COMPASS Upgrade
INSTITUTE OF PLASMA PHYSICS OF THE CAS

Annex no. 5

Methodology of CAD creation and maintenance

Revision 1

Table of Contents

List of abbreviations

CU	COMPASS Upgrade
CAD	Computer Aided Design
DLC	Divertor Lower Center - port aiming at plasma center
DLH	Divertor Lower Horizontal
DLX	Divertor Lower X-point - port aiming at plasma X-point
DUC	Divertor Upper Center - port aiming at plasma center
DUH	Divertor Upper Horizontal
DUX	Divertor Upper X-point - port aiming at plasma X-point
GCS	Global Coordinate System
HFS	High Field Side
IW	Inner Wall
IWL	Inner Wall Limiters
LFS	Low Field Side
MN	Midplane Narrow
MX	Midplane X
OW	Outer Wall
OWL	Outer Wall Limiters
PFC	Plasma Facing Components
PLM	Product Lifecycle Management
PSP	Passive Stabilising Plate
SBS	System Breakdown Structure
VL	Vertical Lower (port)
VU	Vertical Upper (port)
VV	Vacuum Vessel
VVCS	Vacuum Vessel Coordinate System

1. Parts classification and designation

CAD data are at IPP stored in an existing PLM system, called ARAS Innovator. According to defined structure and methodics, every part or assembly has its unique designation in the following format:

CU_AAAA-L2-L3-L4-nnnnnn_Vnn_XYZ_Rgg_TYP_NAME

The designation includes the nomenclature, followed by the part number including the variant and data type, revision and generation and document type and name.

This naming convention shall be respected in any case for all CAD data stored whether in native CATIA or other file formats.

Nomenclature

The nomenclature designation identifies a project (here “CU” stands for Compass Upgrade), specific type of system or area of the project, followed by levels describing the assembly structure (levels).

CU_AAAA-L2-L3-L4

For more details and concrete structure of the Compass Upgrade project please refer to the Annex No. 6 of the Technical specification.

Part number

The part number is a combination of a unique number for individual part, part variant and designation indicating whether it is a part or assembly.

nnnnnn_Vnn_XYZ

- nnnnnn … unique part number with 6 characters
- Vnn … number of variant
- XYZ … abbreviation indicating type of part - PRT (part) or ASM (assembly)

Example of part designation:

100123_V01_PRT

The unique part number is generated by the ARAS PLM system used only by the IPP (the Buyer) when creating new parts or assemblies. If new parts or assemblies are created by the Seller (supplier), a number can be chosen by the Seller or will be agreed.

Variant

The variant describes one or more variants of the CAD model or solution. It always starts with “V”, followed by two digits. “V01” shall be used for newly created models.

nnnnnn_**Vnn**_XYZ

Type of CAD model / classification

The type of CAD model indicates whether the model is part or assembly.

nnnnnn_Vnn_**XYZ**

- PRT … model of an unique CAD part
- ASM … model of an unique CAD assembly
- DRW … drawing

Revision and generation

The revision is used to differentiate and promote significant design changes within one part version. Generation could be optionally used to indicate smaller design changes (if not used "01" is obligatory). Revision shall be described with one letter A - Z, starting with "A". Generation shall be described with two digits, starting with "01". Every other change needed to be indicated increases the generation.

CU_AAAA-L2-L3-L4-nnnnnn_Vnn_XYZ_**Rgg**_TYP_NAME

Document type

The document type parameter determines one of five document types which shall be clearly identified.

CU_AAAA-L2-L3-L4-nnnnnn_Vnn_XYZ_Rgg_**TYP**_NAME

- CAD — CAD model
- SKE — Auxiliary geometry (axis system, wireframe geometry)
- DEV — Development CAD model (e.g. multi-body part of an assembly or concept model)
- SMP — Simplified CAD model
- DRW — Drawing

Name

A proper part name or comment using capital letters is recommended to be added at the end of the part/assembly designation divided by "_". The name shall sufficiently express part's function and its classification. Using official shortcuts only is recommended (see the list of abbreviations in this document). Maximum allowed length of the name is 33 characters.

