Aras Manufacturing Process Planning 19

User Guide

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Document Conventions

The following table highlights the document conventions used in the document:

Convention	Description
Bold	This shows the names of menu items, dialog boxes, dialog box elements, and commands. Example: Click **OK**.
`Code`	Code examples appear in `courier` font. It may represent text you type or data you read.
`Yellow highlight`	Code highlighted in yellow draws attention to the code that is being indicated in the content.
`Yellow highlight with red text`	Red text highlighted in yellow indicates the code parameter that needs to be changed or replaced.
Italics	Reference to other documents.
Note:	Notes contain additional useful information.
Warning	Warnings contain important information. Pay special attention to information highlighted this way.
Successive menu choices	Successive menu choices may appear with a greater than sign (-->) between the items that you select consecutively. Example: Navigate to **File** --> **Save** --> **OK**.

1 Overview of Manufacturing Process Planning

The Aras Manufacturing Process Planning (MPP) application is an important component of Product Lifecycle Management (PLM) that enables global Manufacturing teams to author and manage Manufacturing data, such as Process Plans, Manufacturing Bill of Materials, Resources, Work Instructions etc. in a single source while interfacing with data from other parts of an organization such as Engineering, Quality etc.

The features available in Aras Manufacturing Process Planning are:

- **Author Process Plans**: This feature enables users to create Process Plans, which describe the Operations, Steps, Consumed Parts and Resources required to manufacture a Product or an Assembly.
- **Concurrent Work Instruction authoring**: The Process Plan and Work Instruction are created simultaneously since they are different views of the same underlying data.
- **Ability to create visually rich Work Instructions**: Users can create Work instructions with content such as images, tables, lists etc.
- **Ability to publish Work Instructions**: Work Instructions can be printed and published to PDF and HTML formats.
- **Integrated Process Plan and Manufacturing Bill of Material creation**: This feature enables users to create Process Plans and MBOMs simultaneously. The Process Plan and the MBOM are different views of the same underlying data.
- **Author Manufacturing Bill of Materials**: This feature enables users to restructure and derive the MBOM from the EBOM.
- **Workbench to easily author Process Plan and MBOM**: The workbench window enables users to easily create the Process Plans and author/restructure MBOMs using drag and drop capability.
- **Reconcile Parts between EBOM and MBOM**: The user is provided with automatic real-time indicators to show how Parts in the EBOM are accounted for in the MBOM.
- **Create Location based Process Plans and MBOMs**: Users can create Process Plans and MBOMs specific to different locations.
- **Conflict resolution while saving data**: MBOMs are multi-level BOM structures that can be edited concurrently by multiple users. Thus, there can be conflicts when saving data. This feature enables the user to resolve the data conflicts before saving.

1.1 Glossary

The following terms are used throughout this document. It is important to understand them to effectively use Aras MPP:

Term	Definition
MPP	Manufacturing Process Planning
EBOM	Engineering Bill of Material
MBOM	Manufacturing Bill of Material
WI	Work Instruction
Location	A Manufacturing factory where a product or assembly is manufactured. Locations are also referred to as Plants.
Sub-assembly	An assembly that has a higher level parent assembly
Process Plan	A Process Plan is an Item that describes how a product or assembly will be manufactured. Process Plans are also referred to as routings.
Operation	An Item representing operations performed on the shop floor. An Operation can consist of detailed manufacturing Steps (as defined below). Operations are usually performed at a WorkStation in the Manufacturing factory.
Step	The Step Item is the smallest work element of an Operation that is performed on an assembly.
WorkStation	A work area in a Manufacturing Factory where Operations are performed. Machines, Tools and Technicians come together at a WorkStation to assemble the Product (or work on an Assembly).
Resource	Assets, including Machines, Tools and Humans, necessary to perform an Operation.
Phantom Assembly/Phantom	A grouping of Parts that defines the results of an intermediate step in a manufacturing process. Phantoms are manufacturing-only Parts that do not appear in the EBOM. Like any other assembly, Phantoms are identified by a Part Number. The Part Item is classified as a Phantom.
MBOM only Part	There are consumables that do not appear in the EBOM. Some examples of consumables are glue, paint, etc. The Part Item is classified as a “MBOM only Part.”
Workbench (WB)	A window (in Aras MPP) that provides users access to content (Items) to create Process Plans and MBOMs.
Produced Part	A Produced Part is an Assembly or a Phantom that is manufactured by a Process Plan.
Consumed Part	A Consumed Part is a Part that is required at an Operation to build an assembly.
Sub-process plan	A sub-process plan is not a different Item. It is still the Process Plan Item, but it has a parent process plan. For example, a sub-process plan would define the routing for a sub-assembly or a phantom assembly.

2 Aras MPP TOC Items

Aras MPP Items can be accessed from the Folder named **Process** on the main Table of Contents (TOC). This folder contains six Item Types: **Graphics**, **Locations**, **Machines**, **Process Plans**, **Skills**, and **Tools**.

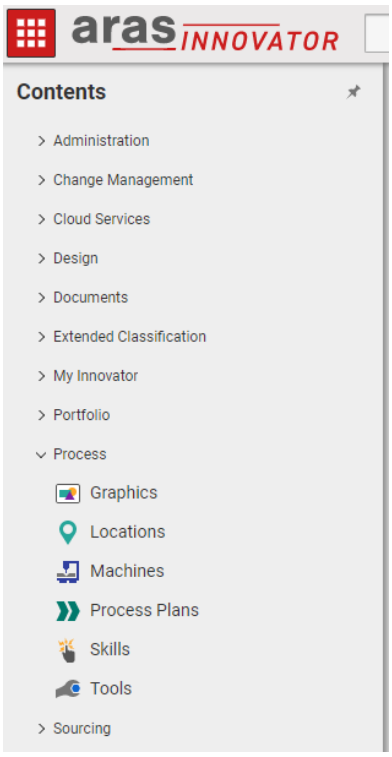


Figure 1.

- **Graphics** – The Graphics Item is inserted in a Work Instruction under an Operation or a Step.
- **Locations** – The Location Item represents a Manufacturing factory where the product or assembly is manufactured. The Location Item is related to the Process Plan Item.
- **Machines** - The Machine Item represents an asset/resource used on the shop floor. It is necessary to perform an Operation. The machine Item is related to an Operation Item.
- **Process Plans –** The Process Plan Item is the top level Item that describes how a product or assembly is manufactured.
- **Skills -** The Skill Item represents the shop floor technician capability that is necessary to perform an Operation. The Skill Item is related to an Operation Item.
- **Tools -** The Tool Item represents an asset/resource used on the shop floor, that is necessary to perform an Operation. The tool Item is related to an Operation Item.

Creating these Items is like creating any Item in Innovator. You can create an Item by either right-clicking on the Item in the TOC and selecting **Create New…** from the popup menu as shown in the following example:

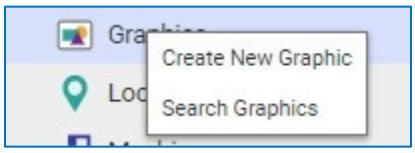


Figure 2.

You can click **Process>*Item Name*** in the TOC to access the menu. The following is an example of a Process menu:

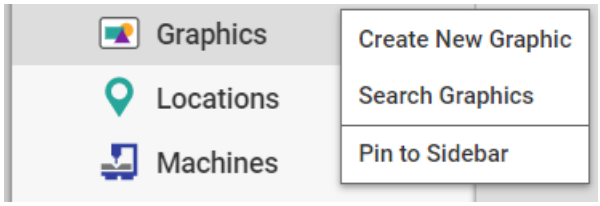


Figure 3.

3 User Interface

This section describes the main User Interface (UI) - Forms and Views in Aras MPP.

3.1 MPP Window

MPP is based on the **Process Plan ItemType** which has a standard Innovator **Form** and three **Views** that you can access through the Sidebar.

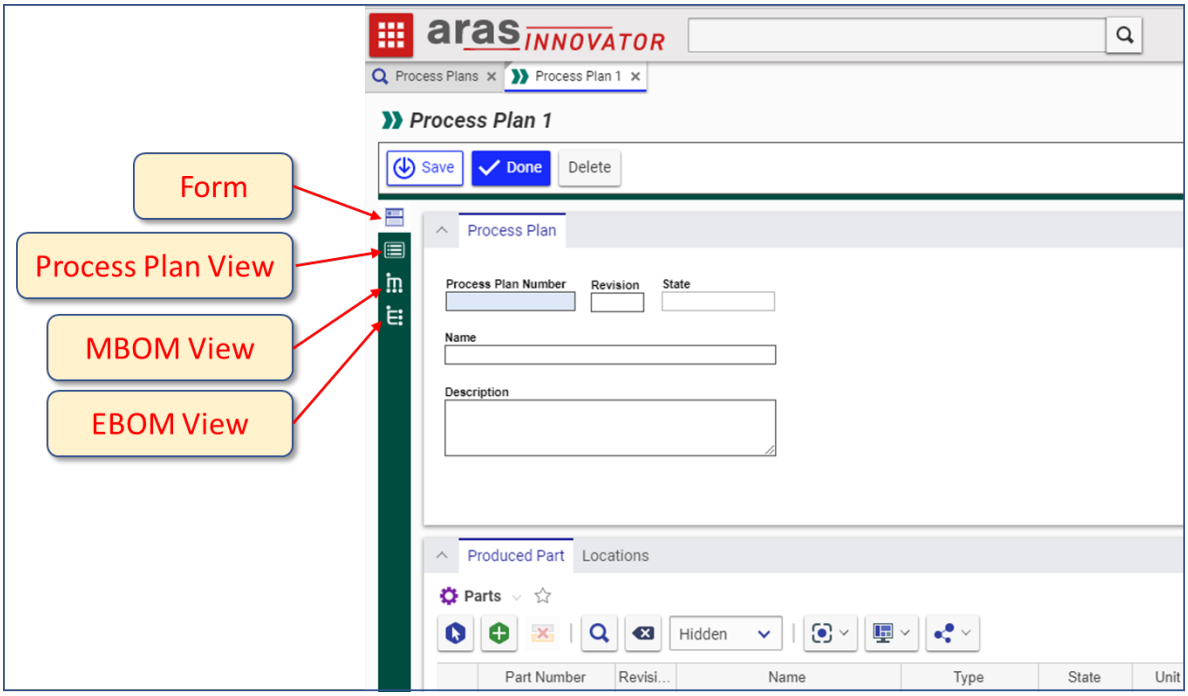


Figure 4.

The MPP window has the sidebar on the left with 4 buttons – the Process Plan Form, Process Plan View, MBOM View and EBOM View. The three Views that are available are:

- **Process Plan View** – The screen is split into 2 sections – Process Plan Tree & Work Instruction. You can edit in this View.
- **MBOM View** – You can edit the multi-level MBOM in this View**.** The **MBOM Reconciliation Status** is a calculated property that also appears in this View.
- **EBOM View** – You cannot edit in this View. You can only view the multi-level EBOM**.** The **EBOM Reconciliation Status** is a calculated property that also appears in this View.

Use one of the following methods to open the MPP Application:

- From the TOC when you want to view/edit an existing Process Plan.
- Create a new Process Plan from TOC.
- Open a Process Plan for a consumed part from the Process Plan Tree.

3.2 Process Plan View

The Process Plan View consists of two main areas:

- The Process Plan Tree with the Workbench
- Work Instruction

The Process Plan View is available for editing, which is described later in the document. It enables you to view the multi-level Process Plan and edit one level of the Process Plan.

You can drag and drop Items from the workbench to the Operations in the Process Plan tree.

You can also resolve the Process Plan for different Locations.

The Work Instruction is rendered from information contained in the Process Plan Tree. The Items in the Process Plan Tree map to the elements in the Work Instruction.

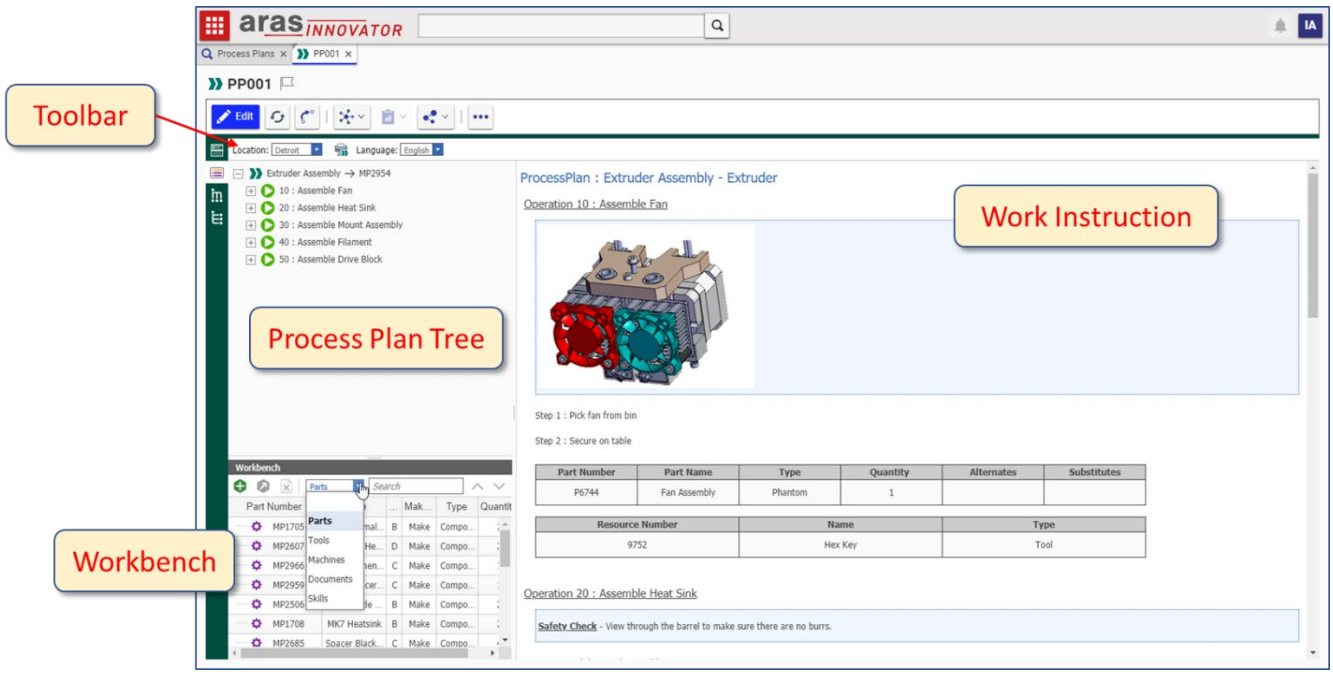


Figure 5.

3.2.1 Process Plan Toolbar

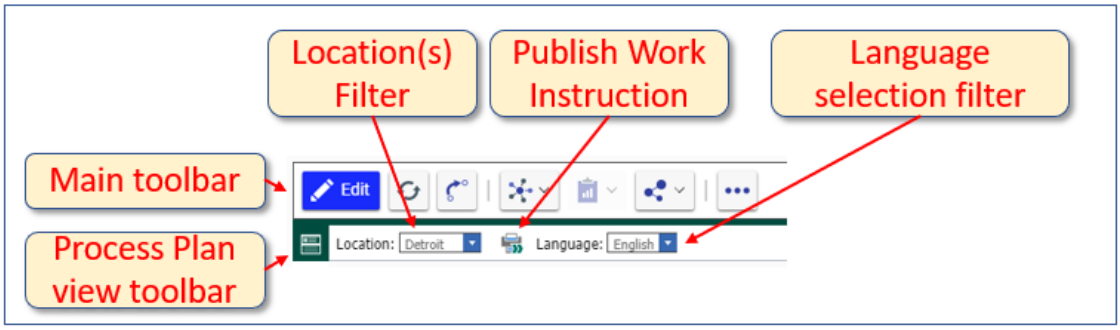


Figure 6.

The Main toolbar is the standard Innovator toolbar.

3.2.2 Process Plan Tree

This section describes the various Items that can be created in a Process Plan Tree and how these Items are structured in the tree hierarchy.

As illustrated in the following diagram, every Item in the tree has its own specific icon. Certain Items can have child Items as illustrated by the red circles around the **"+"** sign. The Items that can have child Items are Process Plans, Operations, Phantoms and Parts. Selecting the **"+"** sign for the Part or the Phantom expands them and shows their Process Plan. This is referred to as the sub-process plan in the context of the parent Process Plan. The parent Process Plan in the following diagram is for the Extruder Assembly. The sub-process plan is for the Phantom – P6744.

If a Process Plan has a sub-process plan, you can view it but not edit it in the context of the parent process plan. To edit the sub-process plan, you must open it in a separate tab.

