Engineering Drawings

Aalto University
School of Engineering

Kaur Jaakma

9.11.2020

Agenda

Part drawings

Assembly drawings

This Week’s Tasks

3.1 Engineering drawing symbols quiz

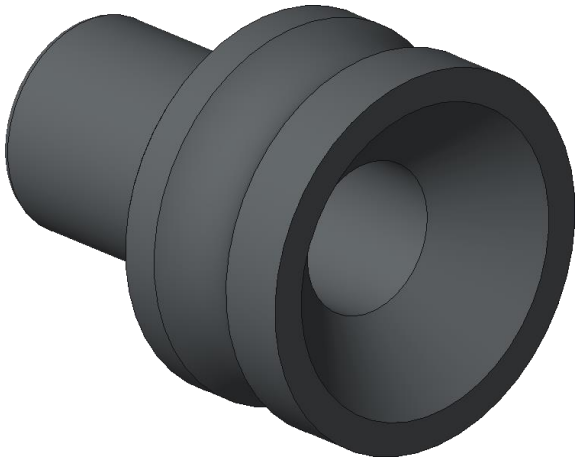
3.2 Part’s engineering drawing

3.3 Assembly’s engineering drawing

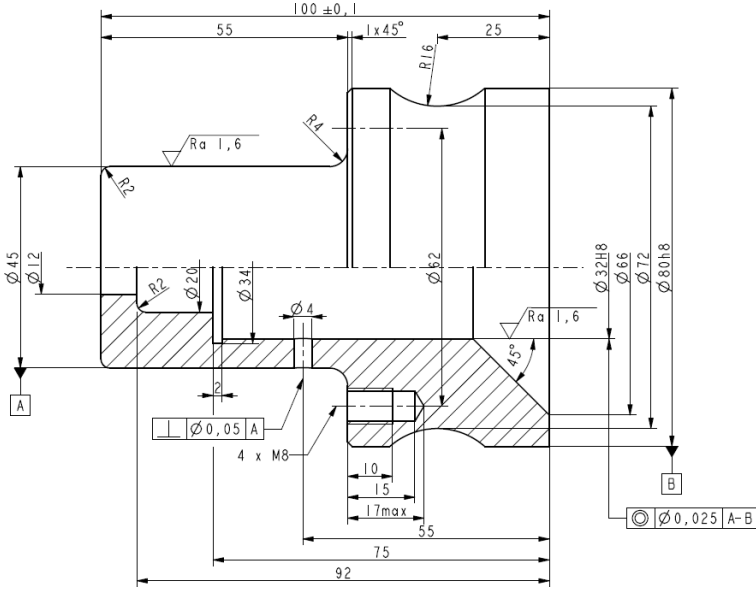
File Types

Drawing file (.drw) is reference to part/assembly file (.prt, .asm)

- Alone not working!