CU_AAAA-L2-L3-L4-nnnnnn_Vnn_XYZ_Rgg_TYP_**NAME**

2. General rules for revisioning CAD models

For creating more concepts or solutions of one CAD model, different versions shall be used. Every significant modification shall be indicated by increasing the revision. Smaller changes could be indicated by increasing the generation. **Part and drawing shall be named with the same relevant version, revision and generation.**

3. Standard components and bought parts

Naming convention of standard parts (i.e. parts which are standardised according to common industry standards like ČSN, EN, ISO etc.). Same applies for non-standard parts bought on the market.

Standard part naming convention:

STANDARD_DIMENSION_NAME
e.g.: ISO-4026_M10x20_BOLT

Non-standard part naming convention (bought part):

MANUFACTURER_PRODUCT-DESIGATION_DIMENSION_NAME

e.g.: Swagelok_316L-8-VCR-1_HALF-INCH_FEMALE-NUT

- Name — name of the product
- Manufacturer — name of manufacturer
- Product designation — designation according to manufacturer catalogue
- Dimension — dimension / size of the product

It is necessary to use underscores only for dividing the individual sections of designation for faster and transparent product identification. In case of any modification of standard or bought part short note after name shall be added, e.g. “MODIFIED”.

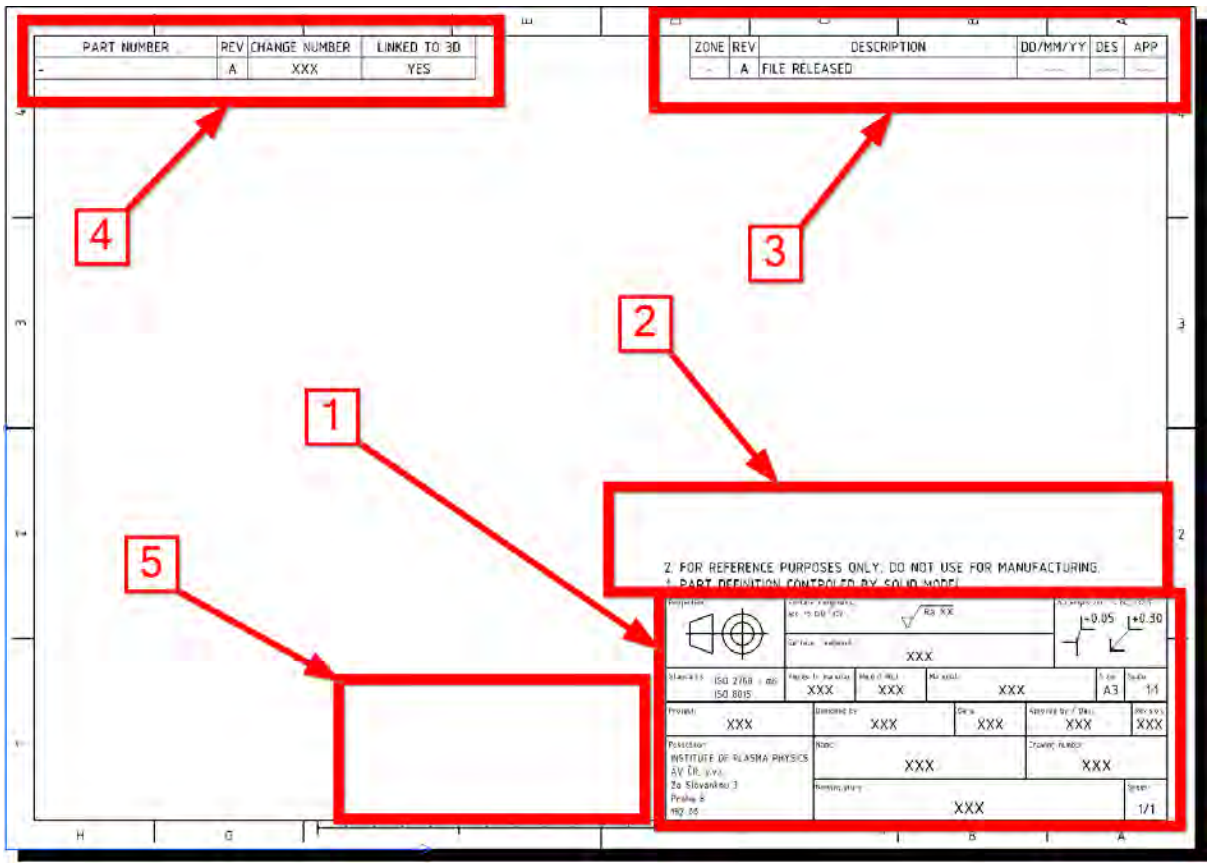
No drawings are necessary for any standard or non-standard (bought) parts!