The hierarchy of the Items in the Process Plan Tree are shown in the following diagram:

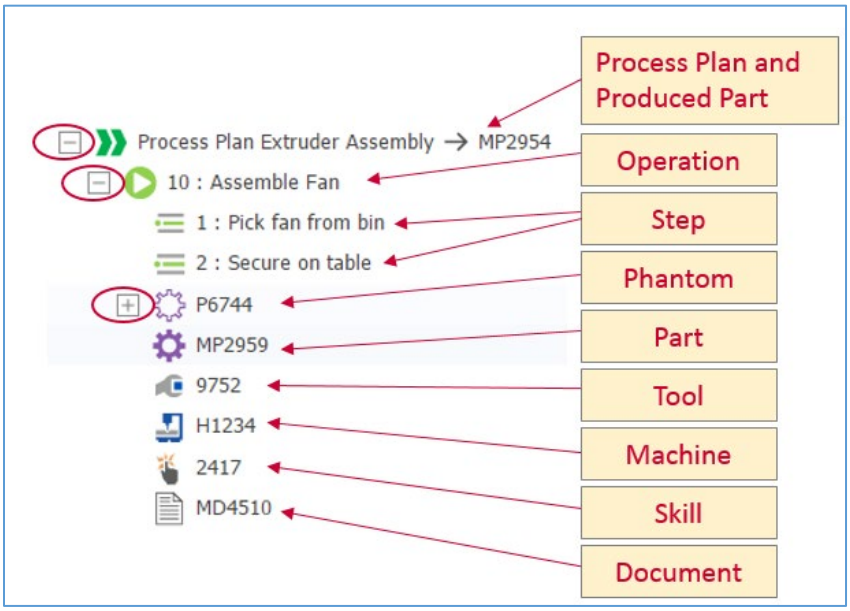


Figure 7.

3.2.3 Process Plan Tree Edit Indicators

When working in the Process Plan Tree, indicators in the form of icons inform you about the Item and its parent nodes in the tree that you are editing.

After you click the **Save Item** button on the top toolbar, the save action is performed and the icons disappear.

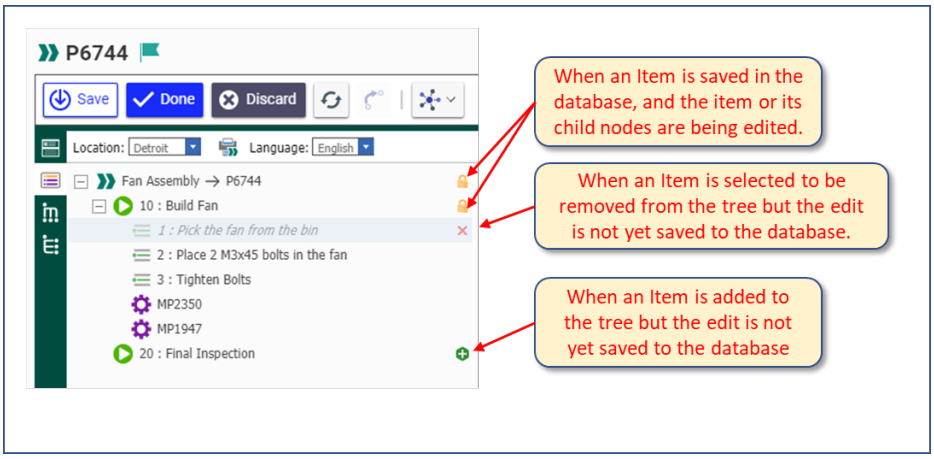
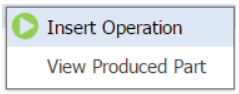
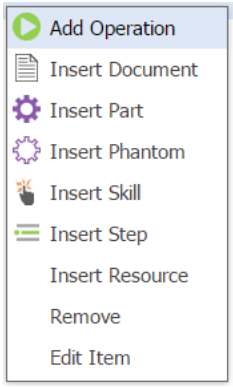


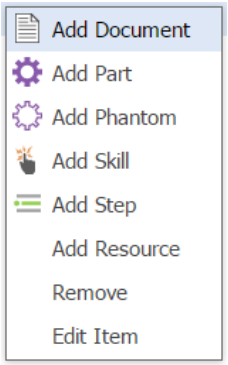
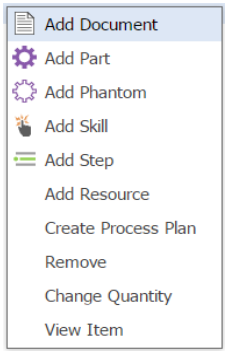
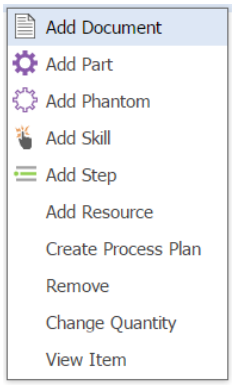
Figure 8.

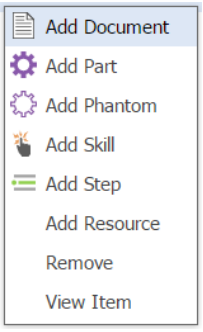
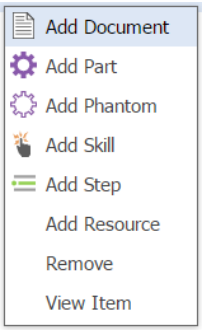
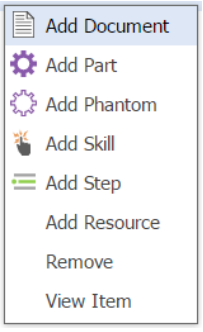
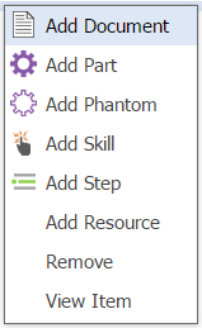
3.2.4 Process Plan Tree Context Menu

The Process Plan Tree contains Items describing how a product or assembly will be manufactured. When the Process Plan is **Unlocked**, you can right-mouse button click and select **View Item** to open the fly-out or the form of the Item.

When the Process Plan is **Locked**, right-mouse button clicking on the Items provide you with selections in the context menu. The Items and their context menus are described in the following table:

Process Plan Tree hierarchy level	Item	RMB Context Menu
1	Process Plan	
2	Operation	 Selecting the “Add Operation” context menu pops the Operation fly-out with a suggested Operation Number based on the current Operation that is selected. The Operation Number can be changed as needed. Selecting the “Insert Resource” context menu opens the Resource Search Dialog that allows you to select Tools and/or Machines.

Process Plan Tree hierarchy level	Item	RMB Context Menu
3	Step	 Selecting the “Add Resource” context menu opens the Resource Search Dialog that allows you to select Tools and/or Machines.
3	Part	 The “Create Process Plan” context menu is available if a Process Plan for the Produced Part has not already been created.
3	Phantom	 The “Create Process Plan” context menu is available if the Process Plan for the Phantom Assembly has not already been created.

Process Plan Tree hierarchy level	Item	RMB Context Menu
3	Tool	
3	Machine	
3	Document	
3	Skill	

3.3 MBOM View

The MBOM View consists of two main areas:

- The main part of the window to view the multi-level MBOM Tree
- Workbench

The MBOM View is available for editing, which is described later in the document. In this View you can view/edit the multi-level MBOM and see the “Reconciliation Status” indicators. These are displayed automatically based on how the parts in the of EBOM are consumed in the MBOM.

You can also drag and drop parts from the workbench to the MBOM tree and resolve the MBOM for different Locations.

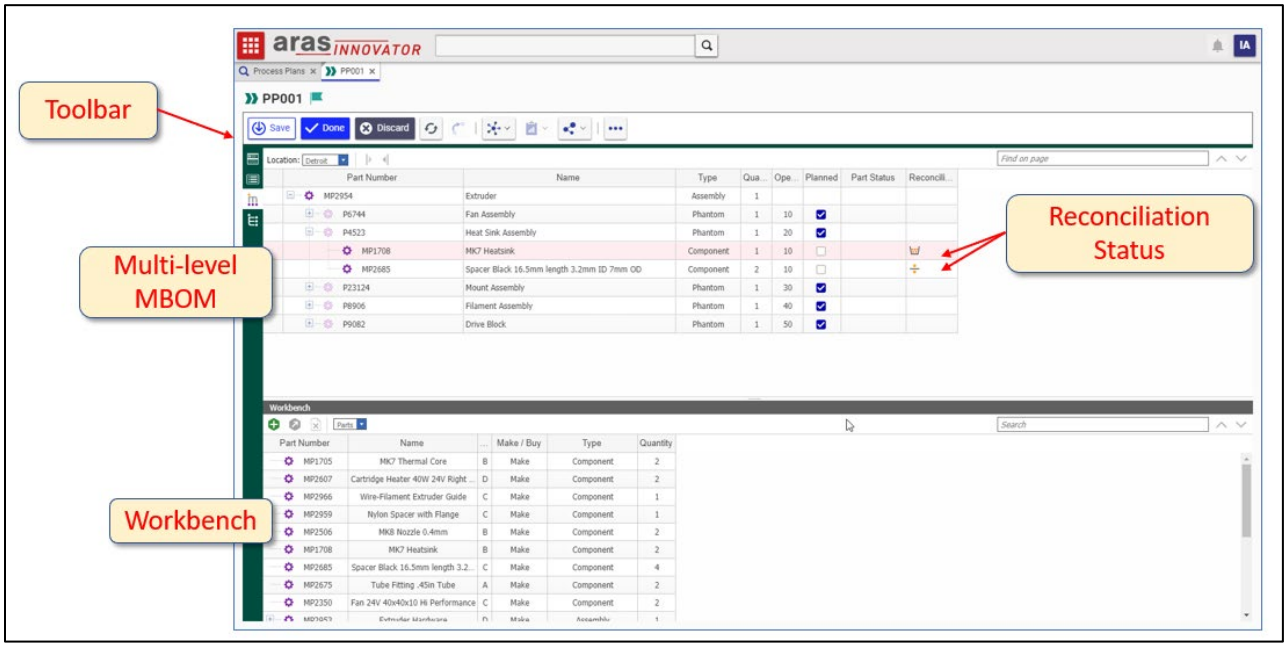


Figure 9.

3.3.1 MBOM Toolbar

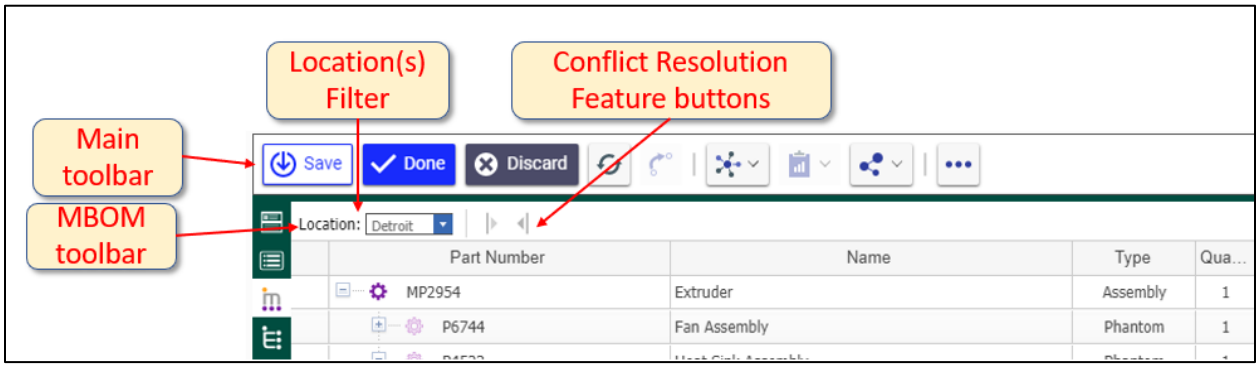


Figure 10.

The Main toolbar is the standard Innovator toolbar available on Tear-off windows.

Note: The Main Toolbar Refresh Button function is not available in the MBOM and the EBOM View.

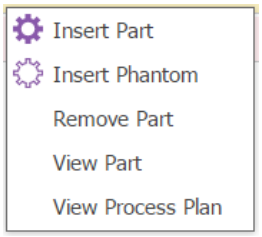
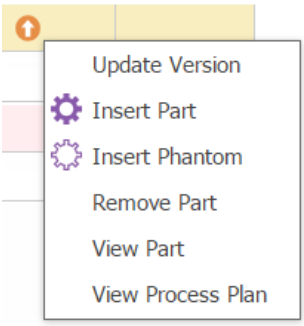
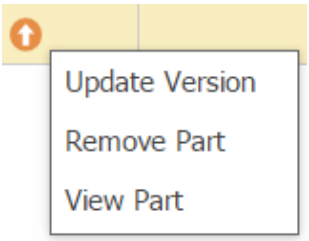
3.3.2 MBOM Tree

The MBOM is a multi-level BOM. When locked, you can edit the entire MBOM that is opened.

3.3.3 MBOM Tree Context Menu

Different options are available for RMB on the MBOM rows depending on whether the Process Plan is **Open for Edit or Read Only**. These menus are described in the following table:

Description	RMB Context Menu
Selecting a Part when the Process Plan/MBOM is Read Only	View Part
Selecting a Part when the Process Plan/MBOM is Read Only and the Part has a corresponding Process Plan.	View Part View Process Plan

Description	RMB Context Menu
Selecting a Part when the Process Plan/MBOM is in Edit mode and the Part has a corresponding Process Plan	
Selecting a Part when the Process Plan/MBOM is in Edit mode. This context menu is available for Parts that have a Part BOM relationship, and have a newer version of the part in the EBOM. That is - Parts that are assemblies.	 Selecting “Update Version” updates the version of the Part in the MBOM to match the version in the EBOM. Note that Update Version does **not** update to the next **revision**.
Selecting a Part when the Process Plan/MBOM is in Edit mode. This context menu is available for Parts that do not have a Part BOM relationship and have a newer version of the part in the EBOM. That is - Parts that are not assemblies.	

Note: In the MBOM View, Parts cannot be inserted, or dragged and dropped to a Part that does not have a Part BOM relationship or is classified as an “MBOM only component.”

3.4 EBOM View

The EBOM View consists of:

- A window to view the multi-level EBOM Tree

The EBOM View is not available for editing. In this View you can view the multi-level EBOM for which the Process Plan/MBOM is being created and see the “Reconciliation Status” indicators displayed automatically based on how the parts in the of EBOM are consumed in the MBOM.

The “View Part” context menu is available to open the Part form.

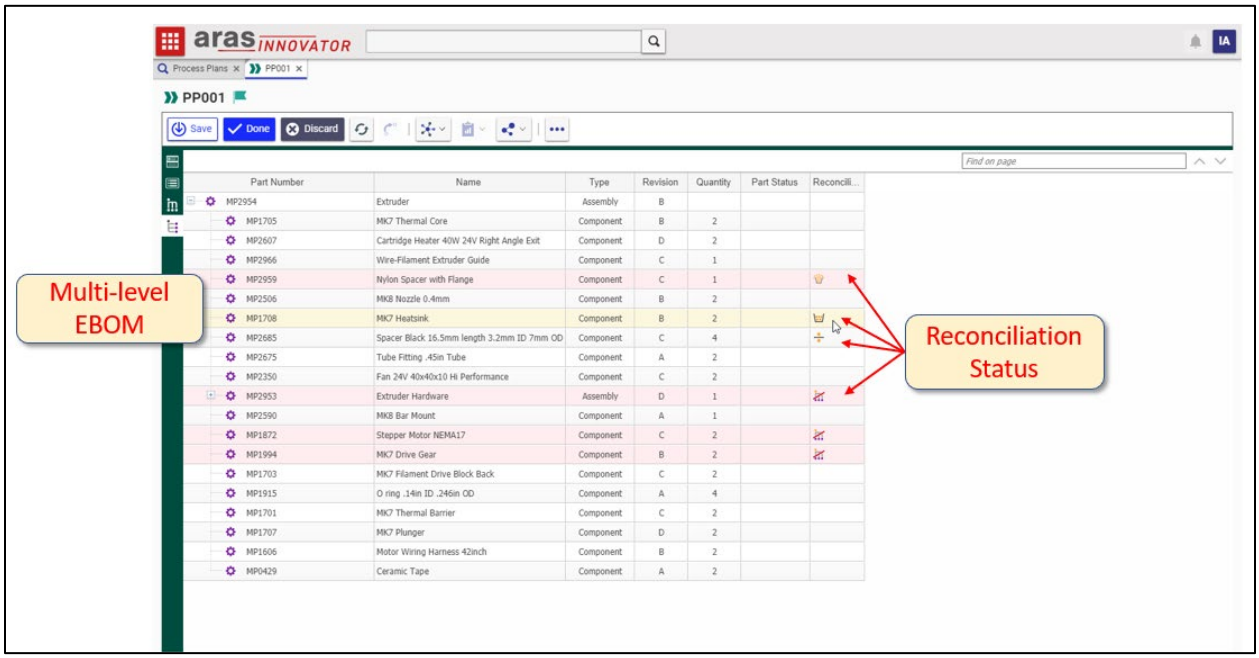


Figure 11.

3.5 Fly-outs

This section describes the behavior of fly-outs in the Process Plan and MBOM Views.

There are 4 fly-outs in the MPP views. The following is a list of fly-outs and the Views from which they can be opened:

- **Operation** - Can be opened in Process Plan Tree and WI
- **Step** - Can be opened in Process Plan Tree and WI
- **Phantom** - Can be opened in Process Plan Tree, WI and MBOM
- **Change Quantity** - Can be opened in Process Plan Tree and WI

In the Process Plan Tree, when creating Items, add the node first and then the fly-out appears.

