

Leseprobe

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Operational training · Metal working

Machine-based material processing

Part: Milling



Basic and
specialized
training

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1. General information

This textbook is part of the METINA method-integrated training model developed by RAG Aktiengesellschaft.

The concept includes the following documents for the main training phases, as specified in the industrial training regulations:

- **Trainer manual**
- **Library (textbook and slides)**
- **Trainee documentation**

In line with the training specifications, this course teaches practical skills and knowledge.

This Milling section is an integral part of the "Machine-based material processing" training section.

Other courses in this training section are:

- ▶ Turning
- ▶ Grinding

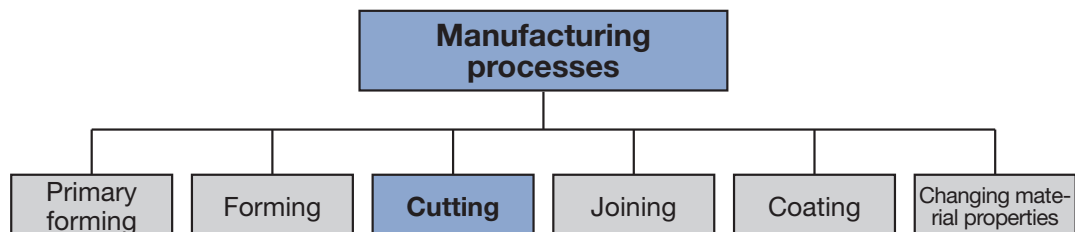
Each course is self-contained and teaches the practical skills, knowledge and typical patterns of behaviour that are required of industrial mechanics following the vocational training plan. Using selected exercises, trainees will learn basic skills and improve their working techniques. Selected practical exercises from the Turning and Milling sections, as well as additional supply parts, will make it possible to assemble a functional drill stand.

General content from "Machine-based material processing", such as cutting materials, service life, geometric tolerances, surface finish and cooling lubricant, are described in the Turning section.

2. Milling techniques

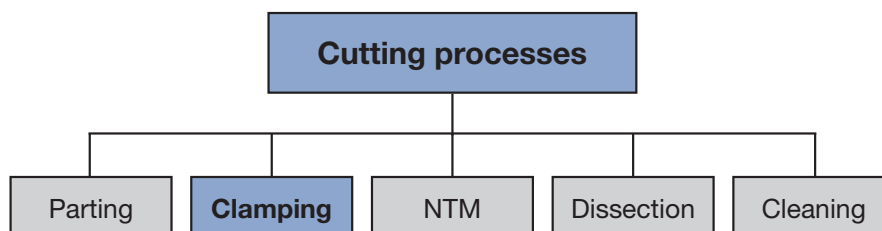
2.1 Manufacturing processes

The manufacturing processes are divided into six main groups according to DIN 8580.



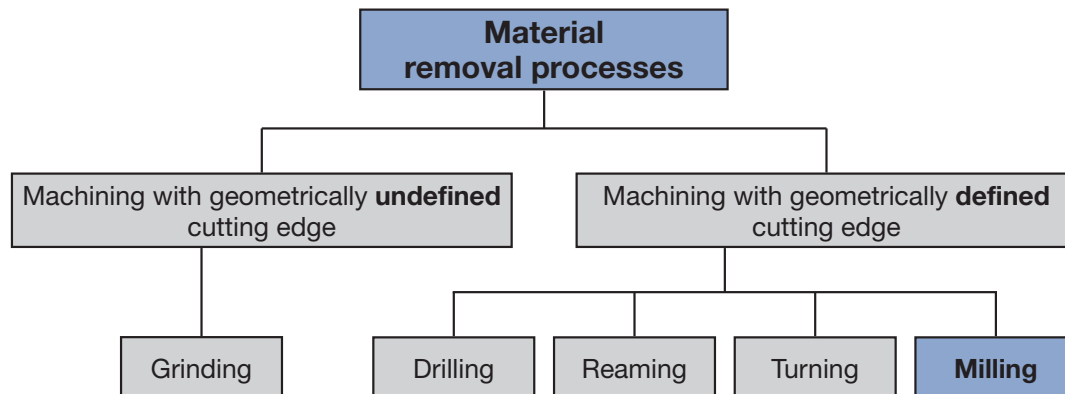
2.2 Cutting processes

Cutting processes are divided into five sub-groups in accordance with DIN 8580.