4. Drawings creation

4.1. General rules

Drawings shall be created according to general industry standards and conventions, i.e. in accordance with at least following standards: EN ISO 128, EN ISO 129, ISO 2768 - mK, EN ISO 1101, EN ISO 8015, EN ISO 13715 and EN ISO 21290. General language of all drawings is **English**.

All drawings shall use standard IPP title block provided by the Buyer. Additional details and style described in next sections. The title block and additional details and tables are shown in Figure below:

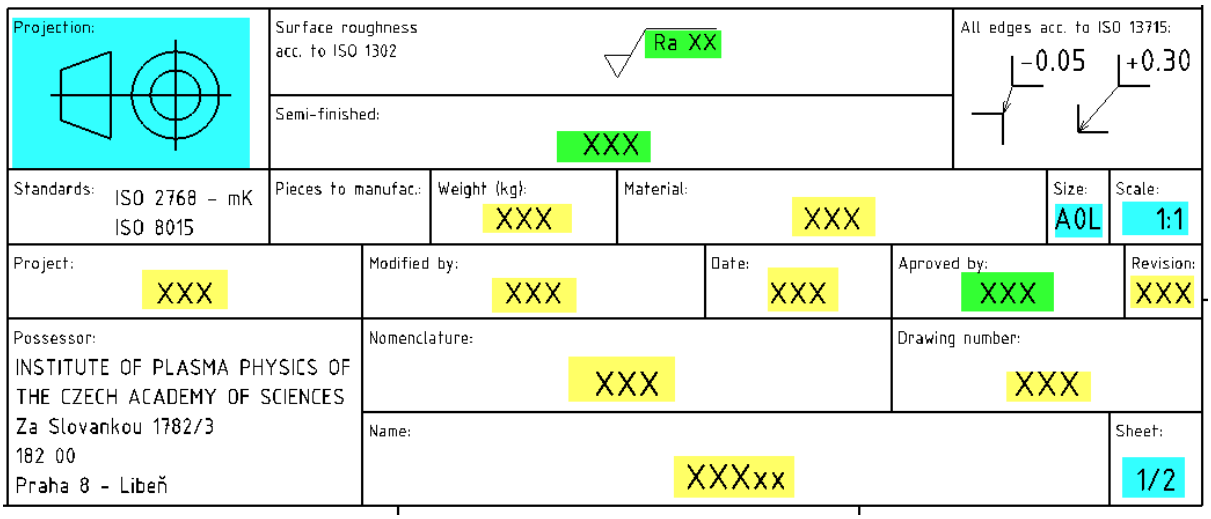


1 - Main drawing title block	see section 4.3
2 - Area for notes	see section 4.4
3 - Revision table	see section 4.5
4 - Part table	see section 4.6
5 - Area for sections overview (optional)	see section 4.7

4.2. Common drawing for more part versions

When reasonable it is possible to create one common drawing representing all part / assembly variations (versions). It should include elementary depiction, dimensions and table of individual variable parameters.

4.3. The main drawing title block



Every drawing shall include the main drawing title block with all essential information about a part or assembly as shown in figure above. All coloured fields have to be filled individually according to the naming convention and CAD model. In case any field should stay blank use "---".

