“Guidelines using Pro/ENGINEER within BMW AG and at suppliers“

1 Principles

This guideline is to be used by all automobile manufactures and suppliers working with CAD system Pro/ENGINEER.

The structure of the Pro/ENGINEER data must be consistent in order to facilitate understanding of the data structure.

In addition data exchange is simplified hereby.

Guidelines used by all manufactures and suppliers will be identified by a star (✸).

1.1 System prerequisites

Information about the currently used Pro/ENGINEER version can be obtained directly from the manufacturer and can be accessed via the Internet. ✸

Within BMW AG: *https://b2b.bmw.com*

Which modules are used in which version must be clarified in advance.

1.2.Standards

The absolute accuracy of the CAD data is defined in the start models.
BMW AG specifies the absolute accuracy as 0.015.
The procedure for data with deviating accuracy must be coordinated in advance..

The generation of new data (Parts, Assemblies, Layouts and Drawings) must always begin with company-specific start models. ✸
These start models specify basic settings. When generating new data the engineer must enter various parameters (refer to 3.7).

The start models can be downloaded from the Internet. ✸

Within BMW AG *https://b2b.bmw.com*

All configurations, start models, drawing formats, drawing symbols and standardized parts used within BMW AG can be downloaded under this address.

In the future a common Internet address is planned with links to various manufacturers.

2 Conventions

2.1 Coordinate systems

Only clockwise coordinate systems are used. ✸

These are defined as follows by BMW AG:

The basic coordinate system is the vehicle coordinate system. It lies in the intersection of the front axle and the longitudinal axis. The X-axis points in the longitudinal axis opposite to the driving direction (to the rear). The Z-axis points upwards. The Y-axis points to the right side of the vehicle.

The origin of the engine coordinate system lies on the crankshaft axis between the center cylinders. The X-axis points in direction of the output and the Z-axis points upwards.

In Parts and Assemblies coordinate systems must be assigned a name in order to allow for logical correlation. ✸

2.2 Naming conventions Features, Datums

In case of functional relevance, reference features (Planes, Axis, Points, Coordinate Systems, Curves, Surfaces) must be assigned corresponding codes.

AX	Datum Axis
C	Curve
CS	Coordinate System

PL	Datum Plane
PT	Datum Point
S	Surface

Functional geometries will be named according to the following table or above listed codes are extended by the following codes.

CG	with COPYGEOM imported elements
CUT	CUT
DR	Draft
EXT	Extend Surface
HO	Hole
KS	Project Coordinate System
SM	Surface merge
PATCH	Protrusion with Patch
PG	Public Geom
PR	Protrusion
Q	Datum plane for X-section
R	Round (for geometry-relevant rounds)
SCUT	Surface Cut

example:
protrusion for snuff 401
PR_BU401

It is not absolutely necessary to name all Rounds and Drafts.

2.3.Naming conventions Part, Assembly, Drawing, Layout

Naming of parts, assemblies, drawings and layouts is in English.

All project partners (also external) must know the naming conventions. ✸

The valid BMW naming conventions can be accessed under:
https://b2b.bmw.com

The names of Pro/ENGINEER models are limited to 31 characters.
(31character.xxx.xxx) ✸

As a rule, the name of the drawing is identical to the name of the Part or Assembly shown therein. Different representation variants (Simplified Reps, see 2.5) are identified differently. ✸

For layouts the same naming conventions apply or, in case the layout controls several assemblies, a generic name is used.

DMU models get the same name like their originals (part or assembly) and begin with ‘dmu’.

2.4 Family Tables

If a Family Table is used the variants (instances) must be named accordingly.

The name of the Generic-Part represents the genus. When naming the Instances the naming convention is complied to.

2.5 Simplified Representation

If a simplified representation is used it must be unambiguously named as such. The name must indicate what is shown or not shown, respectively.

2.6 Layer

Basic parts have standard layers. These are identified by an underscore (_). ✸

It's not allowed to delete the standard layers. ✸

Layers generated by the engineers when creating new models are called User-Layers. These begin with a letter or a number and should be made up of meaningful and comprehensible names. ✸

The different naming of Standard-Layers and User-Layers allows for a visual differentiation. ✸

Parts that build a functional unit must be saved on the same layer. In Assembly Mode, parts forming an Assembly receive different colours for a better graphic overview.

3 Structure of the models

3.1 Structure

All CAD models must begin with the BMW start models. (see section 1.2)

Engineering processes must comply with the following model structure :

1. Datum-Features
2. Geometry-Features
3. Drafts and Rounds

Features that form a functional unit must be generated successively.

3.2 Modelling methodology

The basic strategy for modelling always follows the rule:

Reference geometry → function part/unfinished part → finished part → DMU part ✸

In case of **simple components** the basic strategy must be realized by the selection of appropriate features within an individual part.

Single processing features lie on single layers. These will be summarized according to function in superior layers.

When using Family Tables for each processing variant one layer must be created on which the related processing lies.

Complex components are generated as Assembly. The geometry will be transferred from the functional part/unfinished part to the finished part via a surface copy in Assembly-Mode (MODIFY / MOD PART / FEATURE / CREATE / GEOMETRIE / GEOM COPY / SURFACE REFS / SOLID SURFS). In this case, in Assembly mode the ALL button must be activated under UTILITIES / REFERENCE CONTROL.

