Óbuda University

Bánki Donát Faculty of Mechanical and Safety Engineering
Institute of Material Science and Manufacturing Engineering

Manufacturing Engineering 2
BAGGT23NEC

2013/14 I.

Dr. Mikó Balázs
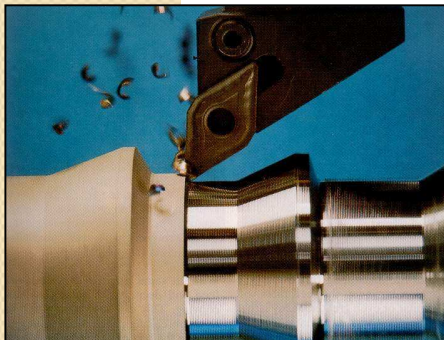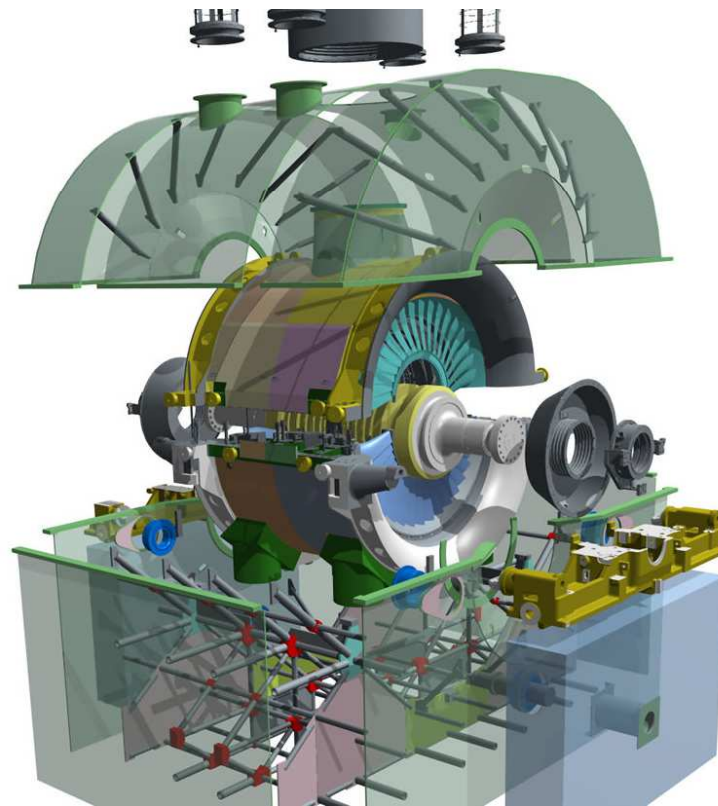miko.balazs@bgk.uni-obuda.hu
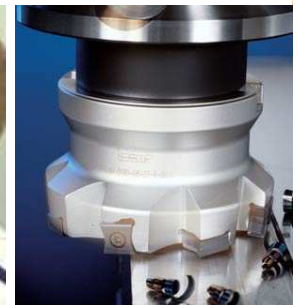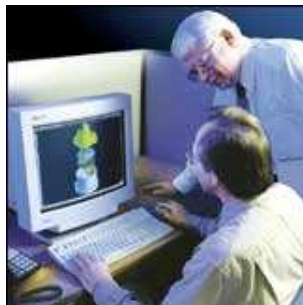
04