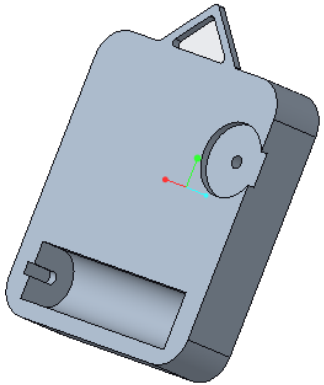
Reference

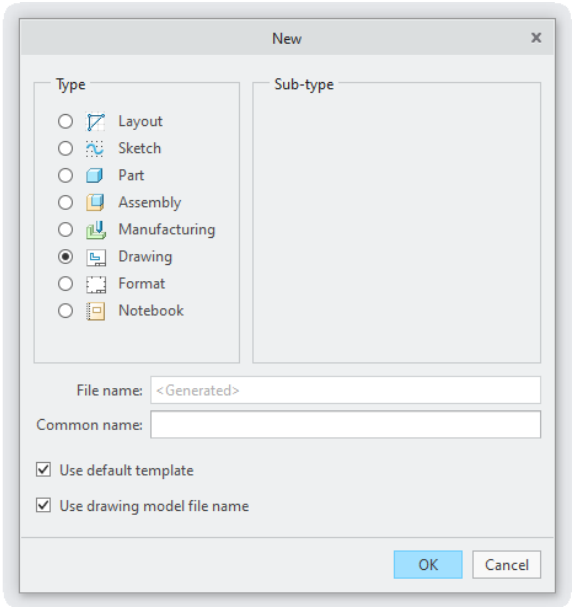


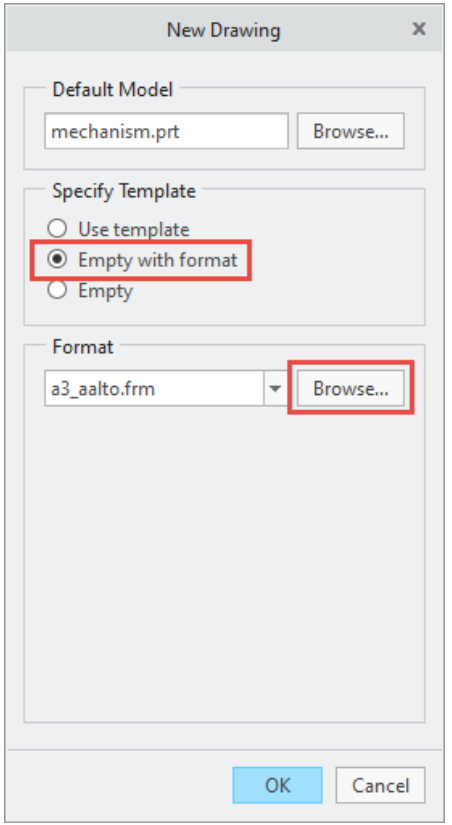
Format file

Predefined template

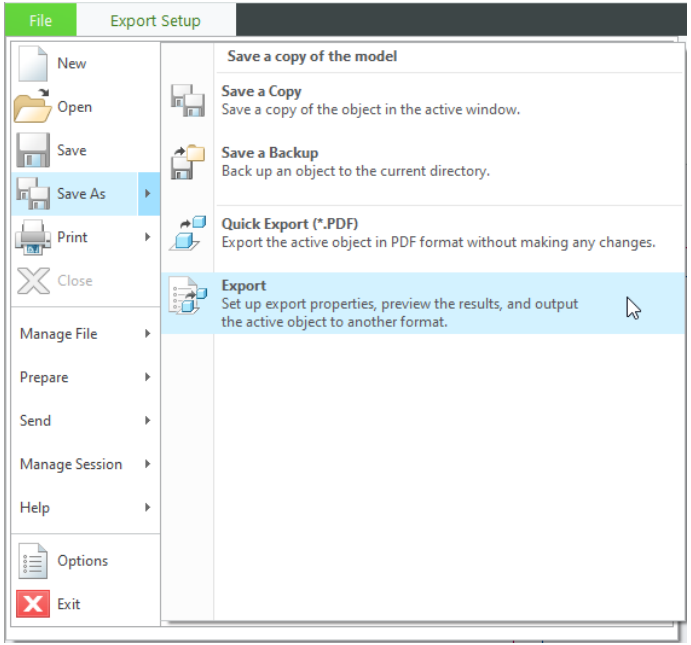
- .frm file

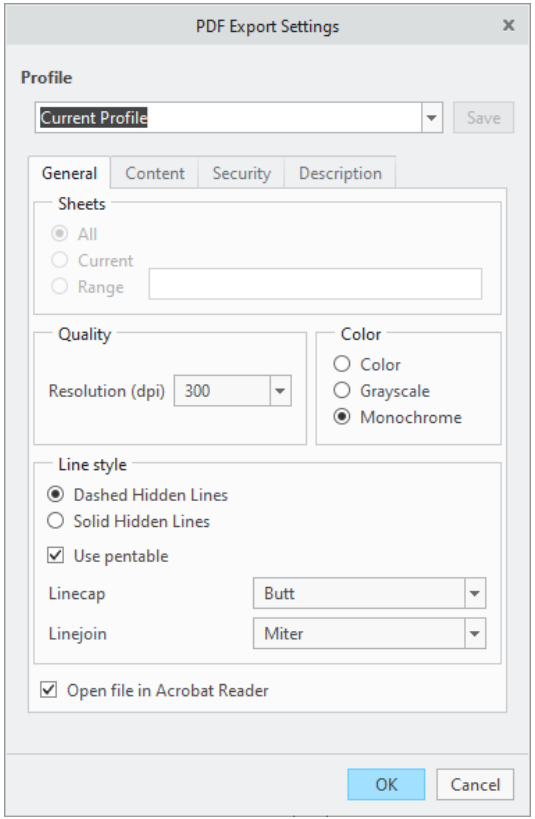






Exporting


File
Export Setup
New
Open
Save
Save As
Print
Close
Manage File
Prepare
Send
Manage Session
Help
Options
Exit
Save a copy of the model
Save a Copy
Save a copy of the object in the active window.
Save a Backup
Back up an object to the current directory.
Quick Export (*.PDF)
Export the active object in PDF format without making any changes.
Export
Set up export properties, preview the results, and output the active object to another format.

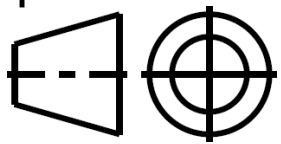

PDF Export Settings
Profile
Current Profile
Save
General
Content
Security
Description
Sheets
All
Current
Range
Quality
Resolution (dpi)
300
Color
Color
Grayscale
Monochrome
Line style
Dashed Hidden Lines
Solid Hidden Lines
Use pentable
Linecap
Butt
Linejoin
Miter
Open file in Acrobat Reader
OK
Cancel

