X-20.815 Y30.817 R50
G03 X-22.925 Y40 R5 M09
G01 G40 Y35 F500
Z5 F2000
M99



Nr.	X	Y	a		b	
			X1	Y1	X2	Y1
1	-24,0	42,6906	-22,0	46,1547	-20,0	42,6906
2	-24,0	31,1769	-20,0	31,1769	-22,0	27,7128
3	-30,0	17,3205	-32,5	21,6506	-35,0	17,3205
4	-30,0	-17,3205	-35,0	-17,3205	-32,5	-21,6506
5	-24,0	-31,1769	-22,0	-27,7128	-20,0	-31,1769
6	-15,0	-35,0	-20,0	-35,0	-15,0	-40,0
7	24,0	42,6906	22,0	46,1547	20,0	42,6906
8	24,0	31,1769	20,0	31,1769	22,0	27,7128
9	30,0	17,3205	32,5	21,6506	35,0	17,3205
10	30,0	-17,3205	35,0	-17,3205	32,5	-21,6506
11	24,0	-31,1769	22,0	-27,7128	20,0	-31,1769
12	15,0	-35,0	15,0	-40,0	20,0	-35,0

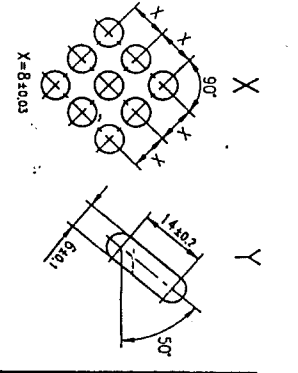
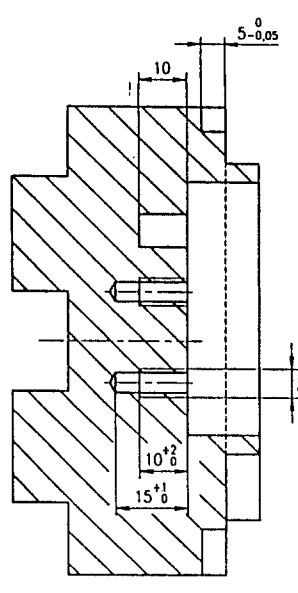
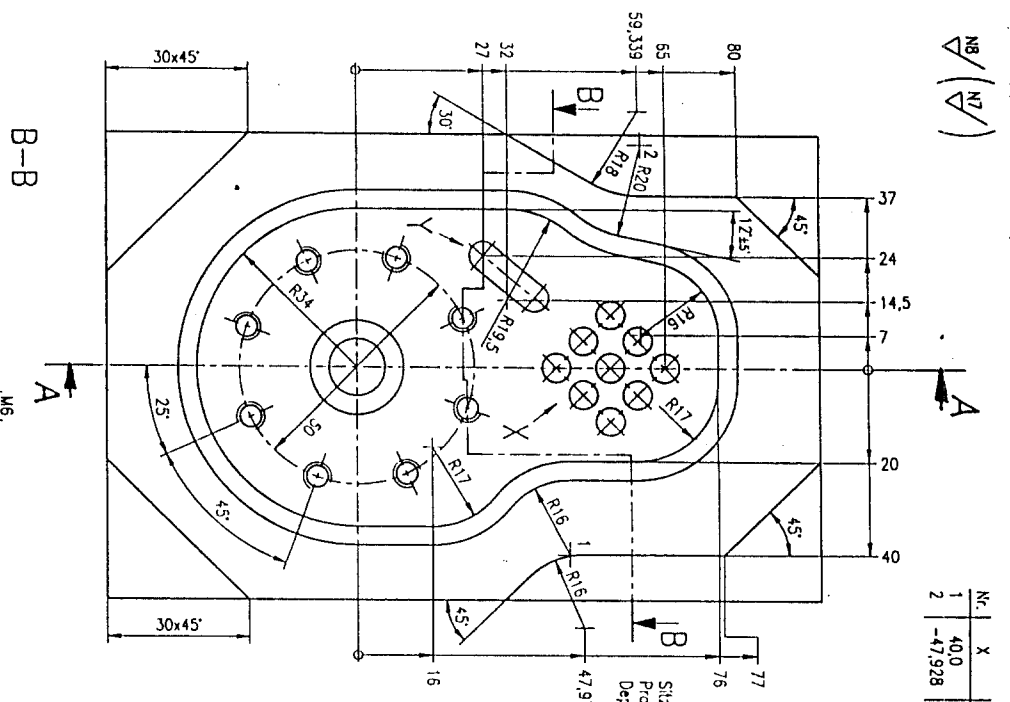