MANUFACTURING PROCESS PLANNING

Task of the manufacturing process planning

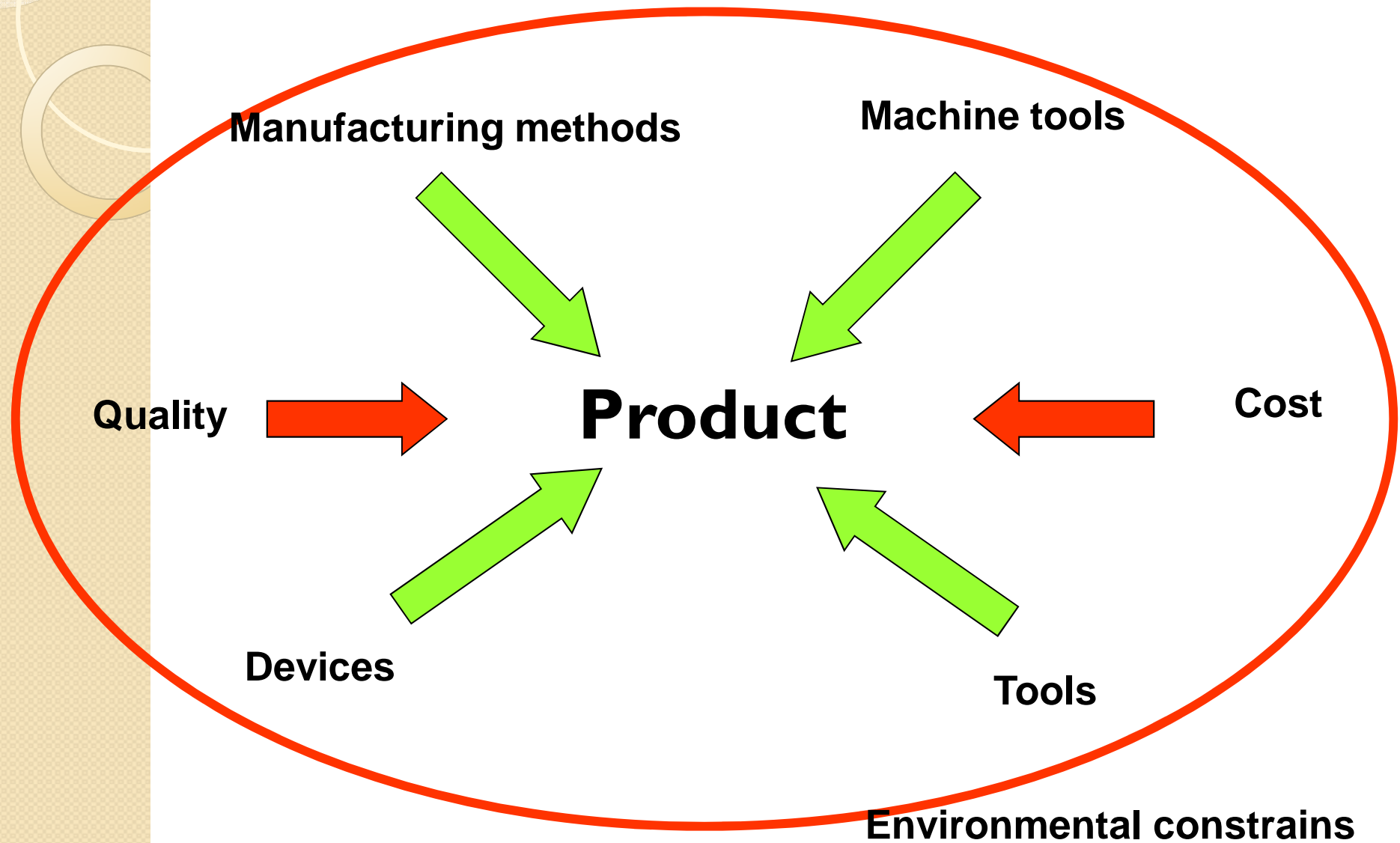Create a manufacturing process for a given (machine) part (product)

