NCT 304

LATHE CONTROL

COLLECTION OF PART PROGRAM EXAMPLES

TABLE OF CONTENTS

1 COMBINED TURNING CYCLES

1.1 Roughing Cycles of Straight Turning (G71)

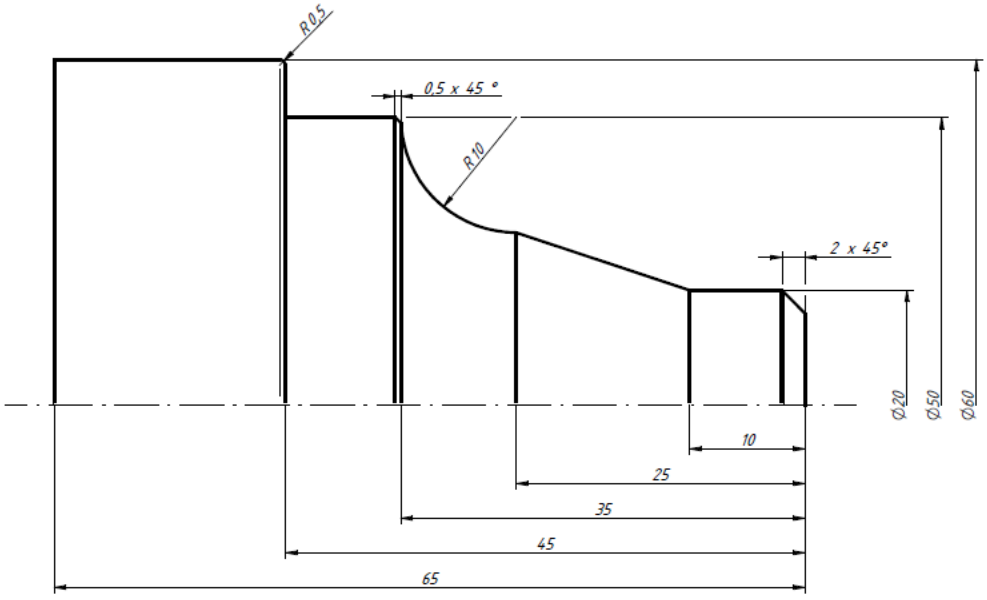

Fig. 1. Shaft-like part

1.1.1 Roughing Cycle of Straight Turning (G71)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (Roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X61.5 Z3
(Simple face turning cycle)
G79 X-0.5 Z2
Z1
Z0
(POSITIONING)
G0 X61.5 Z0.5
(Roughing cycle of straight turning, two-line specification)
G71 U1 R0.5
G71 P1 Q2 U0.3 W0.1
(Tool change POSITIONING)
G0 X100 Z100
T202 (Finishing tool R0.2)
G97 S1200 M4 M8 (Constant spindle speed)
(/Constant cutting speed)
/G96 S200(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
```

```
(POSITIONING)
G0 X16 Z1
(Contour definition)
N1 G1 G42 X15 Z0.5
G1 Z0
G1 X20 ,C2
G1 Z-10
G1 X30 Z-25
G2 X50 Z-35(ZI-10) R10 ,C0.5
G1 Z-45 ,R0.5
G1 X60 ,R0.5
G1 Z-46
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X61(XI1) Z-46(ZI-1)
G0 X100 Z100
M30 (Program end)
```

1.1.2 Roughing and Finishing Cycles of Straight Turning (G71; G70)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (Roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X61.5 Z3
(Simple face turning cycle)
G79 X-0.5 Z2
Z1
Z0
(POSITIONING)
G0 X61.5 Z0.5
(Roughing cycle of straight turning, two-line specification)
G71 U1 R0.5
G71 P1 Q2 U0.3 W0.1
(POSITIONING)
G0 X61.5 Z0.5
(Finishing cycle)
G70 P1 Q2 U0 W0
M30 (Program end)
(Contour definition)
N1 G0 X15 Z0.5
G1 G42 Z0
G1 X20 ,C2
G1 Z-10
G1 X30 Z-25
G2 X50 Z-35(ZI-10) R10 ,C0.5
G1 Z-45 ,R0.5
G1 X60 ,R0.5
G1 Z-46
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X61(XI1) Z-46(ZI-1)
```

Fig. 2. Roughing cycle of straight turning

1.2 Roughing cycles of Face Turning (G72)

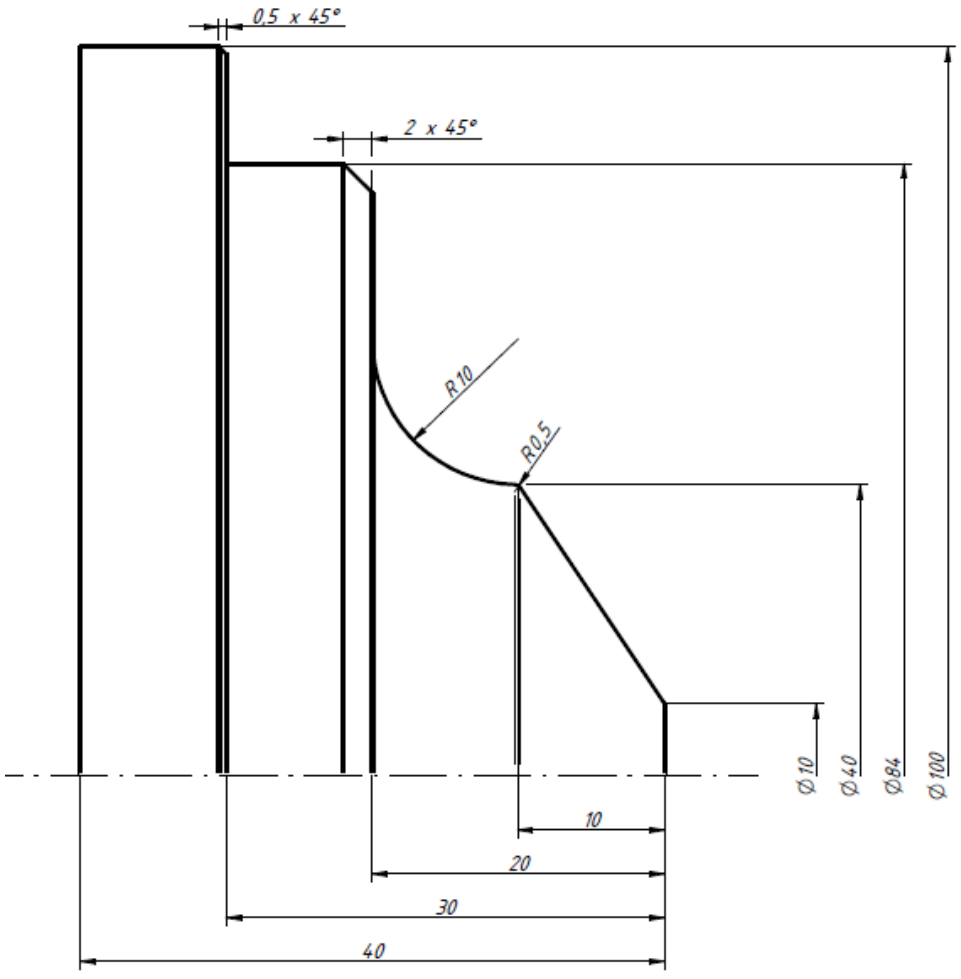

Fig. 3. Disc-like part

1.2.1 Roughing Cycle of Face Turning G72

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (NAGYOLÓ R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X105 Z3
(Simple face turning cycle)
G79 X-0.5 Z2
Z1
Z0.5
(POSITIONING)
G0 X105 Z3
(Roughing cycle of face turning, two-line specification)
G72 W1 R1
G72 P1 Q2 U0.25 W0.25
(POSITIONING)
G0 X150 Z100
T202 (Finishing tool R0.2)
G97 S1200 M4 M8 (Constant spindle speed)
(/Constant cutting speed)
/G96 S200(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X101 Z-31
(Contour definition)
N1G1 G41 Z-31 X101
G1 X100 Z-30.5
G1 Z-30 ,C0.5
G1 X84 ,R0.5
G1 Z-20 ,C2
G1 X60
G3 X40 Z-10 R10 ,R0.5
G1 X10 Z0
G1 X-0.5
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 Z0.5
G0 X150 Z100
M30 (Program end)
```

1.2.2 Roughing and Finishing Cycles of Face Turning (G72; G70)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (Roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
```

```
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X105 Z3
(Simple face turning cycle)
G79 X-0.5 Z2
Z1
Z0.5
(POSITIONING)
G0 X105 Z3
(Roughing cycle of face turning, two-line specification)
G72 W1 R1
G72 P1 Q2 U0.25 W0.25
(POSITIONING)
G0 X105 Z3
(Finishing cycle)
G70 P1 Q2 U0 W0
G0 X150 Z100
M30 (Program end)
(Contour definition)
N1G1 Z-31 X101
G1 G41 X100 Z-30.5
G1 Z-30 ,C0.5
G1 X84 ,R0.5
G1 Z-20 ,C2
G1 X60
G3 X40 Z-10 R10 ,R0.5
G1 X10 Z0
G1 X-0.5
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 Z0.5
```

