Critical manufacturing
an ASM PT company

New Product Introduction (NPI)

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New Product Introduction (NPI) is one of the fundamental concepts of manufacturing because it is the process of establishing a clear plan to take your product from its conceptualization to its final form. This process involves various stages, that may be different from project to project, but the end results are to reduce waste, avoid miscommunication, speed up production, and save time.

The Critical Manufacturing MES NPI module helps you achieve this by supporting the loading, association and visualization of an ECAD file of type ODB++ with a Product, and by supporting the loading of a Product BOM file with the component information.

Info

NPI is a separately licensed module.

This document will guide you through the required configurations for the NPI functionalities.

Overview

While manufacturing a product, it is a common practice to display technical drawings and schematics to assist the operator throughout the production process. Critical Manufacturing MES can help to associate the drawings to the products and to display these drawings when assembling the product. The concepts and functionalities of the Critical Manufacturing MES NPI module will be described in more detail over the next sections.

Concepts

The table below describes the main concepts related to New Product Introduction.

Concept	Description
ECAD	ECAD (electronic computer-aided design) software is used to design and create electronic structures. Typically consists of multiple 2D layers. Some CAD files are very basic and only contain the drawings - in this case, separate additional files (centroid and BOM File) are required. Some CAD files are more advanced and they contain the layout, the list of components as well as the component placement information, Pin, and Net information.
MCAD	MCAD (mechanical computer-aided design) is used to design and create mechanical systems. MCAD can be used for previewing various design iterations, including assessing form factors and the fitment of certain physical elements.
Schematic	A schematic is a representation of the elements of a system using abstract, graphic symbols rather than realistic pictures. A schematic usually omits all details that are not relevant to the key information the schematic is intended to convey and may include oversimplified elements in order to make this essential meaning easier to grasp.

Concept	Description
Drawing	A drawing (technical drawing) is used to convey information about an object. A common use is to specify the geometry necessary for the construction of a component and is called a detailed drawing.
Layer	There are multiple layers in an ECAD, some refer to the top side and others to the bottom side.
Component	A part used in an MCAD model, that is part of the BOM for a higher-level part.
Reference Designator	A Reference Designator identifies a component within an electrical schematic or on a printed circuit board. The Reference Designator usually consists of one or two letters followed by a number.

Table: New Product Introduction main concepts

Setting up New Product Introduction Related Entities

To enable the New Product Introduction functionalities, it is necessary to set up the Critical Manufacturing MES entities.

> **Note**
>
> Take the following example: the User aims to set-up a new Product for manufacturing, Product A. To manufacture Product A, the User has to create the required Products, BOMs and Checklists.

The CAD and BOM files should already be available.

In order to set up the NPI-related Entities it's necessary to follow the steps as described in the Table below.

Step Number	Step	Description
1	**Create the necessary Products**	Create the necessary Products and define their CAD, BOM, Schematic, and Drawing files.
2	**Create the necessary BOMs**	Create the necessary BOMs.
3	**Create the necessary Checklists**	Create the necessary Checklists for the manufacturing steps.

Table: Steps to setup the NPI-related Entities

The MES object model is displayed in the figure below.

```
graph LR
    L1[Checklist Item] --- A1[Checklist]
    A1 --- A2[BOM]
    A2 --- A3[Product]
    A2 --- A4[BOM Product]
    A3 --- N1[Product Component]
    N1 --- N2[Product Component Location]
    A3 --- N2
```

```
classDef mermaid_title color:#000, fill:#fafafa, stroke:#fafafa, stroke-width:0x, font-size:100%,
font-weight:200;
classDef mermaid_start color:#000, fill:#fafafa, stroke:#fafafa, color:#fafafa, stroke-width:0x,
font-size:100%, visibility: hidden;
classDef mermaid_businessdata color:#000, fill:#65CDE8, stroke:#65CDE8, stroke-width:0px, font-
size:100%;
classDef mermaid_nonbusinessdata color:#000, fill:#B7DEE8, stroke:#B7DEE8, stroke-width:0px, font-
size:100%;
classDef mermaid_entity color:#000, fill:#FB9F53, stroke:#FB9F53, stroke-width:0px, font-size:100%;
classDef mermaid_entitylinked color:#000, fill:#FCD5B5, stroke:#FCD5B5, stroke-width:0px, font-
size:100%;
classDef mermaid_context color:#000, fill:#B9CDE5, stroke:#B9CDE5, stroke-width:0px, font-
size:100%;
classDef mermaid_optional color:#000, fill:#B7DEE8, stroke:#65CDE8, stroke-width:1px, font-
size:100%, stroke-dasharray: 5 5;
class Main mermaid_entity
class A1,A2,A3,A4,A5,A6,A7,A8,A9,A10,A11,A12,A13,A14 mermaid_businessdata
class L1,L2,L3,L4,L5,L6,L7 mermaid_entitylinked
class C1,C2,C3,C4,C5,C6 mermaid_context
class N1,N2,N3,N4,N5,N6 mermaid_nonbusinessdata
```

The next sub-sections will cover the required configuration steps in more detail.