Kanten gebrochen 45°
 Chromtreme $0,2 \dots 0,4 \times H^S$
 Eding broken 45°

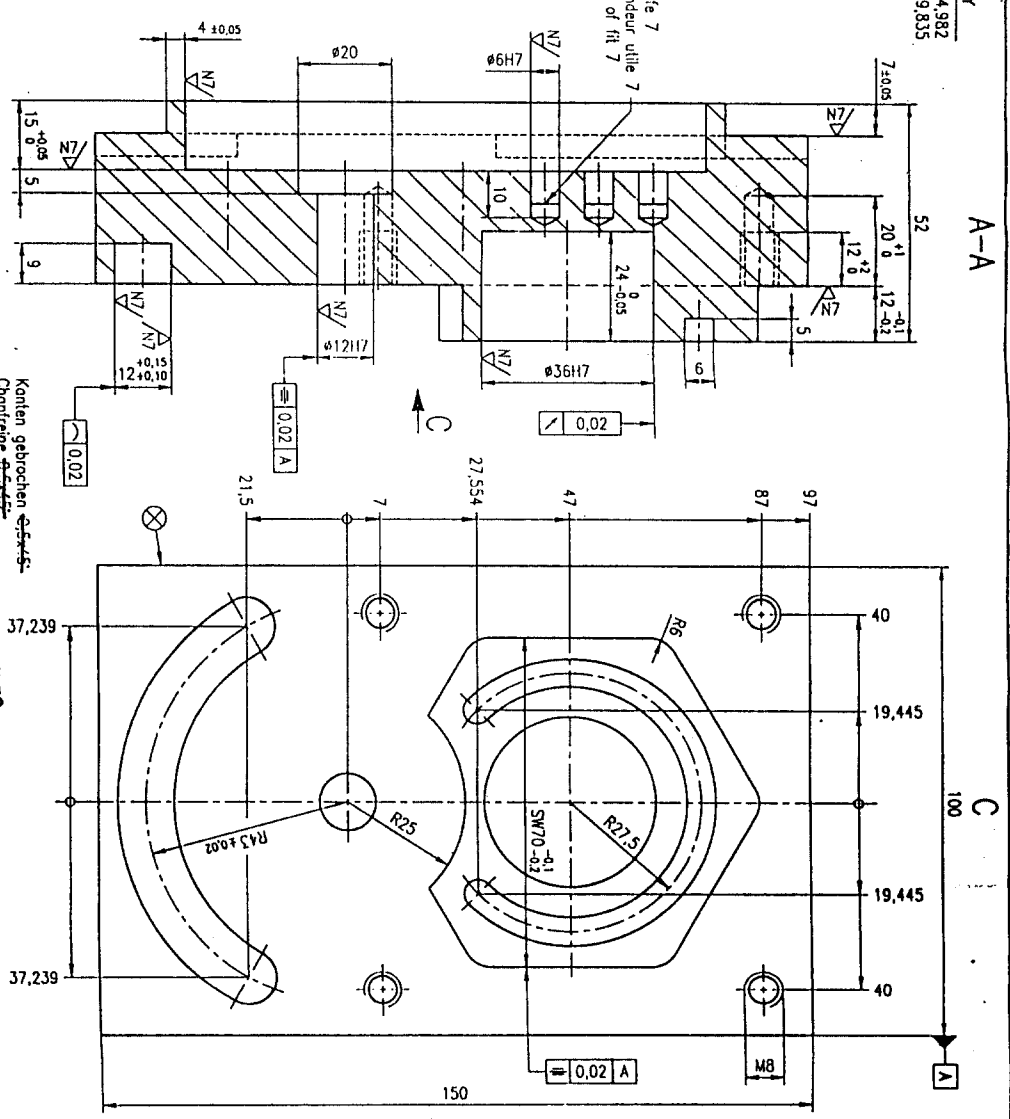
1	Deckplatte Plaque de couverture Cover plate	(2)	ASST/Mahn	105450-105	19.6.97	B0
3	IBW	3	3	10	3	10
4	97	21	3	10	3	10
1	97	07	1	20	+	
3	4	1	9	9	7	-
1	9	9	7	-	0	7
1	2	0	+			

NB (N7)