- Project — In general always use: "CU COMPASS Upgrade"
- Name — Part/assembly name as defined in section 1 of this document (max. 33 characters)
- Nomenclature — Nomenclature as defined in section 1 of this document
- Drawing number — Part number as defined in section 1 of this document
- Modified by — Abbreviation of last person who modified drawing (3 char.)
- Approved by — Abbreviation of person who approved drawing (3 char.)
- Date — Date of last modification
- Revision — Revision as defined in section 1 of this document
- Weight — Total weight of part/assembly
- Material — Material name or designation
- Semi-finished — Requirements for surface treatment
- Surface roughness — Required surface roughness (not for assembly)
- Pieces to manufacture — Pieces to manufacture by workshop (optional)

4.4. Notes

All needed notes shall be placed in the area above the main drawing title block. Notes should use capital letters as shown below:
"PART DEFINITION CONTROLLED BY SOLID MODEL."

"FOR REFERENCE PURPOSES ONLY. DO NOT USE FOR MANUFACTURING."

"CLEANLINESS PER CU_ORD_VacuumRequirements"

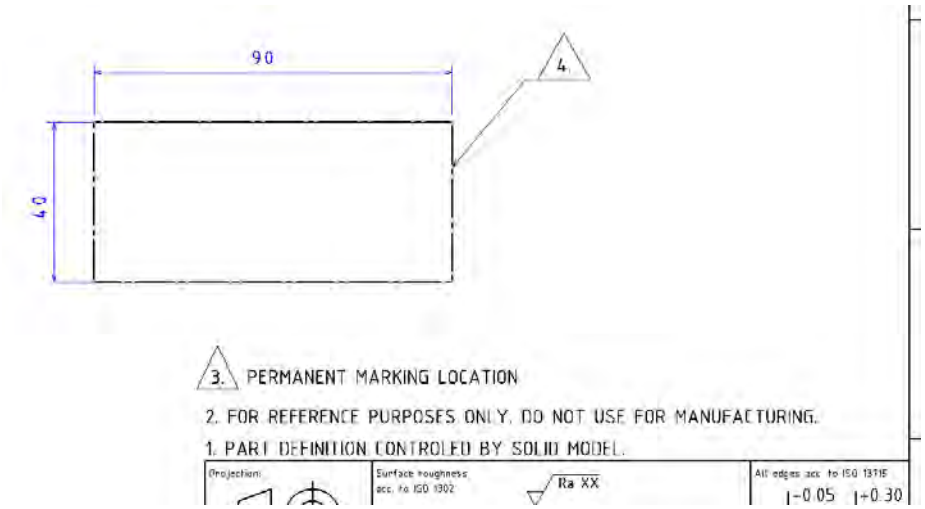
"ELECTROLYTICALLY DEPOSITED COATING PER ISO 4521 - Cu/Ag(99.8)20"

"SEE SHEET ONE FOR NOTES"

"PERMANENT MARKING LOCATION"

“ALL DIMENSIONS ARE APPLICABLE FOR FINISHED PRODUCT INCLUDING/EXCLUDING THE SURFACE TREATMENT/HEAT TREATMENT.”

Example:



Individual notes shall be numbered starting from the main title block up, see the example above.

4.5. Revision table

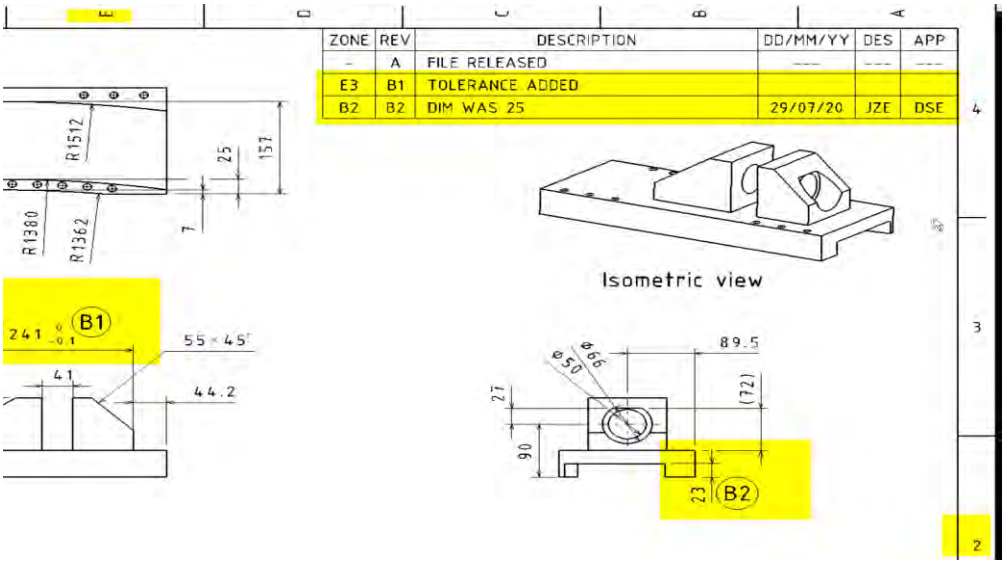
Revision table tracks a complete history of modifications of the part or assembly drawing. It includes information about revision, modification description, date, designer and person who approved the drawing.

