

3.4 Elongated holes on a circle - LONGHOLE



Programming

LONGHOLE (RTP, RFP, SDIS, DP, DPR, NUM, LENG, CPA, CPO, RAD, STA1, INDA, FFD, FFP1, MID)



Parameters

RTP	real	Retraction plane (absolute)
RFP	real	Reference plane (absolute)
SDIS	real	Safety clearance (enter without sign)
DP	real	Elongated hole final drilling depth (absolute)
DPR	real	Elongated hole final drilling depth relative to reference plane (enter without sign)
NUM	int	Number of elongated holes
LENG	real	Length of elongated hole (enter without sign)
CPA	real	Center point of circle, abscissa (absolute)
CPO	real	Center point of circle, ordinate (absolute)
RAD	real	Radius of circle (enter without sign)
STA1	real	Initial angle
INDA	real	Indexing angle
FFD	real	Feedrate for depth infeed
FFP1	real	Feedrate for surface machining
MID	real	Maximum infeed depth for infeed (enter without sign)



The cycle requires a milling cutter with an "end tooth cutting over center" (DIN 844).

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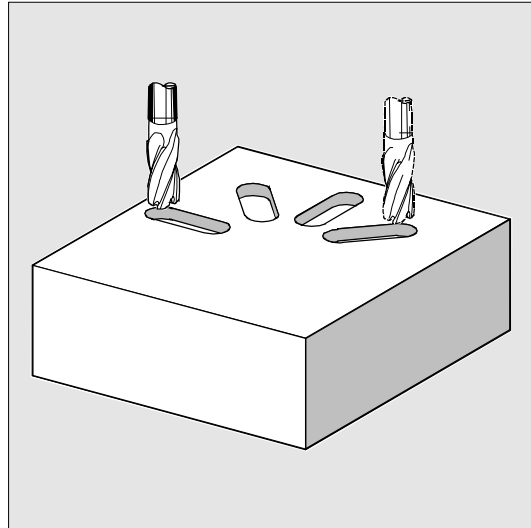


Function

Elongated holes arranged on a circle can be machined with this cycle. The longitudinal axis of the elongated holes is arranged radially.

Unlike the slot, the width of the elongated hole is determined by the diameter of the tool.

To avoid unnecessary travel, the cycle calculates the most optimum path. If several depth infeed movements are required to machine an elongated hole, the infeed is performed at alternate end points. The path to be traversed in the plane along the longitudinal axis of the elongated hole changes direction after every infeed. The cycle automatically looks for the shortest path when changing to the next elongated hole.





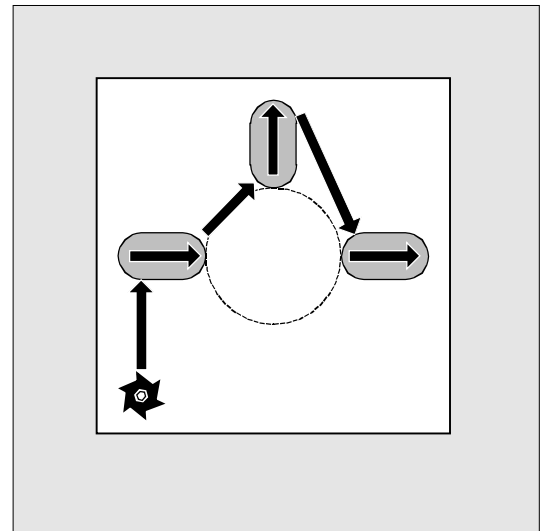
Sequence of operations

Position reached prior to cycle start:

The starting position can be any position from which each of the elongated holes can be approached without collision.

The cycle implements the following motion sequence:

- The starting position of a cycle is approached with G0. The nearest end point of the first elongated hole to be machined is approached in both axes of the current plane at the retraction plane level in the applicator of this plane and then lowered in the applicator to the reference plane brought forward by the safety clearance.
- Each elongated hole is milled in a reciprocating movement. Machining is performed in the plane with G1 and the feedrate programmed under FFP1. At each reversal point, the infeed to the next machining depth calculated by the cycle is performed with G1 and the feedrate FFD until the final depth is reached.
- Retraction to the retraction plane with G0 and approach to the next elongated hole along the shortest path.
- When the last elongated hole has been machined, the tool is traversed from the last position reached in the machining plane to the retraction plane with G0 and the cycle is terminated.





Description of parameters

See Section 2.1.2. (Drilling, Centering – CYCLE81) for a description of parameters RTP, RFP, SDIS. See Section 3.2 for cycle setting data _ZSD[1].

DP and DPR (elongated hole depth)

The elongated hole depth can be defined as either absolute (DP) or relative (DPR) to the reference plane. If it is entered as a relative value, the cycle automatically calculates the correct depth on the basis of the positions of the reference and retraction planes.