Task of the manufacturing process planning

Create the manufacturing documents
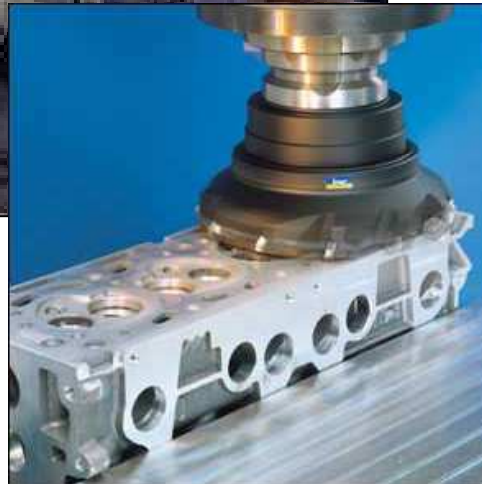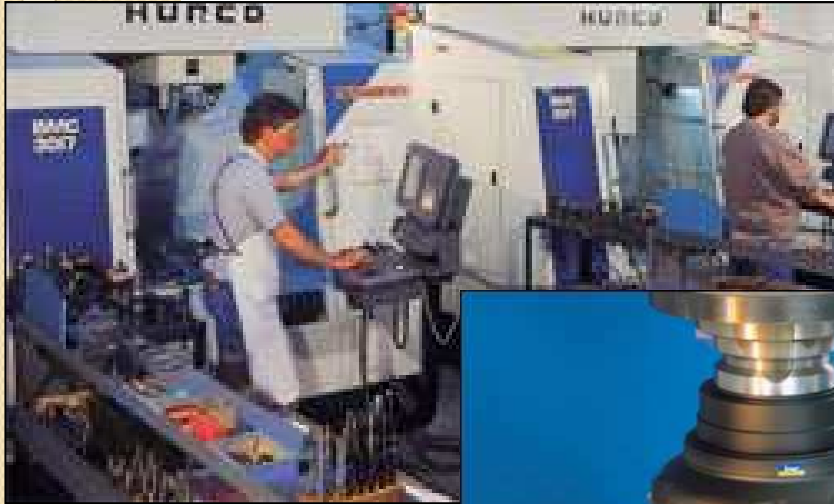
Clear
Definite
Complete

Elements

Manufacturing methods

Machine tools

Quality

Product

Cost

Devices

Tools

Environmental constrains

Engineering Knowledge

Manufacturing

Planning

Elements

```
┌──────────────────┐      ┌──────────────────┐
│      Blank        │      │      Blank        │
│  manufacturing    │      │  manufacturing    │      ...
└──────────────────┘      └──────────────────┘
         │                         │
         ▼                         ▼
┌──────────────────┐      ┌──────────────────┐
│       Part        │      │       Part        │
│  manufacturing    │      │  manufacturing    │      ...
└──────────────────┘      └──────────────────┘
         │                         │
         ▼                         ▼
┌───────────────────────────────────────────────────┐
│                     Assembly                        │
└───────────────────────────────────────────────────┘
```
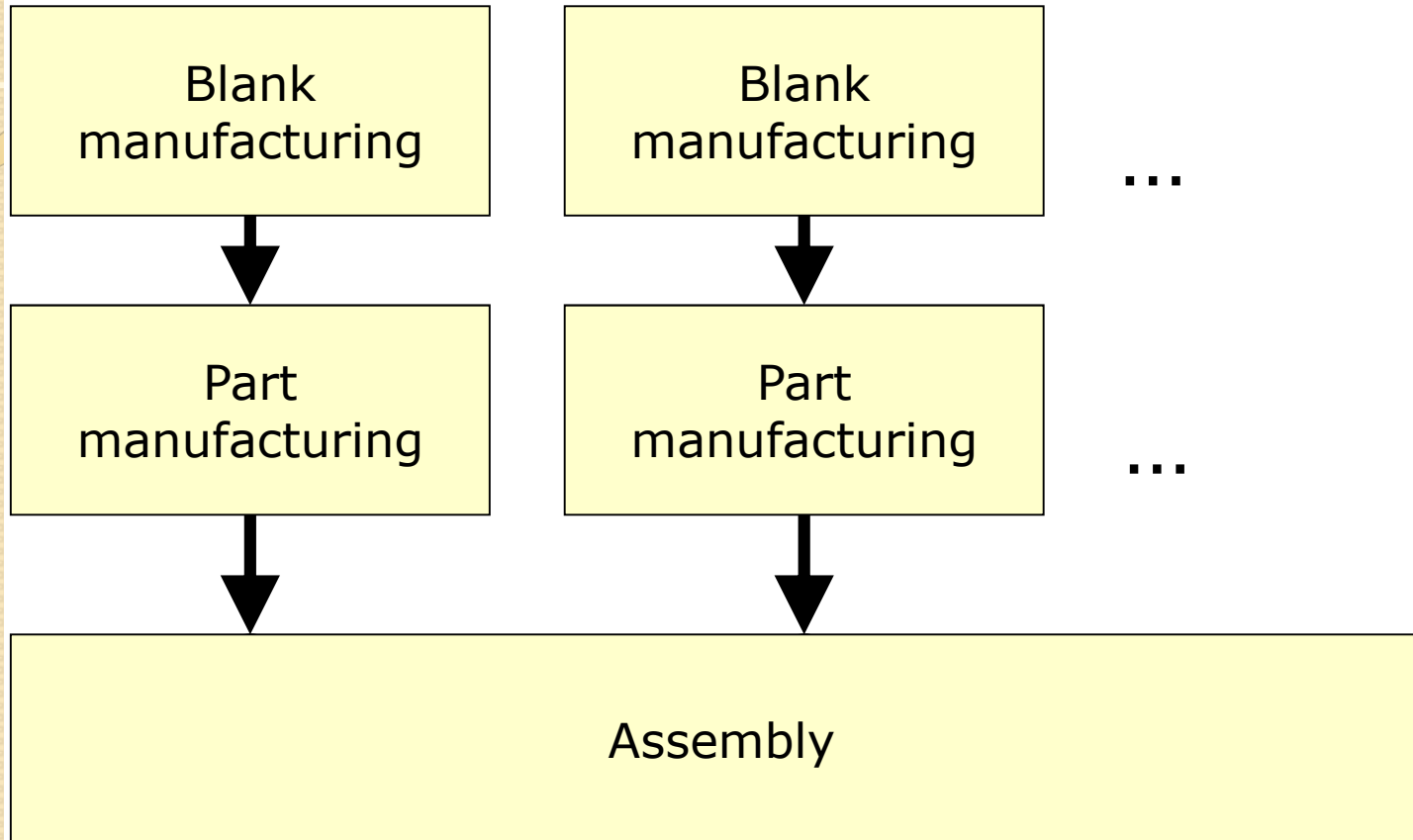
Manufacturing methods