Nr.	X	Y
1	40.0	44.982
2	-47.928	59.835



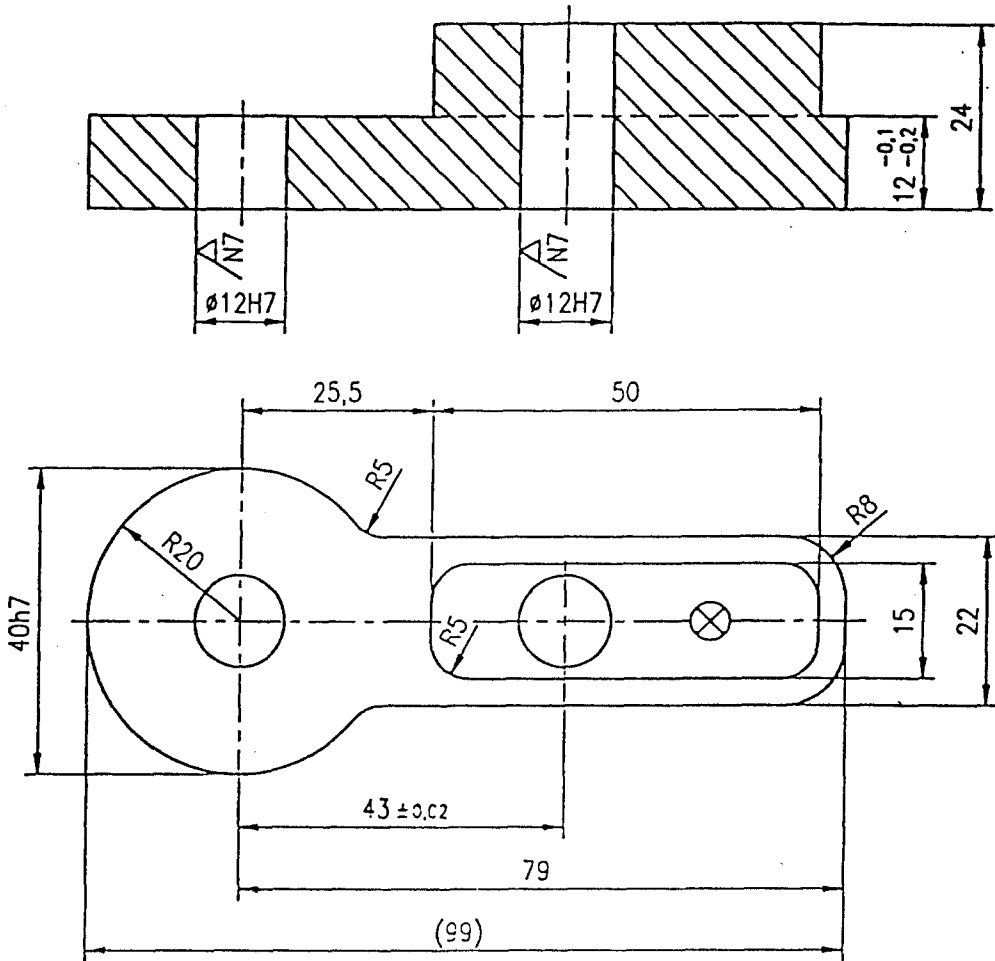
A-A



Kanten gebrochen $\frac{0.45}{0.45}$
 Chamfräne $\frac{0.45}{0.45}$
 Eding broken $\frac{0.45}{0.45}$
 02...0.4x45°

1	Grundplatte Plaque de base Base plate	105.55-155	2.7.97	B0
3	CI/P			
4	IBW N/C CI/P			
1997-07-110+				

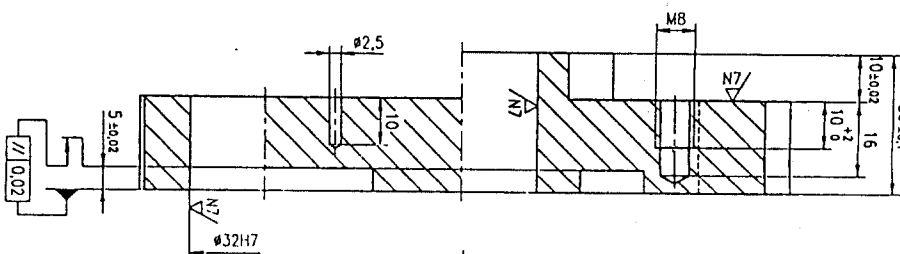
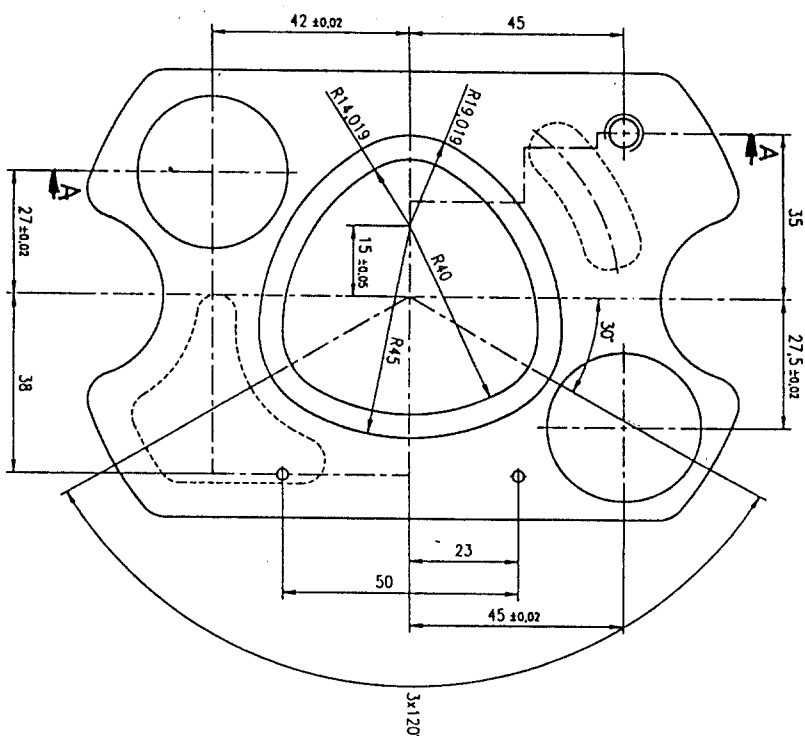
N8 (✓) ✓
 2 2 3 (b)