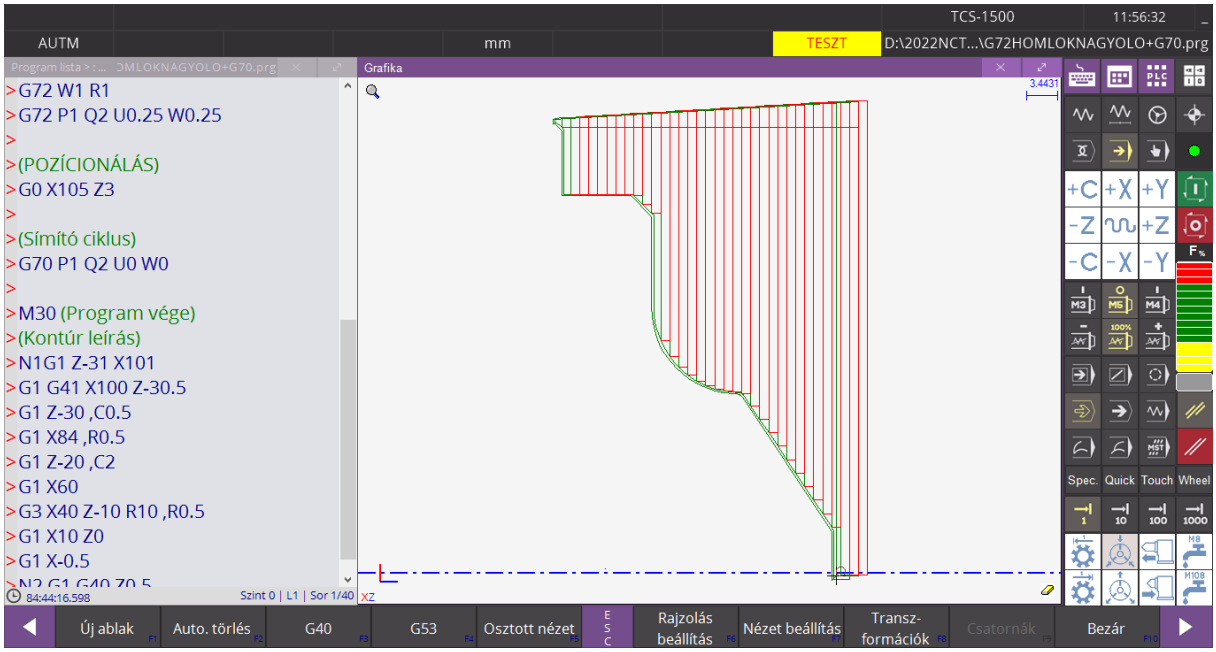

Fig. 4. Roughing cycle of face turning

1.3 Pattern Repeating Cycles G73

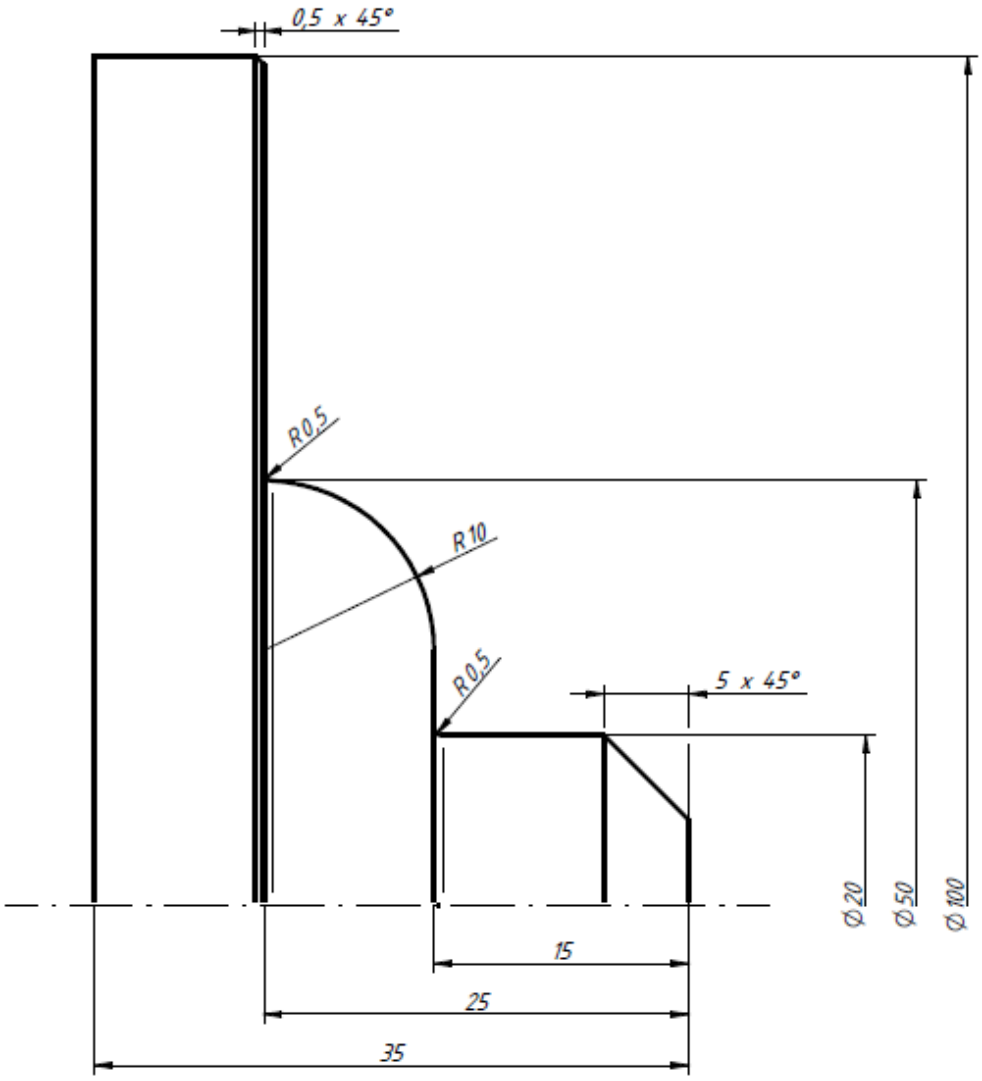

Fig. 5. Dick-like part

1.3.1 Pattern Repeating Cycle (G73)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (Roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X100 Z6
(Pattern repeating cycle)
G73 U5(X allowance for roughing) W2 (Z allowance for roughing) R5(Number of
passes)
G73 P1 Q2 U0.5(X allowance for finishing) W0.2 (Z allowance for finishing)
(POSITIONING)
```