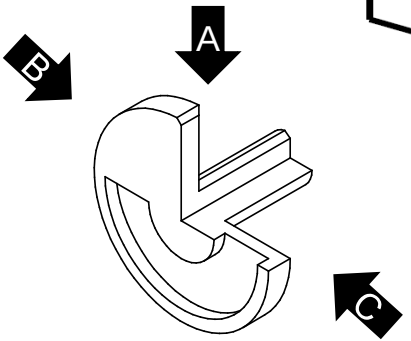
Common Rules

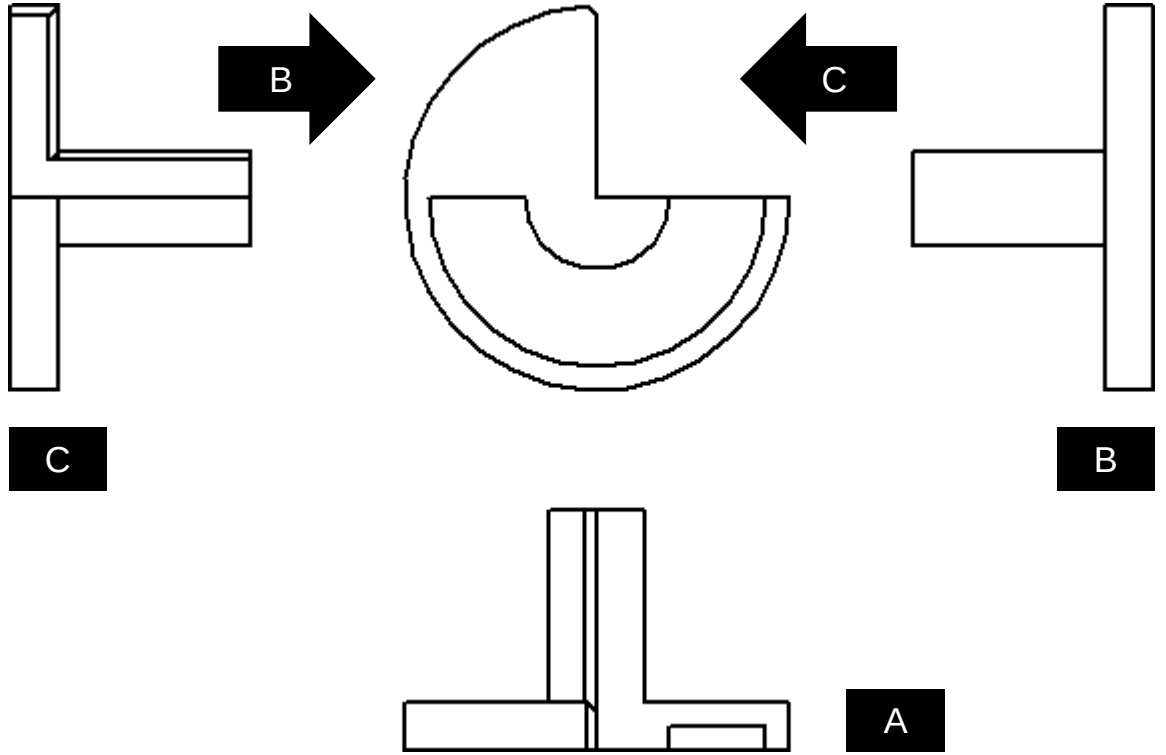
Projection Rules

First angle projection

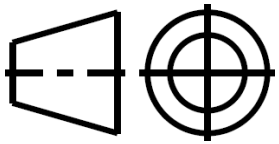
- Generally utilized in Europe







Projection Rules

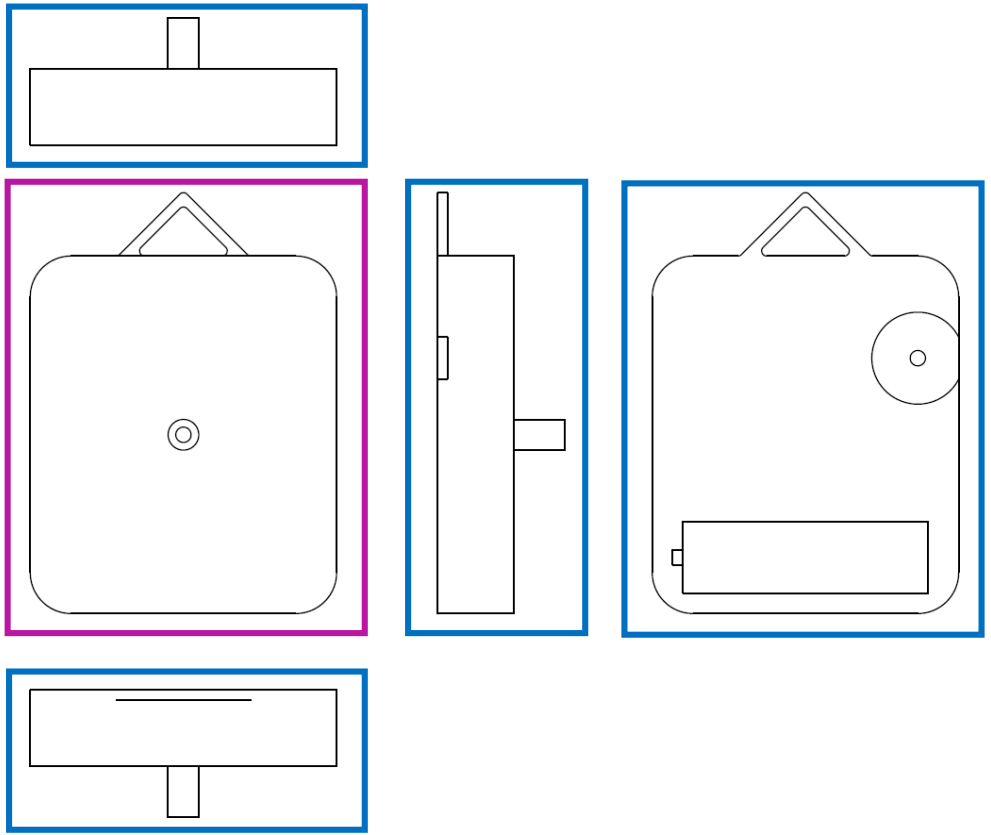


General View

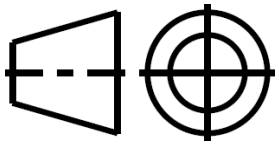
- Main view

Projection View

- Referred to main view
- Follows location

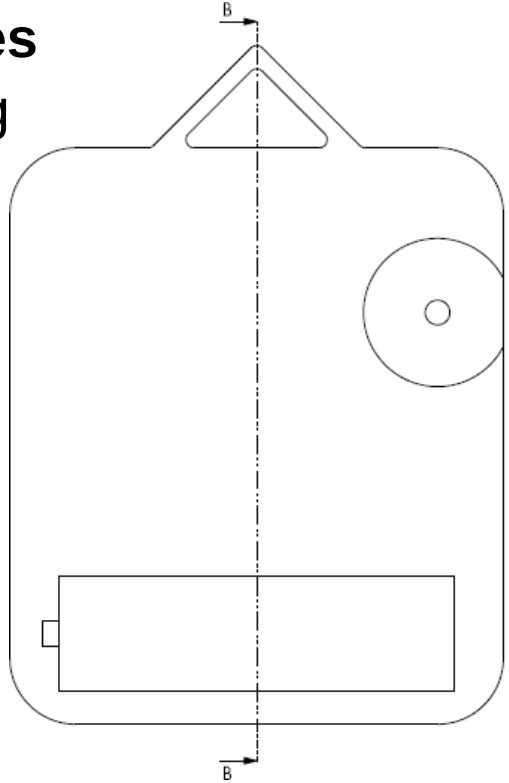


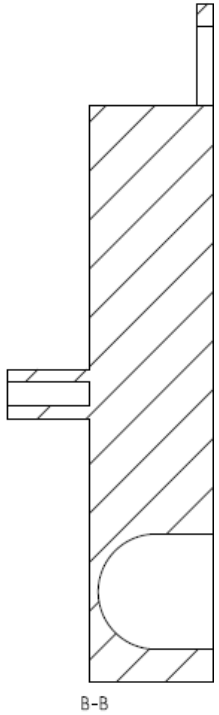
Section Views



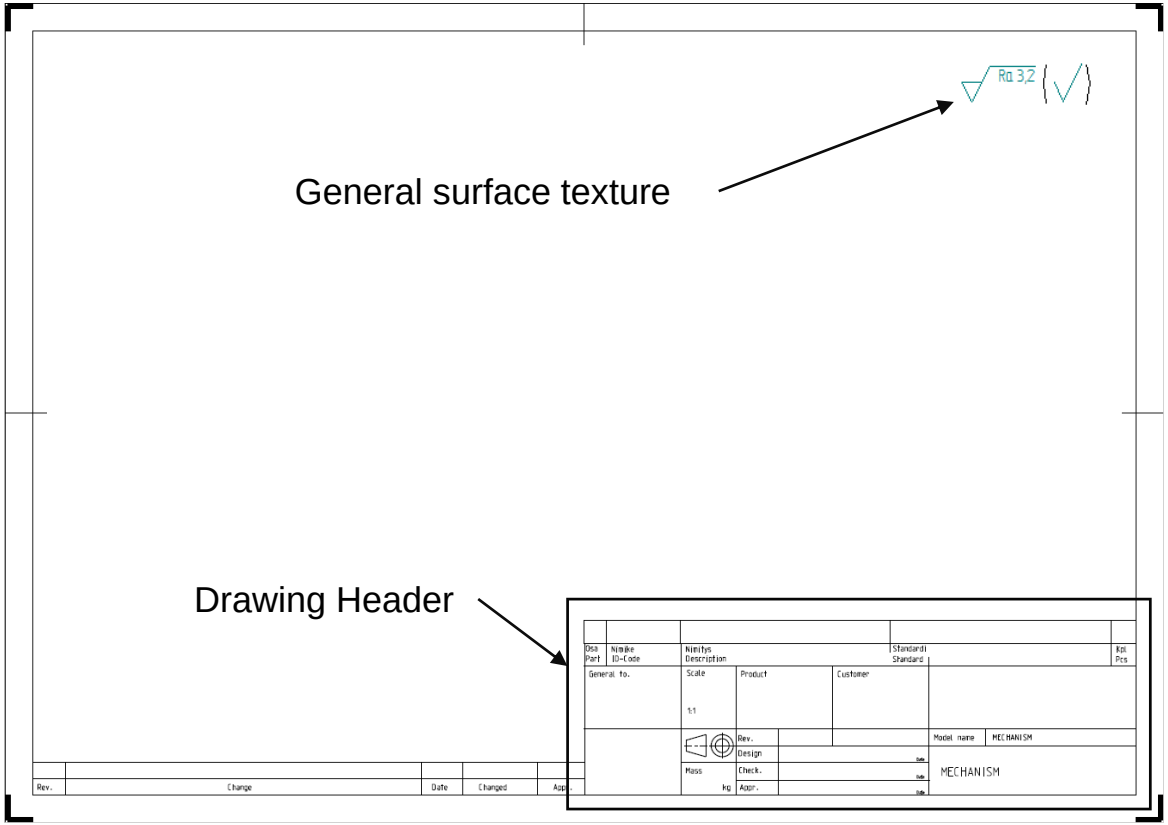
Follows same projection rules

- Section line shows cutting plane/line

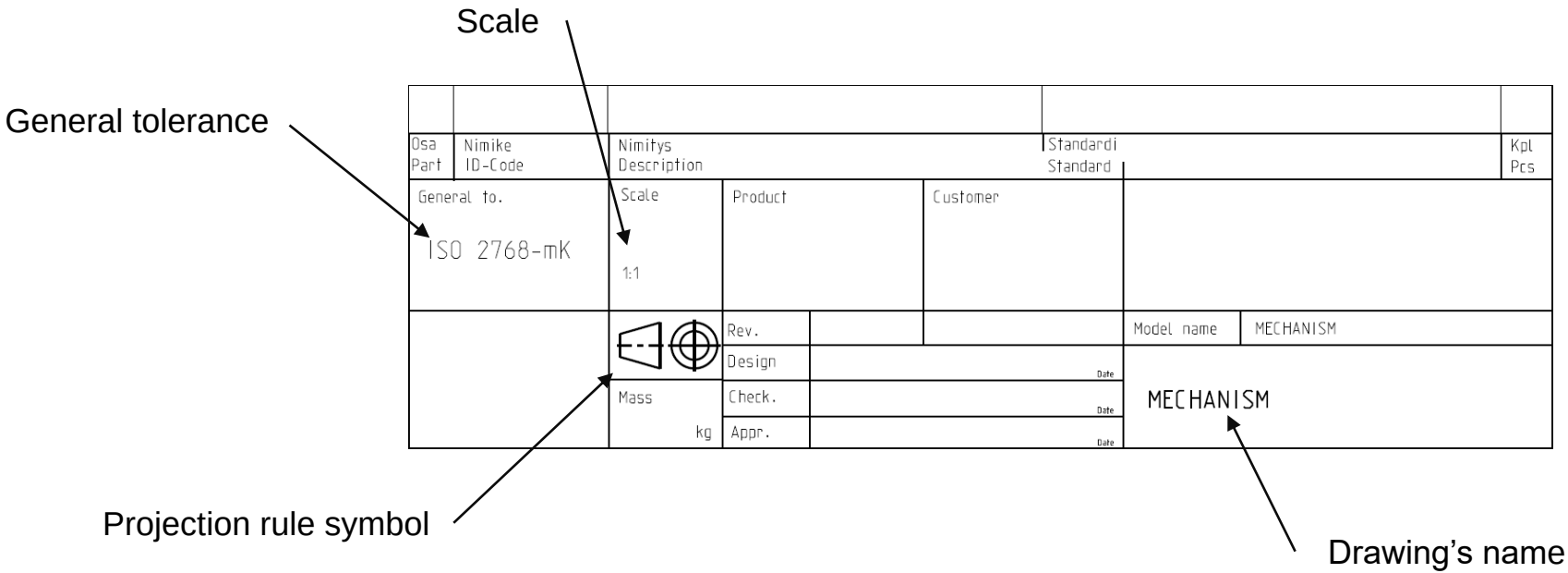




Drawing Template



Drawing Header



General Tolerance

Standards and patens at Library

- SFS standards
- https://libguides.aalto.fi/c.php?g=410693&p=2797584
- ISO 2768-1:1989 for general tolerance

General Tolerance Classes

Lowercase letter for dimension tolerances

Table 1 — Permissible deviations for linear dimensions except for broken edges
(external radii and chamfer heights, see table 2)

Values in millimetres

Tolerance class		Permissible deviations for basic size range							