You can also use Keyboard keys when working with fly-outs. This is in addition to using the mouse to navigate. The following is a list of functions for the different keyboard keys:

- **Escape** key - To Cancel. This results in the fly-out being closed. In case of Operation, Step and Phantom, the Items will not be created.
- **Tab** key - To go between fields in the fly-out. If you are in the last field of the fly-out and select the Tab key, then the cursor moves back to the first field. You can also use the mouse to move between the different fields of the fly-out.
- **Enter** key - To accept/close the information entered in the fly-out. Clicking outside the fly-out would also result in accept/close and in the Item being created.

If a fly-out contains a required field, then an error message appears when you try to accept/close the fly-out without entering the required field. An example of a fly-out with a required field is the fly-out for creating a Phantom Assembly.

If you enter an incorrect data type in a fly-out for a particular field, an error message appears when you try to accept/close the fly-out. For example, in the change quantity fly-out, entering a string instead of a float value results in an error message.

4 Creating a Process Plan

This section describes the procedure for creating a Process Plan and its related information.

To add any of the MPP Items mentioned in section 2, you must belong to the **Manufacturing Engineering** Identity. In Aras MPP the **Manufacturing Engineering** Identity has **Can Add** access.

4.1 Process Plan Form

1. From the TOC, navigate to **Process → Process Plans → Create New Process Plan**. The Process Plan Form appears.
2. Enter the Process Plan Number (required field) and other information as desired.

Note:	The Process Plan Number is a required field and must be unique.

3. In the **Produced Part Relationships Tab**, pick the Produced Part or create a Produced Part. MPP currently allows one Produced Part per Process Plan:
   - The Produced Part is the assembly/end item/product that is manufactured by the Process Plan.
   - Creation of a Phantom assembly would typically be a Produced Part for a separate Process Plan.

Note:	You must select a Produced Part in the Produced Part Relationships tab in order to be able to switch to the other Views in the MPP window. You can only select one Produced Part for a Process Plan.

4. In the **Locations Tab** select the Location(s) where the Produced Part will be manufactured.

Note:	It is not necessary to select a Location in the Locations Tab. But if you do select Location(s) in a Process Plan then its sub-process plans must also have the location defined in order to resolve the Process Plan.

5. Click the **Save Item** button in the top toolbar.

Note:	You must save the Process Plan before switching from the Form view to any other view.

4.2 Process Plan View

4.2.1 Creating Items in the Process Plan Tree

1. After you add and save the information in the Process Plan form, open the Process Plan View by selecting **Show Process Plan** from the sidebar.
    - In the Process Plan Tree, the Process Plan name and the Produced Part are shown as the root level. This is based on the information that you entered in the Process Plan form.
    - In the workbench the BOM of the Produced Part appears and the Work Instruction is rendered with the Process Plan information.

Note: The Work Instruction is automatically rendered with information that is added to the Process Plan tree.

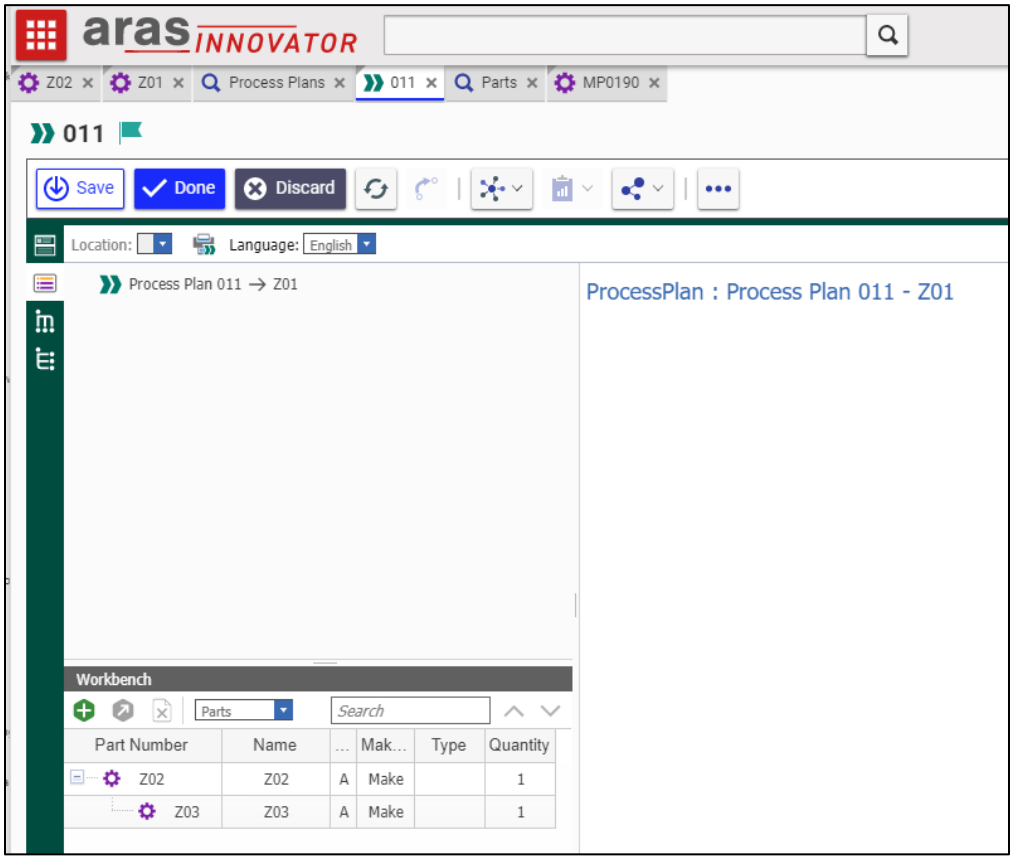


Figure 12.

2. Right- click on the root level Process Plan to see the following options in the context menu:
   - Insert Operation – Opens fly-outs to add Operations to the Process Plan.
   - View Produced Part – Opens the Part form.

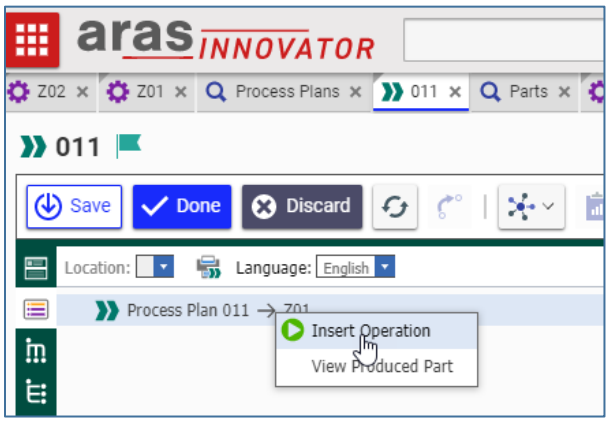


Figure 13.

3. Select **Insert Operation** to create the Operation Node in the Process Plan Tree and open the fly-out.
4. In the fly-out enter the information relevant to the Operation. For an operation, the system asks for an Operation Number. You can change it if required.

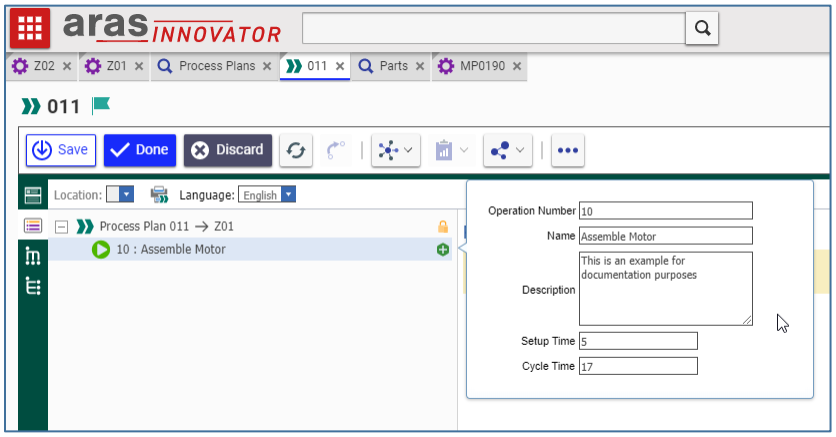


Figure 14.

Refer to section 3.5 for more information about working with fly-outs.

5. To add the next Operation, you can either select Process Plan →RMB → **Insert** Operation or Select the Operation that was previously created → RMB → **Add Operation**.
6. To add Steps to an Operation: Select Operation → RMB → **Insert Step**.

7. Enter the desired information in the fly-out:

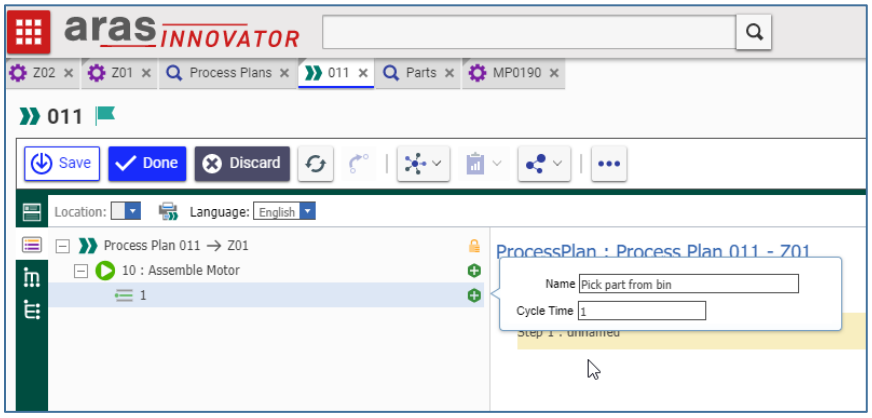


Figure 15.

8. To add the next Step, you can either select Operation →RMB → **Insert Step** or to the Step that was previously created → RMB → **Add Step**.

Note: It is not possible to insert the Produced Part as the Consumed Part because this would cause a circular reference.

9. To consume Part(s) select Operation →RMB → **Insert Part**. Or by selecting one of the Items under the Operation → RMB → **Add Part**. From the Part Search dialog select the Part(s).

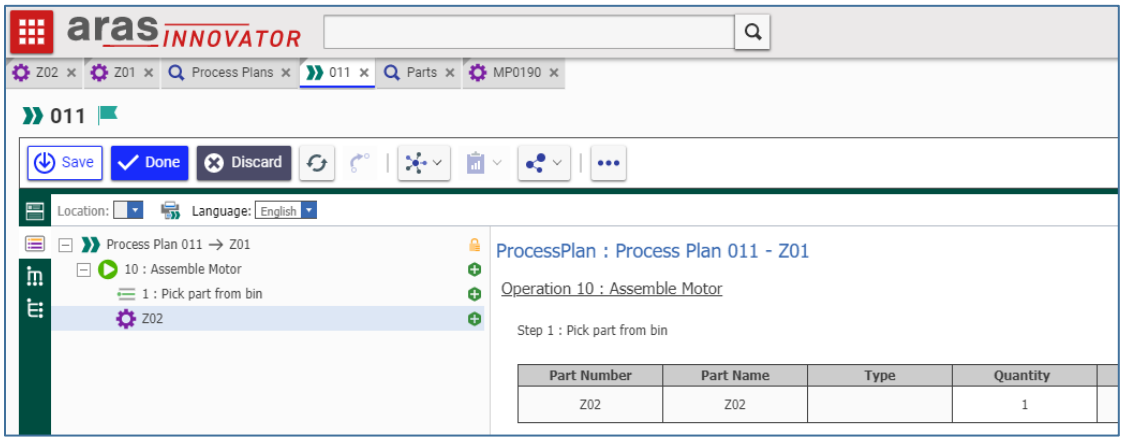


Figure 16.

Note: Parts can also be interested by dragging and dropping them from the Workbench to an Operation. This is described later in the document.

10. To consume a Phantom Assembly to an **Operation →RMB → Insert Phantom**. This enables you to create a Phantom from the Process Plan Tree.

    Part Number is a required field in the Phantom fly-out.

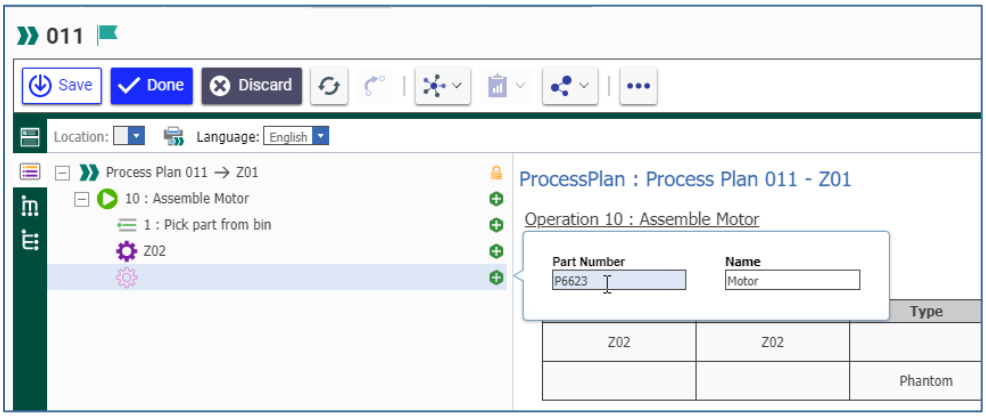


Figure 17.

11. To assign Resource(s) either select **Operation →RMB → Insert Resource**. Select **Operations -> RMB->Add Part** to select one of the Items. Select the Resource from the Resource Search dialog (Tool and/or Machine).

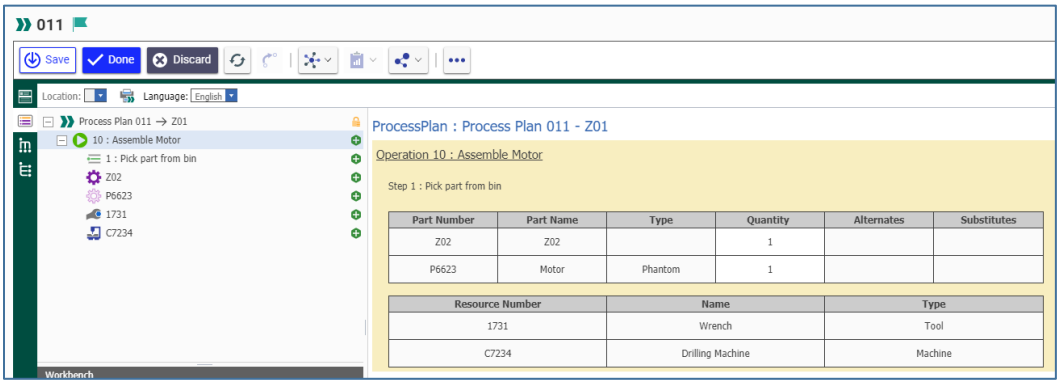


Figure 18.

Note: Resources can also be inserted by dragging and dropping them from the Workbench to an Operation. This is described later in the document.

12. Select **Operation->RMB->Insert Skill** to assign Skill(s). You can also select **Operation->RMB->Add Skill** to select one of the Items.

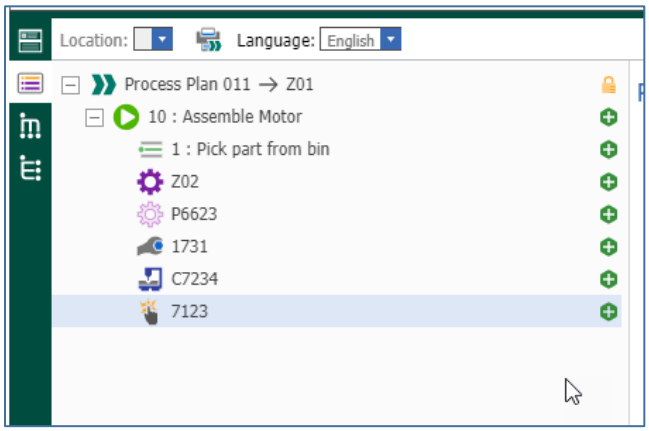


Figure 19.

Note: Skills can also be inserted by dragging and dropping them from the Workbench to an Operation. This is described later in the document.

13. Use **Operation->RMB->Insert Document** to reference Document(s) or use **Operation->RMB->Add Document** to select an Item. Select the document(s) from the Document Search dialog.

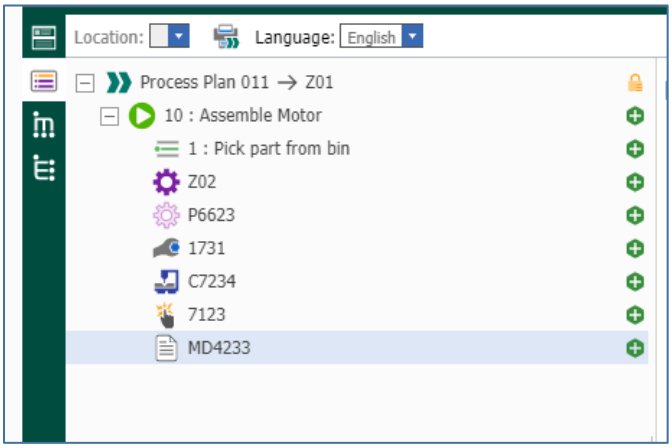


Figure 20.

Note: Documents can also be inserted by dragging and dropping them from the Workbench to an Operation. This is described later in the document.