First document revision, when drawing is released, is always the same. Information necessary to fill in is: revision (“A”), date, designer and who approved the drawing. See figure below. Every further modification shall be included in the newly added row including relevant information about the change.

ZONE	REV	DESCRIPTION	DD/MM/YY	DES	APP
-	A	FILE RELEASED	---	---	---

- ZONE — Affected area of drawing
- REV — Revision of drawing*
- DESCRIPTION — Brief description of modification
- DD/MM/YY — Date of modification
- DES — Abbreviation of responsible designer (three letters)
- APP — Abbreviation of person who approved the drawing

Every modification shall be indicated in the drawing with corresponding ballon mark near the affected area as shown in the figure below. In case more modifications are needed, revision letter + numbering and more rows in the table shall be used.



4.6. Part table

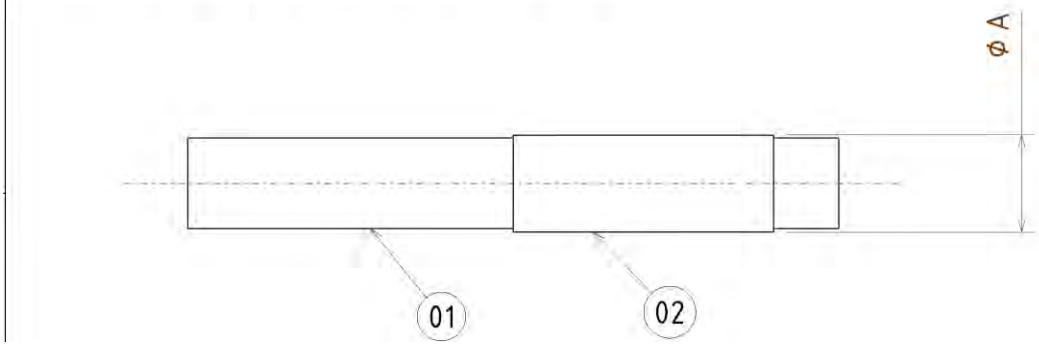
Part table identifies a 3D CAD model linked to drawing representation. It includes following information:

PART NUMBER	REV	CHANGE NUMBER	LINKED TO 3D
-	A	XXX	YES

- PART NUMBER — Part number of relevant 3D CAD model
- REV — Revision of relevant 3D CAD model
- CHANGE NUMBER — Last modification done on the linked 3D CAD model
- LINKED TO 3D — Is drawing linked to the 3D CAD model? No link is acceptable only for not modelled variants of the main part

Following example shows a situation where part version V01 with external diameter 15 H5 was created. Then versions V02 and V03 were created with different diameters. In this case they are not directly linked to the drawing and the dimensions are only indicated in the table.

