DiKon

DigitalKonvergens

VERSION 1.0 · 01 JULY 2024

DiKon Buildings
Guideline on exchange of supplier models

ARKITEMA ARCHITECTS COWI RAMBØLL NCC SWECO MTHøjgaard Danmark AARSLEFF

Guideline on exchange of supplier models

Contents

Introduction to the guideline

In the construction industry, BIM tools such as Revit, Archicad, and Tekla Structures are frequently used.

Suppliers of mechanical and electrical equipment often use other software packages historically adapted to the mechanical industry. This could include software such as Inventor, Fusion 360, Solidworks, Siemens NX, Creo, or similar.

Exchanging models from mechanical software to construction software often presents challenges. Models from equipment suppliers must be able to be integrated into construction software both as reference files in original programs and as sub-models in federated models.

This guideline addresses the requirements that should be set for files exported from mechanical software to ensure they function optimally in software developed for the construction industry.

Known issues include the following:

- Challenges with coordinate systems, causing models to be placed incorrectly and rotated incorrectly when imported into construction software.
- Challenges with 3D models from mechanical software that are too detailed and large, causing performance or display issues when loaded into construction software. For review purposes, the fully detailed model might be relevant, but often there is also a need for a simplified model without high detail levels inside the components, but where the external geometry remains accurate.
- Challenges with formats, where mechanical models are exported in formats that are not well-supported by construction software.
- Challenges with mechanical software's inability to satisfactorily export the IFC format. Either the format is not supported, or if it is, there can be issues with selecting sub-objects and including the tree structure in construction software. Additionally, there are often challenges with including properties in the export.

This guide can be used when discussing the exchange of models from mechanical software to construction software within a project context.

The document can also be included in an agreement framework when making agreements with suppliers of components and equipment. In such cases, the document should be adjusted, and the wording changed from being advisory to having the nature of actual requirements.

This is the first edition of the guide. Comments can be sent to members of DiKon's working group for construction. Please refer to Contact - DiKon – Digital Konvergens.

Abbreviations

Abbreviation	Meaning
DWG	Autodesk AutoCAD (Native Formal)
IFC	Industrial Foundation Classes (Exchange Format)
NWD	Autodesk Navisworks Document Format (Native Format)
NWC	Autodesk Converted Model Geometry Format (Exchange Format)
RFA	Autodesk Revit Family (Native Format)
RVT	Autodesk Revit (Native Format)
LOD	Level of Development (LOR+LOG+LOI)
LOR	Level of Reliability
LOG	Level of Geometry
LOI	Level of Information

Table 1: Table of Abbreviations

Model Requirements

The following applies to files exported from software used in the mechanical industry.

Coordinate System

The coordinate system must be oriented such that the Z-axis points upwards, and the X and Y axes lie in the plane.

See the illustration below:

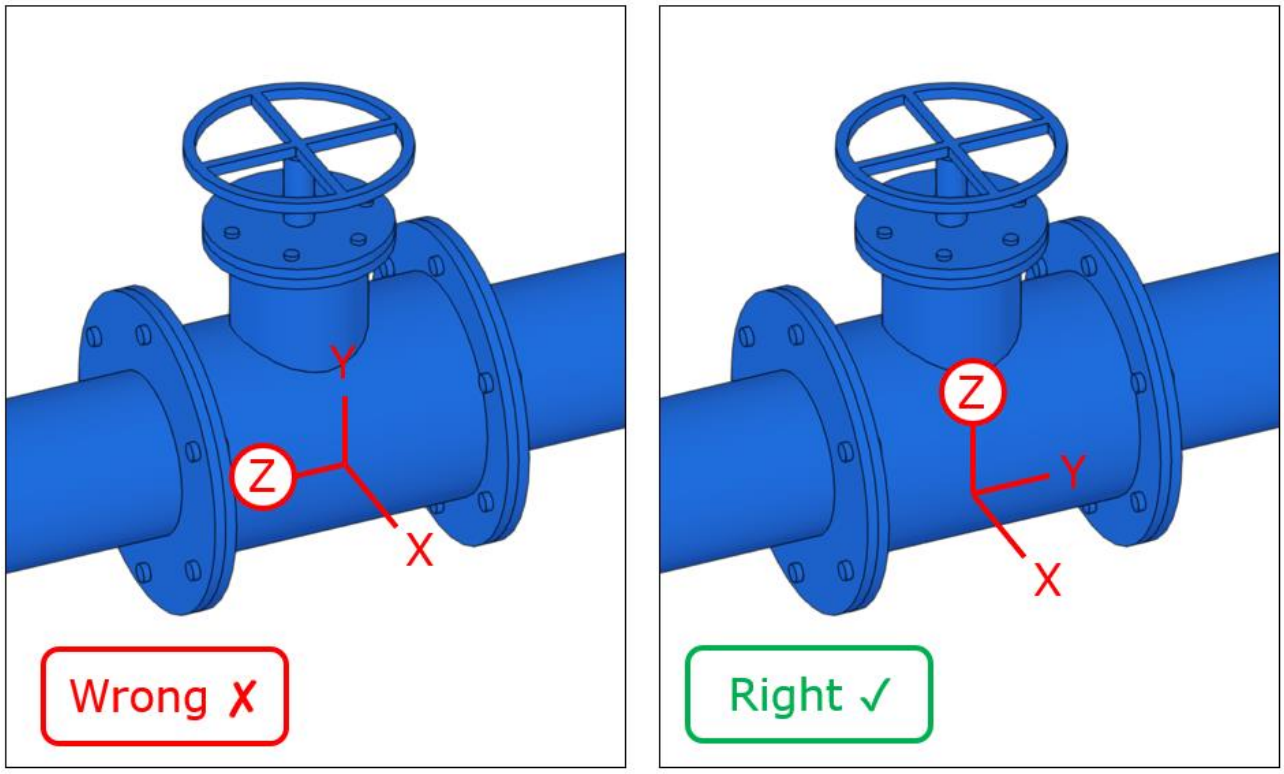


Figure 1: Orientation of the Z-Axis

Zero Point

For components and equipment that are exported, the zero point must be clearly defined and consistent throughout the project, ensuring that future revisions can replace the previous files with newer versions.

If possible, models should be exported relative to the project's zero point so that the models can be referenced in construction software without additional adjustments.

If the models cannot be exported based on the project's zero point, the supplier must communicate to the project's stakeholders how the exported models' zero point relates to the project's overall zero point. The models can be accompanied by one or more drawings that show the position of the equipment in relation to a project zero point or a point within a module grid.

Additionally, the following fundamental principles apply to zero points for equipment models:

In the plan, the zero point is placed according to a general principle agreed upon between the equipment supplier and the recipient of the model.

The zero point should generally be determined considering the connection or attachment of the components to other components in the model where they are imported. If the geometry of the components changes during the design process, the exported models should be easily updated in the construction software used.

For free-standing components, such as those placed on foundations, the zero point can be placed at the center of the component concerning height and width.

In height (Z-axis), the zero point can advantageously be placed so that Z=0 corresponds to the lowest point of the equipment.

Examples of reference points for a mechanical unit can be seen in Figure 2 and Figure 3. Here, the center point in the plan is the geometric center, and the insertion point on the Z-axis corresponds to the lowest point of the unit.