Designation	Description	0,5[1] up to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400	over 400 up to 1 000	over 1 000 up to 2 000	over 2 000 up to 4 000
f	fine	±0,05	±0,05	±0,1	±0,15	±0,2	±0,3	±0,5	–
m	medium	±0,1	±0,1	±0,2	±0,3	±0,5	±0,8	±1,2	±2
c	coarse	±0,2	±0,3	±0,5	±0,8	±1,2	±2	±3	±4
v	very coarse	–	±0,5	±1	±1,5	±2,5	±4	±6	±8

1) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Source: Table 1, SFS-EN 22768-1

General Tolerance Classes

Capital letter for geometric tolerances

Table 1 — General tolerances on straightness and flatness

Values in millimetres

Tolerance class	Straightness and flatness tolerances for ranges of nominal lengths					
	up to 10	over 10 up to 30	over 30 up to 100	over 100 up to 300	over 300 up to 1 000	over 1 000 up to 3 000
H	0,02	0,05	0,1	0,2	0,3	0,4
K	0,05	0,1	0,2	0,4	0,6	0,8
L	0,1	0,2	0,4	0,8	1,2	1,6

Source: Table 1, SFS-EN 22768-2

Part Drawings

Standards

SFS-EN ISO 129-1:2019

- Technical product documentation (TPD). Presentation of dimensions and tolerances.

SFS-EN 22768-1

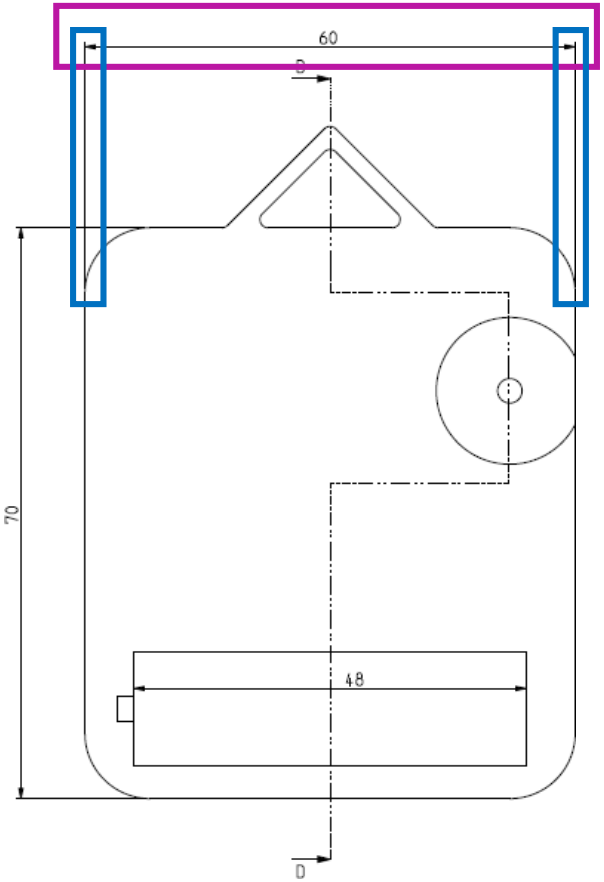
- General tolerances. Part 1: Tolerances for linear and angular dimensions without individual tolerance indications (ISO 2768-1:1989)