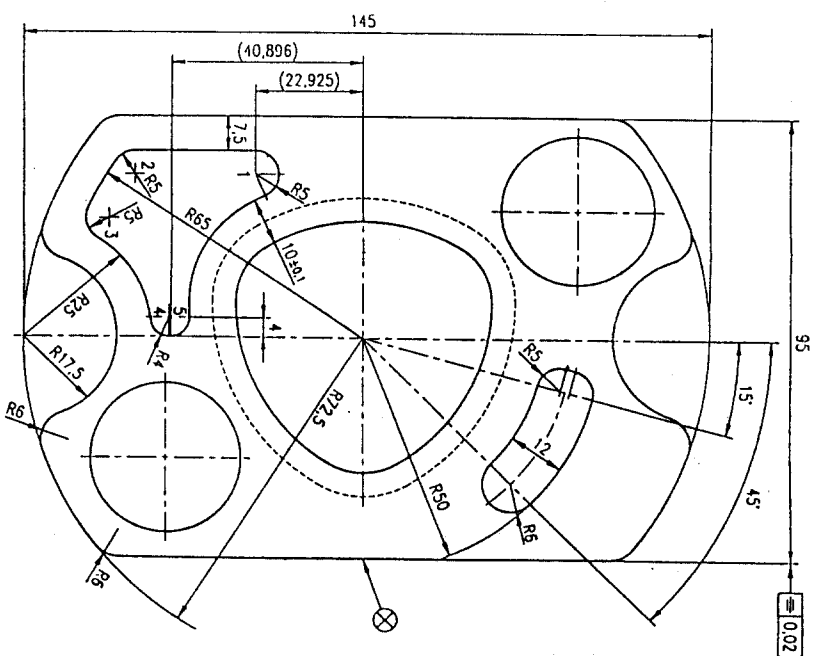
Kanten gebrochen $0,5 \times 45^\circ$
 Chanfreine $0,5 \times 45^\circ$ $0,2 \dots 0,4 \times 45^\circ$
 Eding broken $0,5 \times 45^\circ$

1		(3)	Ck 45	45x30-102	
Menge Quant. Quant.	Gegenstand Spécification Objet	Pos.	Werkstoff Matériau Material	Ausgangsmasse Mesure de départ Starting measure	Bemerkungen Observations Remark
Hebel				Massstab Echelle Scale	Gez. Dess. Draw 19.6.97 Ba

M8 (N7/)



A-A



B

Nr.	X	Y
1	-35.0	-22.913
2	-35.0	-48.723
3	-25.533	-54.286
4	-4.0	-41.277
5	-4.0	-40.896

Allgemeintoleranzen ISO-2768-m
 Tolérances générales ISO-2768-m
 General tolerances ISO-2768-m
 0.1

Kanten gehoochen 0.2..0.4x4.5
 Chanfreine 0.2..0.4x4.5
 Eding broken 0.2..0.4x4.5

1	Quantité	Quantité	AMQS1	100x35-150	2.7.97	Bo
Platte		Plaque		Platte		
CIEP		IBW		MTC		
34		1997-07-135+		CIEP		
1:1		1:1		1:1		
2.7.97		2.7.97		2.7.97		
Bo		Bo		Bo		