4.2.2 Creating a Sub-Process Plan

This section describes how to create a sub-process plan from its parent process plan.

If an Assembly or Phantom is consumed at an operation, then these Items can have their own individual process plan. You can also create the sub-process plan from the TOC.

Note: A sub-process plan is not a different Item. It is still the Process Plan Item,but has a parent process plan. For example, a sub-process plan would define the routing for a sub-assembly or a phantom assembly.

1. **Select Operation->RMB->Create Process Plan** and select the Item (Part or Phantom) for which the sub-process plan should be **created.**

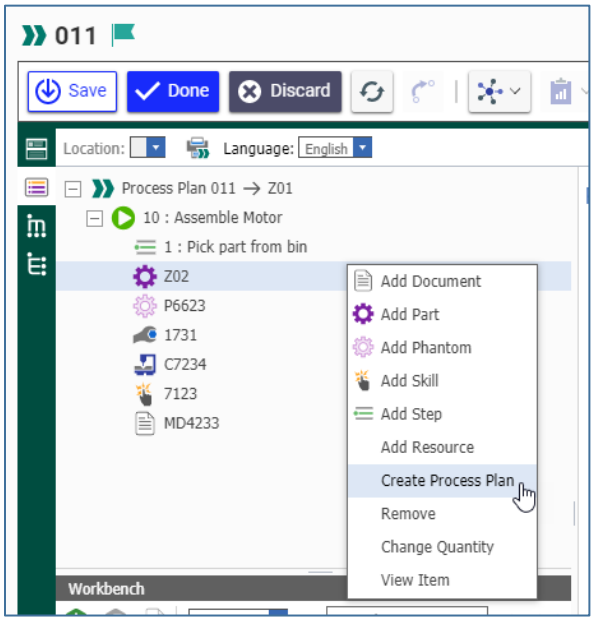


Figure 21.

2. This opens a new MPP window. The produced part is automatically selected in the **Produced Part Relationship Tab** since the system assumes that you are creating a process plan for the consumed part that was in the parent process plan which is now the produced part of the sub-process plan.
3. If you defined the location in the parent process plan, then the Location is automatically selected in the **Location Tab** since the system assumes that you are creating a process plan for the same location that was used in the parent process plan.

Note: It is not necessary to select a Location in the Locations Tab. But if you do select Location(s) in a Process Plan then its sub-process plans must also have the location defined to resolve the Process Plan.

4. To complete the process plan, follow the procedure described in section 4.

Note:	If the process plan for Part Z02 (Produced Part) was first created and then Part Z02 was inserted to the Process Plan Tree then the process plan for Part Z02 is displayed in the parent process plan.

5. When you Save and Close the sub-process plan, the details of the sub-process plan appear in the parent process plan. The following diagram illustrates the sub-process plan for the Produced Part Z02, where Z02 is also the consumed part in the Parent process plan.

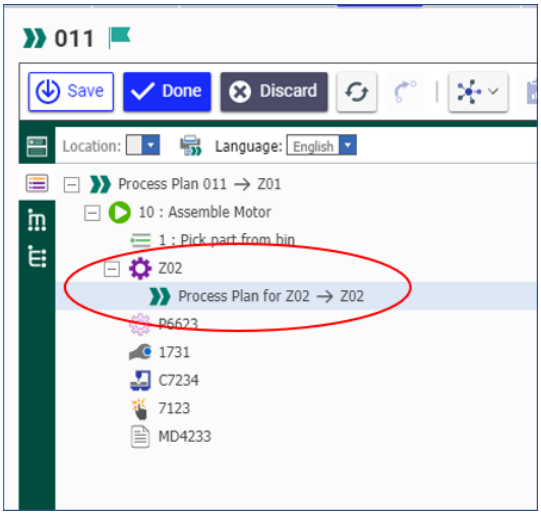


Figure 22.

4.2.3 Resolving sub-process plans and MBOM sub-assemblies

We have 3 main cases to consider when resolving the Process Plan/MBOM:

1. Locations and Produced Part - The sub-process plan for a specific location will not be resolved if the user has set the **same location** and **produced part** for two or more different process plans. This will be handled by providing the user with an error message. The location in the sub-process plan will need to be corrected in the sub-process plan to resolve the parent Process Plan tree.
2. When there is a new revision of the Produced Part - This is indicated to the user in the MBOM/EBOM “Part status” column. In this case, if the user wants to consume the new revision of the produced part in the parent Process Plan, they will have to perform a **Save As** of the sub-process plan and replace the produced part/consumed parts as desired.
3. When the user manually versions a sub-process plan – Manually versioning the process plan is recommended in cases when the user wants to add/remove operations, steps, tools, machines etc. That is any changes to the process plan other than changing the produced part/consumed parts. If a sub-process plan is versioned, then the parent Process Plan automatically points to the latest sub-process plan to resolve the Process Plan and MBOM.

In the following example, when the user selects the “+” sign for a sub-process plan, the following diagram (error message) is shown since the same location is defined in two different sub-process plans (example R001 & R0011) for the same produced part (Part11). The error message displays the process plan numbers so the errors can be corrected for these process plans.

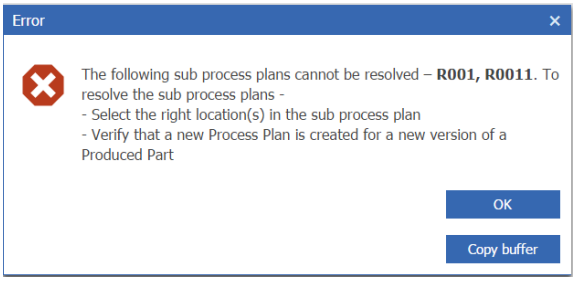


Figure 23.

If a sub-process plan cannot be resolved then nothing is displayed in the MBOM View, including the top level MBOM assembly. The user will be prompted with an error message as shown in the following figure referring to the Produced Part (example Part11) that is causing the MBOM to not be resolved.

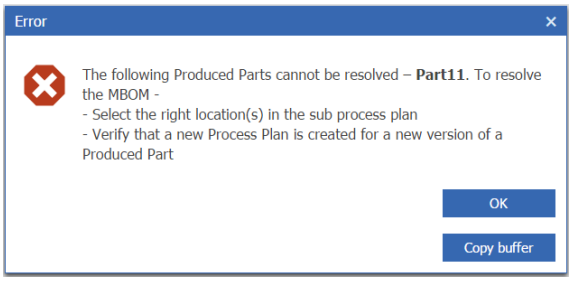


Figure 24.

Note: If there are several Process Plans that cannot be resolved, then all the Process Plan numbers and Produced Part numbers may not fit in the error message dialog. In such cases to read the entire error message, the user should use the “Copy Buffer” button to copy the error message to the clipboard, and then paste this information to a text file (for example notepad).

5 MBOM

There are 2 ways to create a multi-level MBOM:

- **Concurrent Process Plan and MBOM authoring** – you create the Process Plan with Operations and Consumed Parts, and it results in the creation of the MBOM.

OR

- **Editing the MBOM structure in the MBOM View** – By dragging and dropping parts from the Workbench to the MBOM tree.

In the MBOM View, you can edit the following:

- **Properties**
  - Quantity MBOM Structure
  - Operation Number
- **MBOM Structure**
  - Add Parts by Drag & Drop of Parts from the Workbench or using the context menu
  - Remove Parts

The following Figure shows an example of an MBOM and a description of the default properties in the MBOM View:

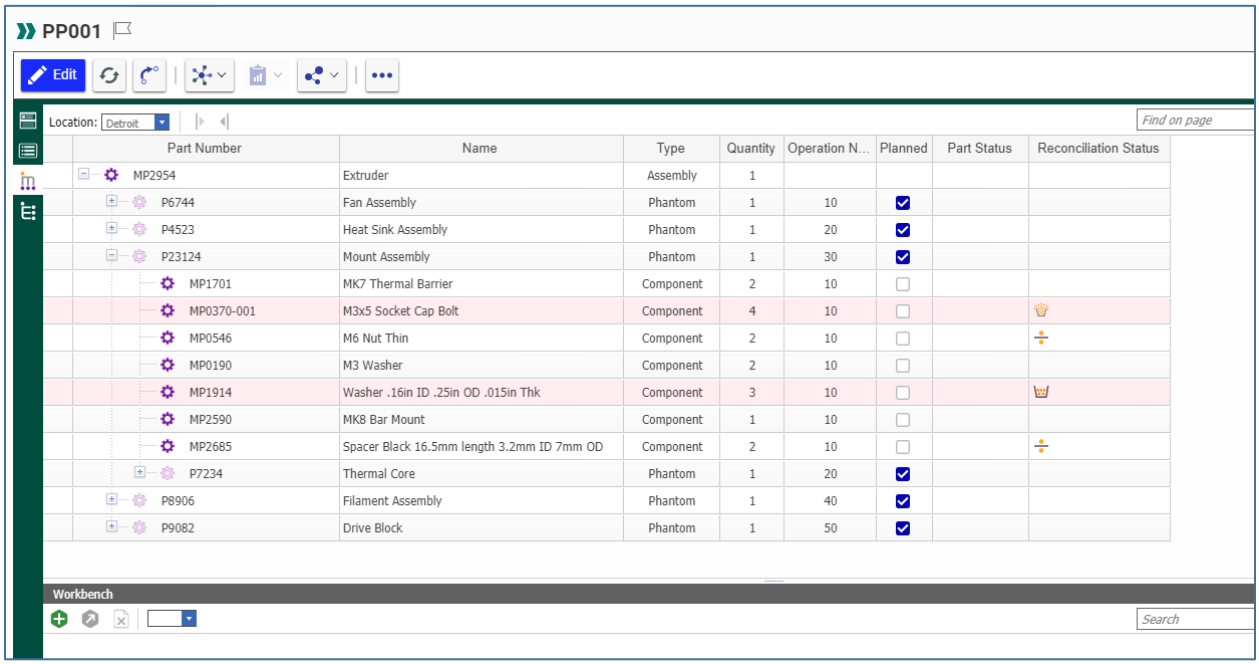


Figure 25.

- **Part Number** - This is the Part Number associated with the Part. You cannot edit the Part Number in the MBOM View.
- **Name** - This is the Name of the Part. You cannot edit the Name in the MBOM View.
- **Type** - This is the Classification of the Part that is consumed at an Operation or under a parent part. You cannot edit the Type in the MBOM View. If the classification of the Part is not defined, then the Type field is blank.
- **Quantity** – The Quantity of a Part can be edited in the MBOM View. By default, the quantity =1 when a part is consumed at an Operation/within a parent part. When you edit the quantity of a part in the MBOM View:
  - The quantity of the Part that is consumed at an Operation in a Process Plan is updated.
  - The quantity of the Part in the Consumed Part Table in the Work Instruction is updated.
  - The Reconciliation status is recalculated based on the part quantity in the EBOM versus the part quantity in the MBOM.
- **Operation Number** – You can edit the Operation Number where a Part is consumed in the MBOM View. If the Operation with the Operation Number that the user specifies exists, then the Part will be consumed under that Operation. If the user edits the Operation Number to a number that does not exist, then a new Operation with that Operation Number is created, and the Part is consumed under it.
- **Planned** – This is automatically calculated and cannot be edited. The system checks if a Part has a Part BOM relationship to identify whether a part is an assembly or not. If the Part is identified as an assembly, then:
  - The planned check-box for that Part is checked if a Process Plan for that part exists.
  - The planned check-box for that Part is not checked and the row is shaded in red if a Process Plan for that part does not exist.
- **Part Status –** This column provides useful information on the status of the Part and cannot be edited. The information is calculated and displayed as icons. The following icons can appear:
  - **Not-Make Assembly** – If an assembly is purchased
  - **New Version available** – This icon tells the user that there is a new version of the Part. For example the Manufacturing engineer has consumed PartZ Rev A Version 1 in the MBOM but the part in the EBOM has a higher version PartZ Rev A Version 2. In such cases, a context menu is available for the user to update the version of the part in the MBOM.
  - **New Revision available** – This icon tells the user that there is a new revision of the Part in the EBOM. For example the Manufacturing engineer has consumed PartZ Rev A Version 1 in the MBOM. And the part in the EBOM has a higher Revision PartZ Rev B Version 3. If the new revision of the part needs to be consumed in the MBOM, then the user must remove the old revision and then insert the new revision of the Part. Individual Process Plans must exist for every revision of a Produced Part.

- **Reconciliation Status -** This column provides useful information on the reconciliation status of the Part and cannot be edited. Reconciliation Status is calculated based on how a Part in the EBOM is consumed in the MBOM. The information is calculated and displayed as icons. The following icons can appear:
  - **Partially Consumed Quantity** – This icon tells the user that the Quantity of a Part in the MBOM is less than the Quantity of the same Part in the EBOM. The system checks all places in the MBOM where a specific part is consumed, adds the quantity of the part in all the positions and compares against the total quantity of the part in all the positions in the EBOM.
  - **Overconsumed** – This icon tells the user that the Quantity of a Part in the MBOM is greater than the Quantity of the same Part in the EBOM. The system checks all places in the MBOM where a specific part is consumed, adds the quantity of the part in all the positions and compares against the total quantity of the part in all the positions in the EBOM.
  - **Quantity Split** – This icon tells the user a Part exists in more positions in the MBOM than it exists in the EBOM, and the total Quantity of the Part in the MBOM = Total Quantity of the Part in the EBOM (for all the positions)

Note: For a part in the MBOM the systems always checks all places in the MBOM where the specific part is consumed.

5.1 Working in the MBOM View

Based on the Process Plan that was created in section 4, the MBOM that is automatically created because of consuming parts will look similar to the following:

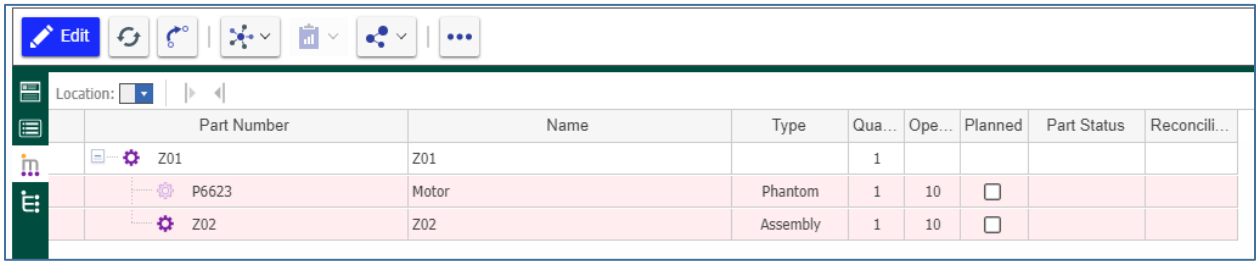


Figure 26.

From the MPP tab open the MBOM View by selecting **Show MBOM** from the sidebar.

The row with part Z02 appears in red shading as Z02 is an EBOM assembly and in the MBOM it is consumed but not planned for (no process plan created).

Note: The system checks if a Part in the EBOM has a Part BOM relationship, if it does then the Part is an Assembly.

The row with part P6623 appears in red shading as P6623 is a Phantom assembly but is not planned for (no process plan created).

> **Note:** If a process plan was created for Z02 and P6623, then the rows will not be shaded in red and the planned check box would be checked.

To insert a part to an MBOM Part, drag and drop the part from the Workbench and the Part on the Parent Part in the MBOM tree.

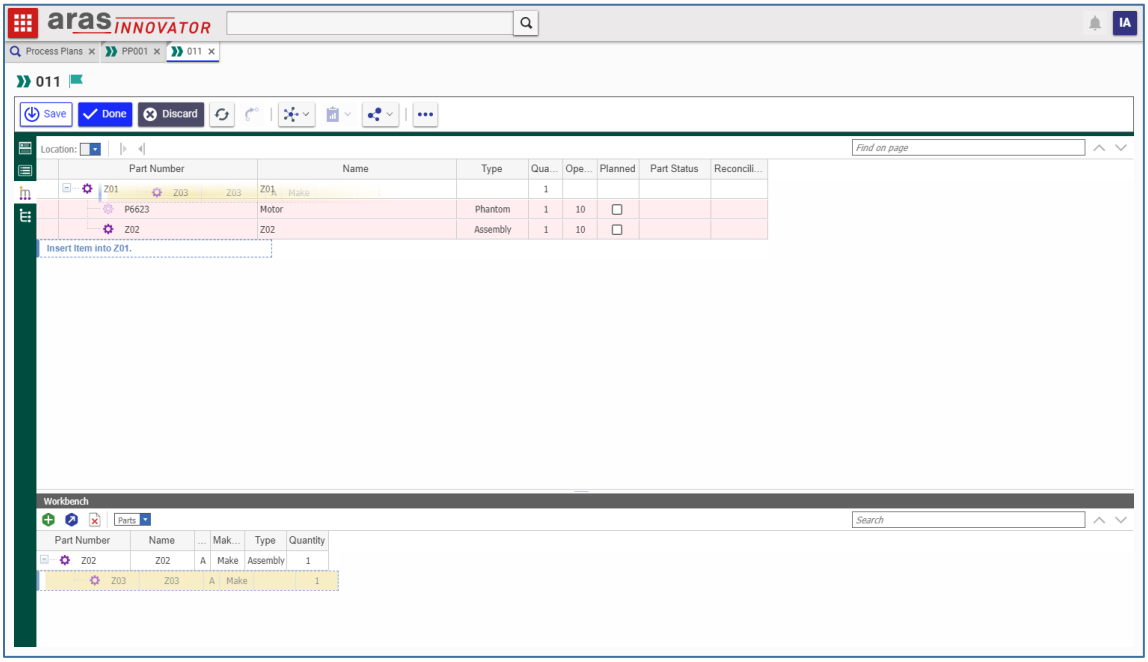


Figure 27.