Nominal Dimensions

Vertical or horizontal dimensions

- “Basic” dimensions
- Parallel to and above line
- Witness lines to clarify affected shape
  - Optional (for ex. 48 dimension without)

Affected by general tolerance

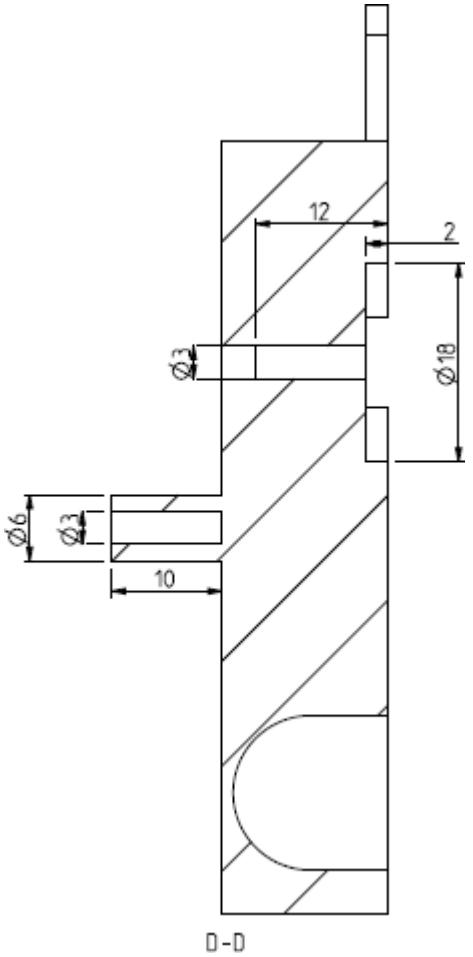


Diameter Dimensions

Defines cylindrical shape

- For ex. Ø6 is tube shape

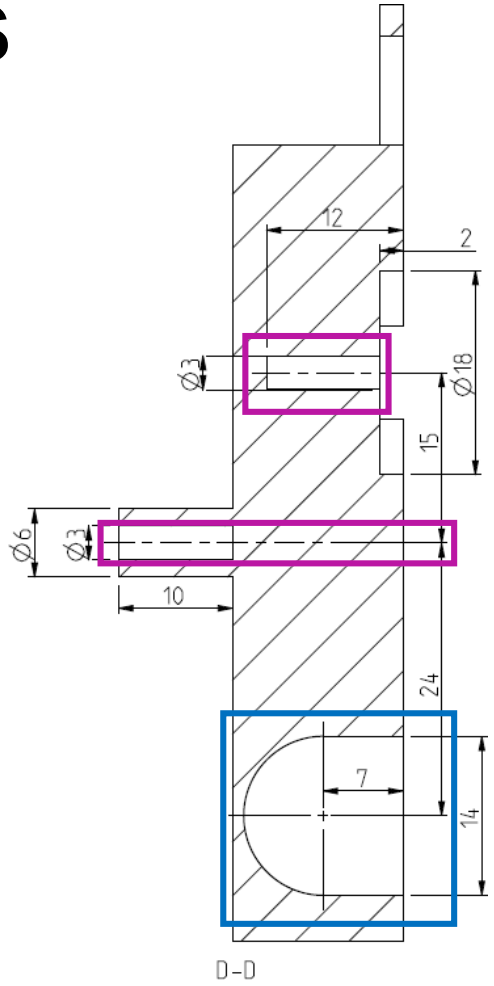
Diameter symbol Ø



Symmetry and Hole Axes

Help to define shape and dimension locations

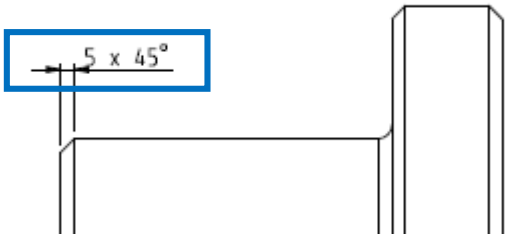
- Center line
- Hole marker