1 - Product

When preparing a Product for production, the User can define a *Default BOM* and it will be used to display the complete Product BOM tree structure by linking the different Product Default BOMs.

> **Note**
>
> For the above-mentioned example, the User should create Product A and the Parts required for assembling it.

CAD File Support

Drawings and Schematics are key for the manufacturing of a product in many assembly and electronics industries. To achieve this, the User can upload **ODB ++** ECAD files in MES. Currently, the system only supports this file type, however, in the future, further file types will be supported.

The generic table *CAD File Information* will be used to maintain general information of imported CAD files. The structure of this table is described in the Table below.

Property	Description	Data Type
File Type	The name of the File Type	String, Mandatory
File Extensions	A semi-colon separate list of possible file extensions for the given File Type	String, Mandatory
Content Type	Content of the FileType	Enumeration, Mandatory: - MCAD - ECAD
Includes BOM Information	Specifies whether the File Type contains BOM Information embedded within it	Boolean, Mandatory

Property	Description	Data Type
Includes Reference Designator Information	Specifies whether the File Type contains Reference Designator information embedded in it **Note:** this applies to ECAD files only	Boolean, Mandatory
Includes Component Location	Specifies whether the File Type contains Component Location information embedded in it **Note:** this applies to ECAD files only	Boolean, Mandatory

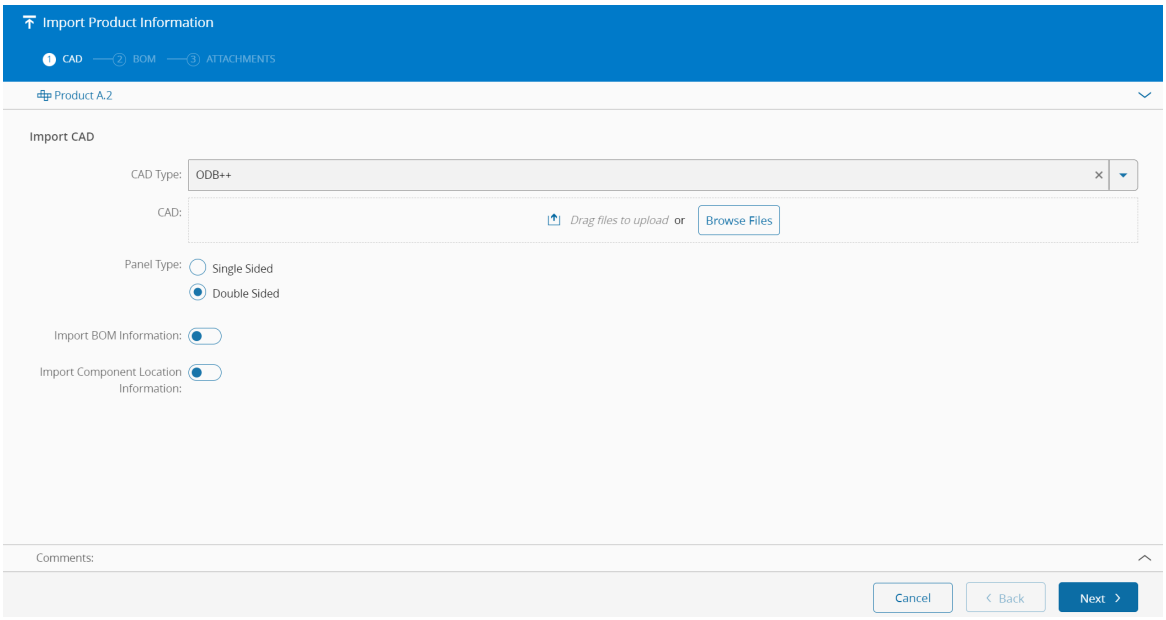
Table: Generic Table CAD File Information properties