```
G0 X100 Z100
T202 (Finishing tool R0.2)
G97 S1200 M4 M8 (Constant spindle speed)
(/Constant cutting speed)
/G96 S200(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X-1 Z1
(Contour definition)
N1 G1 G42 X-1 Z1
G1 X0 Z0
G1 X20 ,C5
G1 Z-15 ,R0.5
G1 X30
G3 X50 Z-25 R10 ,R0.5
G1 X100 ,C0.5
G1 Z-25.5
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X101 Z-26
G0 X150 Z100
M30 (Program end)
Pattern repeating and finishing cycles (G73; G70)
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (NAGYOLÓ R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X100 Z6
(Pattern repeating cycle)
G73 U5(X allowance for roughing) W2 (Z allowance for roughing) R5(Number of
passes)
G73 P1 Q2 U0.5(X allowance for finishing) W0.2 (Z allowance for finishing)
(POSITIONING)
G0 X100 Z6
(Finishing cycle)
G70 P1 Q2 U0 W0
G0 X150 Z100
M30 (Program end)
(Contour definition)
N1 G1 X-1 Z1
G1 G42 X0 Z0
G1 X20 ,C5
G1 Z-15 ,R0.5
G1 X30
G3 X50 Z-25 R10 ,R0.5
G1 X100 ,C0.5
G1 Z-25.5
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X101 Z-26
```

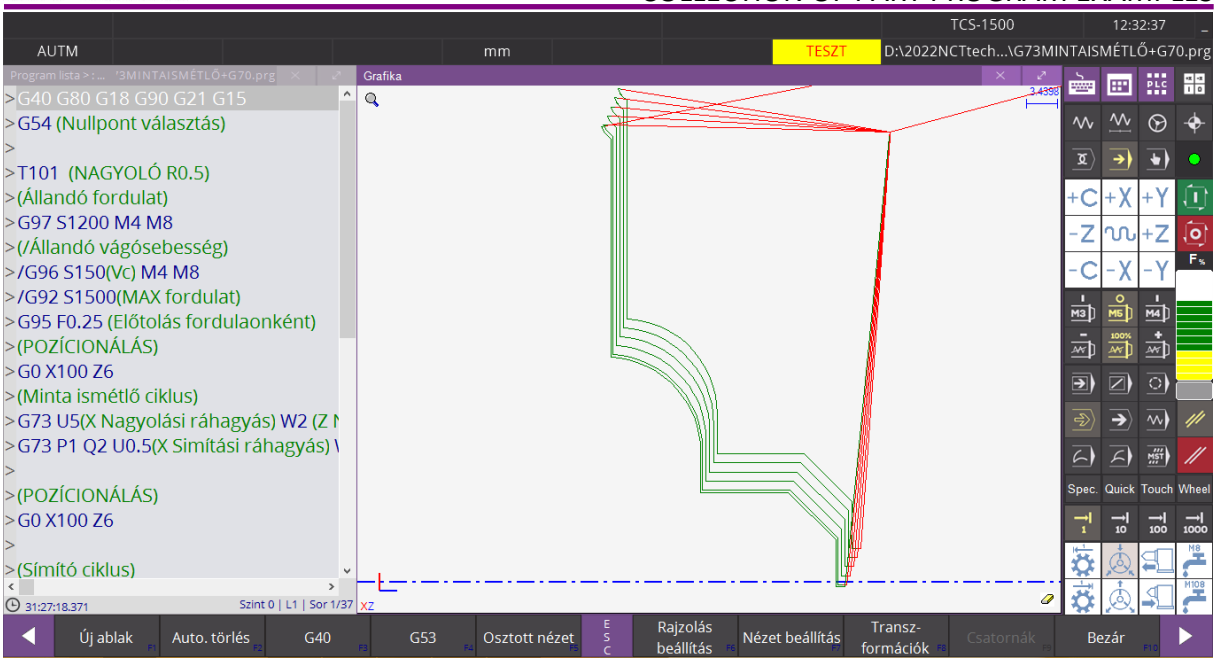

Fig. 6. Pattern repeating cycle

1.4 Face Grooving Cycles (G74)

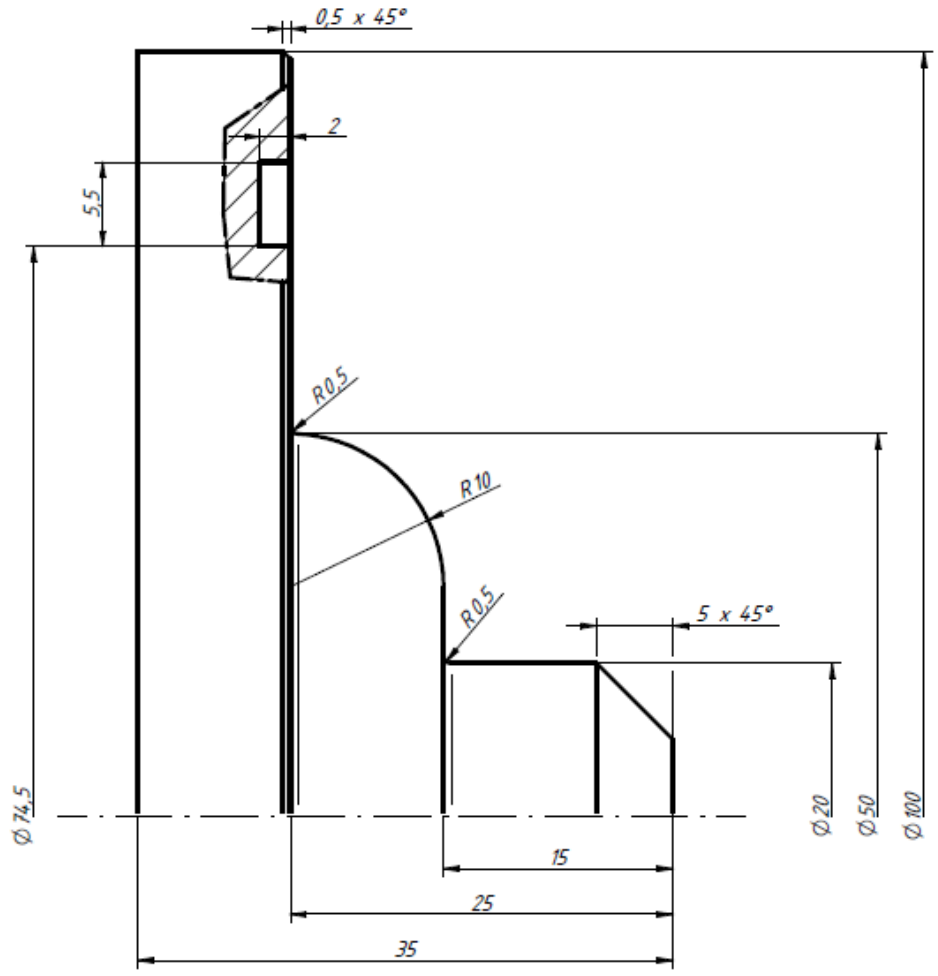

Fig. 7. Disc-like part with face grooving

1.4.1 Face Grooving Cycle Specified by One-Line Method (G74)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (NAGYOLÓ R0.5)
(Constant cutting speed)
G96 S150(Vc) M4 M8
G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X100 Z2
(Roughing cycle of face turning, two-line specification)
/G72 W1 R1
/G72 P1 Q2 U0.25 W0.25
(POSITIONING)
G0 X100 Z6
(Finishing cycle)
G70 P1 Q2 U0 W0
(POSITIONING)
G0 X150 Z150
T404 (3MMFACE GROOVING TOOL)
(Constant cutting speed)
G96 S150(Vc) M4 M8
G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X74.5 Z1
G0 Z-24
(Face grooving cycle, two-line specification)
G74 X79.5 Z-26 I2.5 K1 D0.1 F0.1
(POSITIONING)
G0 X150 Z150
M30 (Program end)
(Contour definition)
N1 G1 X101 Z-26
G1 G41 X100 Z-25.5
G1 Z-25 ,C0.5
G1 X50 ,R0.5
G2 X30 Z-15 R10
G1 X20 ,R0.5
G1 Z0 ,C5
G1 X0
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X-0.5 Z0.5
```

1.4.2 Face Grooving Cycle Specified by Two-Line Method (G74)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (Roughing tool R0.5)
(Constant cutting speed)
G96 S150(Vc) M4 M8
G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X100 Z2
(Face grooving cycle, two-line specification)
```