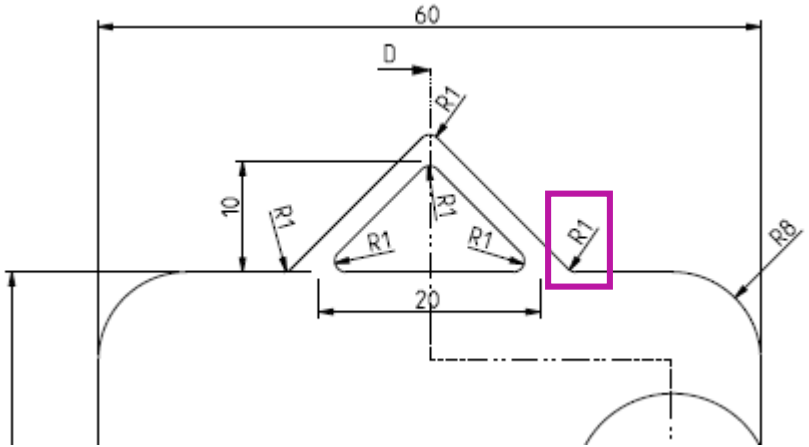


Rounds and Chamfers

To remove sharp edges

- Rounds are marked with R
- Chafers usually with x 45

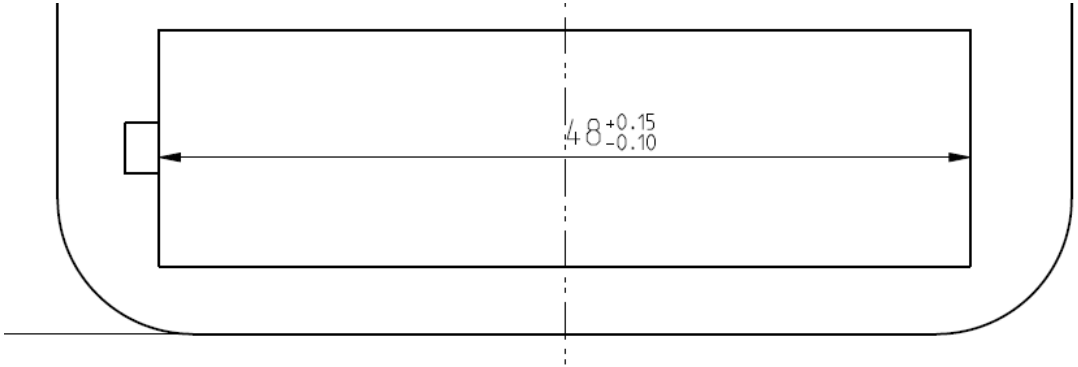


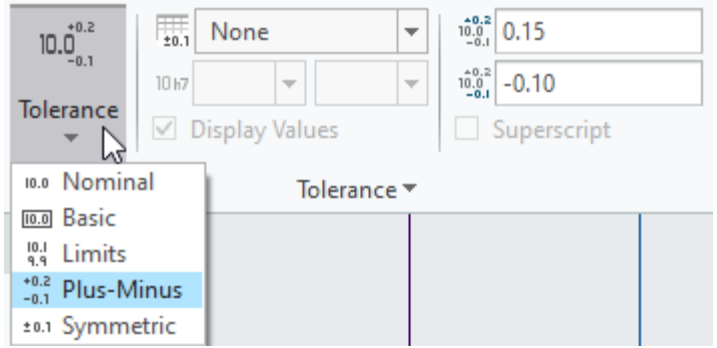


Dimensions with tolerances

When more accurate than general tolerance

- Dimension with limits

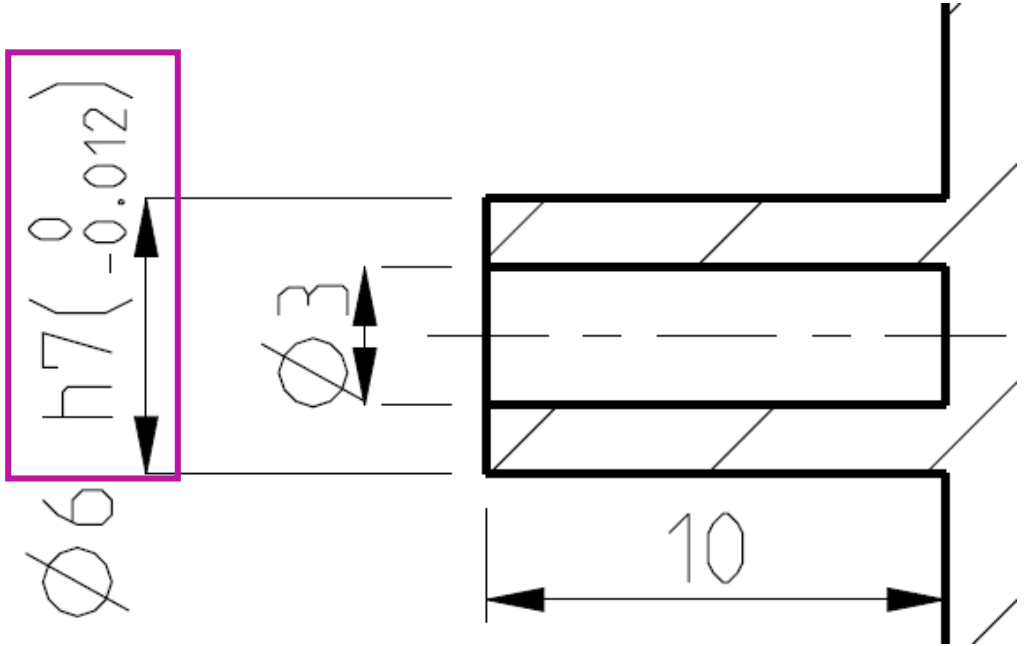




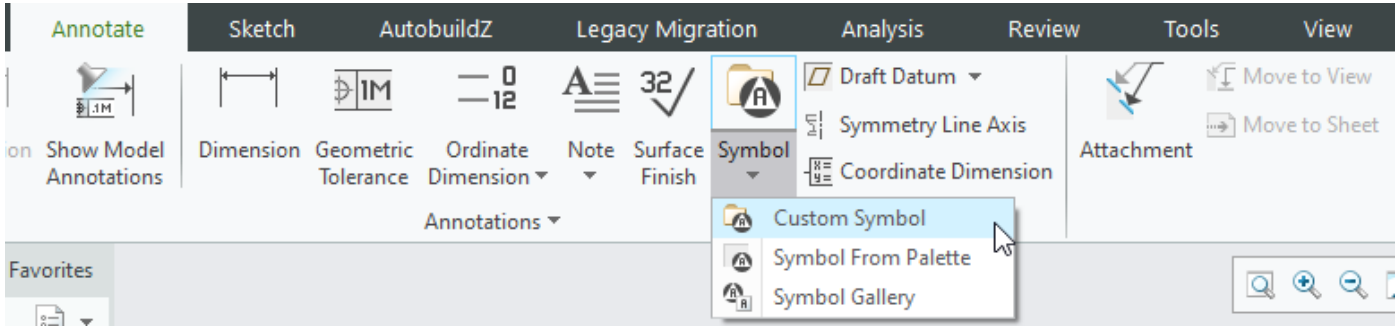
Dimensions with tolerances

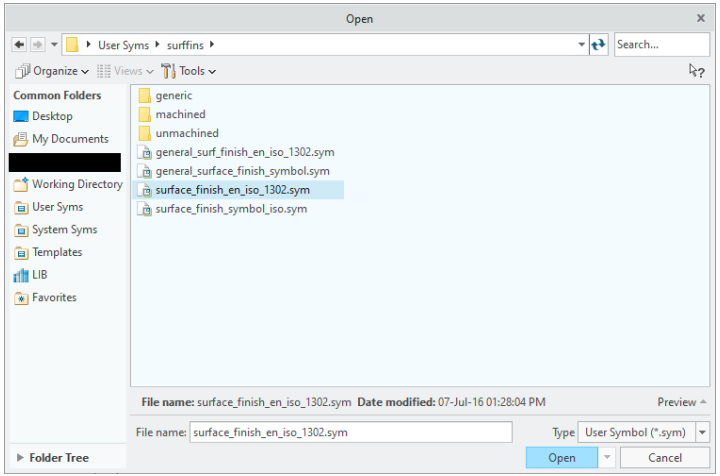
With class (lowercase for shafts, uppercase for holes) and limits

