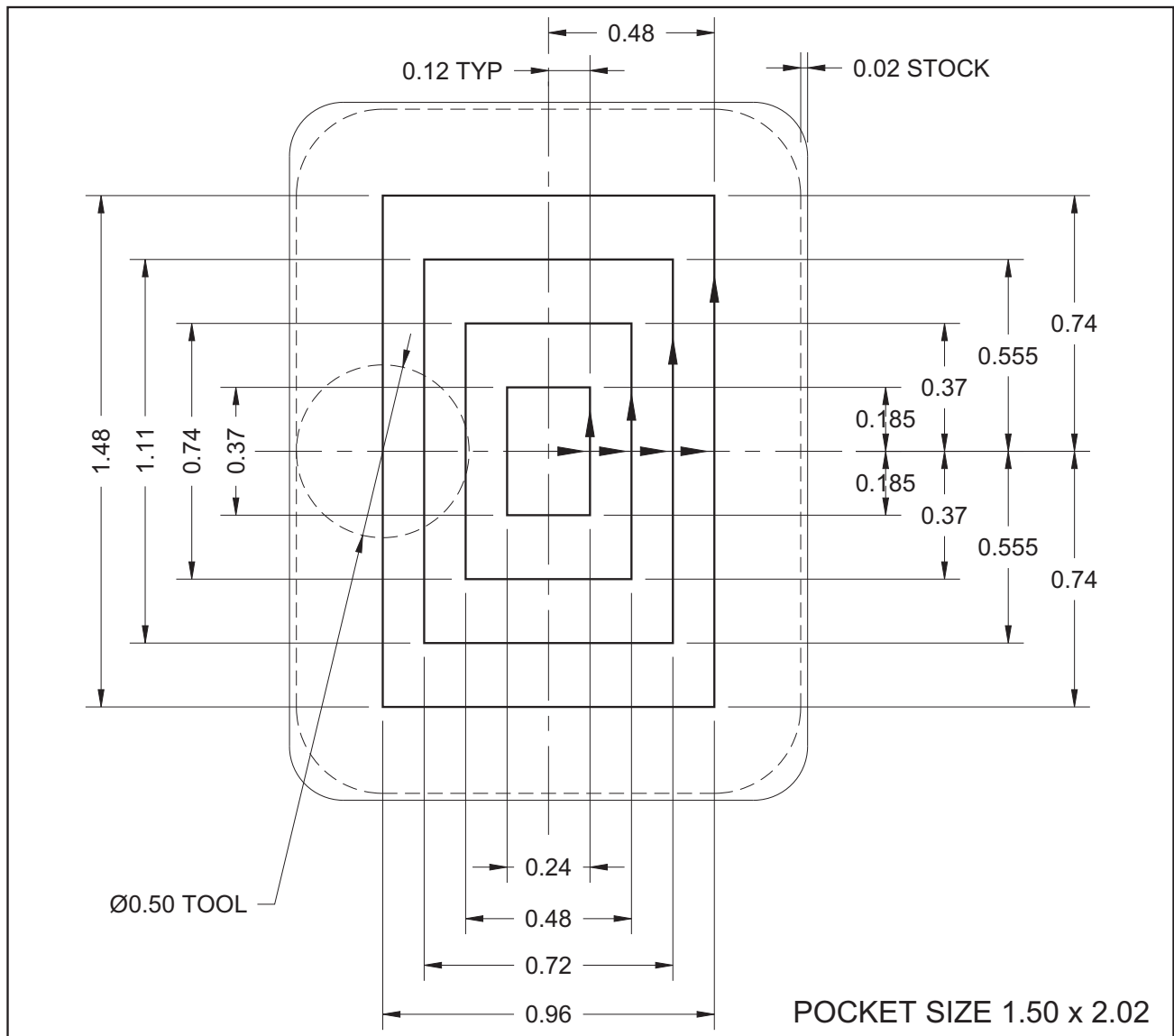


## 2 Pockets

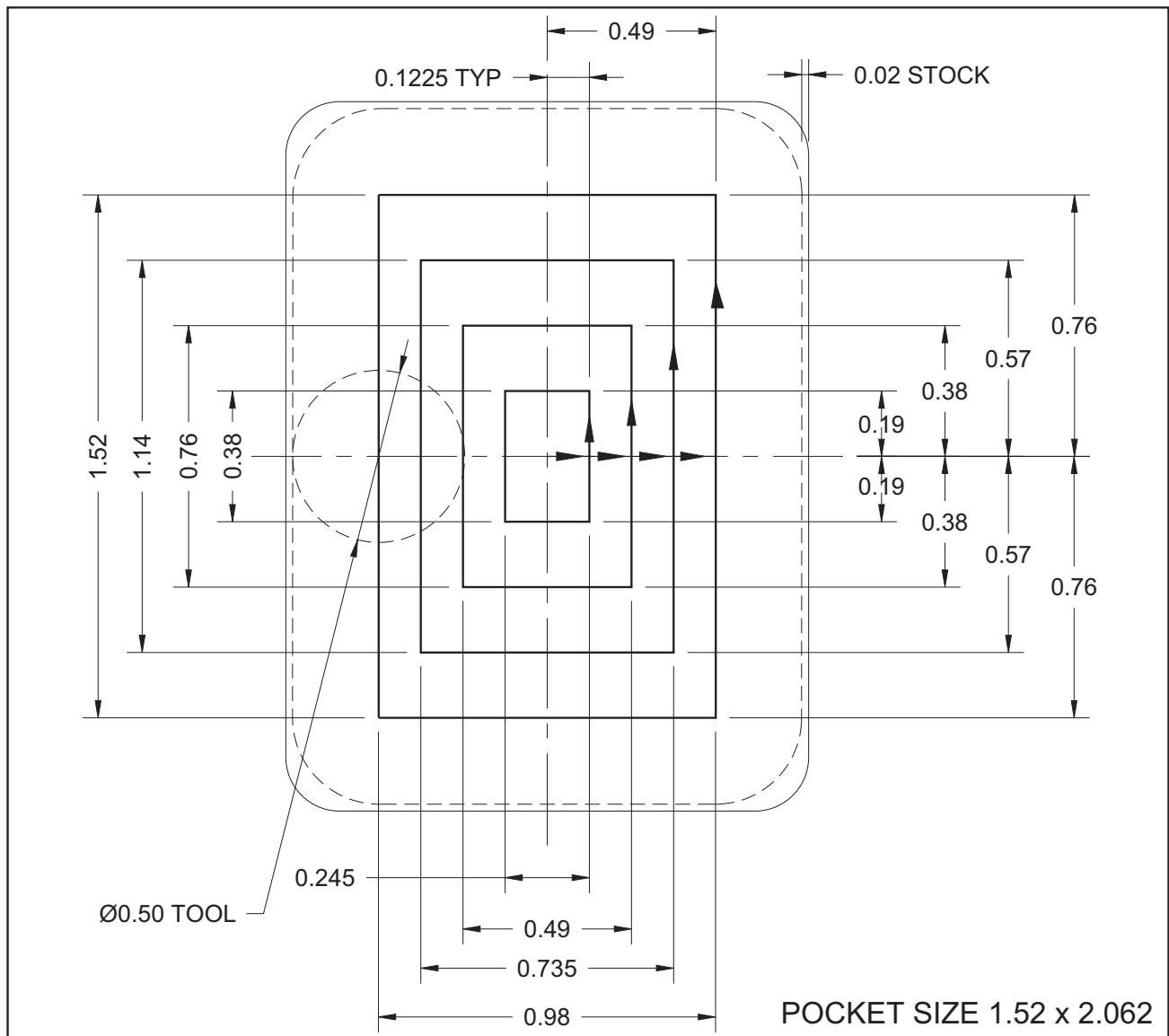
Two tools have been used for this project - T01 and T02. T01 is a Ø0.5 end mill (center cutting) used for roughing, T02 is Ø0.25 end mill, used for finishing. Given the nature of the material, carbide tools should be used.

The following illustrations show details with dimensions for the roughing and finishing toolpaths for each pocket. Six subprograms have been used - for roughing, semi-finishing and finishing. Each subprogram includes a comment as for its purpose.