```
/G72 W1 R1
/G72 P1 Q2 U0.25 W0.25
(POSITIONING)
G0 X100 Z6
(Finishing cycle)
G70 P1 Q2 U0 W0
(POSITIONING)
G0 X150 Z150
T404 (3MMFACE GROOVING TOOL)
(Constant cutting speed)
G96 S150(Vc) M4 M8
G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X74.5 Z1
G0 Z-24
(Face grooving cycle, two-line specification)
G74 R0.2
G74 X79.5 Z-26 P2.5 Q1 R0.1 F0.1
(POSITIONING)
G0 X150 Z150
M30 (Program end)
(Contour definition)
N1 G1 X101 Z-26
G1 G41 X100 Z-25.5
G1 Z-25 ,C0.5
G1 X50 ,R0.5
G2 X30 Z-15 R10
G1 X20 ,R0.5
G1 Z0 ,C5
G1 X0
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X-0.5 Z0.5
```

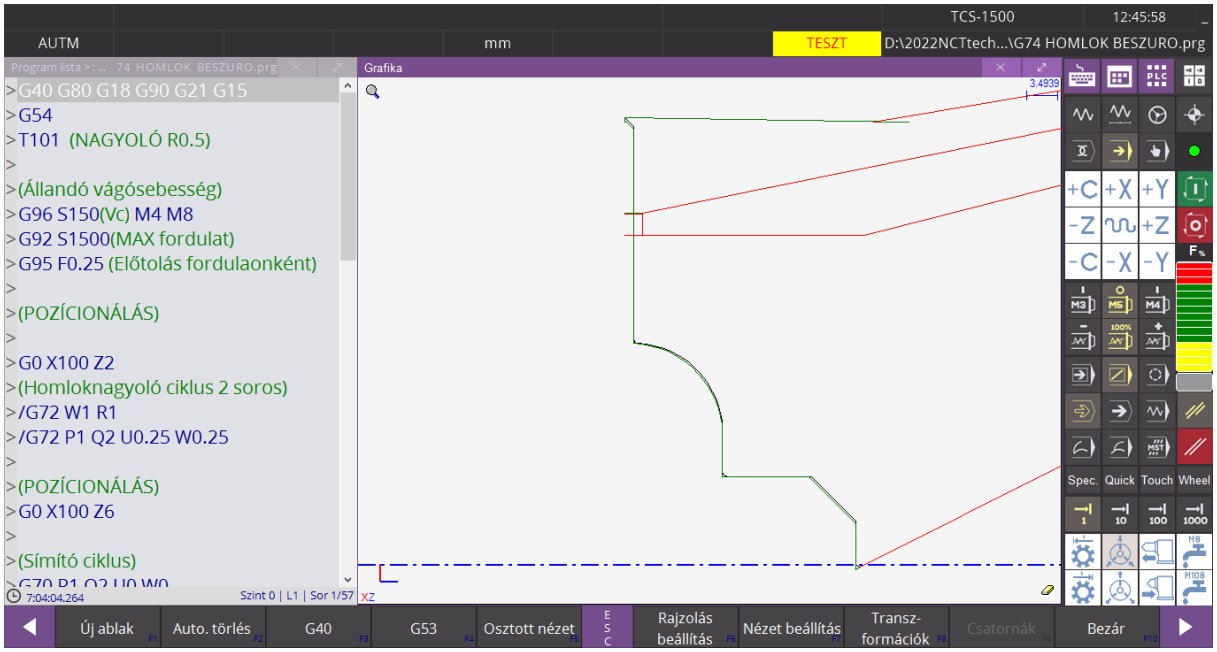

Fig. 8. Face grooving

1.5 Grooving Cycle (G75)

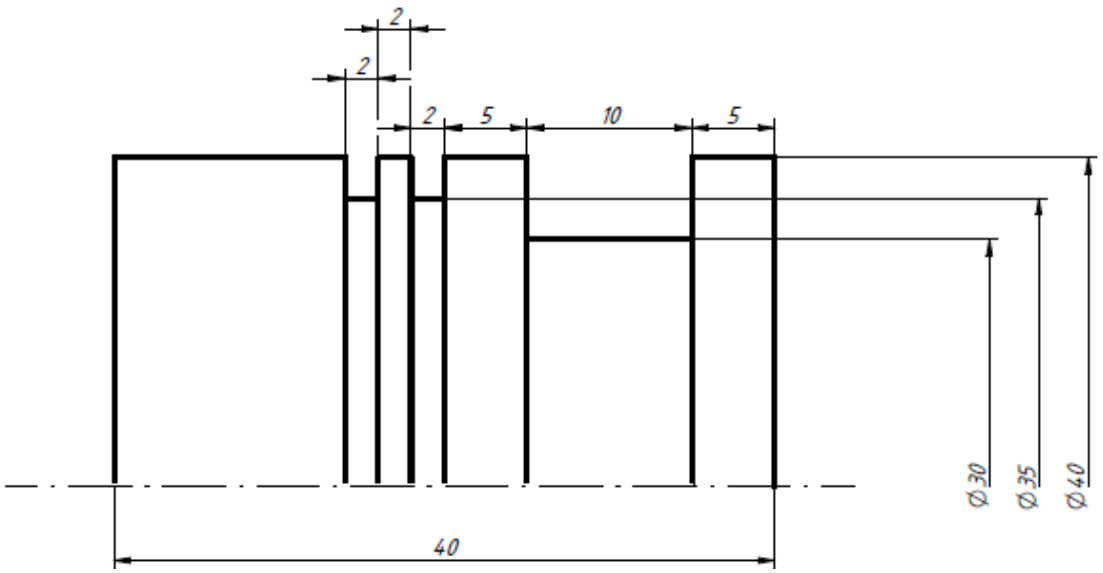

Fig. 9. Part with multiple grooving

1.5.1 Grooving Cycles Specified by One-Line and Two-Line Methods (G75)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T202
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X41 Z-7
(Grooving cycle, two-line specification)
G75 R0.1
G75 X30.25(D30+D0.25 allowance for finishing) ZI-8 P2 Q1.5 R0.1
(POSITIONING)
G0 X41 Z-22
(two-line specification)
G75 R0.1
G75 X35 P2
(POSITIONING)
G0 X41 Z-26
(Grooving cycle, one-line specification)
G75 X35 I2
(POSITIONING for finishing)
G0 X45 Z-17
G0 X41.5
G1 G41 X40.4 Z-15.2
G1 X40
G1 X39.6 Z-15
G1 X30
G1 Z-7.5
G1 G40 X41
```

```
G1 Z-6.4
T203 (2MM Q4)(a new correction field is called for the T202 tool)
G1 G42 X40.4 Z-4.6
G1 X39.6 Z-5
G1 X30
G1 Z-8
G1 G40 X41 Z-8
G0 X100 Z100
M30 (Program end)
```