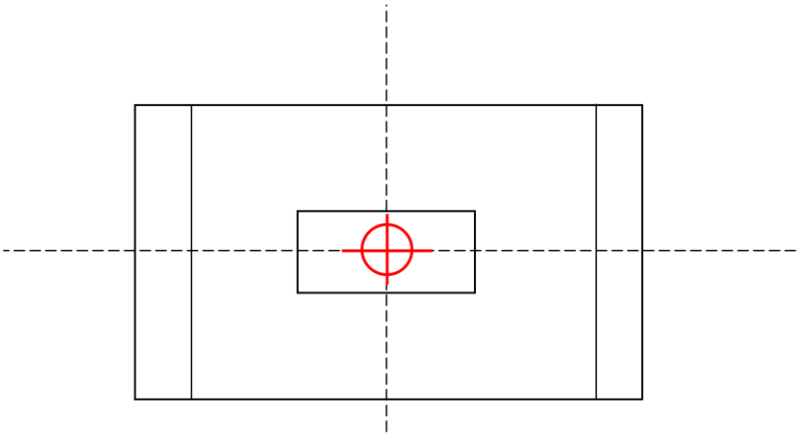


Figure 2. Plan View. Example of Insertion Point.

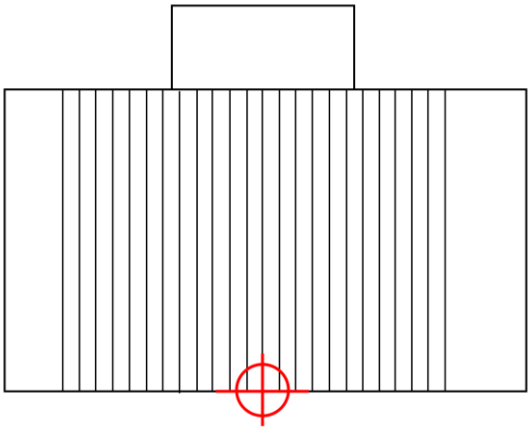


Figure 3. Elevation View. Example of Insertion Point in the Z-axis Direction.

Here is an example of an insertion point for a kitchen, where the insertion point is in the bottom left corner.

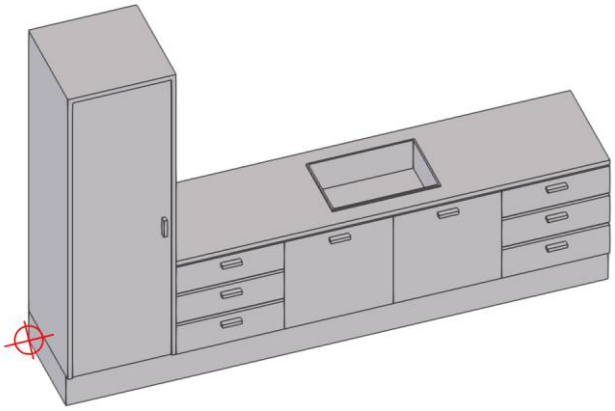


Figure 4. Kitchen. 3D View with Insertion Point

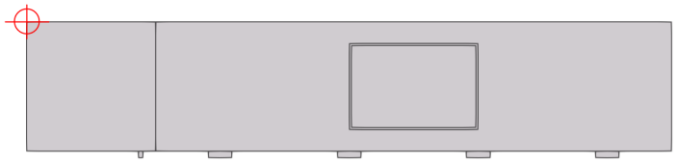


Figure 5. Kitchen. Plan View with Insertion Point

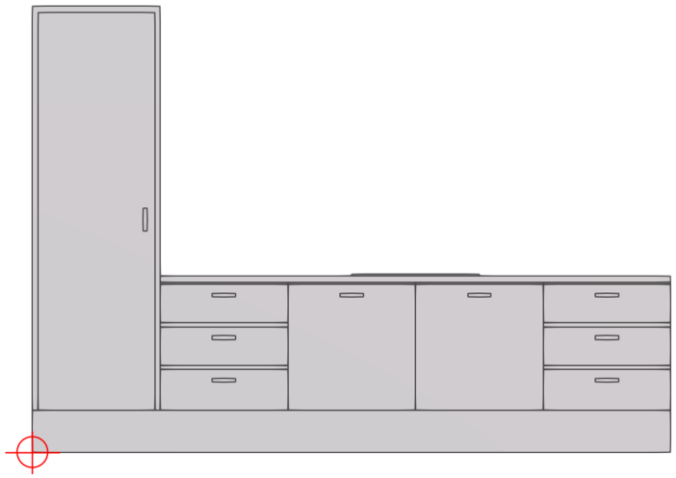


Figure 6. Kitchen. Elevation View with Insertion Point

Contents of Exported Files

The supplier must exchange their own discipline model at the agreed LOD level. The discipline models must only contain objects within the supplier's own area of responsibility.