- In this case h7



Surface Finish Symbols





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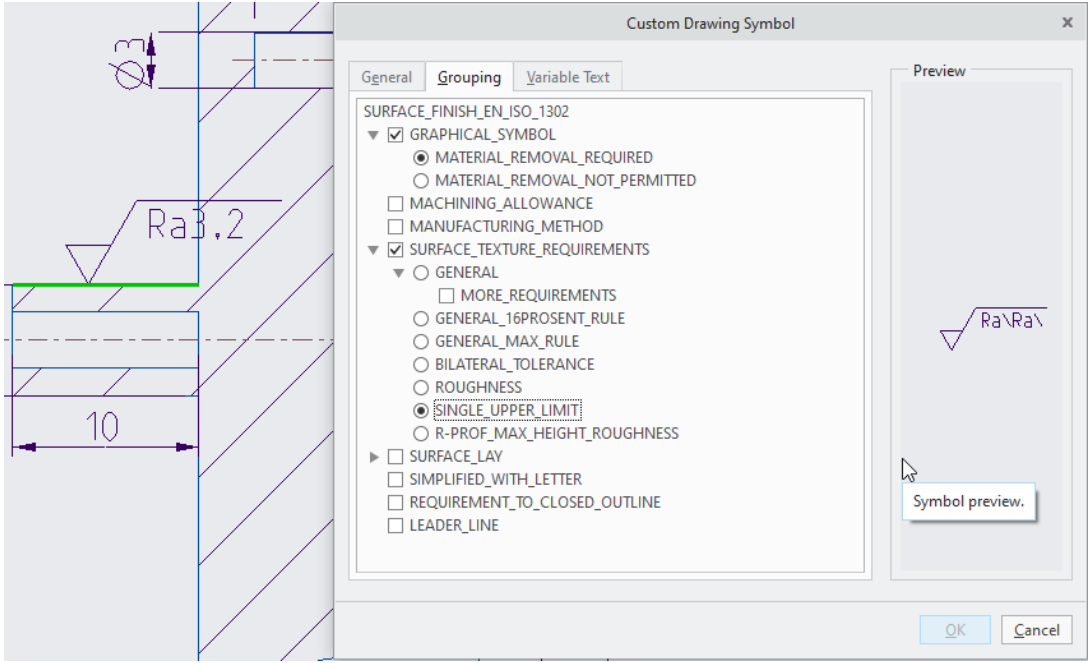
Surface Finish Symbols

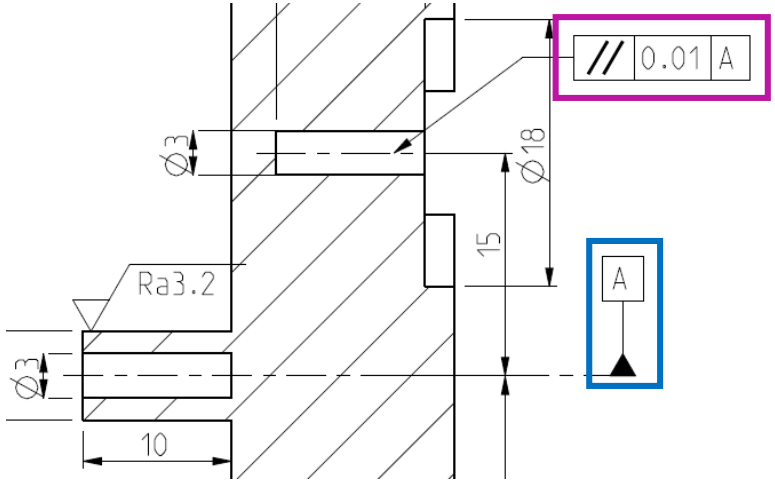
Define Ra value in Variable Text



Geometric Tolerances

Defines shape requirements (not dimensions)

- Tolerance feature indicator
- Tolerance reference indicator
- In this case, two axes needs to be parallel with a tolerance of min 0.01mm



Assembly Drawings

Assembly Drawings

Usually contains at leas one main view of an assembly in exploded stage

- Components exploded separately in a custom view orientation
- Numbering with balloons