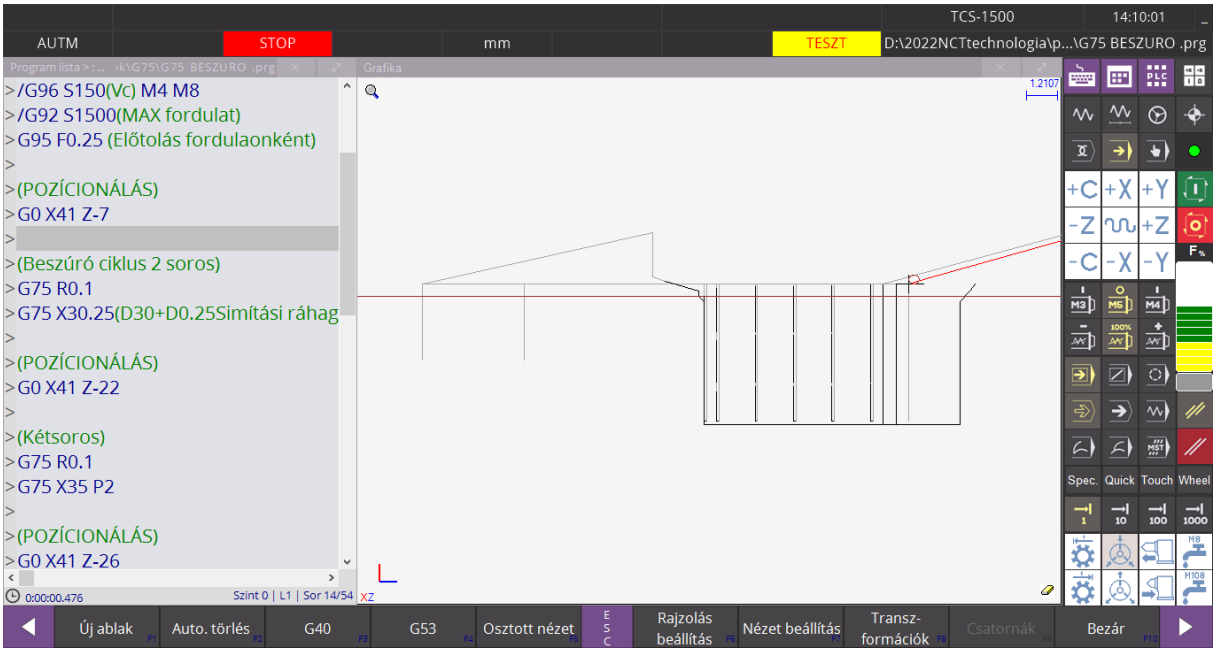

Fig. 10. 10 mm wide grooving by the use of a 2 mm wide tool, with finishing

1.6 Threading Cycle

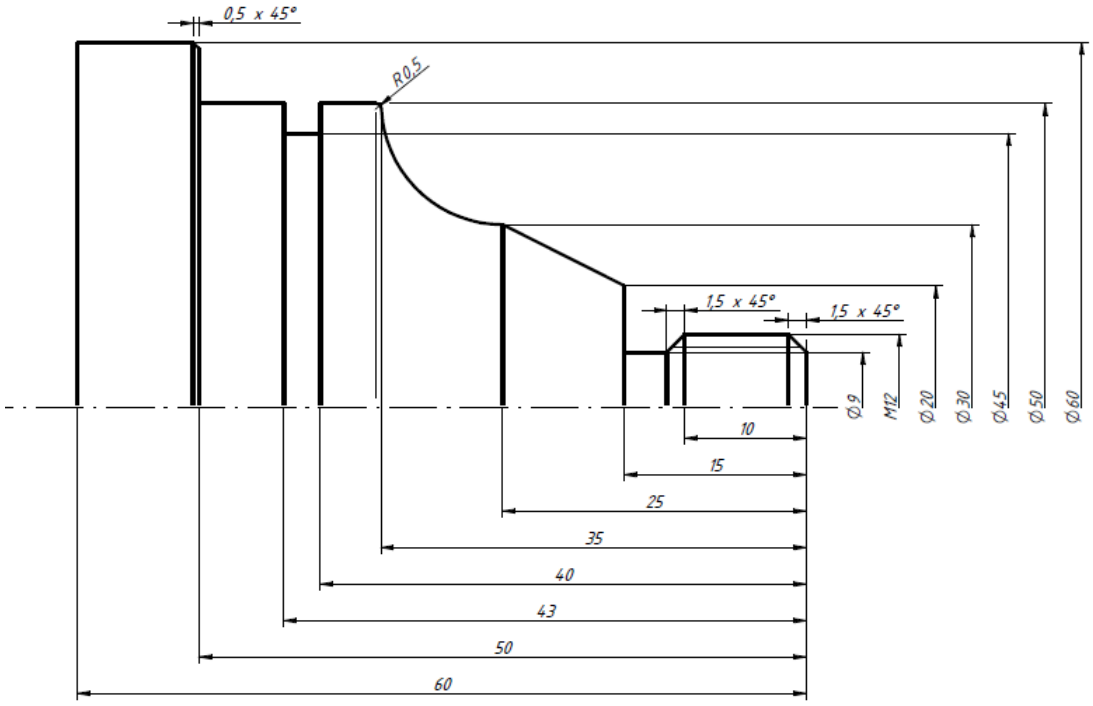

Fig. 11. Complex part

1.6.1 Facing Cycle (G79), Roughing Cycle of Straight Turning (G71), Grooving Cycle (G75) and One-Line Threading Cycle (G76)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X61.5 Z3
(Simple facing cycle)
G79 X-0.5 Z2
Z1
Z0
(POSITIONING)
G0 X61.5 Z0.5
(Roughing cycle of straight turning, two-line specification)
G71 U1 R0.5
G71 P1 Q2 U0.3 W0.1
(POSITIONING)
G0 X61.5 Z0.5
(Finishing cycle)
G70 P1 Q2 U0 W0
(POSITIONING)
G0 X150 Z150
T202 (2MM grooving tool Q3)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X51 Z-43
(one-line grooving cycle)
G75 X45 I2
G0 X150 Z150
T606 (P1.75 G60 threading tool)
(Constant spindle speed)
G97 S1200 M4 M8
G95 F1.75(Feed per revolution)
(POSITIONING)
G0 X13 Z3
(Threading cycle, one-line specification)
G76 X9.851 Z-13 K1.075 D0.25 A60 P5 F1.75
G0 X150 Z150
M30 (Program end)
(Contour definition)
N1 G1 X9 Z1
G1 G42 X9 Z0
G1 X12 ,C1.5
G1 Z-11.5 ,C1.5
```

```
G1 X9
G1 Z-15
G1 X20 ,R0.2
G1 X30 Z-25
G2 X50 Z-35 R10 ,R0.5
G1 Z-50
G1 X60 ,C0.5
G1 Z-50.5
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X61 Z-51
```

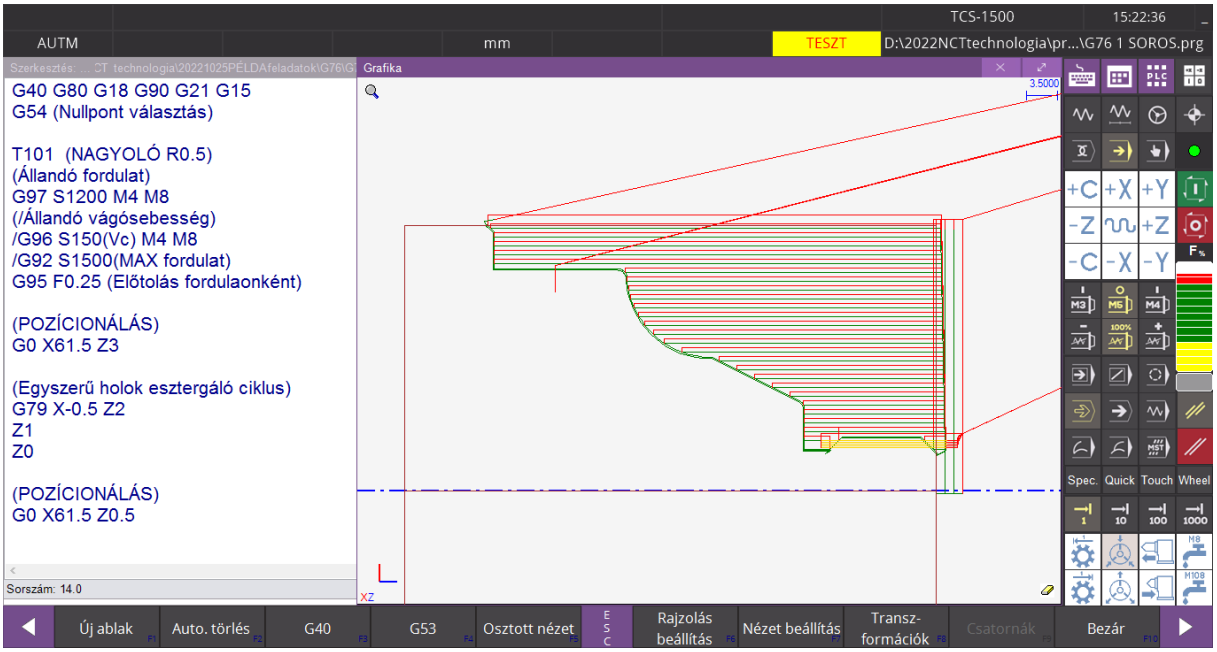

Fig. 12. Thread turning by the use of the one-line specification

1.6.2 Facing Cycle (G79), Roughing Cycle of Straight Turning (G71), Grooving Cycle (G75) and Two-Line Threading Cycle (G76)

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X61.5 Z3
(Simple facing cycle)
G79 X-0.5 Z2
Z1
Z0
(POSITIONING)
G0 X61.5 Z0.5
(Roughing cycle of straight turning, two-line specification)
G71 U1 R0.5
G71 P1 Q2 U0.3 W0.1
(POSITIONING)
```

```
G0 X61.5 Z0.5
(Finishing cycle)
G70 P1 Q2 U0 W0
(POSITIONING)
G0 X150 Z150
T202 (2MM grooving tool Q3)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X51 Z-43
(one-line grooving cycle)
G75 X45 I2
G0 X150 Z150
T606 (P1.75 G60 threading tool)
(Constant spindle speed)
G97 S1200 M4 M8
G95 F1.75(Feed per revolution)
(POSITIONING)
G0 X13 Z3
(Threading cycle, two-line specification)
G76 P030060 Q0.05 R0.1
G76 X9.851 Z-13 P1.075 Q0.25 R0 F1.75
G0 X150 Z150
M30 (Program end)
N1 G1 X9 Z1
G1 G42 X9 Z0
G1 X12 ,C1.5
G1 Z-11.5 ,C1.5
G1 X9
G1 Z-15
G1 X20 ,R0.2
G1 X30 Z-25
G2 X50 Z-35 R10 ,R0.5
G1 Z-50
G1 X60 ,C0.5
G1 Z-50.5
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X61 Z-51
```