Blank manufacturing

Casting
Forgeing
Welding
Rolling
Punching
Parting

…

Part manufacturing

Turning
Milling
Drilling
Reaming
Grinding
EDM
Coating, Painting
Heat treatment
Cleaning

…

Assembly

Integrate
Adjust
Cleaning
Packaging

…

Definitions

Operation: The independent unit of the manufacturing process. The operation is the basic element of the process planning and the manufacturing scheduling.

In case of cutting: an operation consists of manufacturing steps, which require *same* machine tool and *same* set-up (fixture).
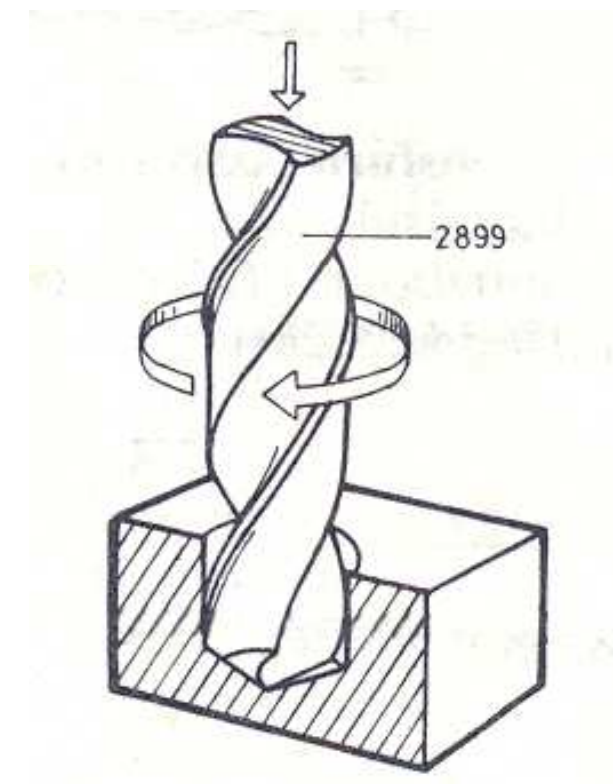
Step: The independent section of the manufacturing operation.

In case of cutting: a step is an independent material removal process done by one tool.