Import Product Information

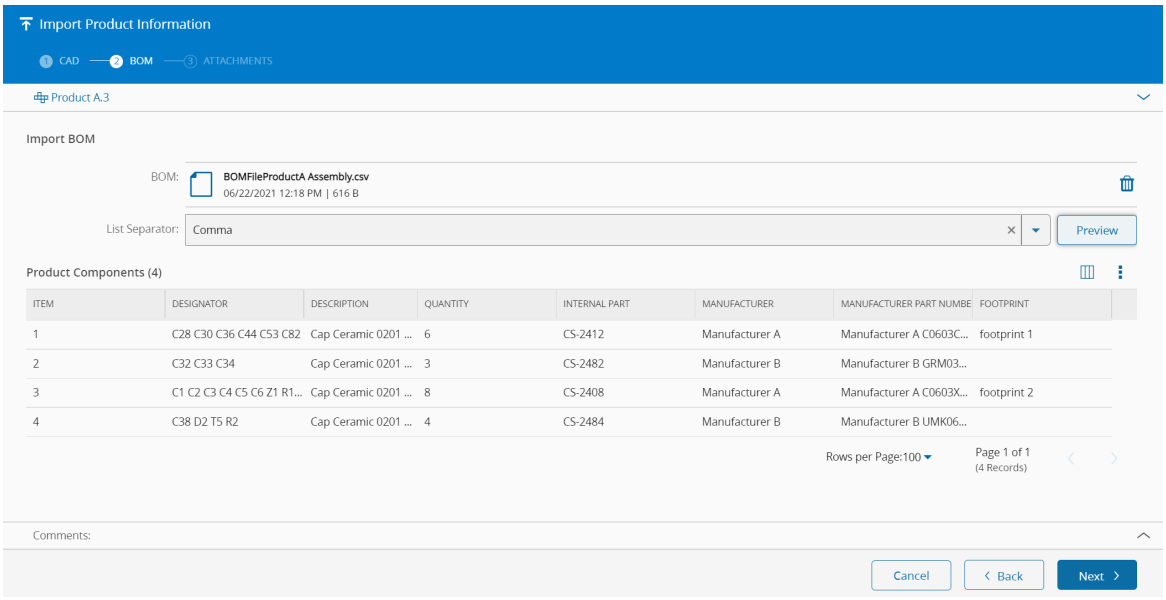
The User can link to the Product ECAD, BOM, Drawings, and Schematics files. Thus, on the creation of a Product, the User can access the Import Product Information wizard, displayed in the Figure below, and define the properties listed in the Table below.

Property	Description
CAD Type	The Product CAD file type. Currently, only the ODB ++ format is supported.
CAD File	To store the Product CAD file.
Panel Type	The Panel Type can be set for ECAD only and it defines whether the Product is single-sided or double-sided. This information is only for reference.
Import BOM Information	Whether the BOM information will be imported from the CAD file.
Import Component Location Information	Whether the Component Location information will be imported from the CAD file.
BOM File	To store the Product BOM file, in case it's not included in the CAD file. The BOM File is parsed according to the File Import Template Generic Table definition.
List Separator	The Separator used within the BOM file (Comma or Semicolon).
Schematic	A Schematic is a representation of the elements of a system.
Drawing	A Drawing is a type of technical drawing that is used to convey information about a Product.

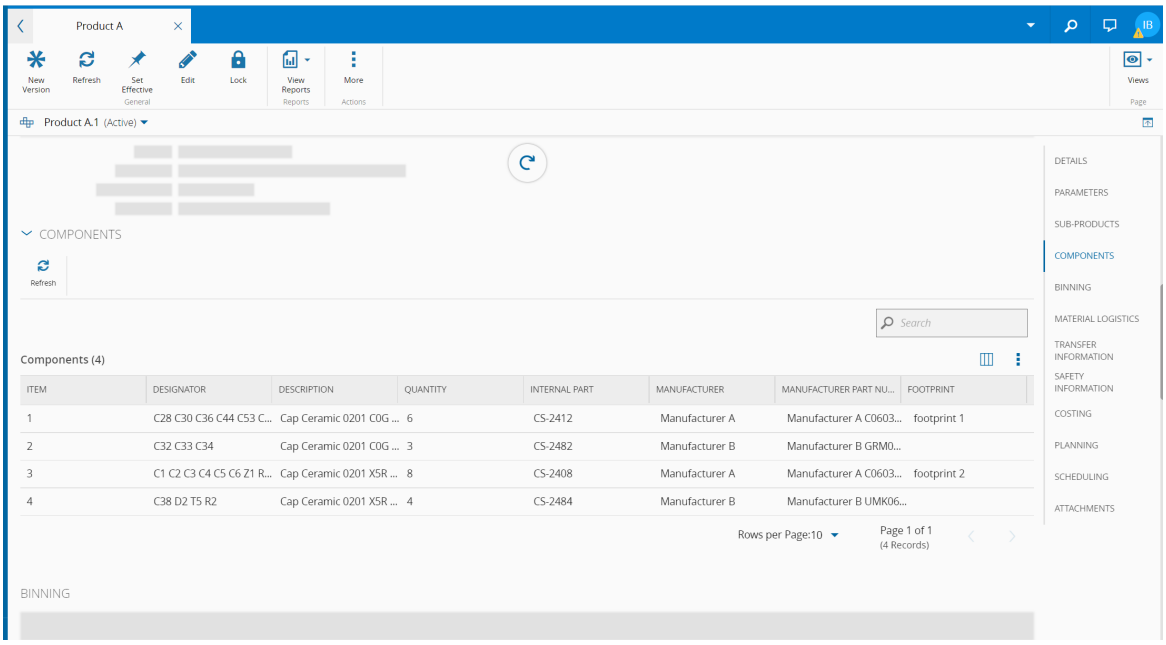
Table: Import Product Information properties



If the User selects a BOM file, the Product Components can be previewed by selecting the Preview button, as displayed in the Figure below. For the required structure of the BOM File please check the BOM File Support sub-section below.