If a Process Plan does not exist for the Parent Part, then you will be prompted with a warning message. Clicking **Cancel** results in the part not being dropped. Clicking **OK** results in a new tab being opened.

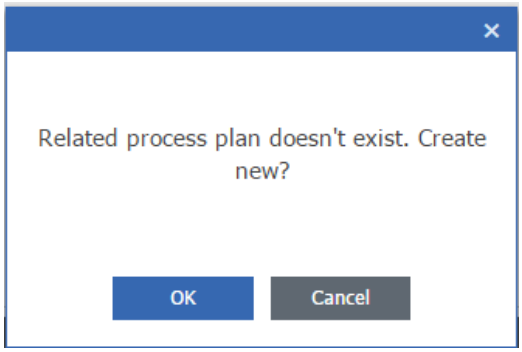


Figure 28.

In the Process Plan form of the new MPP tab that is opened, enter the required information, save and close (unless it's desired to keep working in this Process Plan).

- The produced part is automatically selected in the **Produced Part Relationship Tab** since the system assumes that you are creating a process plan for the parent part on to which you are dropping a part. The parent part is now the produced part.
- If the location was defined in the parent process plan/MBOM, then the Location is automatically selected in the **Location Tab** since the system assumes that you are creating a process plan for the location that was in the parent process plan/MBOM.

If a Process Plan exists for the Parent Part (produced part), then you will not be prompted with a warning message. And you can consume the part and define which operation of the process plan the particular part is consumed at.

Note: Part Z02 cannot be dragged and dropped on part Z02 since that would be a circular reference. If it is attempted, you will be prompted with an error message.

6 EBOM

The EBOM View consists of a window to view the multi-level EBOM

The EBOM View is not available for editing. In this View you can view the multi-level EBOM for which the Process Plan/MBOM is being created and see the ”Reconciliation Status” property of EBOM Parts that are consumed in the MBOM.

Using the context menu “View Part” the Part forms of the individual Parts can also be opened from the EBOM View.

When the user makes a selection of the Produced Part in the Process Plan form, then the EBOM is automatically displayed in the EBOM View. The concept is that the user is creating a Process Plan and MBOM in context of the EBOM that is selected as the Produced Part.

If a Phantom Assembly is selected as a Produced Part, then **no EBOM** is shown in the EBOM view since the Phantom Assembly is used only in the MBOM, and does not have its own corresponding EBOM assembly. Consequently, reconciliation status will not be calculated for the Phantom Assembly (when it is the Produced Part) and its child parts. Only when the Phantom Assembly is consumed in a higher-level assembly that has a corresponding EBOM assembly, will the reconciliation status be calculated.

The reconciliation status is calculated based on how the parts in the EBOM are consumed in the MBOM.

7 EBOM and MBOM Reconciliation

The Reconciliation status is calculated in real time based on how the parts in the EBOM are consumed in the MBOM. The reconciliation status icons are displayed in the **Part Status** and **Reconciliation Status** columns of the MBOM and EBOM views. When the user hovers the cursor over the reconciliation status icons, the tooltips provide more information about the reconciliation.

Rows that have certain reconciliation status icons will be shaded in red. This is to draw the attention of the user to parts in the MBOM and EBOM that are accounted differently.

For children parts in the Phantom assembly reconciliation status will not be calculated since a Phantom can be built using parts from different EBOM assemblies, and hence does not have a corresponding EBOM assembly. Also, the EBOM View for Phantom assembly will be blank for the same reason. When the Phantom is opened in context of a higher-level assembly in the MBOM that has its EBOM assembly, then the reconciliation status will be calculated for the parts in the Phantom assembly.

There can be cases when both the **Part Status** column and **Reconciliation Status** columns have 2 icons.

When the user opens a MBOM, the system calculates the reconciliation of parts in the entire MBOM structure (that the user has opened). The reconciliation status is calculated in real-time:

- When the user edits the **Process Plan View** by consuming parts to the Operations or changes the quantity of a consumed part. The reconciliation status will be displayed when they switch to the MBOM View.
- Or when the user drags and drops a Part to the MBOM, and enters the Operation Number in the Operation Column and Quantity in the Quantity Column.
- Or when the user changes the Operation Number or Quantity of an existing part.

The following table defines the various reconciliation statuses that can appear in the MBOM & EBOM Views.

EBOM/ MBOM View	Reconciliation Status Name	Description	Icon	Reconciliation indicators
Both	Consumed	If a Part in the EBOM is consumed in the MBOM **And** Quantity of the Part in the MBOM = Quantity of the Part in the EBOM	N/A	**Row shading :** No
Both	Partially Consumed Quantity	If Quantity of a Part in the MBOM is less than Quantity of the Part in the EBOM **Or** If the Part exists in more **Positions** in the MBOM than it exists in the EBOM, and Quantity of the Part in MBOM is less than the Quantity of the Part in the EBOM		**Row shading :** Yes **Icon in Reconciliation Status Column**

EBOM/ MBOM View	Reconciliation Status Name	Description	Icon	Reconciliation indicators
Both	Quantity Split	If a Part exists in more positions in the MBOM than it exists in the EBOM **And** total Quantity of the Part in the MBOM = Total Quantity of the Part in the EBOM (for all the positions)		**Row shading :** No **Icon in Reconciliation Status Column**
Both	Overconsumed	If Quantity of Part in the MBOM is greater than Quantity of the Part in the EBOM		**Row shading :** Yes **Icon in Reconciliation Status Column**
Both	Not Make Assembly	When a sub-assembly is consumed in the Process Plan of a higher level Assembly. But the sub-assembly does not require its own Process Plan since the assembly is purchased or pre-built. **And** Quantity of the Part in the MBOM = Quantity of the Part in the EBOM Note if no value is set for make buy property of a Part then it is assumed to be Make Note that in the EBOM the child parts of the “Not Make” assembly are shown in grey text to identify them as purchased parts.		**Row shading :** No **Icon in Part Status Column**
Both	New Version available	When the generation of the Part in the EBOM is greater than the generation of the Part in the MBOM In case of this reconciliation status, in the MBOM view for the part context menu option **“Update Version”** is available to allow the user to update the version of the part in the MBOM to the version of the part in the EBOM.		**Row shading :** No **Icon in Part Status Column**

EBOM/ MBOM View	Reconciliation Status Name	Description	Icon	Reconciliation indicators
MBOM	MBOM only Part	A Part that is classified as MBOM only Part **And** exists only in the MBOM Quantity is user specified and does not impact reconciliation status	N/A	**Row shading :** No **Tree icon :** MBOM only Part Icon
MBOM	Phantom Assembly	A Part that is classified as Phantom Assembly **And** exists only in the MBOM Phantom Assembly can contain parts from different EBOM assemblies.	N/A	**Row shading** : No **Tree icon :** MBOM only Part Icon in Tree
MBOM	Assembly not Complete	When a sub-assembly is consumed in the Process Plan of a higher level Assembly. But the Process Plan for the sub-assembly has not been created	N/A	**Row shading :** Yes **Planned Column:** Does not have check-box checked
MBOM	EBOM only Assembly	If a sub-assembly in the EBOM is not consumed in MBOM. But the children Parts of that sub-assembly have been consumed in the MBOM Note that this is the case when an EBOM assembly item is removed but the children Parts of the assembly are consumed into Phantom Assemblies	N/A	**Row shading :** No The EBOM sub-assembly will be listed in the bottom of the MBOM Tree with a red line striking through it indicating that the Assembly Item is removed or flattened from the MBOM.
MBOM	Phantom Assembly, Assembly not Complete	When the phantom assembly is consumed in the Process Plan of a higher level Assembly. But the Process Plan for the phantom assembly has not been created	N/A	**Row shading :** Yes **Tree icon :** MBOM only Part Icon **Planned Column :** Does not have check-box checked
MBOM	Not in EBOM	A Part that exists only in the MBOM **And** is not classified as MBOM only Part or a Phantom		**Row shading :** Yes **Icon in Reconciliation Status Column**

EBOM/ MBOM View	Reconciliation Status Name	Description	Icon	Reconciliation indicators
Both	New Revision available	When the major revision of the Part in the EBOM is greater than the major revision of the Part in the MBOM		**Row shading :** No **Icon in Part Status Column**
EBOM	Removed from MBOM	When the sub-assembly item is not consumed in the MBOM But the children Parts of the sub-assembly have been consumed in the MBOM The Item with this reconciliation status in the EBOM view = Item in the MBOM view with reconciliation status "EBOM only Assembly"		**Row Shading :** No This row of the Part in the EBOM Tree is displayed with a red Strikethrough across the row indicating that the Assembly Item is removed or flattened from the MBOM.
EBOM	Not accounted in MBOM	When a part that is in the EBOM is not consumed in the MBOM		**Row Shading :** Yes **Icon in Reconciliation Status Column**

8 Workbench

The Workbench Window in the Process Plan and the MBOM View provides access to specific content to author Process Plans and MBOMs. You can drag and drop Items from the workbench to the Process Plan tree or to the MBOM.

Dragging and dropping Items from the Workbench performs the same function as when you use the Insert/Add Items context menu in the Process Plan Tree and in the MBOM.

8.1 Workbench in Process Plan View

In the Process Plan View the Workbench can contain Parts, Tools, Machines, Documents and Skills. When the Process Plan View is opened, the workbench window does not display any Items. You must make a selection from the drop-down list to add or show Items. Only specific Items can be shown at one time depending on what is selected in the drop-down list.

8.1.1 Workbench Toolbar (Process Plan View)

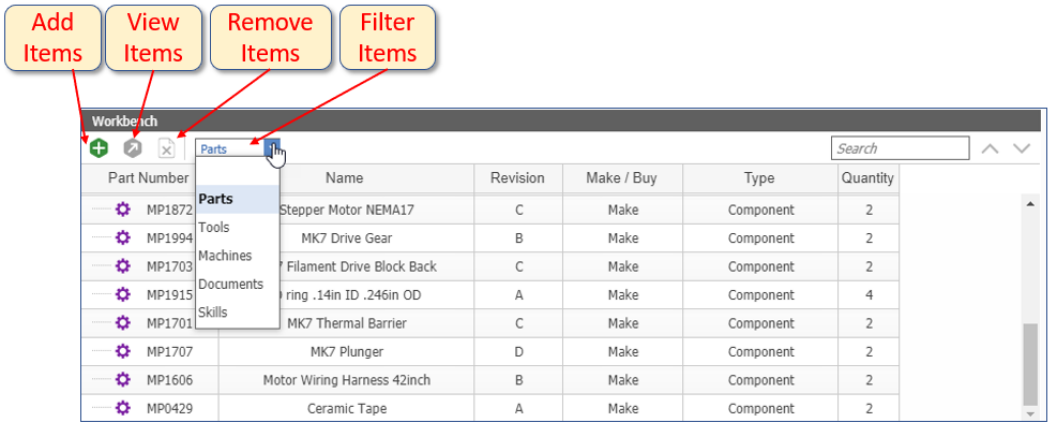


Figure 29.

- **Add Items** – Opens the **Search Form → User Selects the Items that they want to add to the Workbench (Part/Tool/Machine/Document/Skill) → Selects Items (Multi-select of Items from the search dialog is available)**
  - When you Add Items to the Workbench it is appended to the Workbench Item list

> **Note:** You must select the Item from the Filter Items drop-down list to enable the workbench toolbar buttons.

- **View Item** – Opens the Form of the selected Item
  - **Remove Items** – Removes Selected Item(s) from the list of Items in the Workbench. Multi-select is available.
  - **Filter Items** – Allows you to select the Item to View or Add to the Workbench. The drop-down list has the following sections - Parts, Tools, Machines, Documents and Skills.

8.1.2 Parts

When you select the Produced Part in the Process Plan form, then the EBOM is loaded in the Workbench. The Workbench contains the multi-level BOM. Parts from any level of the BOM in the workbench can be dragged and dropped to an Operation in the Process Plan Tree.

If a Phantom Assembly is selected as the Produced Part, then no parts are loaded in the workbench as the Phantom Assembly does not exist in the EBOM. In this case the user can add Parts to the workbench. Parts in the Workbench only persists in cases when the Produced Part is an EBOM assembly.

The following columns are displayed in the Workbench for Parts -

- | Part Number | Name | Revision | Make/Buy | Type | Quantity |

8.1.3 Tools

By default, no Tools are displayed in the Workbench when a Process Plan is opened. Tools will need to be added using the “Add Items” button. Tools in the Workbench do not persist. If you close and re-open the Process Plan, the Tools will need to be added again to the Workbench.

The following columns are displayed in the Workbench for Tools –

- | Tool Number | Name |

8.1.4 Machines

By default, no Machines are displayed in the Workbench when a Process Plan is opened. Machines need to be added using the “Add Items” button. Machines in the Workbench do not persist. If you close and open the MPP tab the Machines will need to be added again to the Workbench.

The following columns are displayed in the Workbench for Machines –

- | Tool Number | Name |

8.1.5 Documents

By default, no Documents are displayed in the Workbench when a Process Plan is opened. Documents will need to be added using the “Add Items” button. Documents in the Workbench do not persist. If you close and open the MPP tab the Documents will need to be added again to the Workbench.

The following columns are displayed in the Workbench for Documents –

- | Document Number | Name | Revision |

8.1.6 Skills

By default, no Skills are displayed in the Workbench when a Process Plan is opened. Skills will need to be added using the “Add Items” button. Skills in the Workbench do not persist. If you close and open the MPP tab the Skills will need to be added again to the Workbench.

The following columns are displayed in the Workbench for Skills:

- | Skill Number | Name |

8.1.7 Drag and Drop Items

Items from the workbench can be dragged and dropped to Operations in the Process Plan Tree. The drag and drop capability enables the creation of a relation between an Operation and the Item (that is being dragged & dropped).

The drag and drop of Items to an Operation will only work when the user attempts to drop Items to the first level Operations of a Process Plan. The user cannot drop to Operations of a sub-process plan. To consume parts within an operation of a sub-process plan the user will need to open and Edit the sub-process plan and then perform the desired actions.

To drag an Item from the workbench, Right-mouse button press on the item (in the workbench) and drop it on the Operation in the Process Plan Tree.

A Part, Document and Skill can be dragged and Dropped to the same Operation multiple times. A Tool or Machine cannot be drag and dropped on an Operation multiple times. If the user attempts to drag a Tool or a Machine that has already been added to an Operation, they will get a warning message **“Item already added.”**

8.2 Workbench in MBOM View

In the MBOM View the Workbench can contain only Parts. When the MBOM View is opened, the workbench window does not display any Items. The user must select “Parts” from the drop-down list to add or show Items.

Note: The Items in the Workbench only persists for the session of the Process Plan/MBOM that it is open in.

8.2.1 Workbench Toolbar (MBOM View)

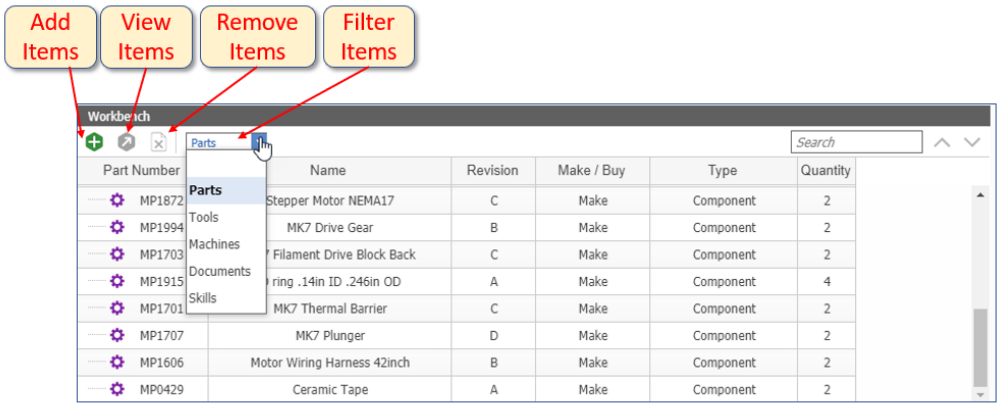


Figure 30.

8.2.2 Parts

When the user selects the Produced Part in the Process Plan form, then the EBOM is loaded in the Workbench. The Workbench contains the multi-level BOM. Parts from any level of the BOM is the workbench can be dragged and dropped to the MBOM.

If a Phantom Assembly is selected as the Produced Part, then no parts are loaded in the workbench as the Phantom Assembly does not exist in the EBOM. In this case the user can add Parts to the workbench. Parts in the Workbench only persist in cases when the Produced Part is an EBOM assembly.