Surrounding objects, which in terms of design and modeling are the responsibility of other parties, must not be included in the export. Figure 7 shows what should be included in the export file.

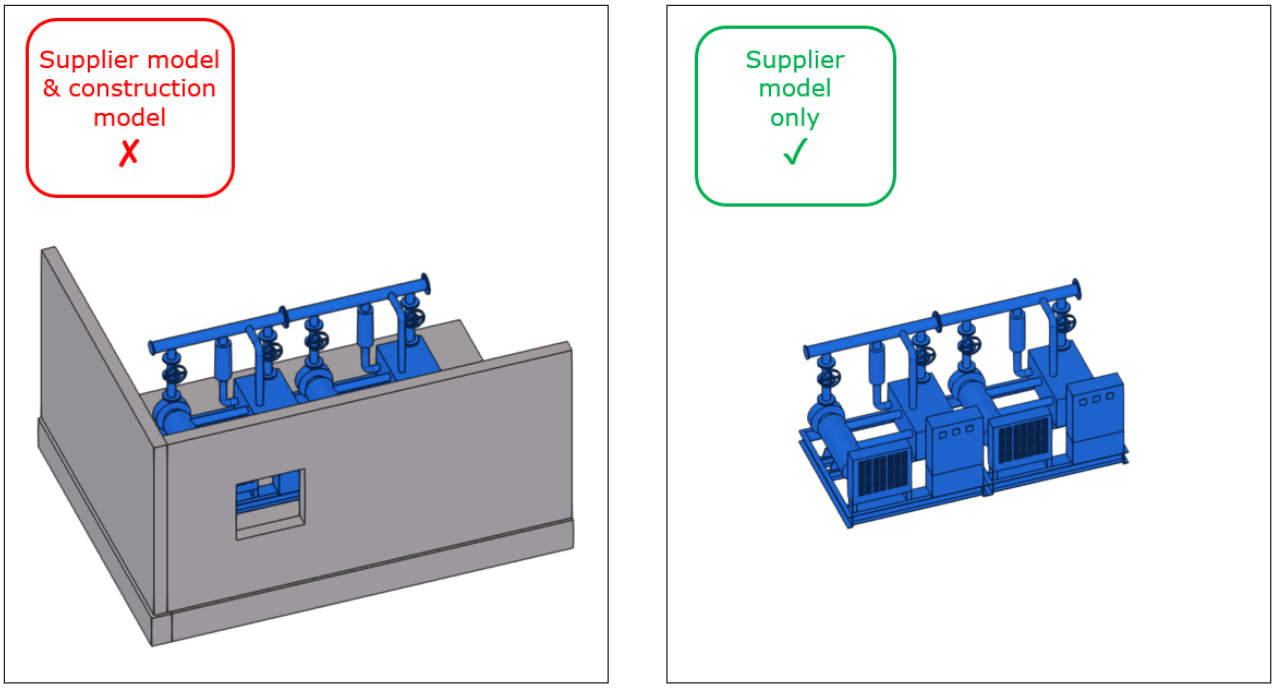


Figure 7. The content of the export file should correspond to the image on the right.

Exchange Formats

The following file formats may be relevant when exporting files from mechanical software to construction software. It should be ensured that at a minimum, IFC files are exchanged. The IFC version must be agreed upon specifically for the project, whether it be IFC 2X3, IFC 4, or a newer released version. For other exchange formats, the file format and version must be agreed upon between the project's parties.

Examples of exchange formats:

- IFC
- NWD
- NWC
- RVT
- DWG
- DGN
- RFA

Exchange Frequency

The exchange frequency must be aligned with the project's timeline. Additionally, the division of supplier models and the requirements for LOD throughout the project duration must be agreed upon.