The Product Components are listed under the Components section available in the Product Details view, as displayed in the Figure below.



Note

For the given example, the User should upload for Product A and for the Products of the Parts required for assembling it: the CAD file, the BOM file, and any relevant Drawings and Schematics.

To perform automatic column mapping of specific file headers and standard system properties, the system uses the Generic Tables *File Import Information*, *File Import Property Information*, and *File Import Column Information*, as described in the Tables below.

Property	Description	Data Type
Entity Type	Describes for which Entity this information applies to	Reference to an Entity Type - mandatory
Type	Describes the information type to import	Enumeration, Mandatory: - BOM - Centroid - CAD
Is Enabled	Defines whether the import is enabled for this information type	Boolean, Mandatory

Table: Generic Table File Import Information properties

Property	Description	Data Type
Entity Type	Describes to which Entity Type this information applies	Entity Type, Mandatory

Property	Description	Data Type
Type	Describes the information to be imported	Enumeration, Mandatory: - BOM - Centroid This must be a list of known types
Property	The name of the system property	String, Mandatory
Data Type	The property data type	Enumeration, Mandatory
Enumeration Name	The enumeration name	Boolean, Optional
Is List	Whether the property is a list or not	Boolean, Mandatory
Is Mandatory	Whether the property is mandatory or not	Boolean, Mandatory

Table: Generic Table File Import Property Information properties

Property	Description	Data Type
Entity Type	Describes for which Entity this information applies to	Reference to an Entity Type - mandatory
Type	Describes the information type to import	Enumeration, Mandatory: - BOM - Centroid This must be a list of known types, same as File Import System Properties
Header	Name of the file column header	String, Mandatory
System Property	Name of the system property	String, Mandatory

Table: Generic Table File Import Column Information properties

BOM File Support

Currently, Critical Manufacturing MES provides support for BOMs in CSV format.

The CSV file has to meet some structure requirements, as described in the Table below. Those are defined for the BOM entity, under the *File Import Property Information* Generic Table.

Info

Please note that in the CSV file, the headers must be set and defined in the first row. The User can set any order for the columns and there is no culture when importing the CSV file.

Property	Description	Data Type
Item Number	The BOM item number	Number, Mandatory
Reference Designator	A list of reference designators, mandatory for ECAD files. Separate by “spaces” or “,” and use “-” for ranges.	String, Optional
Description	The description of the component	String, Optional
Quantity	The BOM item quantity	Long, Mandatory
Internal Part Number	The internal part number of the component	String, Optional
Manufacturer	The manufacturer	String, Optional
Manufacturer Part Number	The manufacturer part number	String, Optional
Footprint	The geometry of pads for soldering certain electronic components **SMT Specific**	String, Optional

Table: BOM CSV file properties

Note

For the given example, the BOM file for Product A would have the following information:

Item Number	Internal Part Number	Description	ReferenceDesignator	Quantity	Manufacture
1	CS-2412	Part A top	C28 C30 C36 C44 C53 C82	6	Manufacturer
2	CS-2482	Part B bottom	C32,C33,C34	3	Manufacturer
3	CS-2408	Part C side	C1-6 Z1 R102	8	Manufacturer

Table: BOM file example

2 - BOM

When creating a BOM with Scope Materials or Weigh & Dispense it is possible to define the properties listed in the Table below.

Property	Description
Product	The selected Product will allow to link the BOM to that specific Product and to re-use the Product CAD, Drawing, and Schematic files.
Drawing File	The User can add a Drawing file.

Table: BOM properties

For each BOM Item of a BOM with Scope Materials it is possible to define a **Reference Designator**. This only applies to BOMs that reference a Product that contains an ECAD file.

Note

For the given example, the User should create the BOMs required for assembling Product A and for assembling the Parts of Product A.

3 - Checklist

When processing a Material at a certain Step, the User might require some visual aid in order to guide him/her throughout the operation's steps. This can be attained by having an instruction displayed when performing a Checklist. The properties to be configured are detailed in the Table below.

Property	Description
Scope	The Scope must be defined as Material Tracking.
Execution Mode	The Execution Mode must be defined as Long Running.
BOM	The BOMs available for selection have the Type defined as Materials or Weigh & Dispense.