Definitions

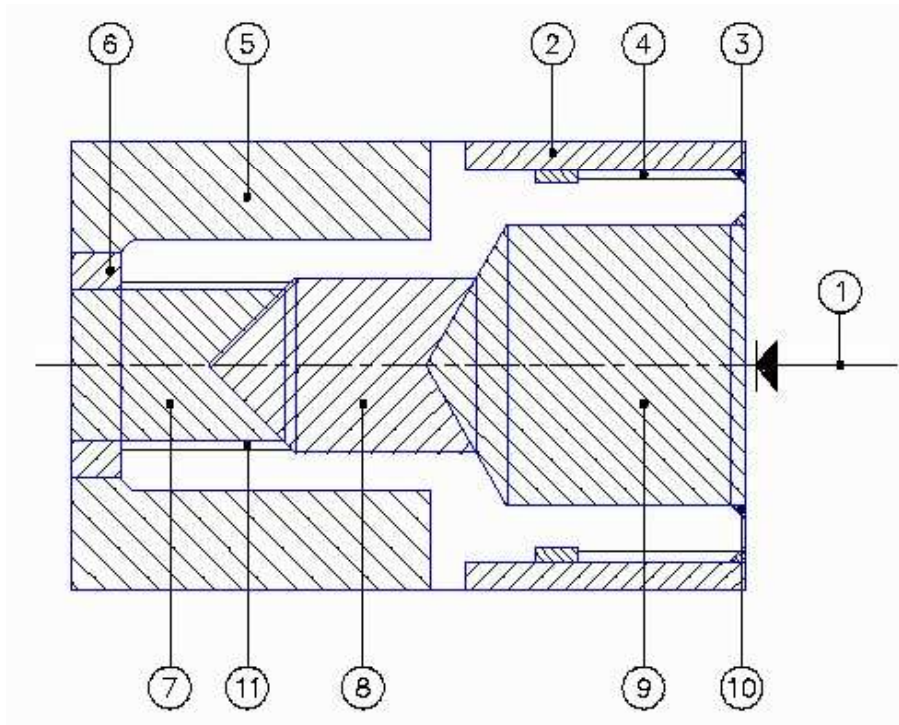**Surface element**: a basic geometrical shape element: plane, cylider, cone, …

Surface group: manufacturing viewpoint

Definitions

Manufacturing requirement: the differences between the raw and finished state of the part.

Manufacturing allowances: geometrical part of the differences

Manufacturing types

	Piece production	Batch production	Mass production
Repetition	Random	Periodical	Continuous
Number of parts	One	Several	Many
Machine tools, tools, devices	Universal	Mixed	Special
Machine lay-out	Workshop based	Mixed	Workflow based
Qualification of the workers	Skilled workers (or engineers)	Unskilled worker	Unskilled worker + Skilled worker (for setup)
Process plan Planning cost	Weak Low	Medium	Deep Expensive
Manufacturing cost per piece	Highest	Medium	Cheap

Mass production index

$$T_f = \frac{Q \cdot T}{I_{mh}} = \frac{Q \cdot \sum_{i=1}^{n} t_i}{\sum_{i=1}^{n} g_i (I_m - I_v)_i}$$

T$_f$:   mass production index

Q: number of required parts (piece / year)

T: required manufacturing time (hour / piece)

I$_{mh}$:   real manufacturing time capacity (hour / year)

t$_i$:   manufacturing time of a manufacturing operation (hour / piece)

g$_i$:   number of machine tool in a workplace

I$_m$:   theoretical manufacturing time capacity of a workplace (hour / year)

I$_v$:   waste time (hour / year)