PART NUMBER	REV	⌀A	CHANGE NUMBER	LINKED TO 3D
100522_V01_ASM	B	15 h5	ECO-00001026	YES
100522_V02_ASM	A	15 j5		NO
100522_V03_ASM	A	14.5 h5		NO

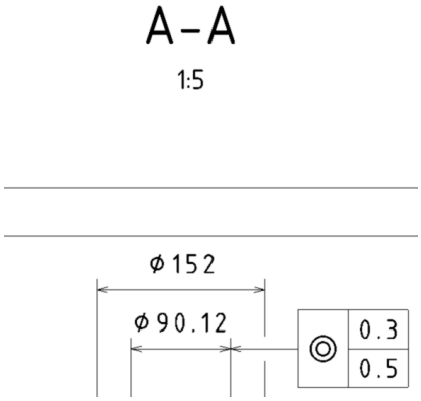


4.7. Views creation

Identification of views and section cuts

In general, the first view and relevant projected views do not need to be named. Auxiliary views and section cuts shall be identified by letters, starting with “A” and ending with “Q”, excluding following letters: “I”, “O” a “X”. When letters are depleted, the combination of two letters can be used: “AA”, “AB”, “AC”.

Detail views shall be identified by letter(s) starting with “R”, ending with “Y”, eventually by combination of letters as shown in Figure below.



View and section cut identification/description shall be placed above the feature with letter size 7. When scale differs from the main scale size, then scale follows with letter size 3.5.

Views and sections table

The views and sections table gives an overview of all identifiers used for views, details and sections. It brings more transparency and effectiveness when creating drawings with a lot of views. When the identifier is used, then a relevant cell shall be crossed out in the table. Table could be placed either in the lower left area of drawing or left from the main drawing title block

Use of this table is **optional**.

Sections & Views	~~A~~	~~B~~	C	D	E	F	G	H	J	K	L	M	N	O	P	Q
	AA	BA	CA	DA	EA	FA	GA	HA	JA	KA	LA	MA	NA	OA	PA	QA
Detail views	R	S	T	U	V	W	X	Y								
	RA	SA	TA	UA	VA	WA	XA	YA								

4.8. Hatching

Hatching in section cuts shall be performed according to EN ISO 128. Full colour filling in the section cuts is not allowed.

4.9. Bill of material (BOM)

The bill of material of an assembly gives an overview about the structure of an assembly. The bill of material should be placed on the last sheet of drawing or in case of one individual drawing on a separate sheet according to the provided template.

Recommended form of the BOM should include at least following information:

- Position no.
- Nomenclature
- Part number

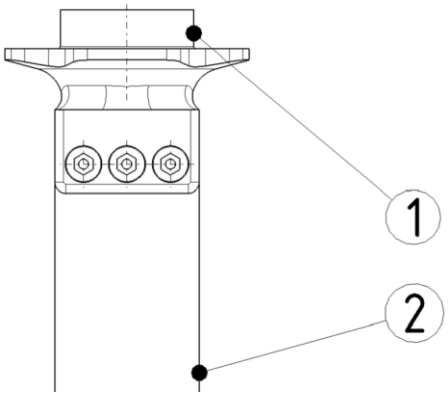
- Revision
- Name of part or sub-assembly
- Weight
- Material
- Quantity

Following figure shows how the BOM table could look like:

POSITION	NOMENCLATURE	PART NUMBER	REV.	NAME	WEIGHT	MATERIAL	QUANTITY
1	CU_CUPG-01-01-01	100349_V07_ASM	A3	VESSEL	0kg	---	1
2	CU_CUPG-01-01-02	100350_V06_ASM	B1	VV_SUPPORTS	0kg	---	1
3	CU_CUPG-01-01-03	100357_V03_ASM	A2	VV_HEATING_LOOPS	0kg	---	1
4	CU_CUPG-01-01-04	100839_V02_ASM	A2	PADS AND INTERFACES	0kg	---	1
5	CU_CUPG-01-01-04	100359_V01_ASM	A1	VV_MNT_ELEMENTS	0kg	---	1

4.10. Marking of positions of individual parts acc. to the BOM

The positions according to the BOM table shall be indicated in the assembly drawing with corresponding balloon marks.