The following columns appear in the Workbench for Parts:

- | Part Number | Name | Revision | Make/Buy | Type | Quantity |

Note: The Parts that are displayed in the Process Plan and MBOM Views are always the same. If you add or remove a part in the workbench in one View, that change will also occur in the other View also.

8.2.3 Drag and Drop Parts

Items (Parts) from the workbench can be dragged and dropped to Parts in any level of the MBOM. The drag & drop capability enables creating a relationship between an Operation and the Part (that is being dragged & dropped).

Note: In the MBOM View, Parts cannot be inserted, or dragged and dropped to a Part that does not have a Part BOM relationship or is classified as “MBOM only component.”

9 Work Instructions

The Work Instruction (WI) document is rendered from information in the Process Plan Tree. When the user creates an Item in the Process Plan Tree, then its corresponding information is also rendered automatically in the WI. The Process Plan Tree and the WI are different views of the same underlying data.

The format of the WI is determined by an XML Schema. The elements in the MPP Schema are mapped to specific Items of the MPP Data Model.

The Work Instruction displays information of the first level Items of the Process Plan Tree. The following information is rendered to the WI:

- Process Plan
- Operations
- Steps
- Parts – Parts consumed at individual Operations are rendered in the Consumed Parts Table
- Resources – Tools and Machines assigned to an Operation are rendered in a Resource Table

If the Consumed Part is an assembly with its own Process Plan then the WI of the consumed part is not rendered in the parent WI. To view the WI of a sub-process plan, open the sub-process plan in a separate tab.

The following figure shows the Items in the Process Plan Tree mapped to their respective elements in the WI. Skill and Document Items are not rendered to the WI.

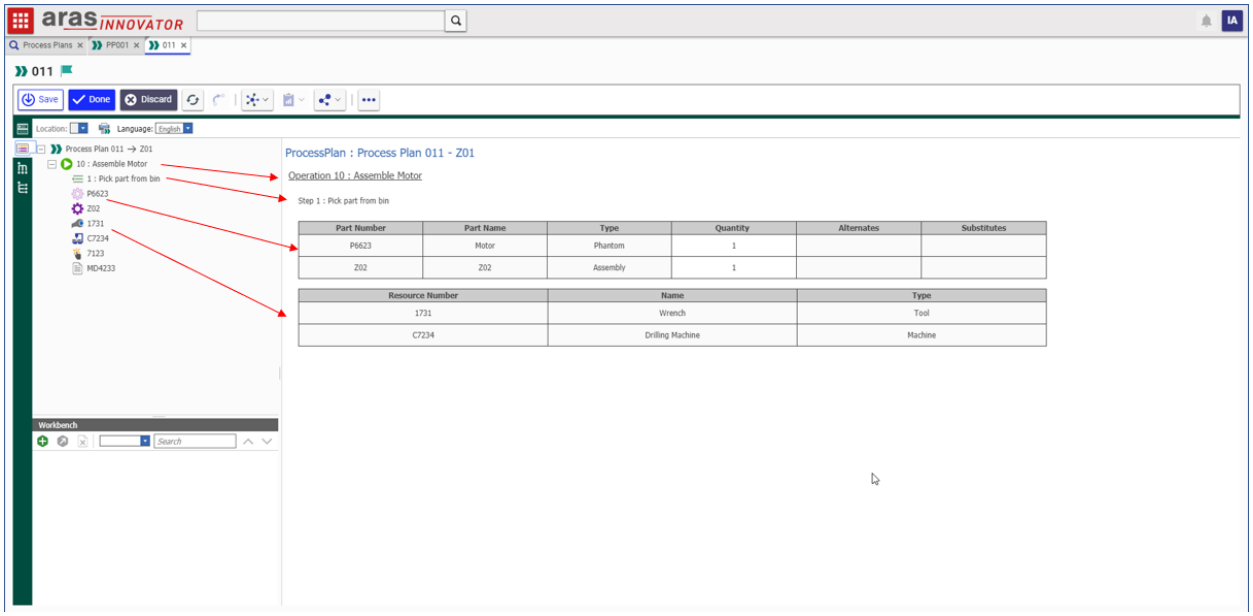


Figure 31.

Note: In the previous figure, Z02 has its own process plan. This is indicated by the “+” expand symbol. Open a separate MPP tear-off window to view the WI of the sub-process plan.

9.1 Creating Items from a Work Instruction

From the Work Instruction you can perform all the functions that can be performed from the Process Plan Tree.

When a selection is made in the Process Plan Tree, then its corresponding WI element is highlighted. Similarly, if a WI element is selected, then the corresponding Item in the Process Plan Tree is also highlighted. Performing any function from the WI will also result in the creation of the Item in the Process Plan Tree. There are certain functions that do not result in creation of Items in the Process Plan Tree. This is described later in the document.

To open the context menu from the WI, right mouse button click on the element in the WI. The following sections provides information regarding the various context-menu functions that are available from the WI elements.

9.1.1 Context menu for Process Plan

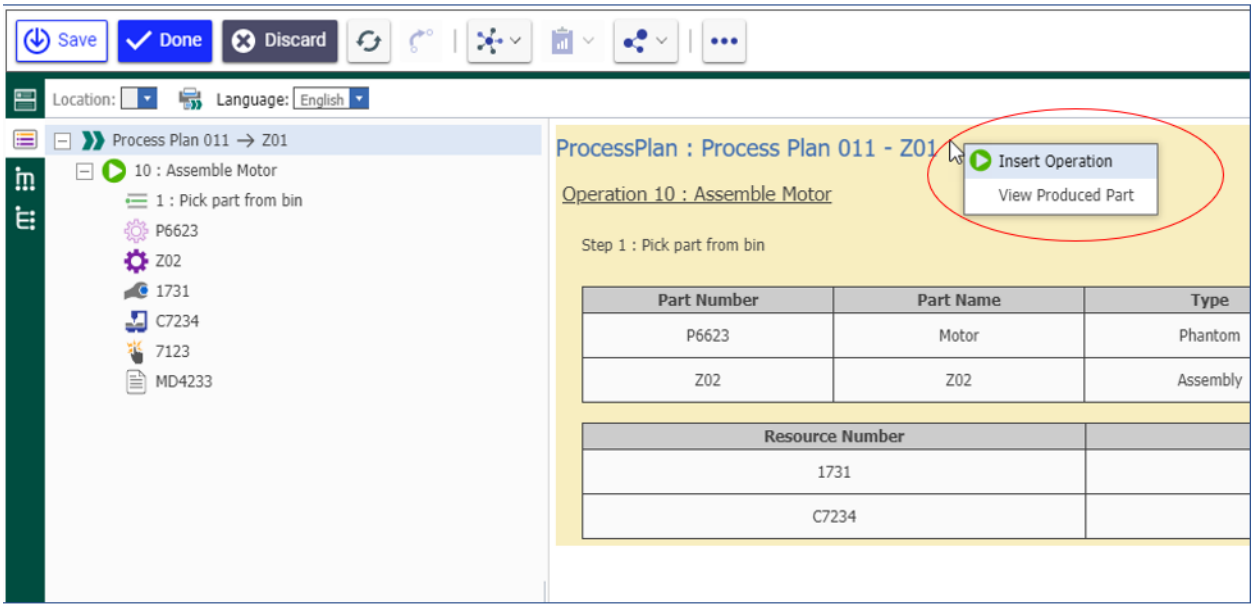


Figure 32.

9.1.2 Context menu for Operation

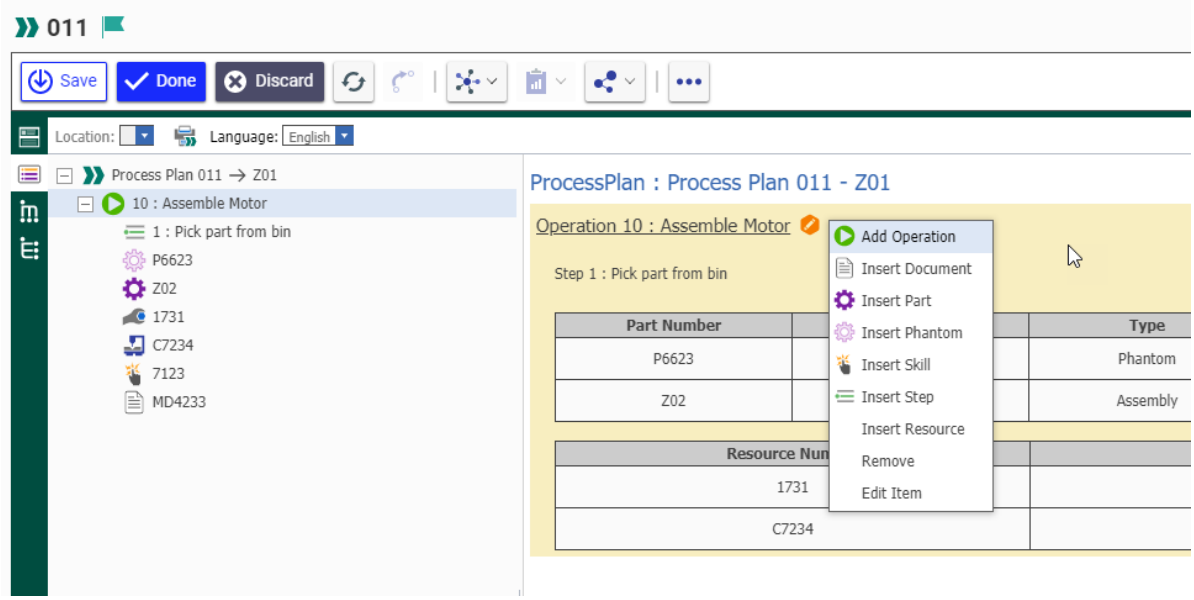


Figure 33.

9.1.3 Context menu for Step

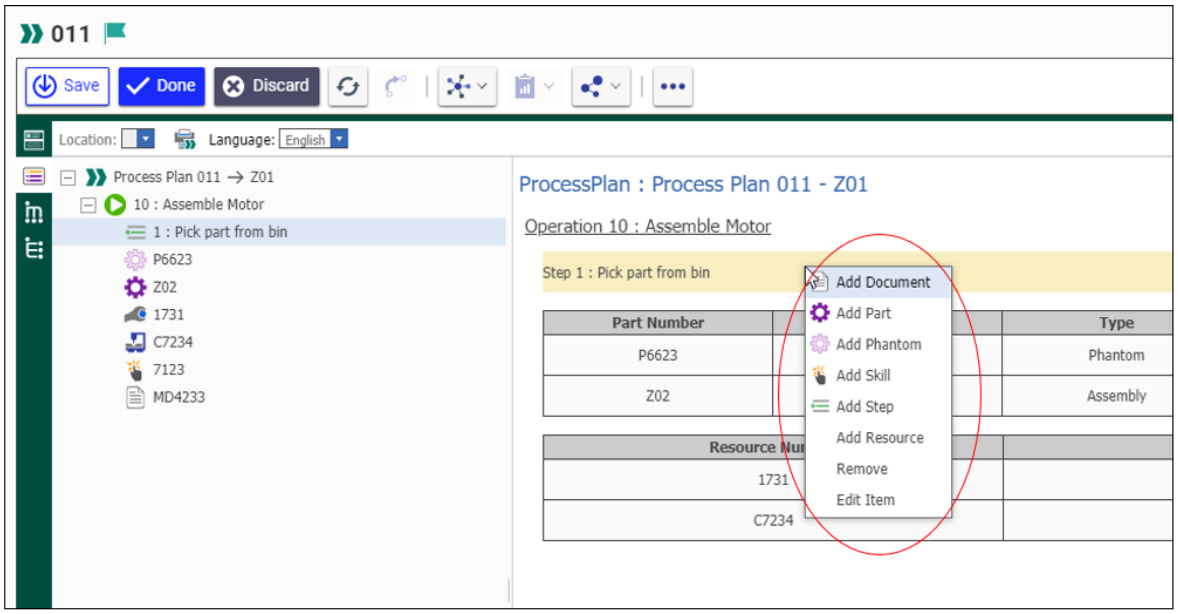


Figure 34.

9.1.4 Context menu for Consumed Part

The Quantity of the consumed part can be changed in the WI. Hovering the cursor over the Quantity column of the Consumed Part table highlights the edit icon.

Selecting the Quantity cell of a consumed Part opens the ‘Change Quantity’ fly-out.

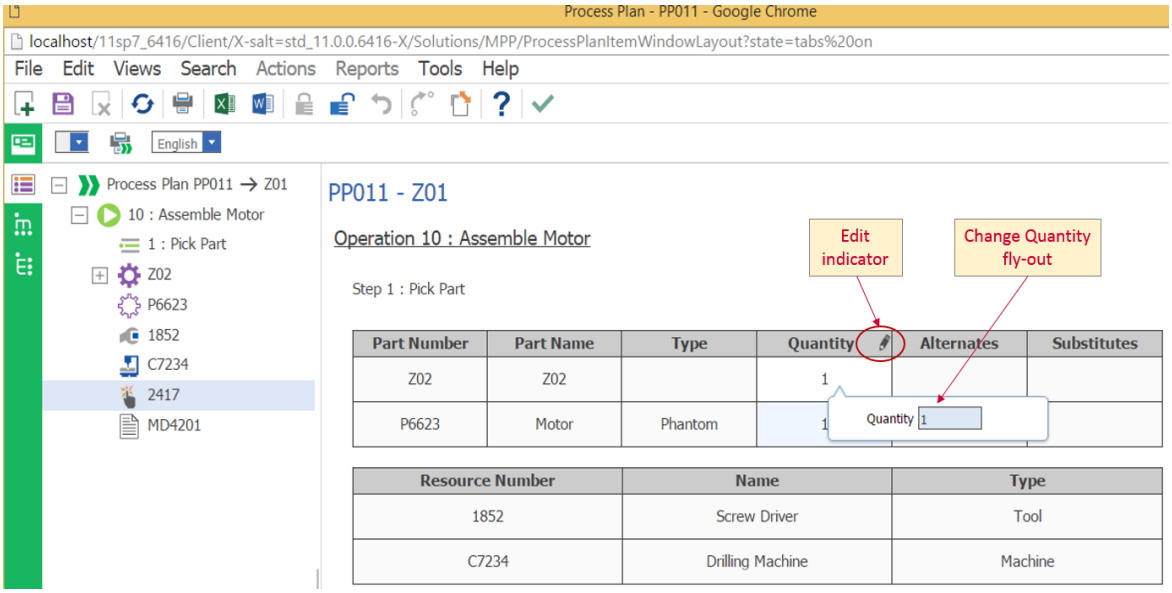


Figure 35.

9.2 Adding other Elements to a Work Instruction

Elements other than Items of the Process Plan Tree can also be created in a WI. Adding these elements to a WI enables the user to make the WI visually rich. These elements can be created for an Operation and for a Step. The elements that can be created in the WI are:

- Graphic
- List
- Table
- Text
- Title

9.2.1 Creating Elements for an Operation Item

1. When you hover the mouse over an Operation in a WI, the **Edit** indicator appears.

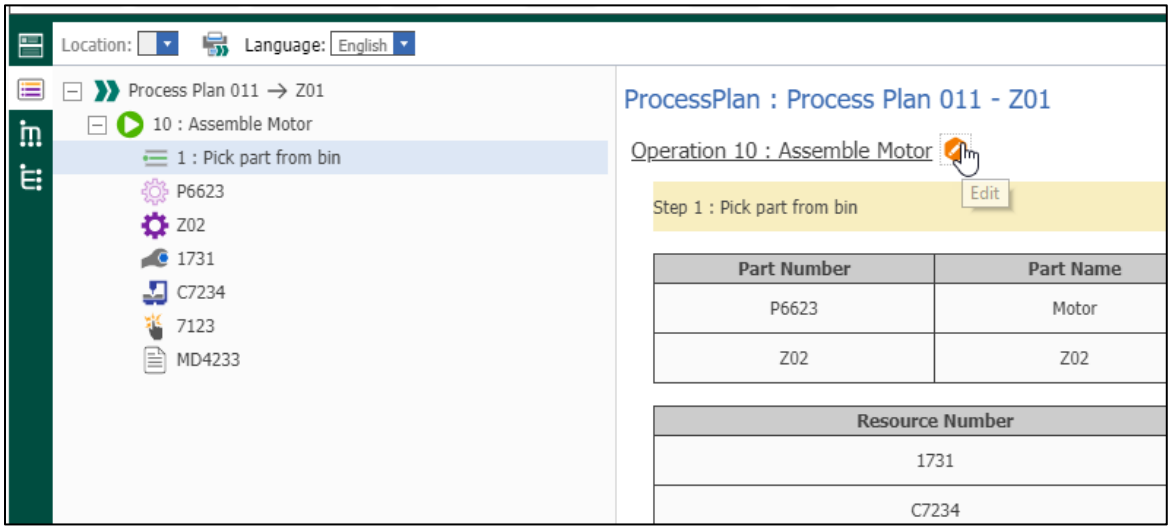


Figure 36.

2. Clicking on the indicator adds a container below the Operation. To remove the Container, select Remove from the context menu.