In case of particularly complex components (cylinder head, crankcase) the data structure must be coordinated with BMW. Here, the design methods specified by BMW AG must be applied. As a rule, the design procedure must be harmonized with the BMW specialist department.

3.3 References

Large assemblies contain a reference part which is the first to be built in the Assembly. All subsequently built components reference to this part.✸
In very large and complicated assemblies it makes sense to work with several reference parts. Functional sub-assemblies will be used here.

Features in Reference Parts must be named unambiguously. ✸

Reference for complex parts

In the Reference Part all essential design details will be determined with datums and surfaces. The functional dependencies between concepts, functional geometry/unfinished part geometry and processings in the finished part are defined here.

Reference for assemblies

These include functional installation references onto which the parts to be built are referenced.

The reference part shows different motion states which must be identified accordingly.

3.4 Layouts

In case of complicated models of which different variants are shown, all parameters must be controlled with a layout. This will ensure that values that apply to several parts are controlled in a consistent manner.

Relations will be commented function-related and in an ordered manner.

3.5 DMU-Parts

For all models required for package space investigations DMU parts must be created. ✸

If a supplier generates a model it must be clarified in advance who creates the DMU parts.

In DMU parts only the „outer skin“ of the models is shown.

From functional assemblies only one DMU part is derived.

All DMU parts must have a vehicle-specific or an engine-specific coordinate system.✸
The orientation of the coordinate system is to be coordinated.

3.6 Layer

Complex parts require a meaningful layer structure.

As a rule, only layer buttons “Blanked“ and “Shown“ are allowed.
Button “Isolated“ is not allowed. ✸

3.7 Fundamentals

Only models created with the start part shall be built into an assembly. Instruction **COMPONENT;CREATE;PART** must not be used in Assembly mode.

In Assembly mode components must not be processed. They may be processed in part mode only.

Parameters

When creating models the following parameters must be entered:

PARAMTER	**BRIEF DESCRIPTION**
TAIS_NUMBER	BMW part number
DESCRIPT_GERMAN	Name in German
FIRST_USED	Project for first use
CO_MAIN_GRP	Main U.P.G.
CO_SUB_GRP	Subordinate U.P.G.
DESCRIBT_ENGL	Name in English
CREATOR	Creator
SUPPLIER	Supplier
MATERIAL	Material
WEIGHT	Mass-
CO_GROUP	Σ of CO_MAIN_GRP and CO_SUB_GRP
TO_ROUGH_PART	Rough/unfinished part

PDMREV	old PDM-revision number
PDMRL	old PDM-release number
PDMDP	
PROI_REVISION	Pro/INTRALINK revisions
PROI_VERSION	Pro/INTRALINK versions
PROI_BRANCH	Pro/INTRALINK branch
PROI_RELEASE	Pro/INTRALINK release
PROI_MODIFIED	Pro/INTRALINK modification

Sketcher

During creating of protrusions, cuts,... the number of Sketcher elements is to be kept as low as possible. Complicated contours require several features.

Sketcher must show the intention of the design.

Features

Features must be created using the appropriate commands.
Rounds, chamfers, ... will not be created with sketcher. ✸

CUTS must not be filled completely with PROTRUSIONS.

Use REDEFINE and REROUTE instead of DELETE and create new.

Dimensional and geometrical tolerances

Tolerance information are always contained in the part as to allow the use along the entire process chain. They must not be defined in the drawing. By „geometry inheritance“ the tolerance information get lost. Therefore, in particular cases it is of advantage to define the tolerances in the Reference Part. These will then be available again in the Assembly.

Processing features will be toleranced and referenced relative to a support point.

Pattern

Are used for identical features (patterning). ✸

Reference patterns must be used where available.

Variable roundings

Must not end on radius zero.

4 Documentation

For complicated parts the heredity of the component geometry should be documented in a flow chart.

5 Data quality ✸

The 3D-model and the drawing must be created in parametric Pro/ENGINEER format.

The 3D-model must be created fully as solid. Deviations must be coordinated in advance.

Referencing to read-in foreign formats (e.g. IGES) is not allowed.

The 2D-drawing must be derived from the 3D-model. In the 2D drawing a geometry must not be sketched. Generated dimensions must be referenced to surfaces, not to edges.

When plotting drawings it must be ensured that the drawing references to the latest status of the model. In the plotable condition it must not contain unnecessary auxiliary geometries (Planes etc.).

GEOM CHECKs creating corrupt geometries are to be avoided.

Completed models must always be cleaned up. Features no longer required must be deleted and not be suppressed., exception Family Tables.

Models shall only be saved with standard references (included in basic models) and with installation references

It must be possible to fully regenerate the models. You can check this with INFO / REGEN INFO / BEGINNING / QUIT.

Models must not include incompletely regenerated features.

6 Data exchange

It must be checked whether the design is based on the start models.

Upon data exchange all files of the overall model (Assemblies, Parts etc.) must be transferred.

7 Data management Pro/INTRALINK

Suppliers may obtain data from Pro/INTRALINK as follows:

The data is transferred from Pro/INTRALINK via PRESTO to PRISMA. In PRISMA the data are saved in CATIA-format. Only suppliers authorized for PRISMA can retrieve these data.

If a supplier needs Pro/ENGINEER data, these must be „ckecked-out“ from Pro/INTRALINK and sent to the supplier. They then loose their details specific to Pro/INTRALINK. If the supplier changes these data manual „check-in“ is required.