NUM (number)

The number of elongated holes is determined with the parameter NUM.

LENG (elongated hole length)

The elongated hole length is programmed under LENG.

If it is detected during the cycle run that this length is less than the cutter diameter, then the cycle is aborted with alarm 61105 "Cutter radius too large".

MID (infeed depth)

The maximum infeed depth is defined with this parameter.

The depth infeed is performed by the cycle in equally sized infeed steps.

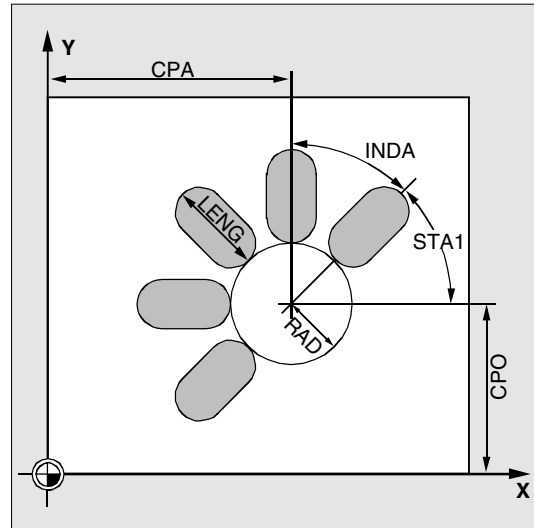
Using MID and the total depth, the cycle automatically calculates this infeed which lies between 0.5 x maximum infeed depth and the maximum infeed depth.

The minimum possible number of infeed steps is used as the basis. _MID=0 means that the cut to pocket depth is made with one infeed.

The depth infeed commences at the reference plane moved forward by the safety clearance (as a function of _ZSD[1]).

FFD and FFP1 (feedrate depth and plane)

Feedrate FFP1 is active for all traversing movements performed in the plane at feedrate. FFD is active for infeeds that are perpendicular to this plane.



CPA, CPO and RAD (center point and radius)

The position of the circle in the machining plane is defined by the center point (parameters CPA and CPO) and the radius (parameter RAD). Only positive values are permissible for the radius.

STA1 and INDA (start angle and indexing angle)

The arrangement of the elongated holes around the circle is defined by these parameters.

If INDA=0 the indexing angle is calculated from the number of elongated holes so that they are equally distributed around the circle.

**Further notes**

A tool offset must be activated before the cycle is called. Otherwise the cycle is aborted and alarm 61000 "No tool offset active" is output.

If incorrect values are assigned to the parameters that determine the arrangement and size of the elongated holes and thus cause mutual contour violation of the elongated holes, the cycle is not started. The cycle is aborted after the error message 61104 "Contour violation of slots/elongated holes" is output.

During the cycle, the workpiece coordinate system is shifted and rotated. The values in the workpiece coordinate system are displayed on the actual value display as if the longitudinal axis of the elongated hole being machined were positioned on the first axis of the current machining plane.

When the cycle is completed, the workpiece coordinate system is again in the same position as it was before the cycle was called.

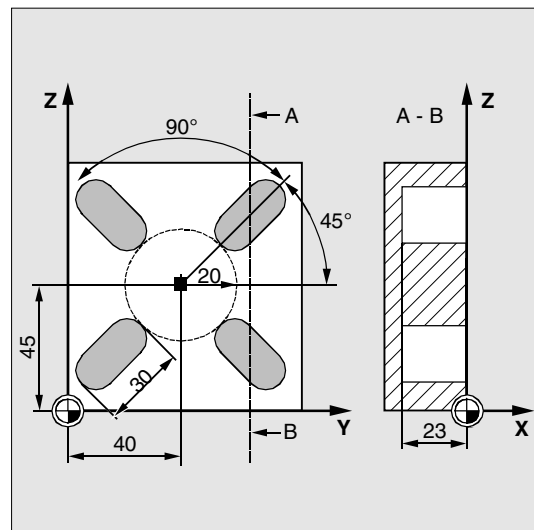
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Programming example

Machining elongated holes

With this program you can machine 4 elongated holes 30 mm in length and with a relative depth of 23 mm (difference between the reference plane and the base of the elongated hole) that lie in a circle with the center point Z45 Y40 and a radius of 20 mm in the YZ plane. The initial angle is 45 degrees, the indexing angle is 90 degrees. The maximum infeed depth is 6 mm, the safety clearance is 1 mm.



```
N10 G19 G90 D9 T10 S600 M3
```

Specification of technology values

```
N20 G0 Y50 Z25 X5
```

Approach starting position

```
N30 LONGHOLE (5, 0, 1, , 23, 4, 30, ->  
-> 40, 45, 20, 45, 90, 100 ,320, 6)
```

Cycle call

```
N40 M30
```

End of program

-> Must be programmed in a single block