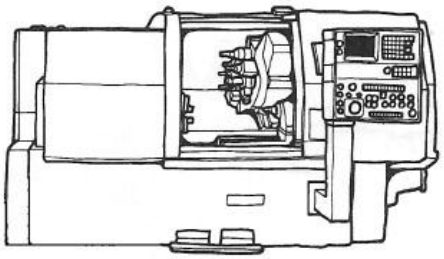
Integral improvement in metal cutting operations

Metal working industries knows various machining operations. And in this article we focus on metal cutting according to DIN 8589 part 1, 2 and 3.

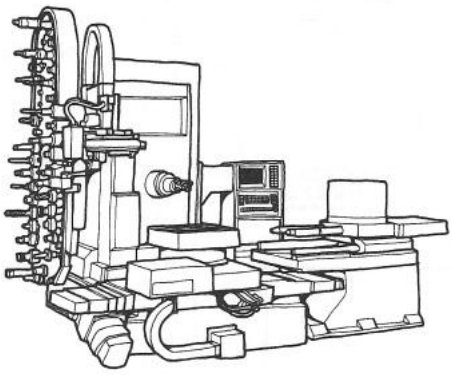
The cutting process on it self is in this article refers to a tooling the feature geometrical determined cutting edes. Like turning, milling, drilling, boring, reaming and threading.

Environments

Part 1.
This is the stationary tooling application to be seen on lathes. And is called turning operations
Meaning that the part to be machined is rotating and the tooling is fixed on a machine adapter were only movements along the workpiece shape is allowed.



Part 2.
Belongs to both the stationary- and rotating applications on lathes and machining centers as well. This operation is better known as drilling into solid material. So the workpiece might be rotating or the tool it self. Even a combination of these two is possible.



Part 3.
Milling is the rotating application in machining centers. The workpiece is fixed on the table of the machine and allowed to move around the simultaneous rotating tooling.

Note: todays machines allow us to combine the above mentioned operations at the same time in one and the same machine. Even with externally connected robots.
Therefore the complexity will elevate even more.

Main parameters in the whole process.

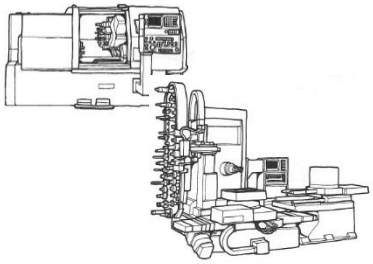
This report enumerates some important production means to be found in all kind of workshops. And were mechanical engineers meet upon the given situation or even unexpected restrictions of the environment were they work.

Keeping this in mind for the moment. Everybody likes to see that the return on investment is working out as planned. And exactly here lies the importance of the possibilities in using ***integral improvement*** or anticipating this. Let's have a closer look at the next shown production means. The ones we all know.

But do we understand the effects of full mutual integration and their effects on out-put

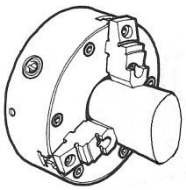
The machine tool. And in what extend does the machine tool choice support:

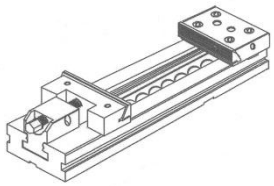
- all the parts and shapes to be machined
- connection to the fixture lay-out
- connection to the tooling types
- features and possibilities given by lubricants
- features and possibilities given by raw materials
- programming methods
- flexibility to change all these later on



The fixture lay-out. How does this support rigidity, reliability and quick set up of products:

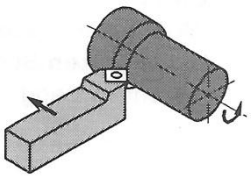
- conventional market standards
- modular design
- universal own factory design
- special compact design
- machine down-time due to variable products

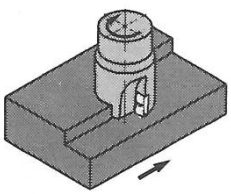




The features of tooling types and their junction to the machine tool:

- conventional market standards
- tailer made
- modular
- type of cutting materials
- Machine down-time due to tool change



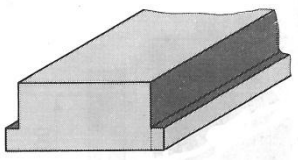


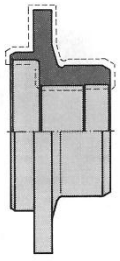
The applied lubricants. And in what extend does these support obtainable cutting parameters:

- chemical features and mechanical wear
- chemical features and diffusion wear
- environment and health issues
- preservation features to the machine tool

The raw materials. How does these support the obtainable product shape and features:

- conventional grades as market standards
- enriched grades as market standard
- solid material
- casted material
- near net shape design





The programming methods. And how these support to the whole process:

- CAD / CAM work station
- statistics on production badges
- simulation work stations
- single stand alone solutions

```
T0101
S6000 M3
G0 X30 Z0.3
G4 X1.5
G0 Z5
X0 Z0.5
G1 F0.36 Z-18
G0 Z1
```

See the next page for enhanced situation

Integral improvement event with advanced cutting materials versus machine rigidity.

Task:
- more products per 8 hour shift by extreme high cutting speeds and feeds on brake disc material EN GJL 400.

Intake research:
- Insert chipping on Si3N4 cutting grade due to machine tool condition at high revolutions.

Measurements on the machine tool:
- modification on spindel bearings and equilibration on chucks with build up special jaws.

Measurements on the cutting grade:
- gradient effect within the inserts by SiC α / β SiALON grade
- higher reliabilty and more wear resistant

Results in shorter machining time per product due to higher chip volume and simular tool live;

Before:
Vc = 650 m/min
fz = 0.25 mm/rev
Ap ≈ 3.5 mm

After:
Vc = 1000 m/min
fz = 0.38 mm/rev
Ap ≈ 3.5 mm

Evaluation meeting

Menno Scheepmaker
July 2012

info@amwsystems.nl
www.amwsystems.nl