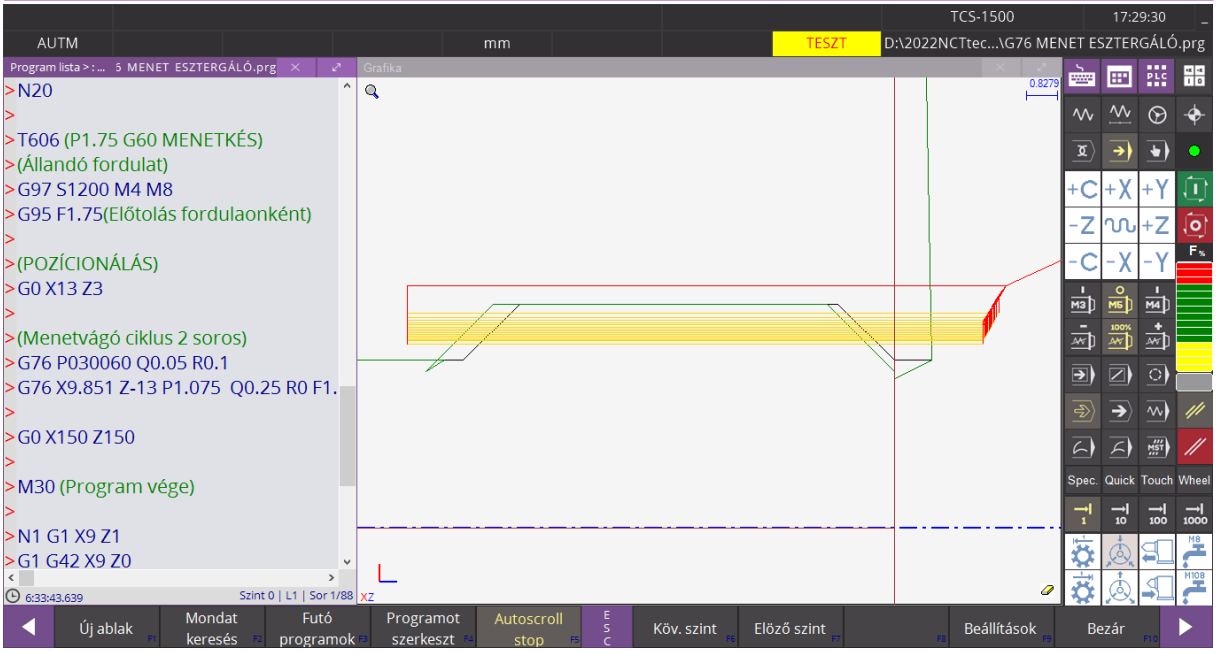

Fig. 13. Thread turning by the use of the two-line specification

2 AUTOMATIC GEOMETRIC CALCULATIONS

2.1 Intersection Calculations

2.1.1 Intersection of Two Lines

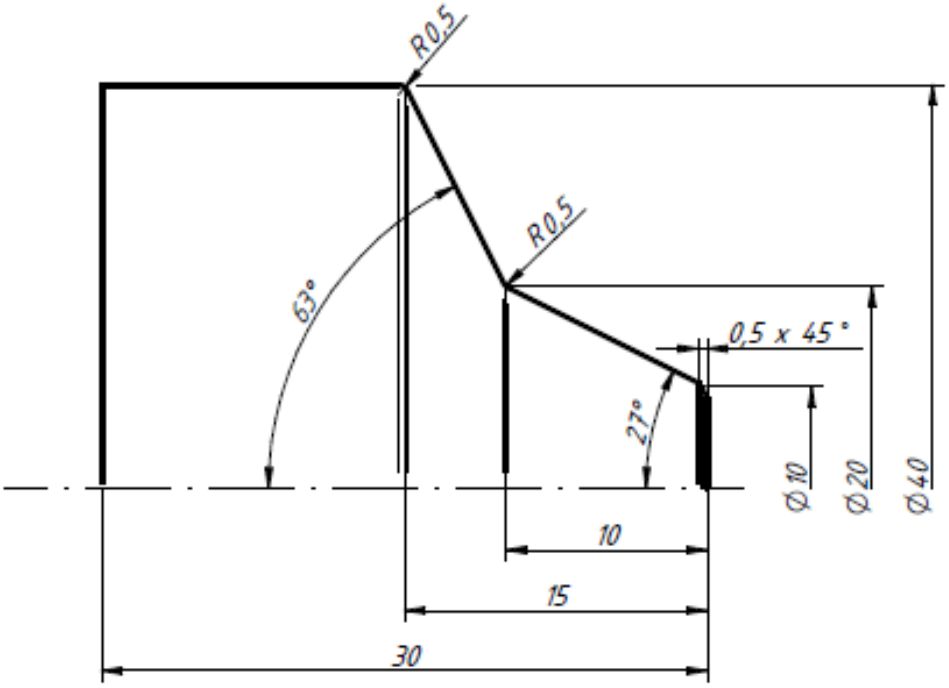

Fig. 14. Intersection of two lines

```
G40 G80 G18 G90 G21 G15
G54
T101 (roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X41.5 Z3
(Simple facing cycle)
(G79 X-0.5 Z2)
(Z1)
(Z0)
(POSITIONING)
G0 X41.5 Z0.5
(Roughing cycle of straight turning, two-line specification)
(G71 U1 R0.5)
(G71 P1 Q2 U0.3 W0.1)
(POSITIONING)
G0 X41.5 Z0.5
(Finishing cycle)
G70 P1 Q2 U0 W0
G0 X100 Z100
```

```
M30 (Program end)
(Contour definition)
N1 G0 X8 Z0.5
G1 G42 X9 Z0
G1 X10 ,C0.5
G1,A153 ,R0.5
G1 X40 Z-15 ,A117 ,R0.5
G1 Z-18
(Minimum displacement = tool radius, in the line N2)
N2 G1 G40 X41 Z-19
```

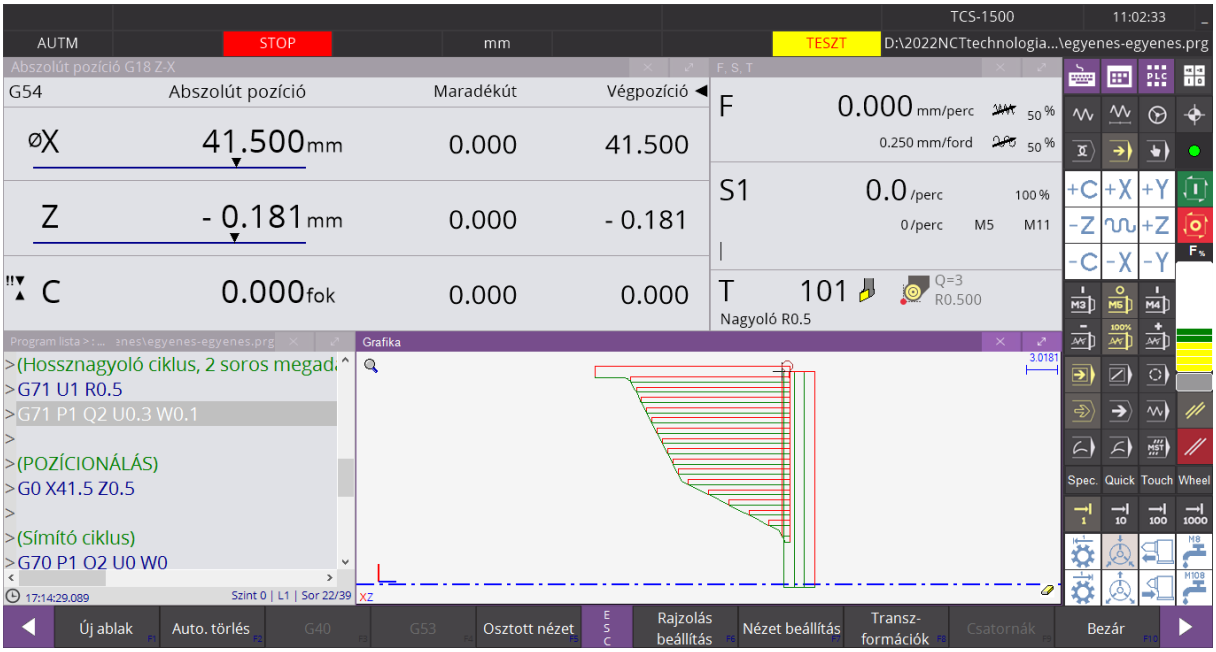

Fig. 15. Intersection of two lines

2.1.2 Intersection of a Line and a Circle

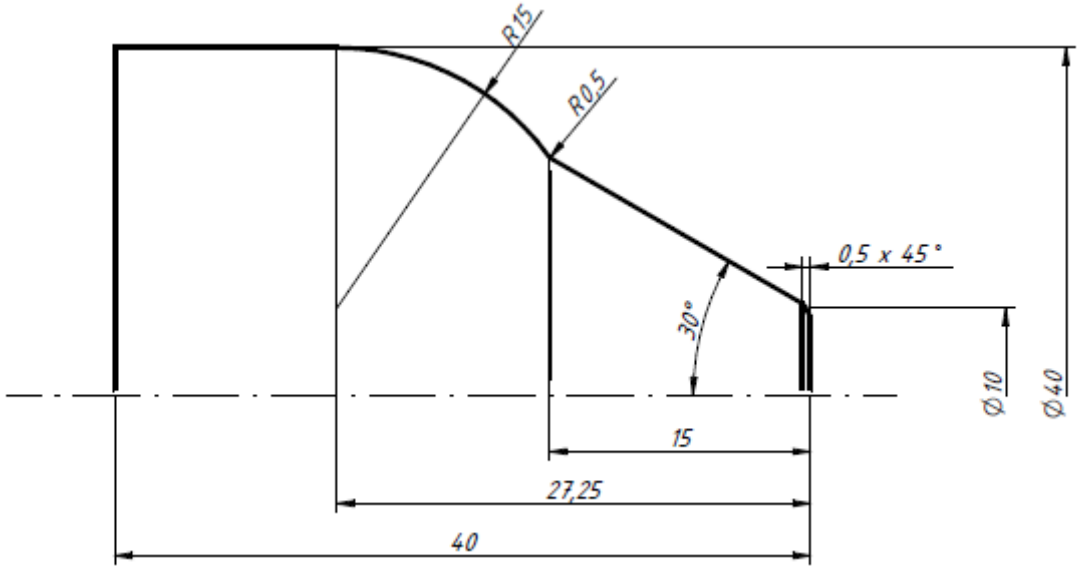

Fig. 16. Intersection of a line and an arc

```
G40 G80 G18 G90 G21 G15
G54 (Zero point selection)
T101 (roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X41.5 Z3
(Simple facing cycle)
G79 X-0.5 Z2
Z1
Z0
(POSITIONING)
G0 X41.5 Z0.5
G71 U1 R0.5
G71 P1 Q2 U0.3 W0.1
(POSITIONING)
G0 X41.5 Z0.5
(Finishing cycle)
G70 P1 Q2 U0 W0
M30 (Program end)
(Contour definition)
N1 G0 X8 Z0.5
G1 G42 X9 Z0
G1 X10 ,C0.5
G1,A150 ,R0.5
G3 X40 Z-27.5 I5 K-27.5 R15 Q-1
G1 X40 Z-27.5
G1 Z-28
(Minimum displacement = tool radius, in the line N2)
N2 G40 X41 Z-29
```