Table: Checklist properties

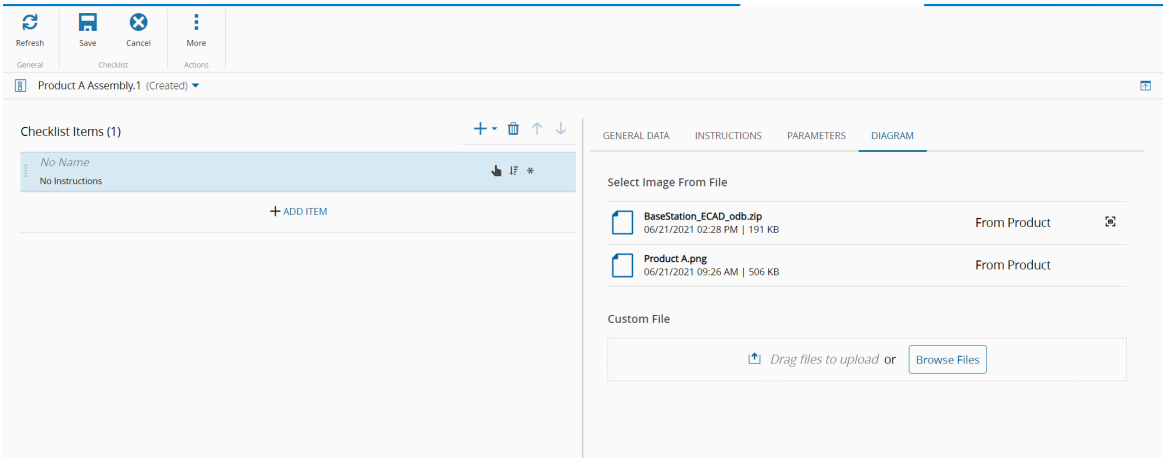
Note

For the given example, the User should create the Checklists to guide the User when assembling Product A and when assembling the Parts of Product A.

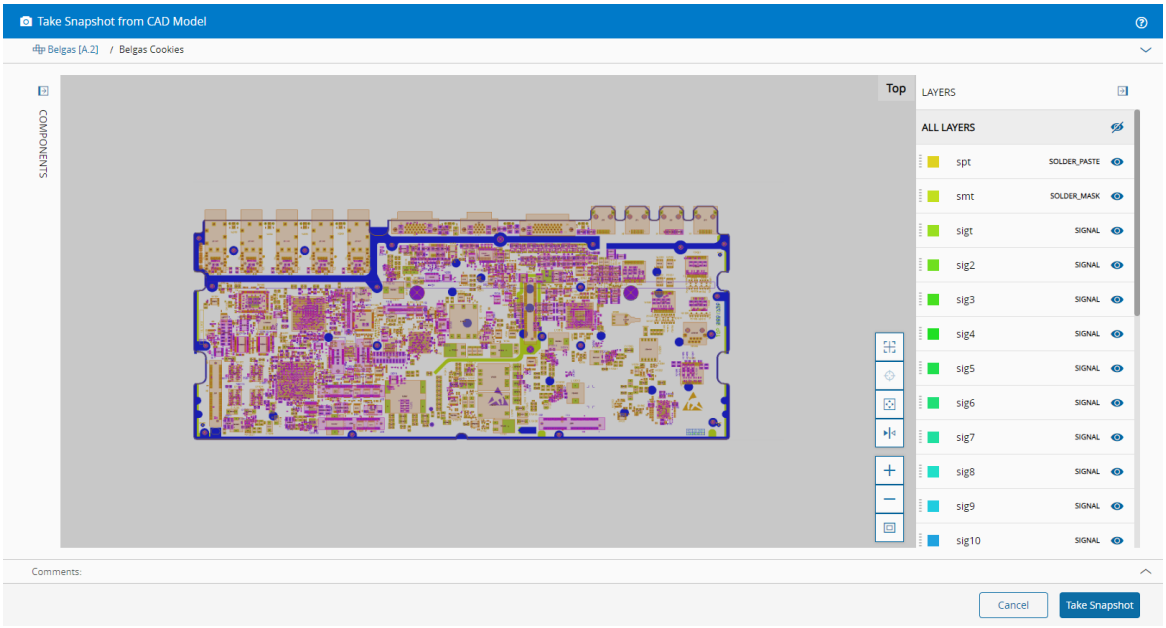
Diagram

It is possible to define a Diagram for a Checklist Item, i.e. a file that provides instruction with some sort of visual aid for the User when performing the Checklist.