3. Right mouse button click in the container to open the context menu.

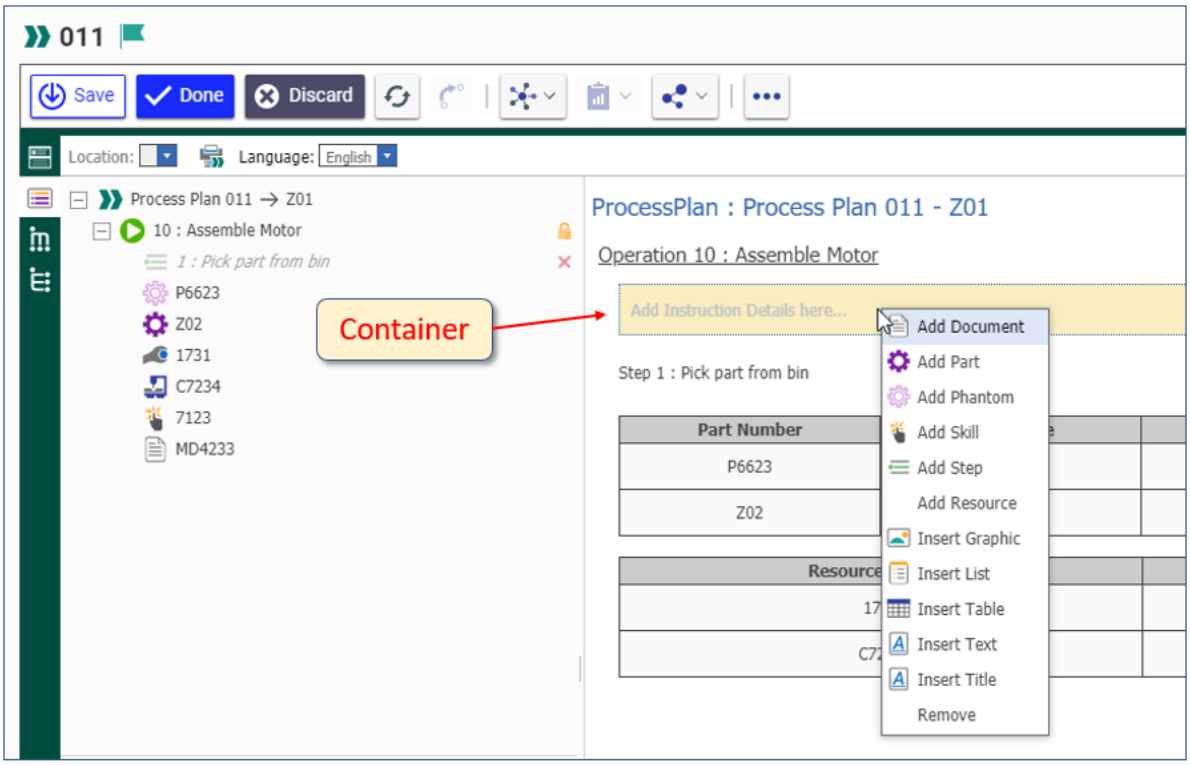


Figure 37.

4. Select from the context menu to add the element to the Container.

9.2.2 Creating Elements for a Step Item

1. Similar to creating elements for an Operation, when you hover over a Step in the WI, the **Edit** indicator appears.
2. Clicking on the indicator adds a container below the Step. To remove the Container, select Remove from the context menu.

3. Right mouse button click in the container to open the context menu.

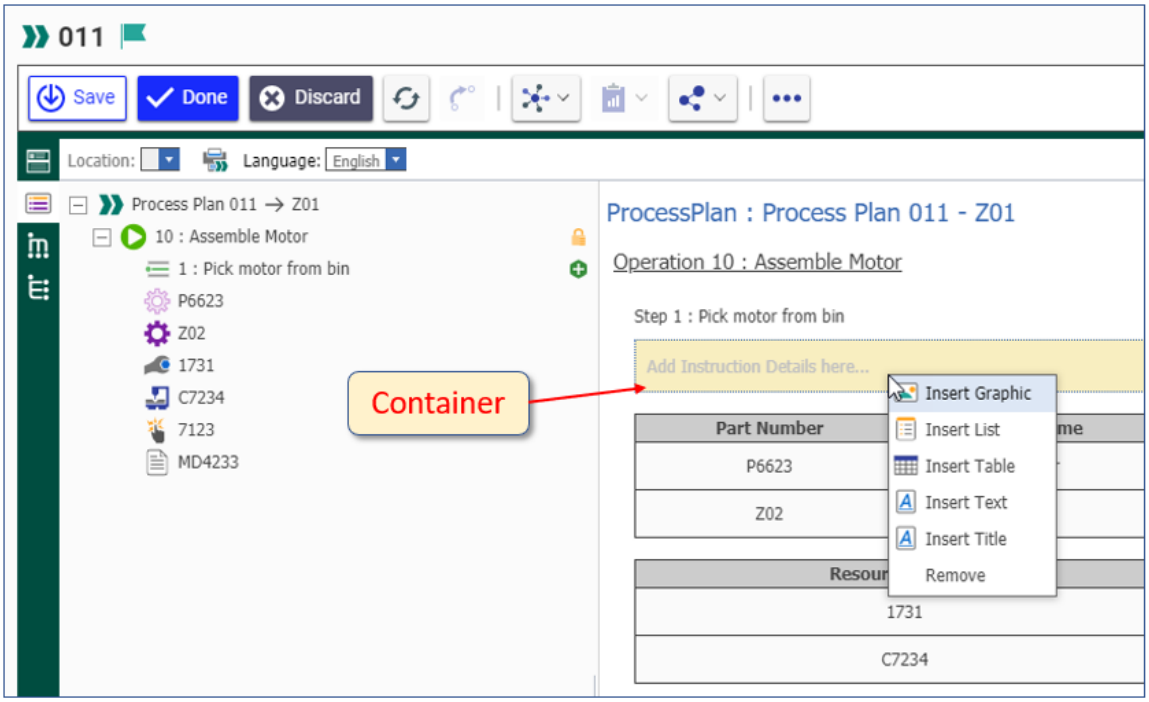


Figure 38.

4. Select from the context menu to add the element to the Container.

9.3 Publishing a Work Instruction

The Work Instruction can be published to HTML or PDF Formats from the Process Plan View. To publish a WI:

1. Open the Process Plan.

2. In the Process Plan View click the Publish Work Instructions button  from the top tool bar. This will open the following window.

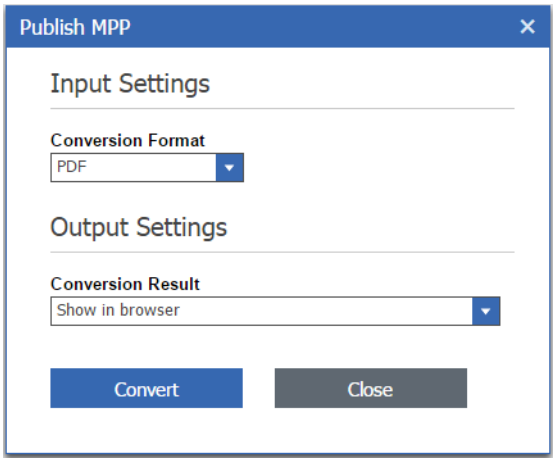


Figure 39.

3. Make the desired selection for Input and Output Settings:
   - **Conversion Format** – PDF OR HTML
   - **Conversion Result** – Show in Browser OR Save to File
4. Click the Convert Button.

Note: The MPP Publishing feature is only available for subscribers. Aras.Essentials.Subscription license is required to be able to publish to HTML or PDF formats. In addition, HTMLtoPDFConverter is also required to be able to publish to PDF format.

10 Location

A location is a manufacturing site where a product/assembly is manufactured. There can be differences in the Process Plan and MBOM depending on the Location where the Product or assembly is manufactured. For example, the parts that are consumed by the process plan and MBOM can be different for the different locations. Also, there can be differences in the operations, steps, resources etc. in the Process Plans for the different locations.

The Process Plan form has a **Locations** relationship tab. The user can define which location(s) the specific Produced Part is manufactured at.

The following diagram shows the Process Plan form for Produced Part - Extruder Assembly that can be manufactured at 2 Locations – Detroit and Toulouse.

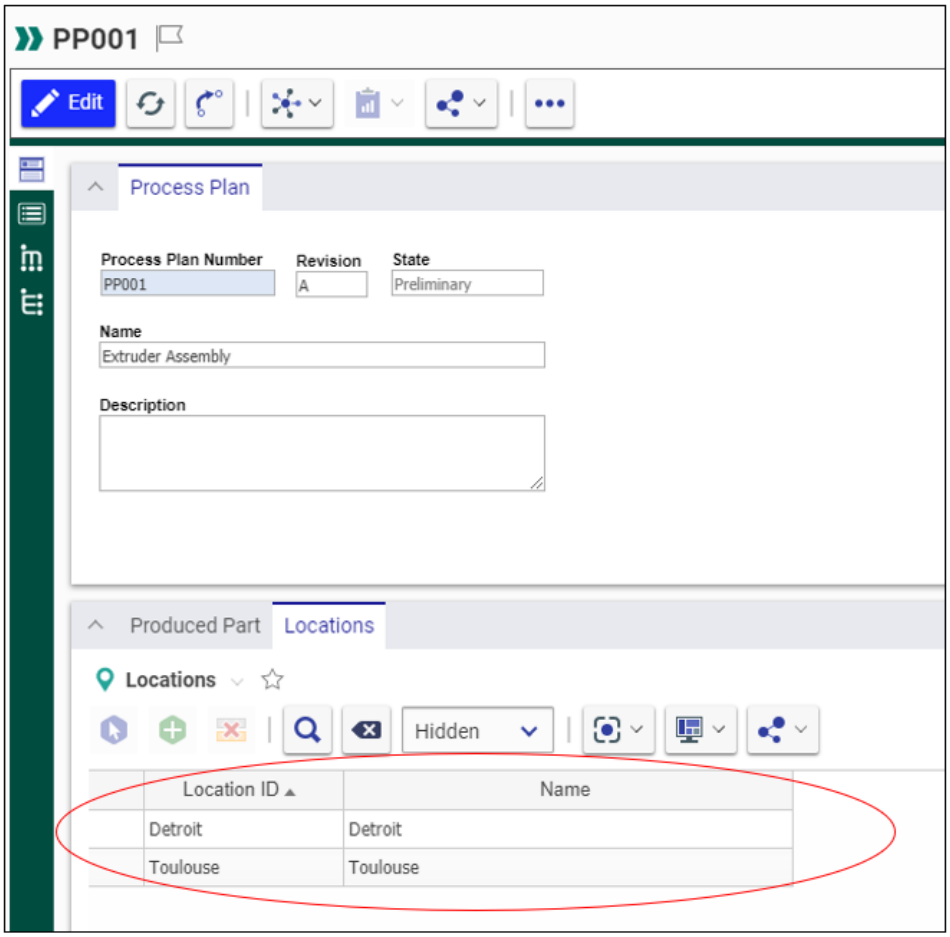


Figure 40.

The Location can be created from the **TOC** or from the Locations Relationship tab by selecting **Actions: Create Related.**

Warning Location does not need to be entered in the Locations Relationship tab. But if a Location is entered in the parent Process Plan then for all its sub-process plans, make sure to define the Locations as well. If not, the Process Plan will not be resolved for the sub-process plans that don't have the Location defined.

By default, when the user opens a Process Plan, the Location(s) filter in the Process Plan and MBOM View will be populated with the first Location in the Locations Relationship Tab (of the Process Plan Form). The Process Plan and the MBOM will also be resolved for this Location. From the above example, the Process Plan and MOBM will be resolved for the Detroit Location. If no Location is entered in the relationship tab, then the filter will be left blank.

The Process Plan and MBOM for only one location can be viewed at one time.

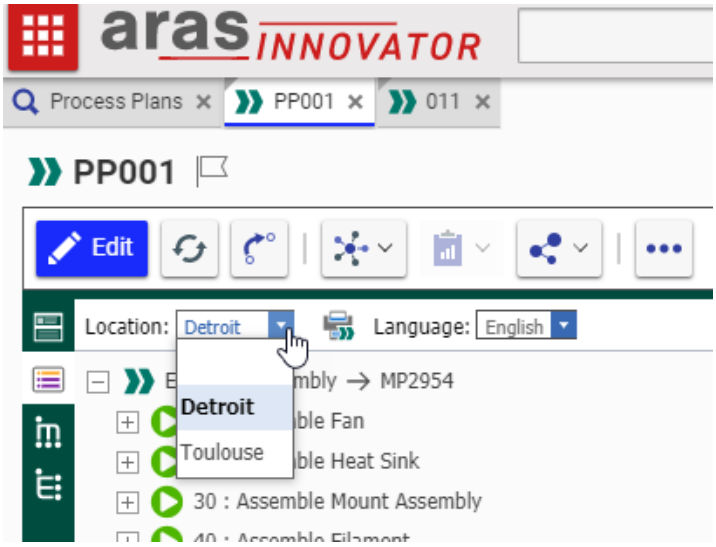


Figure 41.

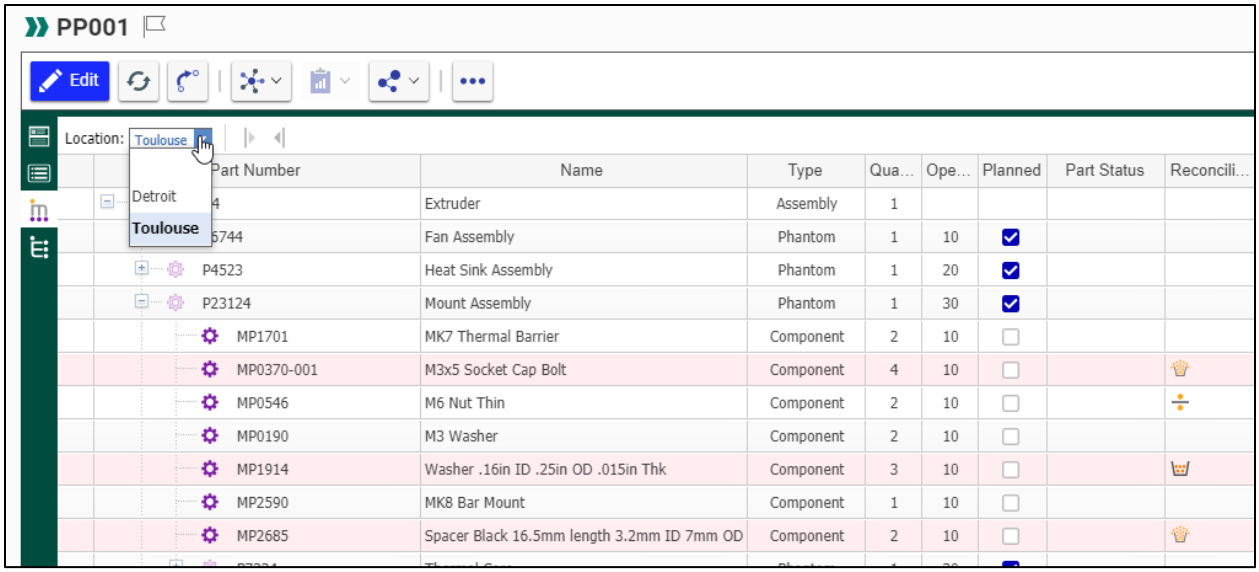


Figure 42.

To resolve the Process Plan and MBOM for a different location, for example – Toulouse, make the selection from the Location(s) filter.

Selecting a location in one view will update the structure in the other view also. For example, if you select Toulouse from the Location(s) filter in the MBOM View, then the MBOM will be resolved for the Toulouse location. And the Process Plan will also be resolved for the Toulouse location.

11 Conflict Resolution

Process Plans can be edited by a user only one level at a time. Whereas in case of the MBOM, multiple users can edit different levels of the MBOM at the same time. It is possible that conflicts can arise in saving data when one user has edited and saved data to a row while the other user is editing data to the same row. Before saving the Process Plan/MBOM the system checks if what is being saved by one user conflicts with the changes that are made and saved by other users.

The conflicts are detected when the user hits the "**Save"** or "**Done**" button in . If conflicts are detected, then the below error message is shown –

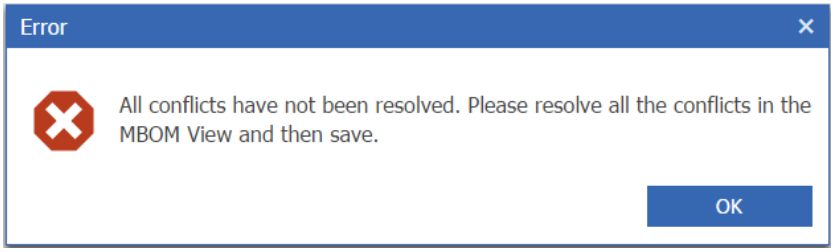


Figure 43.

In the MBOM view the following edits can be made:

- Change Quantity (Of a part)
- Change Operation Number (Move a part to a different Operation)
- Remove Part/Phantom (From an Operation)
- Insert Part/Phantom (To an Operation)

The following table describes the various icons for the Conflict Resolution feature.

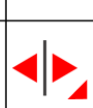
Icon		Description
1		Unresolved conflict
2		Conflict resolved by “Use my edits” option
3		Conflict resolved by “Use other user’s edits” option
4		If Conflicts are detected in lower level children of the MBOM
5		If a particular Part has an Unresolved conflict, plus conflicts are detected in lower level children of the MBOM
6		If conflict for a particular part is resolved by “Use my edits” option, plus conflicts are still detected in lower level children of the MBOM
7		If conflict for a particular part is resolved by “Use other user’s edits” option, plus conflicts are still detected in lower level children of the MBOM

Figure 44.