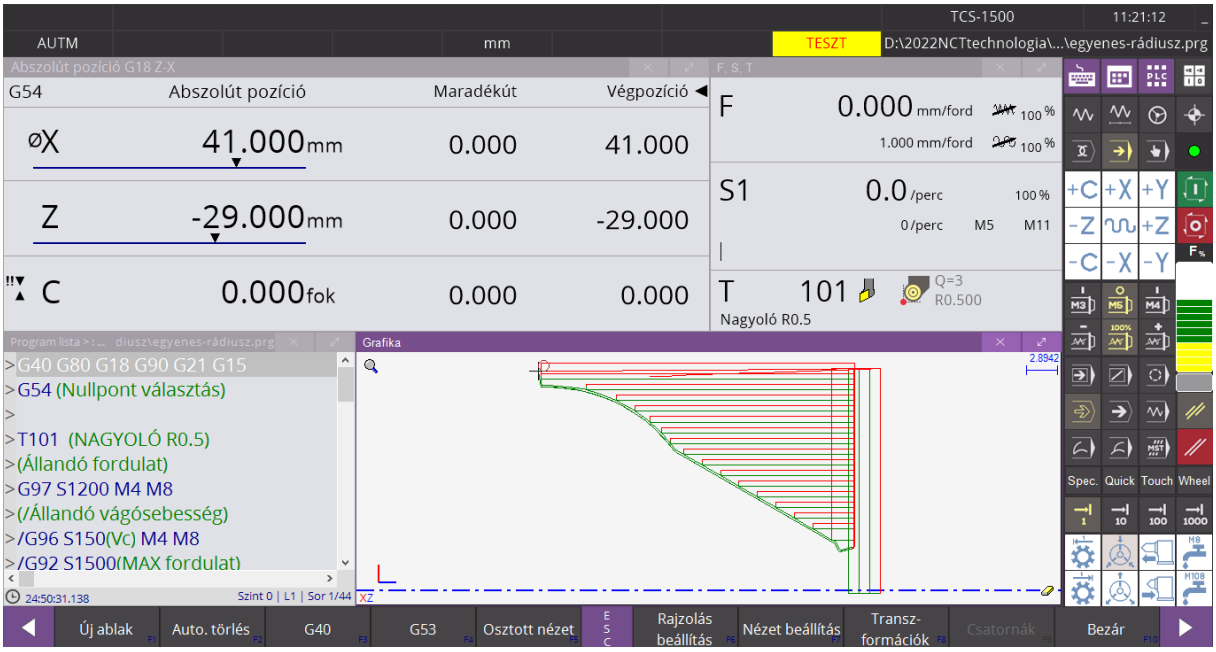

Fig. 17. Intersection of a line and an arc

2.1.3 Line-Arc-Arc-Line Intersection

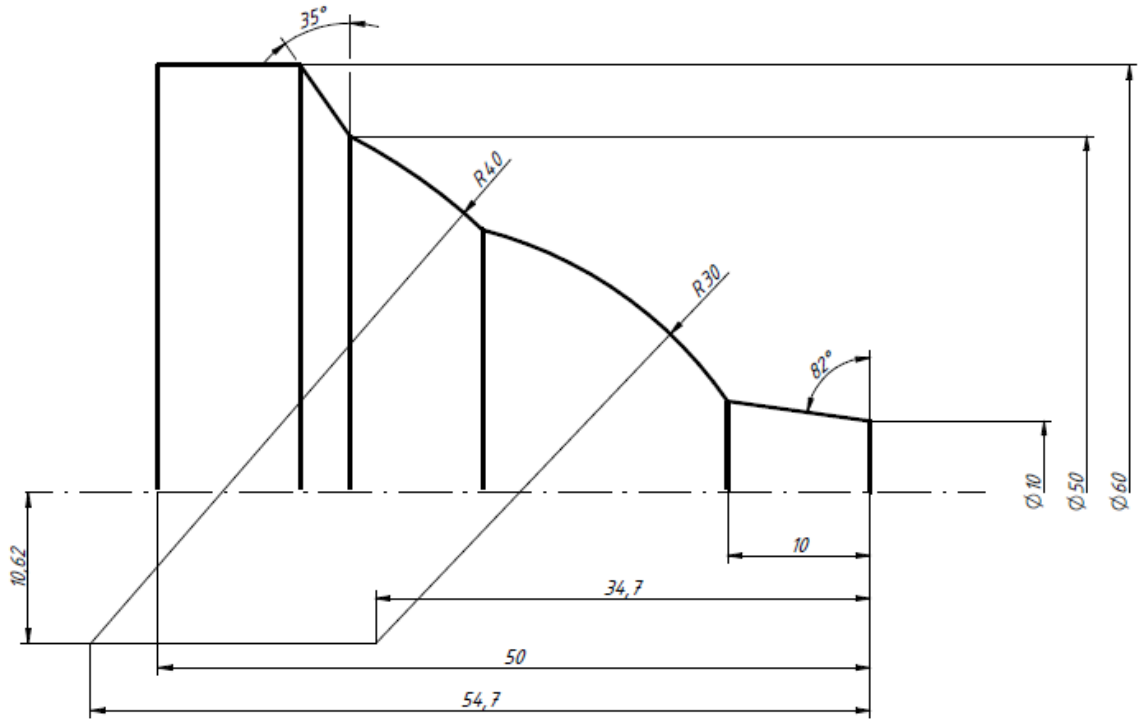

Fig. 18. Line-Arc-Arc-Line Intersection

```
G40 G80 G18 G90 G21 G15
G54
T101 (roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X61.5 Z3
(Simple facing cycle)
G79 X-0.5 Z2
Z1
Z0
(POSITIONING)
G0 X61.5 Z0.5
(Roughing cycle of straight turning, two-line specification)
G71 U1 R0.5
G71 P1 Q2 U0.3 W0.1
POSITIONING
G0 X61.5 Z0.5
(Finishing cycle)
G70 P1 Q2 U0 W0
M30 (Program end)
(Contour definition)
N1 G0 X8 Z0.5
G1 G41 X9 Z0
G1 X10
G1,A172
```

```
G3 X38.76 Z-34.7 I-10.62 K-34.7 R30 Q-1
G3 X58.76 Z-54.7 I-10.62 K-54.7 R40 Q1
G1 ,A115 X60
G1 ZI-1
N2 G1 G40 ZI-1 X61
```