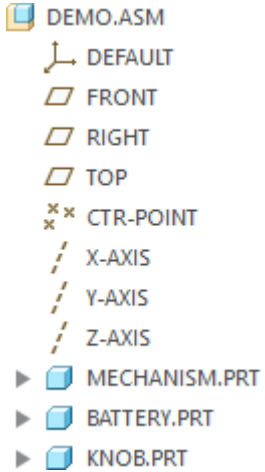
Contains a table form Bill of Materials

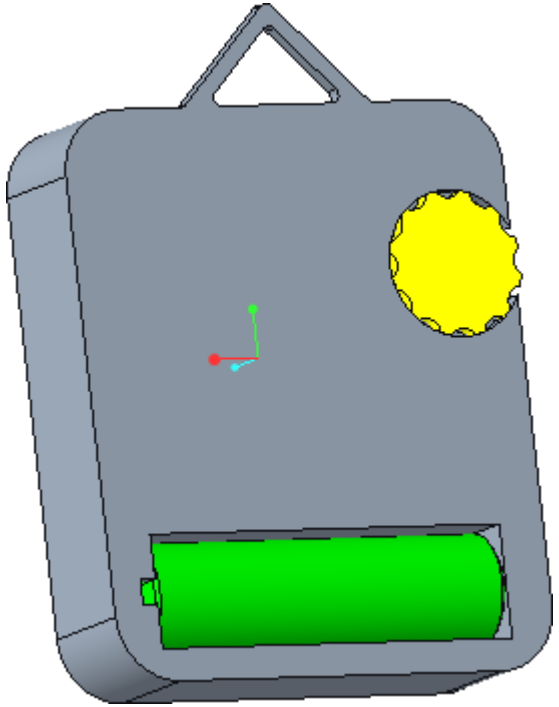
- i.e. what components and how many

Normal projection rules apply

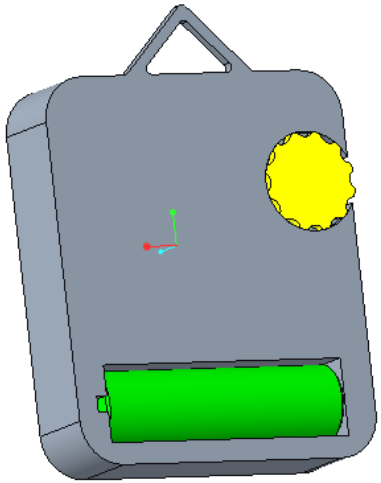
An Assembly

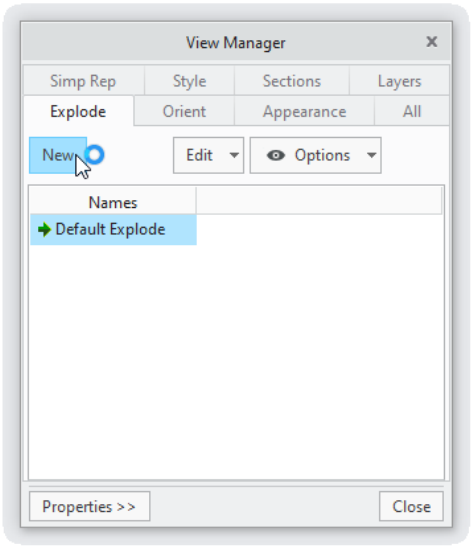
Three component assembly

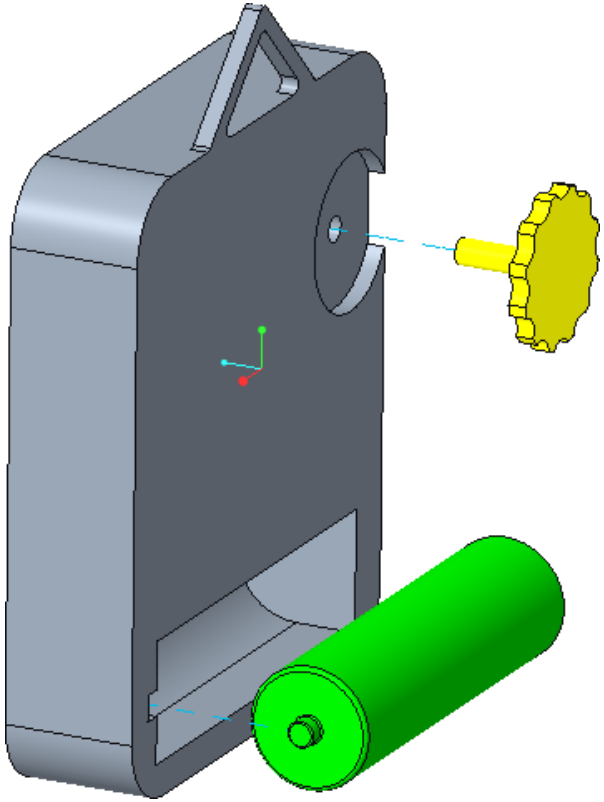




Explode View







Bill of Materials

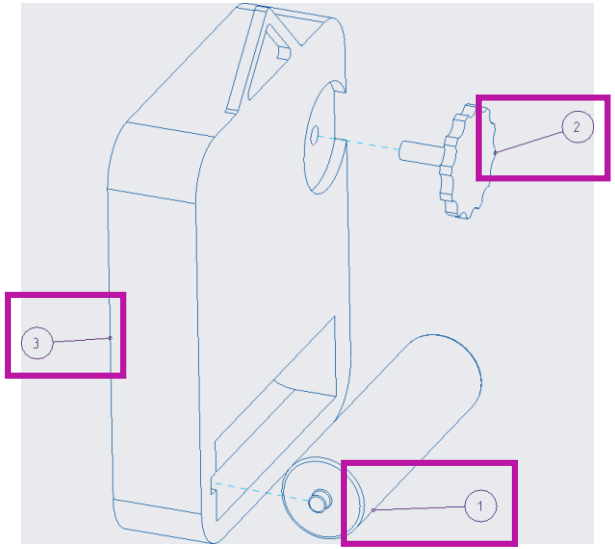
In A3_Aalto.frm template, component's DESCRIPTION parameter is used to create list

- Each part needs to have a value for that parameter
- Component count is automatic

Osa Part	Nimike ID-Code	Nimitys Description	Standardi Standard	Kpl Pcs
3		Mechanism		1
2		Knob		1
1		Battery		1

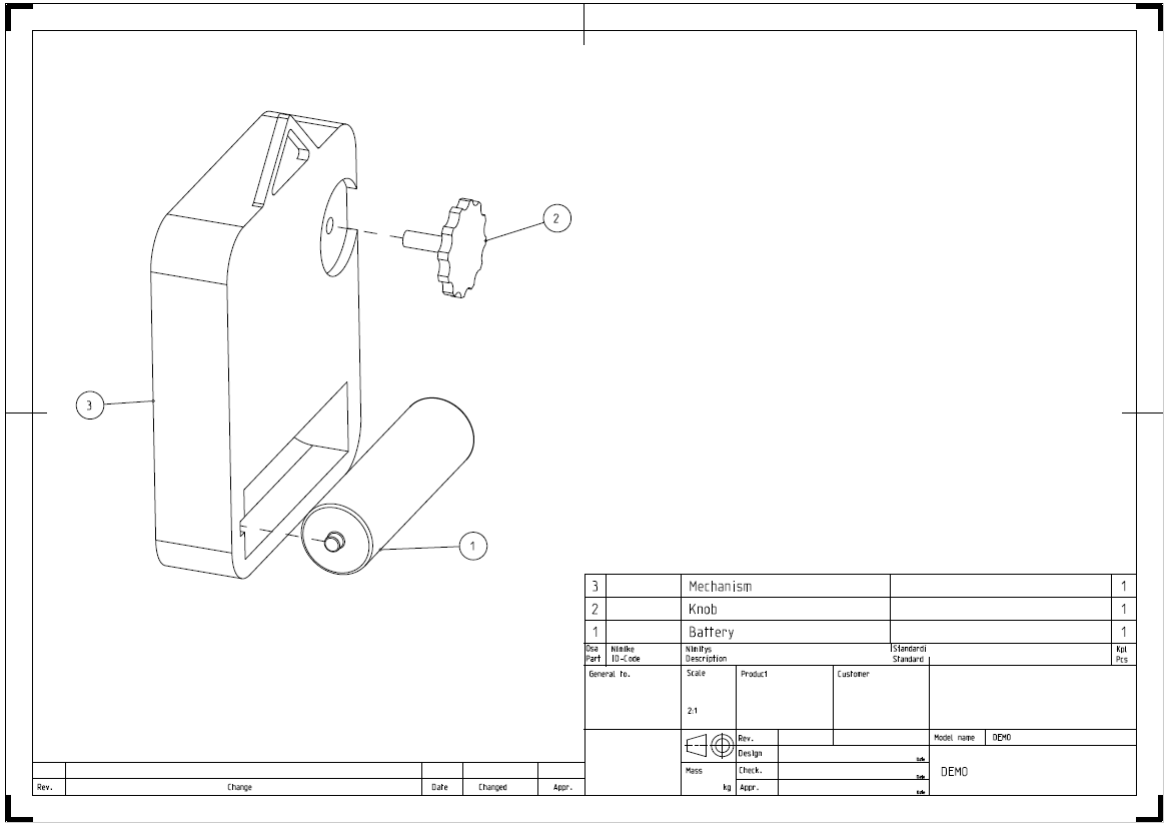
Balloons

Component Balloons link Bill of Material and Exploded view together



Ready Drawing

PDF, A3 size, monochrome, select suitable scale



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