11.1 Resolving a Conflict

If conflicts are detected for any rows, they are indicated to the user in the first column of the MBOM view via an icon as shown in the diagram below. If there are no conflicts, this column is blank. The user must resolve all the conflicts detected in all the rows in the MBOM View to be able to save their changes. Selecting the **Save** button after resolving the conflicts will save the Process Plan/MBOM to the database.

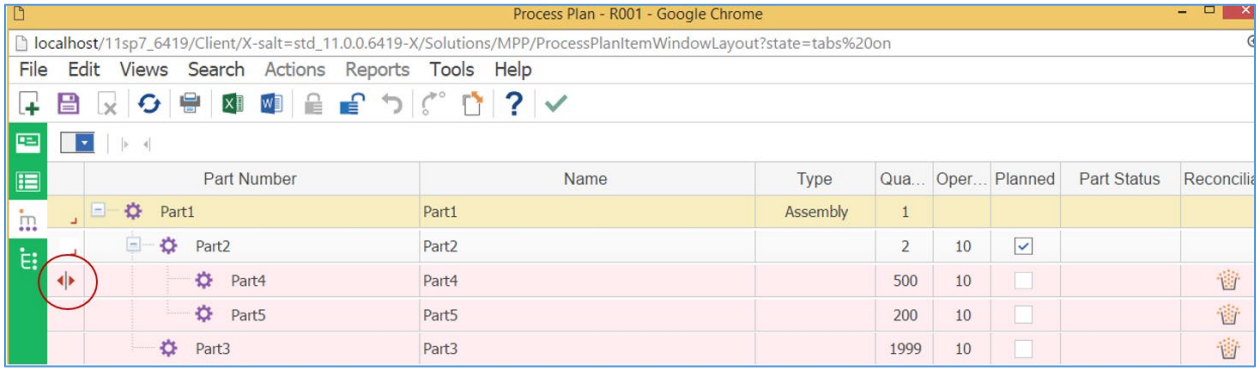


Figure 45.

The conflicts should be resolved by making one of the two selections from the context menu or by selecting buttons in the top tool bar in the MBOM View. The user has two choices to resolve a conflict –

- **Use my edits –** The conflict will be resolved by selecting the current user’s edits.

- **Use other user's edits –** The conflict will be resolved by selecting what was already saved to the database by another user.

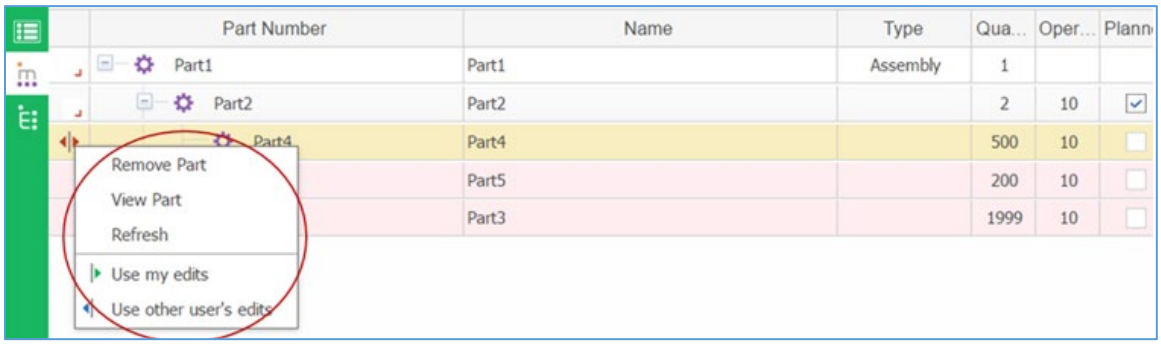


Figure 46.

Selecting "Use my edits" will change the information in the row to the current user's edits and the icon will change to green indicating that the user has selected "Use my edits" option as shown in the diagram below.

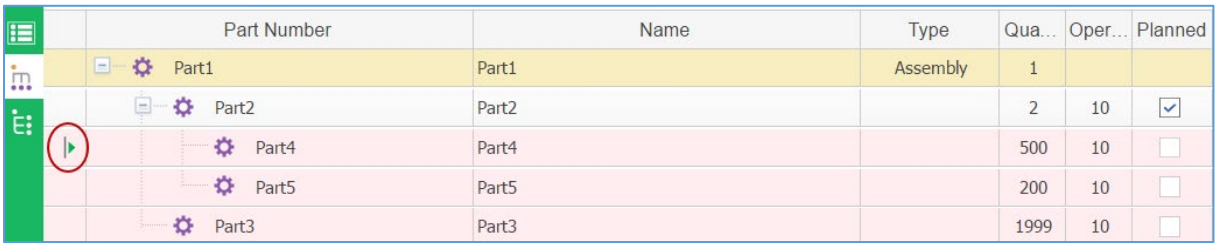


Figure 47.

Selecting "Use other user's edits" will change the information in the row to what is saved in the database by another user. The icon will change to blue indicating that the user has selected "Use other user's edits" option as shown in the diagram below.

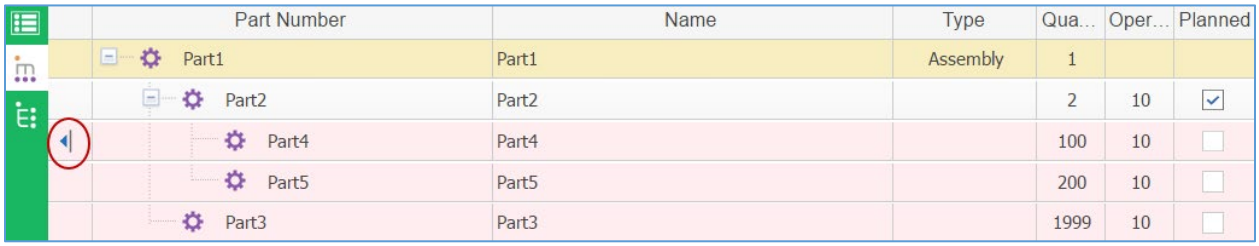


Figure 48.

Note: Before the final Save of the Process Plan/MBOM, the user can switch between "Use my edits" and "Use other user's edits" options.

11.2 Conflict Use Cases

This section describes some of the Use Cases when there are two users - User1 and User2 editing different levels of the MBOM. User2 edits and saves while User1 is editing and before he/she saves the MBOM. The Use Cases are for the example EBOM, Process Plan and MBOM shown in the following diagram.

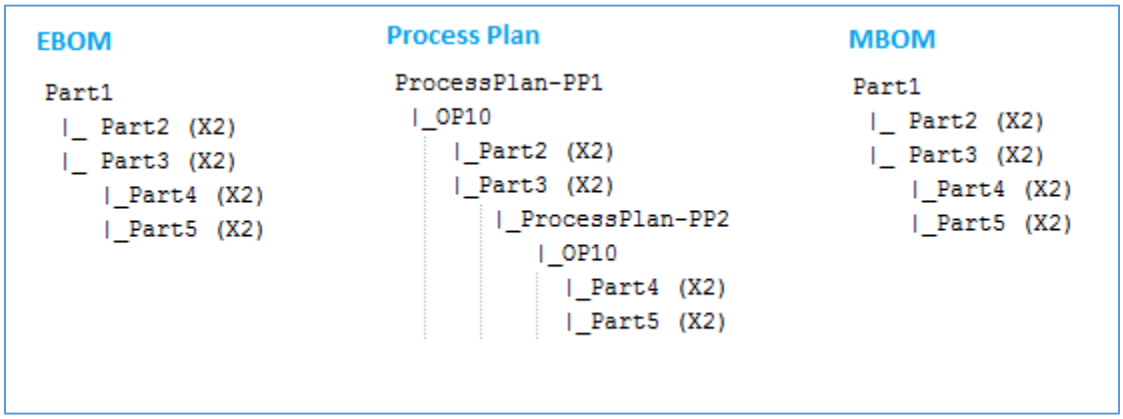


Figure 49.

* The quantity of the part is mentioned in parentheses.

Use Case 1 – When User2 changes the quantity of a part and User1 does not make any changes.

1. User2 opens PP1
2. User1 opens PP2
3. User2 edits Part4 Quantity = 5 and saves
4. User1 hits Save

   No Conflict

   Part4 Quantity = 5 is updated in User1's MBOM

Use Case 2 – When User1 and User2 change the quantity of a part to the same value.

1. User2 opens PP1
2. User1 opens PP2
3. User2 edits Part4 Quantity = 5 and saves
4. Use1 edits Part4 Quantity = 5 and saves.

   No conflict.

Use Case 3 - When User1 and User2 change the quantity of a part to a different value.

1. User2 opens PP1
2. User1 opens PP2
3. User2 edits Part4 Quantity = 5 and saves
4. User1 edits Part4 Quantity = 10 and saves. Conflict error message displayed.

5. Red conflict icon displayed in “Conflict” column of Part4
6. User1 selects “Use my edits”. Icon switches to resolved (green) and row remains as-is (my edits, Quantity = 10)
7. OR User1 selects “Use other user’s edits”. Icon switches to resolved (blue) and row changes to User2’s Quantity (other user’s edits, Quantity = 5)
8. User1 hits Save.

   No conflict.

Use case 4 - When User1 and User2 change the Operation# and quantity of a part to the same value

1. User2 opens PP1
2. User1 opens PP2
3. User2 edits Part4 Quantity = 10 and Operation# = 20 and saves
4. User1 edits Part4 Quantity = 10 and Operation# = 20 and saves.

   No conflict.

   If the operation does not exist then in the Process Plan then 2 Operations are created (#20) both with consumed part - Part4

Use case 5 - When User1 and User2 change the quantity and Operation# of a part to a different value

1. User2 opens PP1
2. User1 opens PP2
3. User2 edits Part4 Operation# = 20 and saves
4. User1 edits Part4 Operation# = 30 and Quantity = 10 and saves.

   No conflict.

   If the operation does not exist then in the Process Plan 2 Operations are created both with consumed part - Part4

Use case 6 - When User1 and User2 remove the same part/phantom.

1. User1 opens PP2
2. User2 removes Part4 and saves
3. User1 removes Part4 and saves

   No conflict.

Use case 7 - When User2 removes a part and saves. And User1 edits the Quantity and/or Operation# of the part that was removed

1. User2 opens PP1
2. User1 opens PP2
3. User2 removes Part4 and saves
4. User1 edits Part4 Quantity = 10 and Operation# = 20 and saves.

   No conflict.

Use case 8 - When User 2 edits the Quantity and Operation# of a part and saves. And User1 removes the part.

1. User2 opens PP1
2. User1 opens PP2
3. User2 edits Part4 Quantity = 10 and Operation# = 20 and saves.
4. User1 removes Part4 and saves

   No conflict.

Use case 9 – When User2 removes a Part and User1 does not make any changes.

1. User2 opens PP1
2. User1 opens PP2
3. User2 removes Part4 and saves
4. User1 hits Save.

   No Conflict
   Part4 is removed from User1's MBOM

Use case 10 – When User2 inserts a Part and User1 does not make any changes.

1. User2 opens PP1
2. User1 opens PP2
3. User1 inserts Part6 and saves
4. User1 hits Save.

   No Conflict
   Part6 is added to User1's MBOM

Use case 11 - When User1 and User2 insert the same part/phantom with the same Quantity and same Operation#

1. User2 opens PP1
2. User1 opens PP2
3. User2 inserts Part6, Quantity= 10 and Operation# = 20 and saves
4. User1 inserts Part6, Quantity= 10 and Operation# = 20 and saves

   No conflict. (2 separate rows of Part6 added to Operation# 20)
   If the operation does not exist, then in the Process Plan 2 Operations are created (#20) both with consumed part - Part6

Use case 12 - When User1 and User2 insert the same part/phantom with different Quantity and same Operation#

1. User2 opens PP1
2. User1 opens PP2

3. User2 inserts Part6, Quantity= 10 and saves
4. User1 inserts Part6, Quantity= 20 and saves

   No conflict. (2 separate rows of Part6 added to Operation# 20)

   If the operation does not exist then in the Process Plan 2 Operations are created (#20) both with consumed part Part6

Use case 14 – When User2 removes an Operation (from Process Plan) and User1 adds a part to that Operation

1. User2 opens PP1
2. User1 opens PP2
3. User2 removes Operation#=10 from Process Plan view and saves
4. User1 inserts Part6, Quantity= 20, Operation#=10 and saves

   No Conflict

   New Operation item with Operation#=10 is created

Use Case 15 – When User 2 removes a Process Plan where a Part is consumed and User1 changes quantity or Operation Number of that Part

1. User1 opens PP2.
2. User2 removes Process Plan PP2 and saves.
3. User1 changes Part4, Quantity= 20, and saves. Conflict error message displayed.
4. Red conflict icon displayed in “Conflict” column of Part4.
5. User1 selects “Use my edits”.
6. Warning message displayed - “Parent Process Plan was deleted. ‘Use my edits’ option is unavailable”.
7. User1 selects “Use other user’s edits”. Icon switches to resolved (blue) and Part 4 is removed from the MBOM. Part 5 will also be is removed from the MBOM since its Process Plan was removed.
8. User1 hits Save.

   No conflict.

Use Case 16 – When User 2 removes an Operation where a Part is consumed and User1 changes quantity of that Part

1. User1 opens PP2
2. User2 removes Operation OP#10 and saves
3. User1 changes Part4, Quantity= 20, and saves. Conflict error message displayed.
4. Red conflict icon displayed in “Conflict” column of Part4
5. User1 selects “Use my edits”.
6. Warning message displayed - “Parent Operation was deleted. ‘Use my edits’ option is unavailable”.

7. User1 selects “Use other user’s edits”. Icon switches to resolved (blue) and Part 4 is removed from the MBOM.
8. User1 hits Save.

   No conflict.

12 Process Plan Revision Control

The “Process Plan” Lifecycle is associated to the Process Plan ItemType. To release a Process Plan the user must manually promote the Process Plan Item to Released state and then create the next revision of the Process Plan Item.

When the Process Plan Item is revised, the new revision of the Process Plan will point to the Parts (Produced & Consumed) and the other related Items (Tools, Machines, Documents, Skills) in the Origin Process Plan.

The user should manually replace the Produced Part to the new revision of the Produced Part and change the Consumed Parts if required.

The below diagram shows the Process Plan lifecycle –

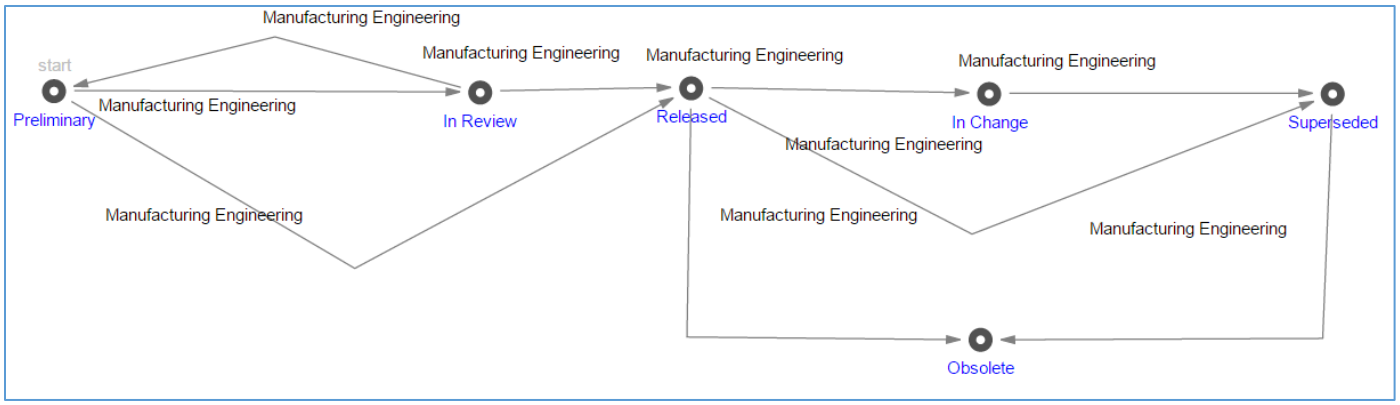


Figure 50.

Warning The behavior for all the states in the Process Plan lifecycle is set to fixed. Changing the behavior of a state(s) to float or to a different behavior must not be done as this will result in MPP functionality to not work correctly.

12.1 New revision of a Produced Part

When there is a new revision of the Produced Part it is indicated to the user in the MBOM/EBOM “Part status” column as an icon. If the user wants to consume the new revision of the produced part in the parent Process Plan, they will have to do a save as of the sub-process plan and replace the produced part/consumed parts as required.

12.2 Manual Versioning of a Process Plan

Manually versioning the process plan is recommended in cases when the user wants to add/remove operations, steps, tools, machines etc. That is any changes to the process plan other than changing the produced part/consumed parts. If a sub-process plan is versioned, then the system automatically points to the latest sub-process plan in order to resolve the Process Plan and MBOM.