- ➡ In the following illustration, the roughing toolpath for the **left** pocket is shown (used in subprogram 07001):



➡ In the following illustration, the roughing toolpath for the **right** pocket is shown (used in subprogram 07002):



In both cases, the toolpath represents the cutter center, starting from the middle point of the pocket. In rectangular pockets, middle point offers symmetry in programming, making the effort easier. As no cutter radius offset is used in roughing, it is important to plan well. The best approach is to start from the outside walls, and work towards the middle point. The goal is to establish the stepover amount and the number of stepovers. Using the above illustration as an example, here are the calculations:

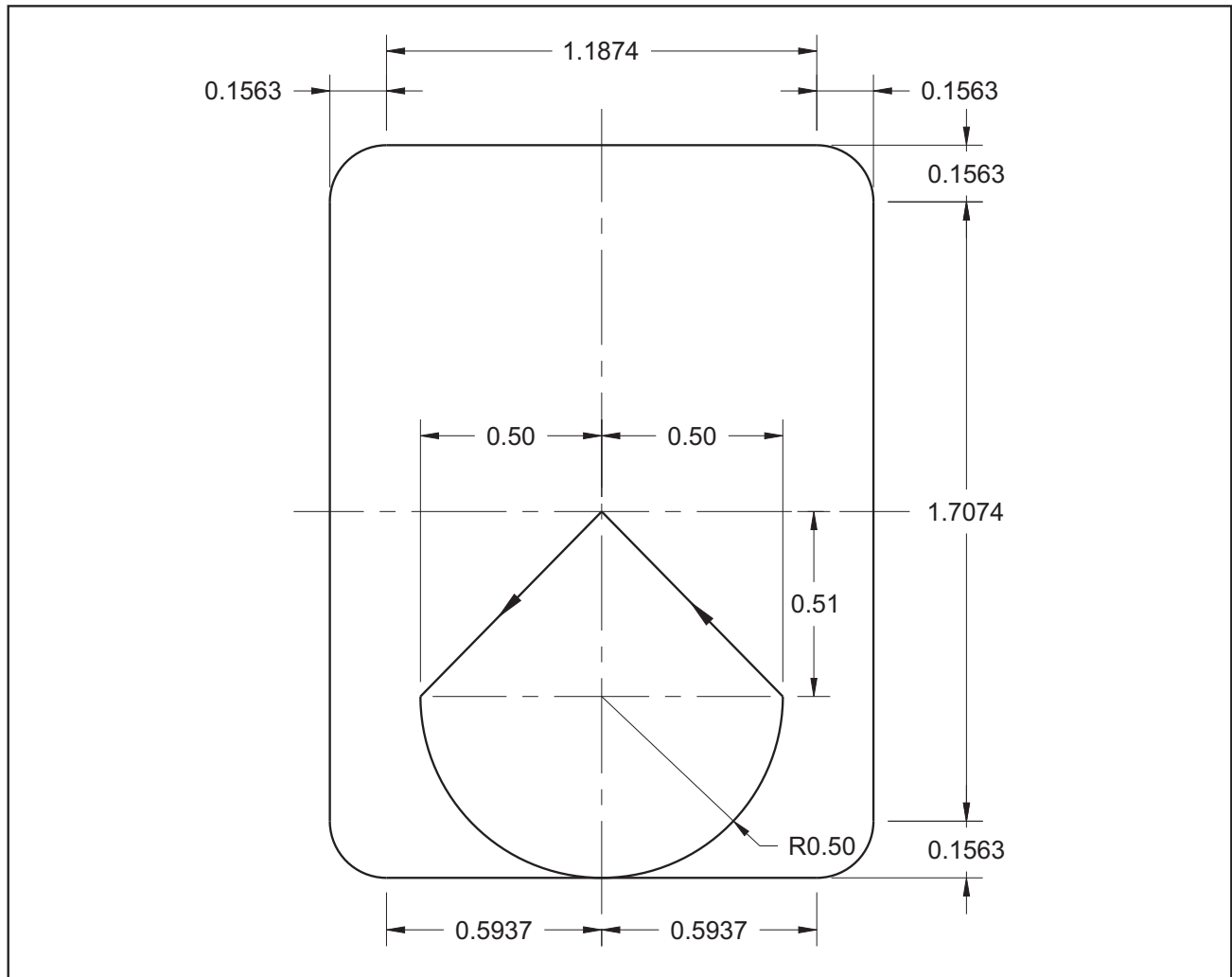
Pocket width is 1.52, one half is 0.76. From the 0.76 dimension, take away the stock allowance (0.02) and the cutter radius (0.25) - the result is the amount of material to remove from the midpoint to one side:

$$0.76 - 0.02 - 0.25 = 0.49$$

Fewer errors take place if all stepover are identical. To calculate the stepover, divide 0.49 in the example by the number of stepovers -  $0.49 / 3 = 0.163$ ,  $0.49 / 4 = 0.1225$ ,  $0.49 / 5 = 0.098$ . Four stepovers of 0.1225 each were selected for the right pocket. Similar calculation is done to calculate the other axis movement.

During machining, changes would be time consuming to implement. Plan carefully, so the toolpaths in the program are right the first time.

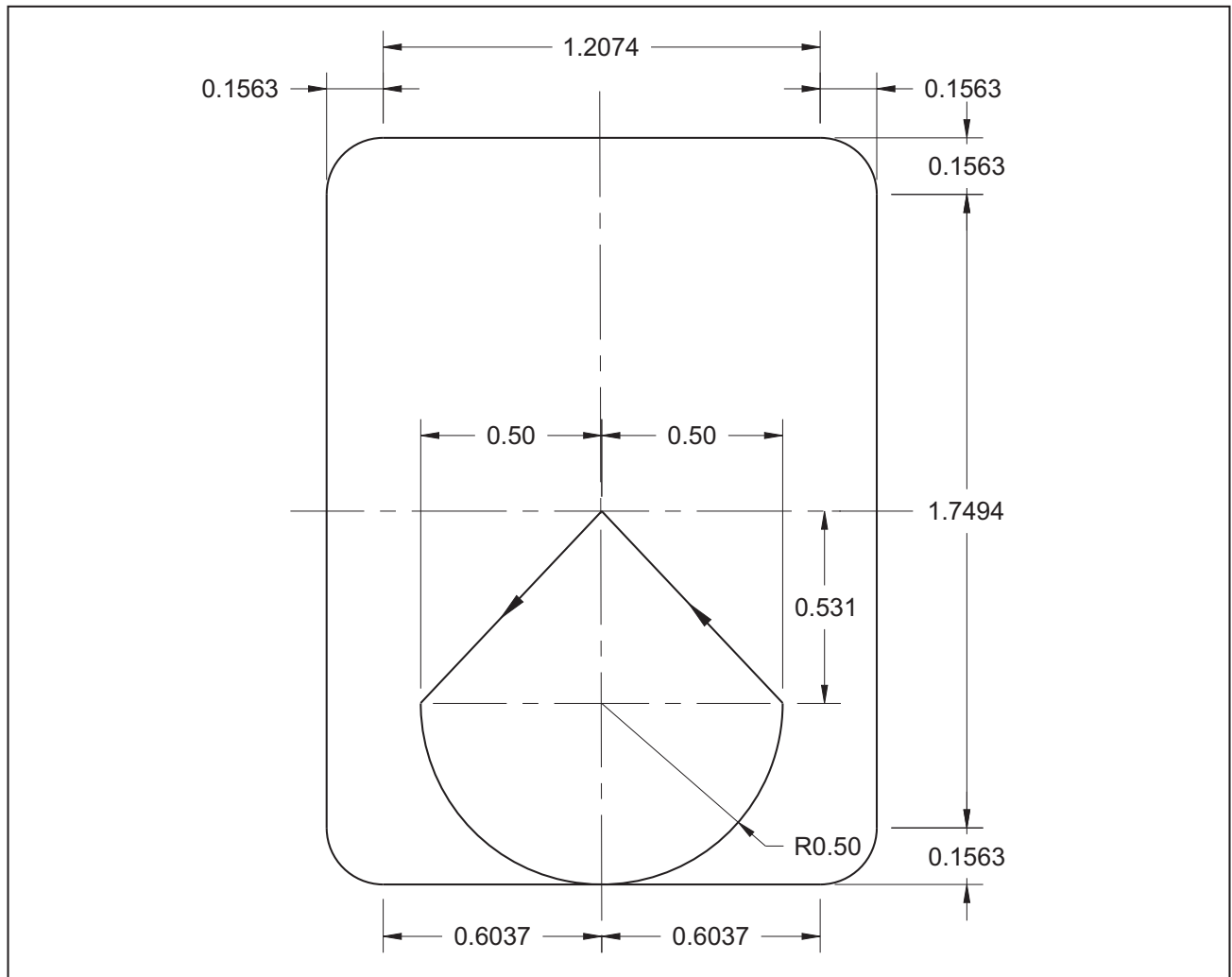
➡ For the finishing, the pocket middle point may be used, or any other suitable position - the left pocket is illustrated below:



If the pocket is large, and the middle point is too far, start closer to the pocket walls. For semi-finishing and finishing, use cutter radius offset. As rule, never start in the pocket corner, always at a middle point of any wall. If the pocket is small, pay particular attention to the lead-in and lead-out radius - it must always be greater than the cutter radius, as stored in the control registry.

If the pocket bottom has to be finished as well, make sure the bottom is completely done before the final contour is machined.

- ➡ For the finishing, the pocket middle point may be used, or any other suitable position - the right pocket is illustrated below:



- ➡ The complete CNC program is listed next:

```
(33-05 - 2 POCKETS)
(SIMPLE VMC - FANUC 0-M CONTROL - LIMITED FEATURES - TOOLS AND OFFSETS:)
(T01 - 1/2 DIA ROUGH END MILL      H01 - TOOL LENGTH OFFSET)
(T02 - 1/4 DIA FINISH END MILL     H02 - TOOL LENGTH OFFSET)
(H22 - RADIUS OFFSET FOR ROUGHING   0.130 SUGGESTED)
(H23 - RADIUS OFFSET FOR FINISHING  0.125 SUGGESTED)

(MAIN PROGRAM)
(X0Y0 AT THE UPPER LEFT CORNER - Z0 AT THE TOP OF WORK)
N5 G20 G40 G80 G17 G49
N10 M06 T01
N15 G90 G54 G00 X1.25 Y-1.51 S450 M03
N20 G43 Z0.25 H01 M08
N25 G01 Z0 F5.0
N30 M98 P047001 (M98 P7001 L4)      (ROUGH LEFT POCKET - REPEAT 4 TIMES)
N35 G90 G00 Z0.25
N40 X3.26 Y-1.531
N45 G01 Z0 F5.0
N50 M98 P047002 (M98 P7002 L4)      (ROUGH RIGHT POCKET - REPEAT 4 TIMES)
N55 G90 G00 Z0.25 M09
N60 G28 Z0.25 M05
N65 M01
```

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N70 M06 T02
N75 G90 G54 G00 X3.26 Y-1.531 S950 M03
N80 G43 Z0.1 H02 M08
N85 M98 P7004 (SEMI-FINISH AND FINISH RIGHT POCKET)
N90 G00 X1.25 Y-1.51
N95 M98 P7003 (SEMI-FINISH AND FINISH LEFT POCKET)
N100 G28 Z0.1 M09
N105 G28 X1.25 Y-1.51 M05
N110 M30
%

O7001 (SUBPROGRAM FOR ROUGHING THE LEFT POCKET)
(CALL SUBPROGRAM AT XY POCKET CENTER AND Z0 AS M98 P047001)
N5 G91 G01 Z-0.08 F1.0 (0.08 INCREMENTAL DEPTH 4 TIMES TO 0.3200)
N10 X0.12 F3.0 (ROUGH PASS 1 OF 4)
N15 Y0.185
N20 X-0.24
N25 Y-0.37
N30 X0.24
N35 Y0.185
N40 X0.12 (ROUGH PASS 2 OF 4)
N45 Y0.37
N50 X-0.48
N55 Y-0.74
N60 X0.48
N65 Y0.37
N70 X0.12 (ROUGH PASS 3 OF 4)
N75 Y0.555
N80 X-0.72
N85 Y-1.11
N90 X0.72
N95 Y0.555
N100 X0.12 (ROUGH PASS 4 OF 4)
N105 Y0.74
N110 X-0.96
N115 Y-1.48
N120 X0.96
N125 Y0.74
N130 X-0.48 (RETURN TO POCKET CENTER)
N135 M99
%