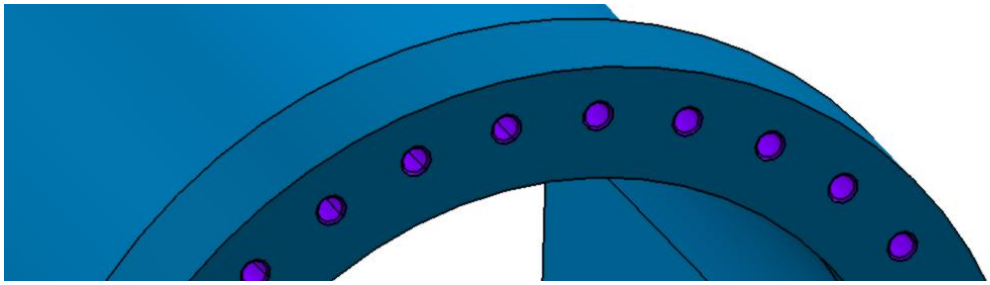
5. Colour coding

The colour coding in 3D CAD models is used for following purposes:

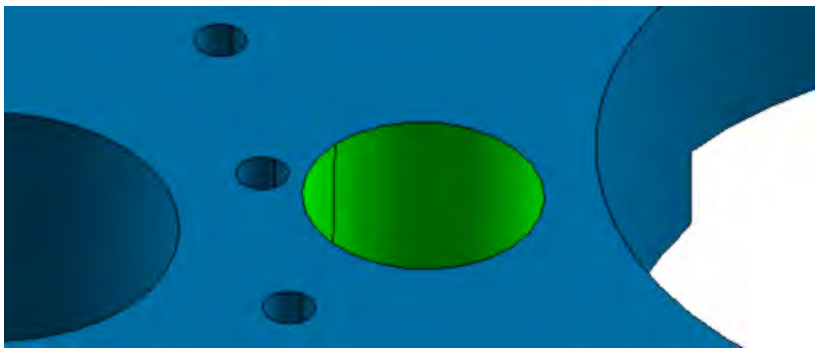
- Marking threads and centering holes
- Marking surfaces with different properties

Marking threads and centering holes

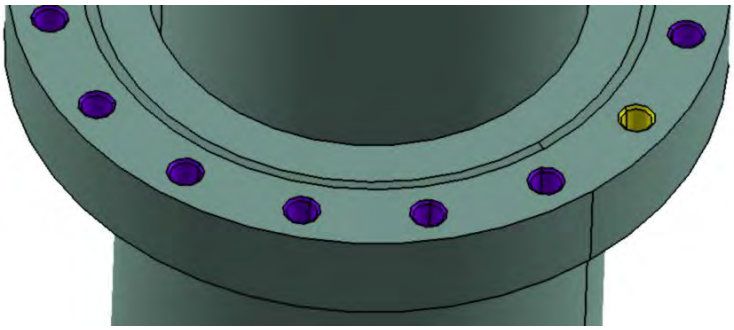
Threaded holes shall be indicated by dark violet colour with following RGB code:
128, 0, 255



Centering or calibration holes shall be indicated by light green colour with following RGB code:
0, 255, 0

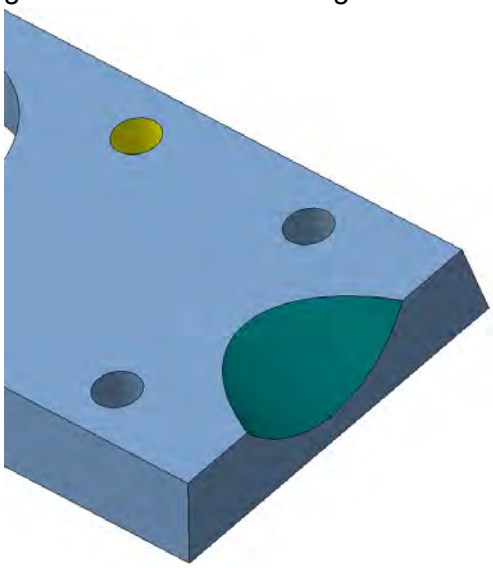


In case of hole pattern, first hole could be indicated by yellow colour with following RGB code:
255, 255, 0



Marking surfaces with different properties

Surfaces where no special form and shape tolerance is required could be indicated by dark green colour with following RGB code: 0, 128, 128



Use of following colours is forbidden:

- red (RGB: 255, 0, 0)
- orange (RGB: 255, 128, 0)