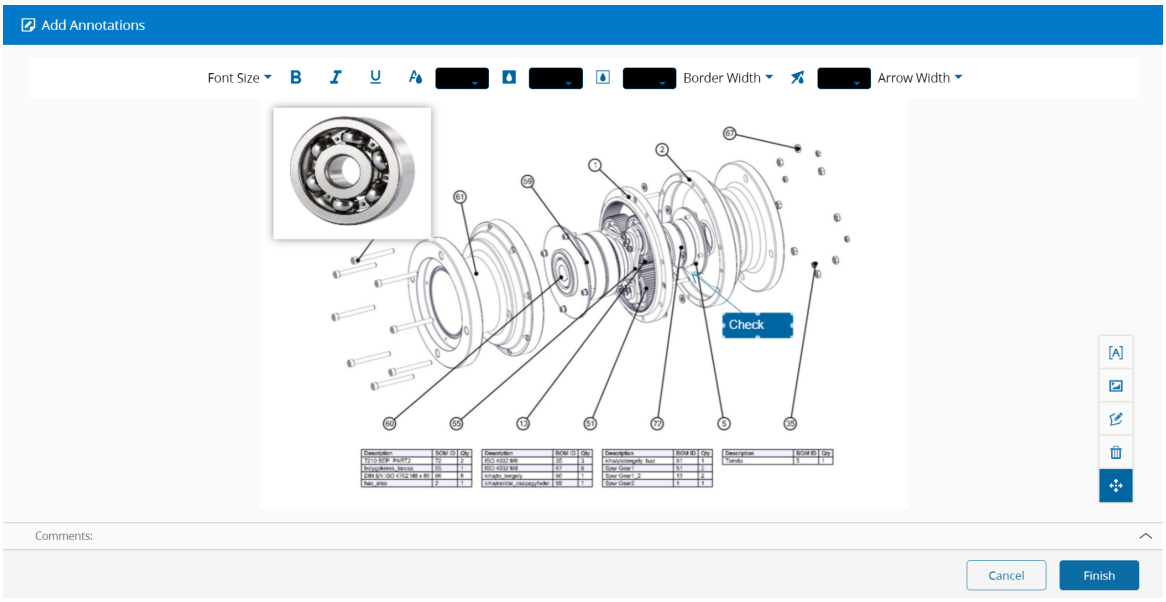
The BOM property Drawing File and the Product properties CAD File, Schematic, and Drawing are available for selection if a BOM is defined for the Checklist and this BOM as a Product defined, as displayed in the Figure below.

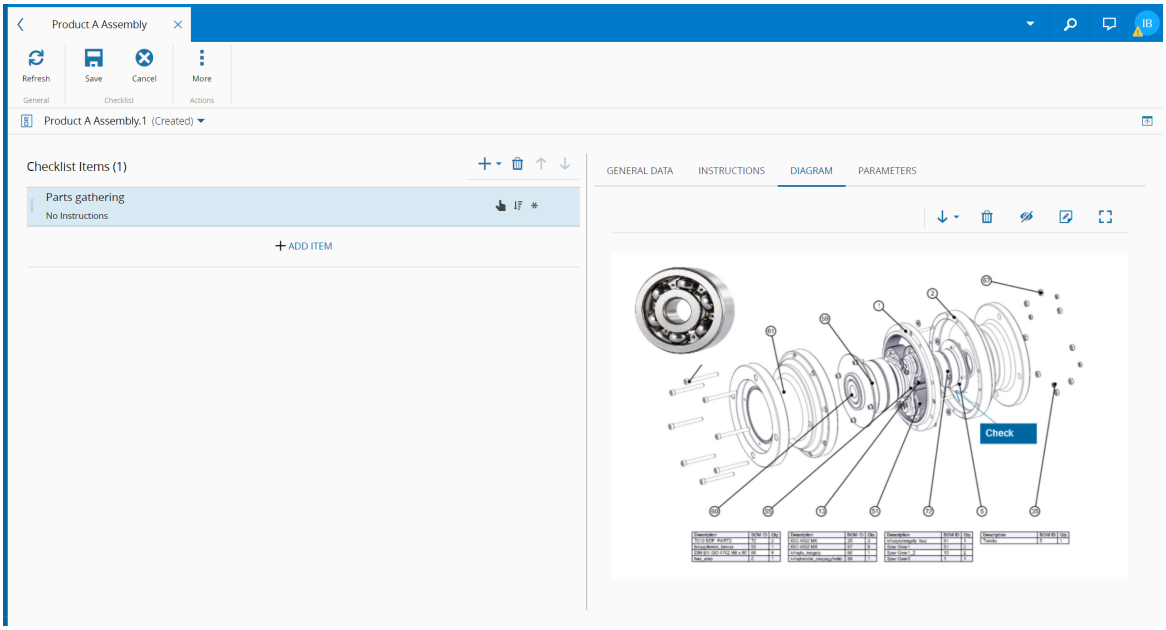


For dynamic files (e.g CAD), the User needs to take a snapshot from the CAD viewer to use as a static image and to be able to add annotations, as displayed in the Figure below.



It is also possible to configure annotations and add ../../images for files or snapshots through the Add Annotations wizard available in the Diagram tab of the Checklist Item, as displayed in the Figures below.