O7002 (SUBPROGRAM FOR ROUGHING THE RIGHT POCKET)
(CALL SUBPROGRAM AT XY POCKET CENTER AND Z0 AS M98 P047002)
N5 G91 G01 Z-0.08 F1.0 (0.08 INCREMENTAL DEPTH 4 TIMES TO 0.3200)
N10 X0.1225 F3.0 (ROUGH PASS 1 OF 4)
N15 Y0.19
N20 X-0.245
N25 Y-0.38
N30 X0.245
N35 Y0.19
N40 X0.1225 (ROUGH PASS 2 OF 4)
N45 Y0.38
N50 X-0.49
N55 Y-0.76
N60 X0.49
N65 Y0.38
N70 X0.1225 (ROUGH PASS 3 OF 4)
N75 Y0.57
N80 X-0.735
N85 Y-1.14
N90 X0.735
N95 Y0.57
N100 X0.1225 (ROUGH PASS 4 OF 4)
N105 Y0.76
N110 X-0.98
N115 Y-1.52
N120 X0.98
N125 Y0.76
N130 X-0.49 (RETURN TO POCKET CENTER)
N135 M99
%
```

```

O7003 (LEFT POCKET SEMIFINISH AND FINISH)
(CALL SUBPROGRAM AT XY POCKET CENTER AS M98 P7003)
N5 G90 G01 Z-0.32 F3.0
N10 G91 G41 X-0.5 Y-0.51 H22 (H22 - SEMI-FINISHING)
N15 M98 P7005 (CALL COMMON SUB FOR SEMI-FINISH - LEFT POCKET)
N20 G41 X-0.5 Y-0.51 H23 (H23 - FINISHING)
N25 M98 P7005 (CALL COMMON SUB FOR FINISH - LEFT POCKET)
N30 G90 G00 Z0.1
N35 M99
%

O7004 (RIGHT POCKET SEMIFINISH AND FINISH)
(CALL SUBPROGRAM AT XY POCKET CENTER AS M98 P7004)
N5 G90 G01 Z-0.32 F3.0
N10 G91 G41 X-0.5 Y-0.531 H22 (H22 - SEMI-FINISHING)
N15 M98 P7006 (CALL COMMON SUB FOR SEMI-FINISH - RIGHT POCKET)
N20 G41 X-0.5 Y-0.531 H23 (H23 - FINISHING)
N25 M98 P7006 (CALL COMMON SUB FOR FINISH - RIGHT POCKET)
N30 G90 G00 Z0.1
N35 M99
%

O7005 (LEFT POCKET - COMMON TOOL PATH FOR SEMI-FINISH AND FINISH)
N5 G03 X0.5 Y-0.5 R0.5
N10 G01 X0.5937
N15 G03 X0.1563 Y0.1563 R0.1563
N20 G01 Y1.7074
N25 G03 X-0.1563 Y0.1563 R0.1563
N30 G01 X-1.1874
N35 G03 X-0.1563 Y-0.1563 R0.1563
N40 G01 Y-1.7074
N45 G03 X0.1563 Y-0.1563 R0.1563
N50 G01 X0.5937
N55 G03 X0.5 Y0.5 R0.5
N60 G01 G40 X-0.5 Y0.51
N65 M99
%

O7006 (RIGHT POCKET - COMMON TOOL PATH FOR SEMI-FINISH AND FINISH)
N5 G03 X0.5 Y-0.5 R0.5
N10 G01 X0.6037
N15 G03 X0.1563 Y0.1563 R0.1563
N20 G01 Y1.7494
N25 G03 X-0.1563 Y0.1563 R0.1563
N30 G01 X-1.2074
N35 G03 X-0.1563 Y-0.1563 R0.1563
N40 G01 Y-1.7494
N45 G03 X0.1563 Y-0.1563 R0.1563
N50 G01 X0.6037
N55 G03 X0.5 Y0.5 R0.5
N60 G01 G40 X-0.5 Y0.531
N65 M99
%

```