Naming of Files

The supplier must use a naming syntax that fits within the overall naming conventions of the project's models. It should be agreed upon before the start of the project which naming syntax will be used.

The filename must be consistent from export to export and should not contain, for example, initials or dates, as a new version of an exported file should be able to replace an earlier version.

The principles from "Molio A104 Information Management" can advantageously be used.

LOD for Supplier Models

Geometric Detailing

To ensure optimal collaboration between an equipment supplier using mechanical software and a recipient using construction-oriented software, the equipment supplier should at a minimum provide a coordination model focused on external geometry and interfaces.

Additionally, it may be agreed that a fully detailed model should also be delivered, which can be used for review purposes.

Coordination Model

The coordination model is exported from the original program and is a simplified version of the fully detailed model. The focus is on the external geometry and all interfaces and connection points concerning adjacent building parts such as load-bearing structures or other mechanical equipment. Detailing hidden within the main components is removed, and the geometry is generally simplified to achieve a model with fewer polygons, resulting in a smaller file size.

Fully Detailed Model

The fully detailed model is exported from the original program and includes all geometric details present in the original model, both internally and externally. The model can be used for review purposes.

An example of a coordination model is shown in Figure 8.

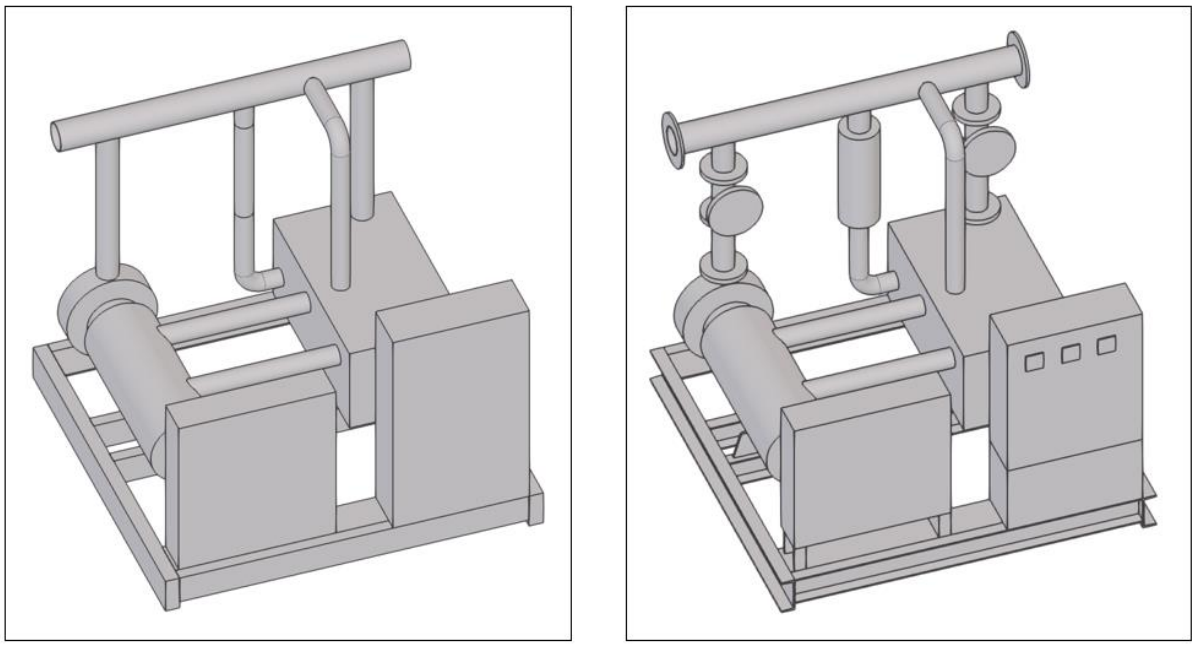


Figure 8 Coordination Model in LOD 300 and LOD 325.

An example of a fully detailed model is shown in Figure 9.