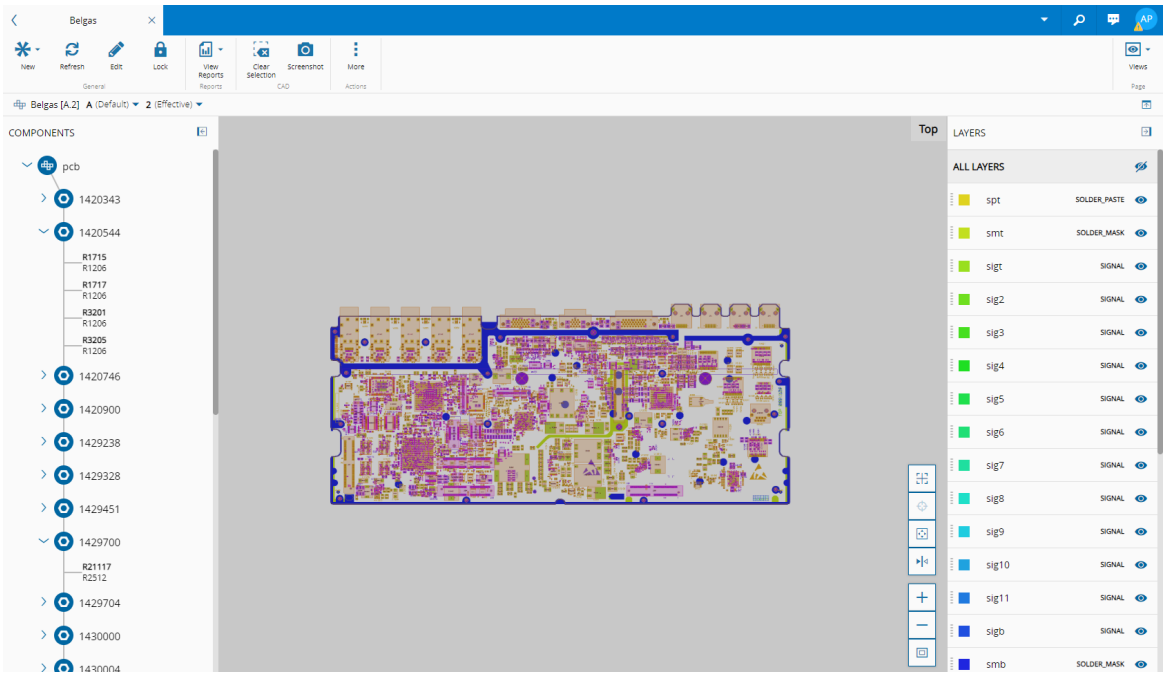
Using New Product Introduction

After setting up the required configurations mentioned in the previous sections, the NPI functionalities can be used, as described in the next sections.

CAD Visualization

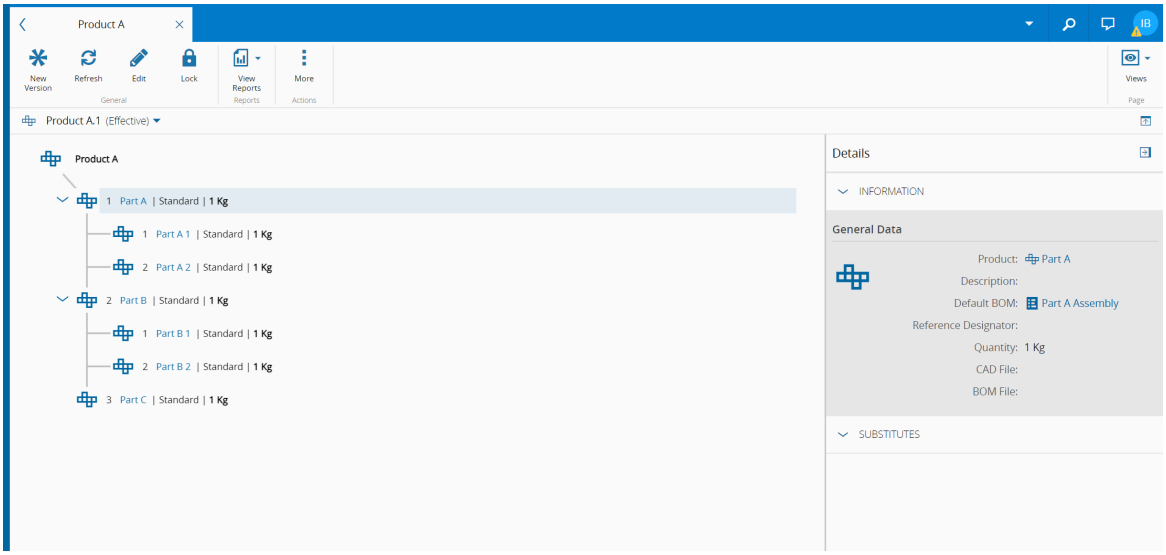
If a Product has a CAD file defined, the CAD view will become available, as displayed in the Figure below.

On the right-hand side of the screen it possible to show/hide layers. On the left-hand side of the screen, it is displayed the Product tree, with the Product Components and Reference Designators and it is also possible to select a Reference Designator that will be highlighted in the CAD drawing. By double-clicking on a Reference Designator in the CAD drawing, the Reference Designator name will be highlighted in the Product tree.