$0.0 < T_f < 0.2$ Piece produrtion

$0.2 < T_f < 0.4$ Small batch produrtion

$0.4 < T_f < 0.6$ Medium batch produrtion

$0.6 < T_f < 0.8$ High batch produrtion

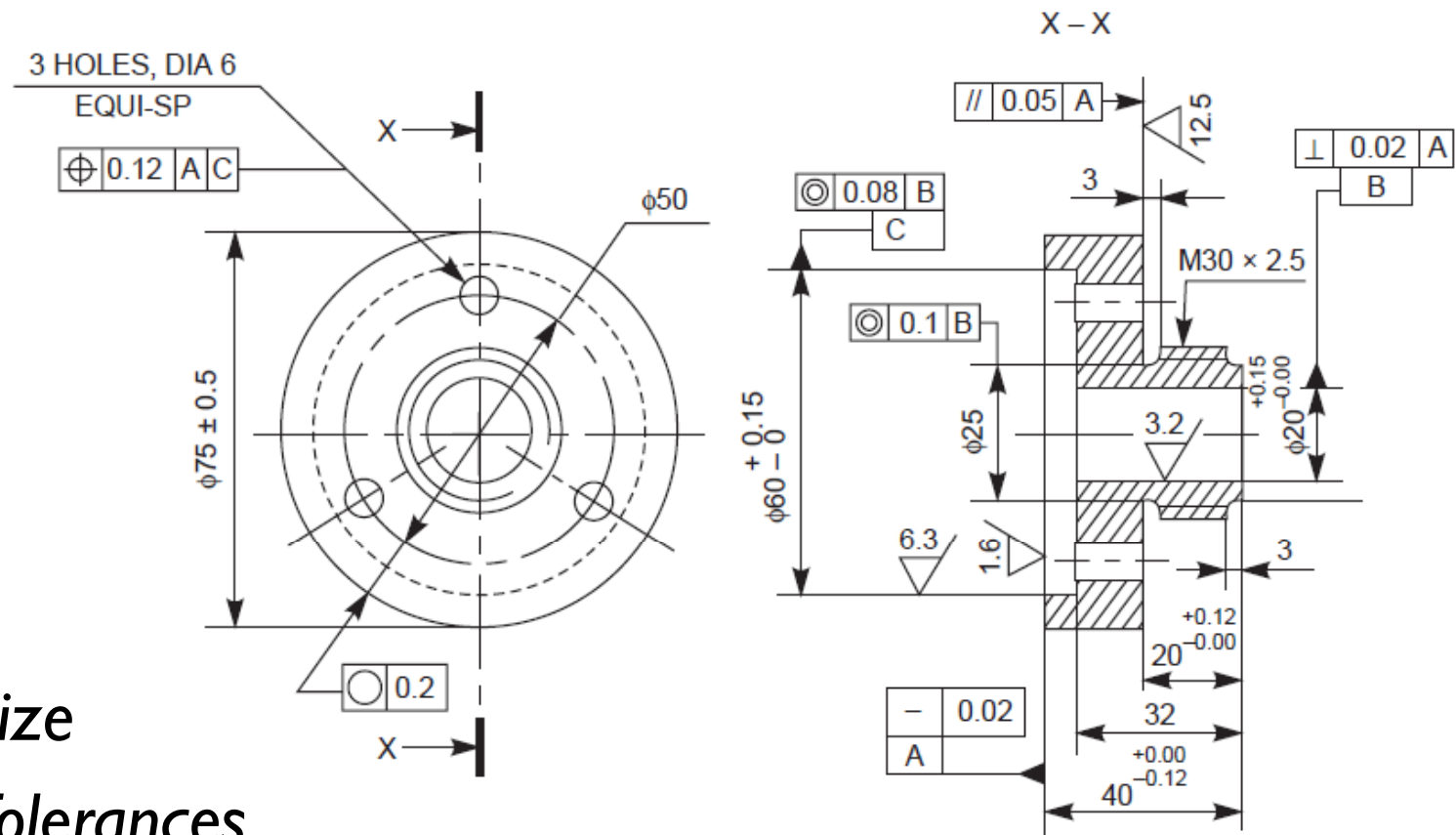$0.8 < T_f < 1.0$ Mass produrtion

Documentation

- Input documents
  - Drawings, BOM, text docs
- Background documents
  - Manufacturing system's data
  - Standards
  - QA
- Manufacturing documents
  - Manufacturing order plan
  - Operation plan
  - Operation instruction
  - Tooling plan

X – X

3 HOLES, DIA 6
EQUI-SP

⊕ | 0.12 | A | C

⌖ | 0.05 | A

12.5

3

⟂ | 0.02 | A
B

φ50

M30 × 2.5

◎ | 0.08 | B
C

◎ | 0.1 | B

φ75 ± 0.5

φ60 $^{+0.15}_{-0}$

φ25

3.2

φ20 $^{+0.15}_{-0.00}$

6.3

1.6

3 × 45°

$20^{+0.12}_{-0.00}$

○ | 0.2

32

– | 0.02
A

$40^{+0.00}_{-0.12}$

09.10.2013. *Miko*	Flywheels
Material: **C45W**	Drw. No.: 142-12-20

Manufacturing analysis

- *Size*
- *Tolerances*
- *Nature, character*
- *Material*
- *Required number*

⟷ Possibilities