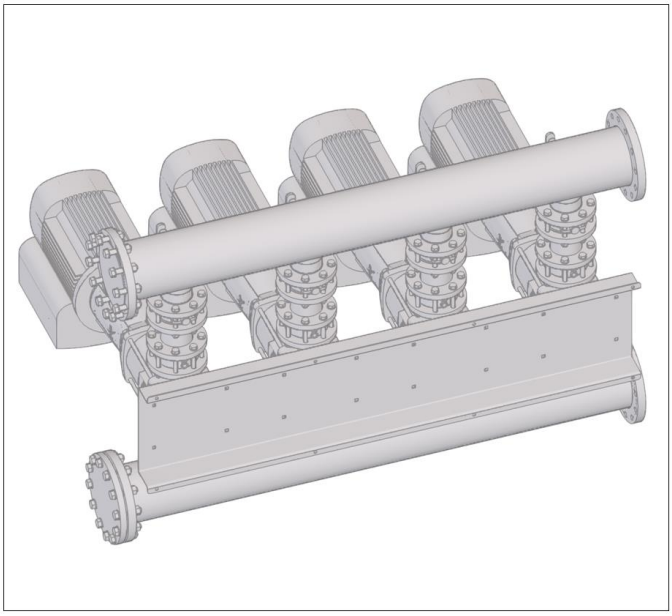


Figure 9 Fully Detailed Model

Table 2 shows the requirements for LOD levels for 3D models exported from mechanical software.

It must be agreed upon specifically for each project which models and LOD levels are to be delivered at what times.

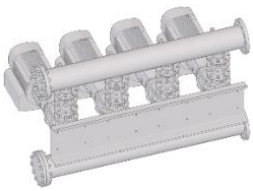
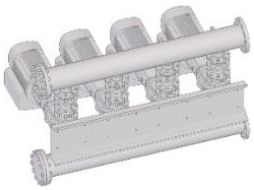
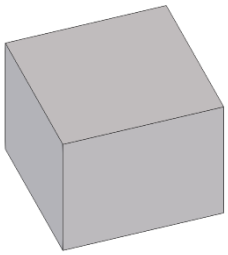
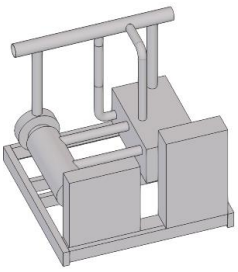
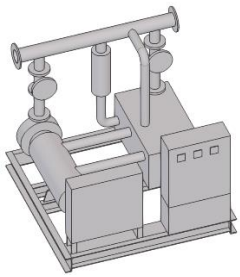
DiKon Digital Konvergens	**LOD for Objects in Supplier Models**			
LOD – Level of Development	**LOD 200**	**LOD 300**	**LOD 325**	
	Assumed	Defined	Final	
LOR – Level of Reliability	**LOR 200**	**LOR 300**	**LOR 325**	
	Objects are defined at the assumed level for geometry, location, and associated attribute data.	Objects are defined at a defined level for geometry, location, and associated attribute data.	Objects are defined at a final level for geometry, location, and associated attribute data.	
LOG – Level of Geometry	**LOG 200**	**LOG 300**	**LOG 325**	
	Objects are modeled at an assumed level in relation to geometry.	Objects are modeled at a defined level in relation to geometry, with particular focus on interfaces with adjacent disciplines.	Objects are modeled at a final level in relation to geometry.	
Fully Detailed Model				The export model contains all the geometric details present in the original mechanical software. The model is used for, among other things, review purposes.
Coordination Model				The model is a simplified version of the fully detailed model. The focus is on the external geometry and all interfaces and connection points with adjacent building components such as load-bearing structures or other mechanical equipment. Detailing hidden inside the main components is removed, and the geometry is generally simplified to achieve a model with fewer polygons and to reduce the file size.
LOI – Level of Information	**LOI 200**	**LOI 300**	**LOI 325**	

Table 2: Overview of LOD for Objects in supplier models