Technical Information

Thread production with thread milling cutters and their advantages

Thread milling is like thread cutting in that it is a chip forming production process. A major benefit of thread milling is the size of the thread to be produced, as the cost of taps in large dimensions can question the economic efficiency of the production process. Furthermore, with larger diameters thread cutting requires more power from the machine tool. The possibility of machining materials with a higher tensile strength or hardness can also be a decisive factor in choosing thread milling.

With conventional thread cutting the thread is produced from the image of the tool profile, conditional on the chamfer lead for the workpiece. In contrast, with thread milling the thread is produced via a series of cutting paths by the milling cutter, whereby the pitch is generated by the machine. The thread mill makes numerous passes through the axis section of a thread during a spiral motion in axial tool-workpiece direction and thereby interpolates the contour of the thread.

A major factor is that cutting speeds and feed rates can be chosen independently of each other. Chip formation and tool loading can be considerably influenced via these setting parameters. A feature of the process is the formation of short, comma shaped chips in contrast to thread cutting.

To detach the chips, the direction of rotation of the machine spindle does not need to be reversed. The tools applied have a thread profile without pitch. Initially, the thread milling cutter is lowered along the hole axis to the required thread depth. In the approach cycle the thread milling cutter is plunged to the nominal diameter of the thread.

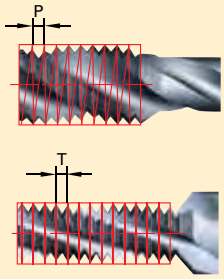
The thread is produced by a 360° circular interpolation. Finally, in the exit cycle the thread milling cutter is radially returned to the hole axis and then axially withdrawn from the thread.

A thread milling cutter can produce threads of varying diameters (or tolerances) with the same pitch. Right- or left-handed threads can be produced with the one tool. As thread milling produces only short chips, chip evacuation does not cause any problems.

With thread milling, an identical tool geometry can be applied for a multitude of materials. This considerably limits the multiplicity of tools required. In contrast to thread cutting, thread milling produces a complete thread which is virtually the total length of the applied tool.

Comparison of tool design between taps/thread milling cutters

In contrast to a tap, which basically consists of a single spiral shaped tooth, the series of teeth of a thread milling cutter do not form a spiral but are configured without pitch. This fundamental difference in tool design is attributed to the different processes which have already been described in an earlier chapter.



Tap
The pitch P is produced by the tap/fluteless tap.

Milling cutter
The pitch P is produced by CNC control circular program)

Dimensions and cutting section measurements

Apart from the thread pitch of the tool, the design of a thread milling cutter is principally very similar to that of a tap. Thread milling cutters are also characterized by dimensions and the size of the cutting section. The thread length l_2 and the total length l_1 are also part of the dimensions.

The different design forms incorporate milling cutters with or without collar as well as with or without countersinking chamfer. The cutting section sizes of a thread milling cutter consist of the flute length l_4, the flute profile, the tooth with Z_b and the relief S. As with a tap, the flute length also incorporates the run-out of the flutes. They do not have to be as large as the flutes of a tap, as this machining process produces smaller chips. The chips do not remain in the flutes during the process and do therefore not restrict further chip development. The width of the tooth is therefore larger than with taps. The relief grinding helps to create the clearance angle required for milling cutters.