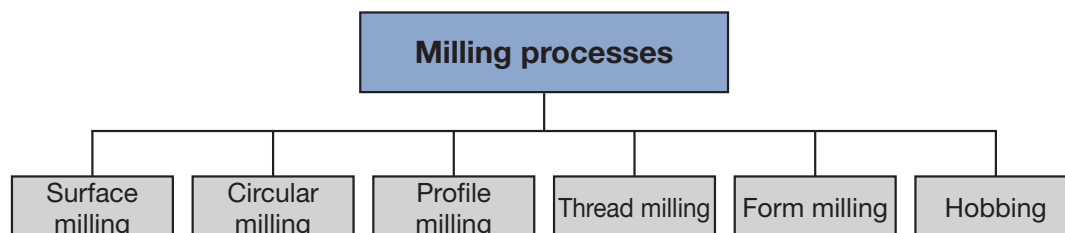
2.3 Material removal processes

Machine-based material removal processes are sub-divided in accordance with DIN 8589 (Part 0) as follows:



2.4 Milling processes

The milling processes are sub-divided in accordance with DIN 8589 (Part 3).



3. General principles

Flat and curved surfaces, such as slots, gears and inverted V-tracks can be manufactured by milling.

For each of these tasks, a specific tool – a "milling cutter" – is required.

In the overview of the material removal processes, it can be seen that milling uses geometrically defined cutting edges. One or more cutting edges can be involved in the removal process at the cutting point.

3.1 Motions on a milling machine

Cutting motion

When milling, material is removed as a result of a circular cutting motion from the milling cutter.

The number of tool revolutions correspond to the set rotational speed (n).

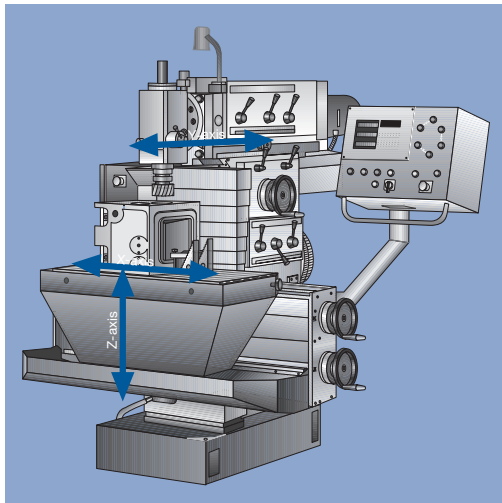
The rotational speed unit is given in rpm.

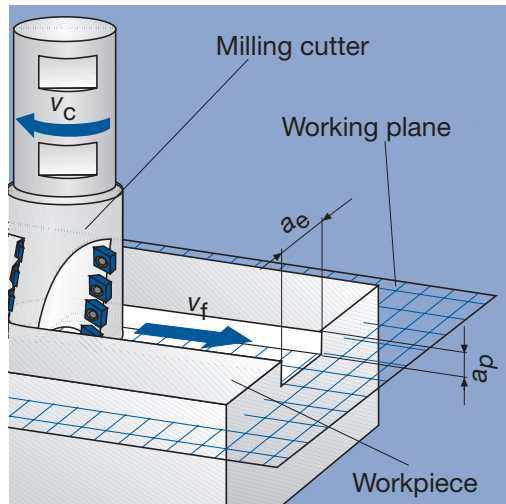
Feed motions

When milling, the workpiece that is to be machined is clamped on the milling machine table.

The table can be moved in various directions using adjustment devices. On vertical milling machines, the height is adjusted by adjusting the Z-axis. The X-axis (longitudinal) and Y-axis (lateral) represent the horizontal position of the workpiece. On the milling machine pictured here, the Y-axis is adjusted via the milling head rather than via the milling machine table.

Either the milling machine table or the milling machine head therefore generates the feed motion. The feed (f) corresponds to the distance travelled by the milling machine table or head in mm/min.





Since not all the milling cutter's cutting edges are removing material at the same time, the feed generated by an individual cutting edge within the overall feed (feed/tooth f_z) must also be considered.

Cutting width

When milling, the infeed of the milling cutter into the workpiece is defined by the cutting depth (a_p) and by the cutting width (a_e). Virtual planes have been added to the figures shown here in order to illustrate the working infeed. Among other things, these figures show the cutting direction of the milling cutter and the feed direction of the workpiece.

The cutting depth (a_p) is usually measured vertically to the working plane. The cutting width (a_e) of the milling cutter runs parallel to the working plane.