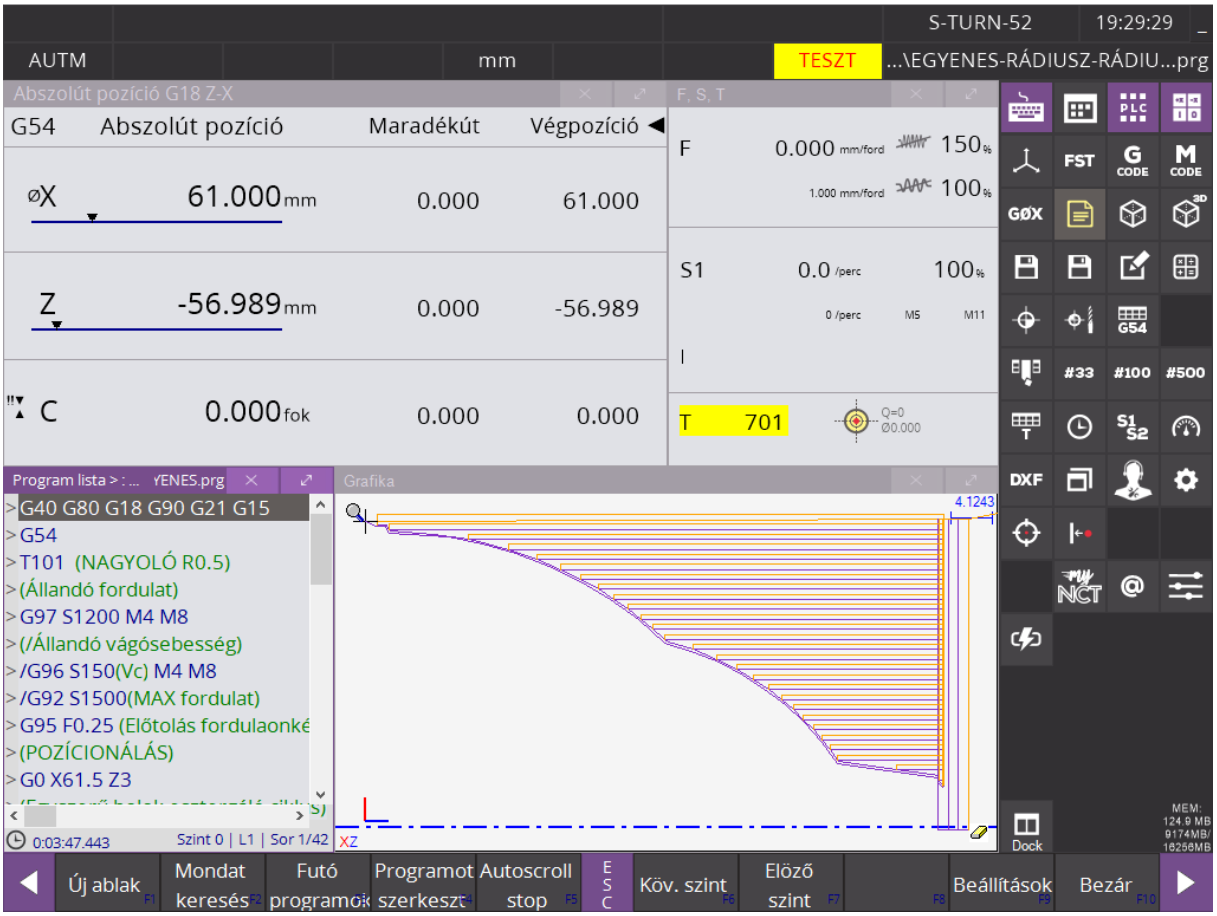

Fig. 19. Line-Arc-Arc-Line Intersection

2.1.4 Intersection of Two Arcs

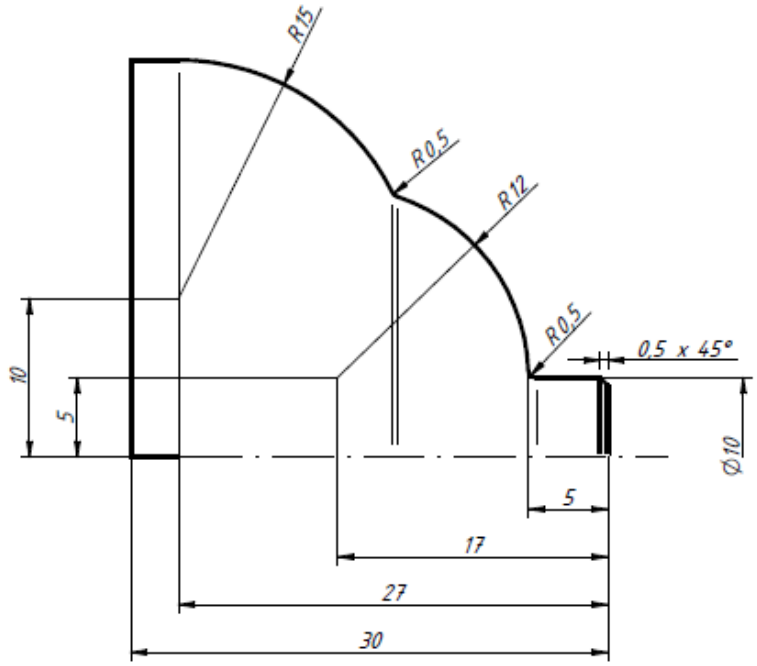

Fig. 20. Intersection of Two Arcs

```
G40 G80 G18 G90 G21 G15
G54
T101 (roughing tool R0.5)
(Constant spindle speed)
G97 S1200 M4 M8
(/Constant cutting speed)
/G96 S150(Vc) M4 M8
/G92 S1500(MAX spindle speed)
G95 F0.25 (Feed per revolution)
(POSITIONING)
G0 X51.5 Z3
(Simple facing cycle)
G79 X-0.5 Z2
Z1
Z0
(POSITIONING)
G0 X51.5 Z0.5
(Roughing cycle of straight turning, two-line specification)
G71 U1 R0.5
G71 P1 Q2 U0.3 W0.1
(POSITIONING)
G0 X51.5 Z0.5
(Finishing cycle)
G70 P1 Q2 U0 W0
M30 (Program end)
(Contour definition)
N1 G0 X8 Z0.5
G1 G41 X9 Z0
G1 X10 ,R0.5
G1 X10 Z-5
```

```
G3 XI24 ZI-12 R12
G3 X50 Z-27 I10 K-27 R15 Q1
G1 Z-27 X50
G1 Z-27.5
N2 G1 G40 X51 Z-28
```

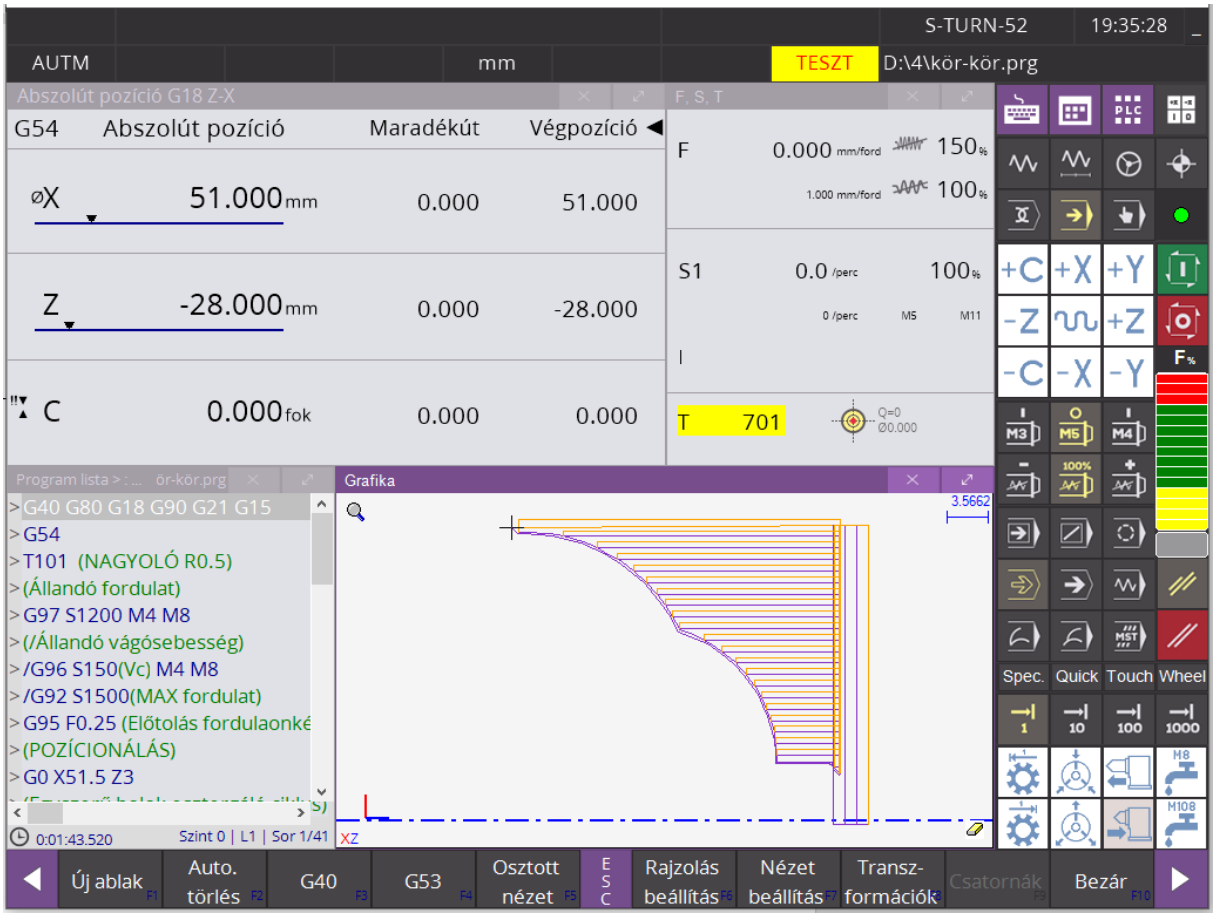

Fig. 21. Intersection of two arcs