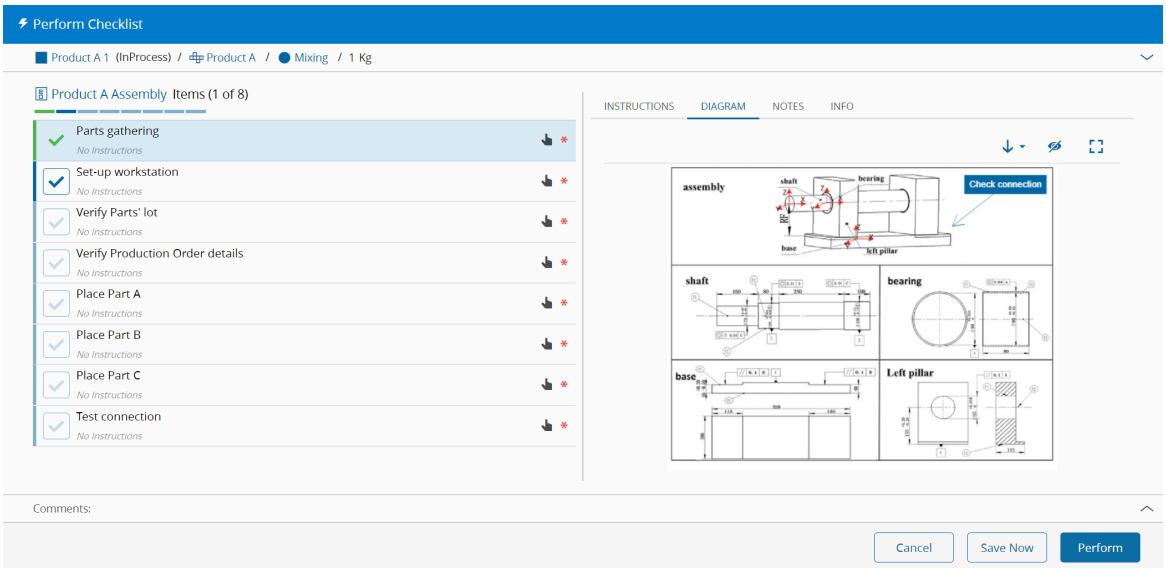
Product BOM Structure Visualization

If a Product has a Default BOM defined, the BOM Structure view will become available, as displayed in the Figure below. If the BOM Items of the Product also have a Default BOM defined, their BOM Items will be displayed as well.



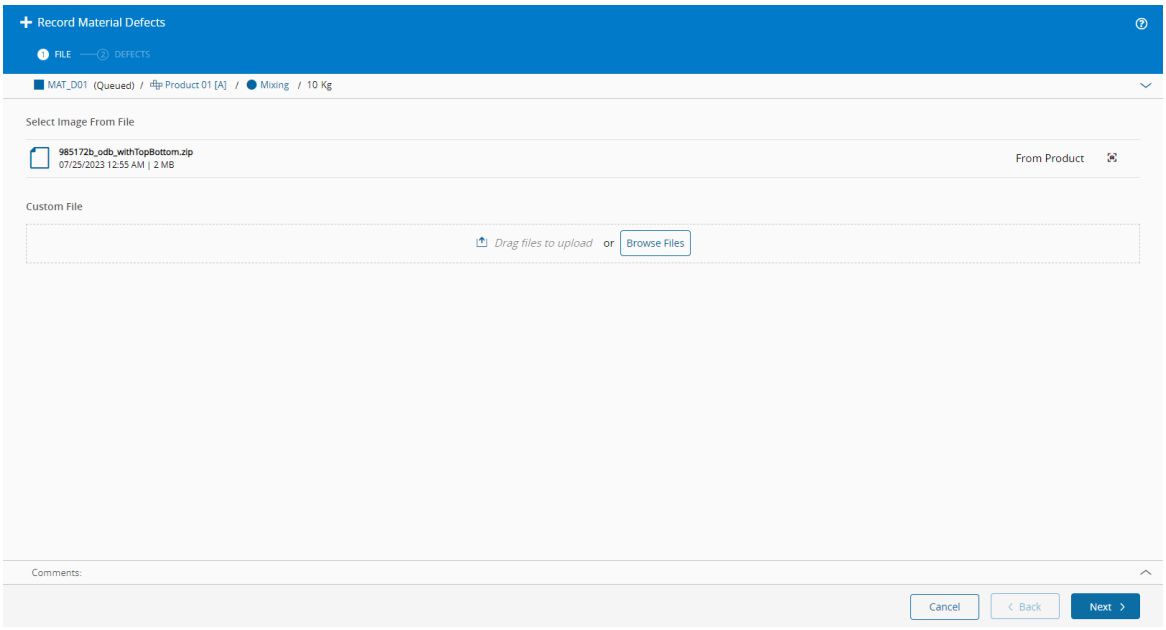
Perform Checklist

When performing a Checklist, if a Diagram is defined, it will appear together with the defined annotations, as displayed in the Figure below.



Record Material Defect using Picture

When recording a Defect for a Material, the User can specify a Defect Reason in a Drawing, either in a snapshot of the Product CAD file or in an image. The image can either be provided by the Drawings linked to the Product of the Material or provided when recording the Defect, as displayed in the Figure below.



Info

For further information please refer to the Material Defects Tutorial

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