



BOM Management with Autodesk® PLM 360: Advanced Topics

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PL2570 This class covers advanced topics and customization abilities for bill of materials (BOM) and change management processes in Autodesk PLM 360 cloud-based product lifecycle management software, including changes to the lifecycle map, BOM views configuration, permission and access management, and more.

Learning Objectives

At the end of this class, you will be able to:

- Explain what the lifecycle map is and manage it within Autodesk PLM 360
- Implement version and revision management
- Serve the needs of different users by giving user exactly what each one needs
- Tweak the engineering change order (ECO) process to meet your needs

About the Speaker

With degrees in Mechanical Engineering, Computer Science, and Business Administration, I've spent the past 17 years working on software solutions for manufacturers in PLM related areas such as Manufacturing Process Planning, System Engineering, and BOM Management. Over the past 2 years I've been on the Autodesk PLM 360 Product Management team with specific focus on engineering business processes in general and BOM functionality in particular.

My goal as a product manager is to deliver functionality that solves our customer's business needs. As such, I am always eager to learn more about the business challenges our customers face, and the needs they have from the Autodesk PLM 360 solution.

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Introduction

PLM 360 is a highly configurable system. The purpose of this class is to introduce you to some of the configuration abilities specifically related to BOM management functionality to help you match the unique requirements of the environment you are working in.

Items and Revisions

The basic currency in PLM 360 is an Item. When items go through changes, when they are 'ready' for consumption by a business process, they get frozen in a Revision. There are many different business processes that consume 'ready' items – design review, prototyping, production, and more. When an item is frozen, a Revision of the item is created and shows the state of the item at that point in time. The revisions of an item form a Linked List

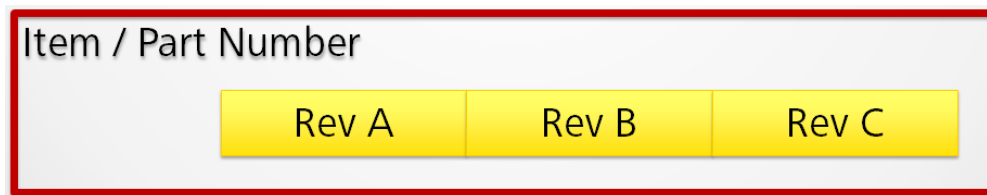


Figure 1 - Item Revisions form a Linked List

The Lifecycle Map

Lifecycle states in PLM 360 allow our users to manage the 'readiness' of an item for a given purpose. The lifecycle states represent maturity of the items or sometimes gateway readiness. What each state means is totally up to the customer (there are no assumed behaviors associated with the lifecycle states other than those defined in the lifecycle map itself), and the number of states and transitions between them are also customer specific. Out of the box the lifecycle map looks something like this

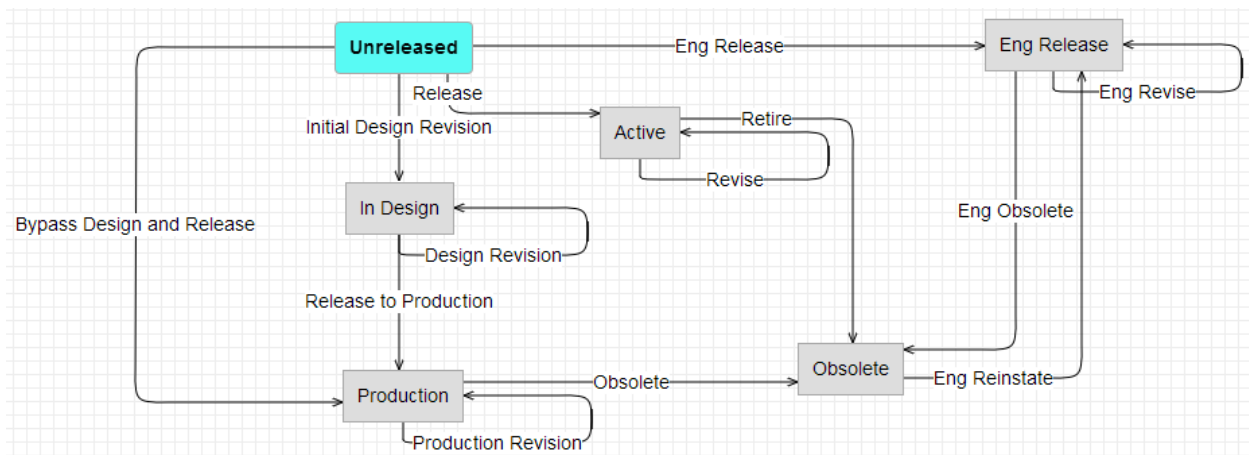


Figure 2 - Example of a Lifecycle map

As you can see in the map, if the customer’s business processes allows for an item to iterate within a lifecycle state, a transition from that lifecycle state to itself is necessary. In the example above, you can see an iteration loop for the ‘In Design’ state and for the ‘Production’ state. That means that you can release newer revisions of the same item into the same lifecycle state.

Effectivity

Normally, when freezing a revision, it immediately goes into effect. Unless otherwise specified, the Effective or Effectivity date of an item is identical to the Release date of the item. However, sometimes it is important to make a revision effective only at a point in time in the future. For example, when an assembly will stop using an item supplied by one manufacturer and start using a comparable item supplied by another manufacturer that requires some additional changes in tooling. You want to approve the change immediately so that manufacturing can order the new tooling and procurement can order the new parts, but you don’t want the assembly personnel to get confused with the new design until its time. In that case, the user can specify an effectivity date that is later than the release date.

Once a new revision of the item has been released with the new effective date, this is when the prior revision of the item is no longer effective. PLM 360 does not store an ‘End Effectivity’ date for an item. Instead, it is assumed to always be one day prior to the effective date of the next revision in the linked list of revisions. This ensures that there is never a gap in effectivity for an item.

The Release/Revision Process

PLM 360 allows defining workspaces as subject to Revision Control. Items that are created in ‘Revision Controlled’ workspaces may be released, and will have revisions as seen in ‘Figure 1 - Item Revisions form a Linked List’ above. In order to release or revise items that are subject to Revision Control, you must associate it to a Revisioning Item. Revisioning Items are part of a specific type of workspace called Revisioning Workspace. If you create a new workspace, you will see both types of workspaces in the dialog.

Workspace Name

Workspace ID WS_

Description

Workspace Type

- Basic Workspace *Workspace without workflow management*
- Basic Workspace with workflow *Workspace with workflow management*
- Revision Controlled Workspace** *Items in this workspace are revision controlled. Lifecycle and revisions are controlled via a Revisioning workspace*
- Revisioning Workspace *Workspace used to revision items in a Revision Controlled Workspace*
- Supplier Management *Workspace used to manage suppliers for sourcing*
- Supplier Management with workflow *Workspace used to manage suppliers for sourcing*

Display in My Outstanding Work

Expire My Outstanding Work

Figure 3 - Revision Controlled and Revisioning Workspaces

Lifecycles

Lifecycle States

Every tenant has a Lifecycle Map and PLM 360 makes it easy to change it to your needs. To view your lifecycle map and edit it go to 'Administration' → 'System Configuration' → 'Lifecycle Editor'. The Lifecycle Map should look something like what you see in Figure 3.

There are two sections to this view. The top part of the Lifecycle Map shows all the Lifecycle States that have been defined so far. The bottom part of the Map allow you to associate specific Transitions to specific Revisioning Items.

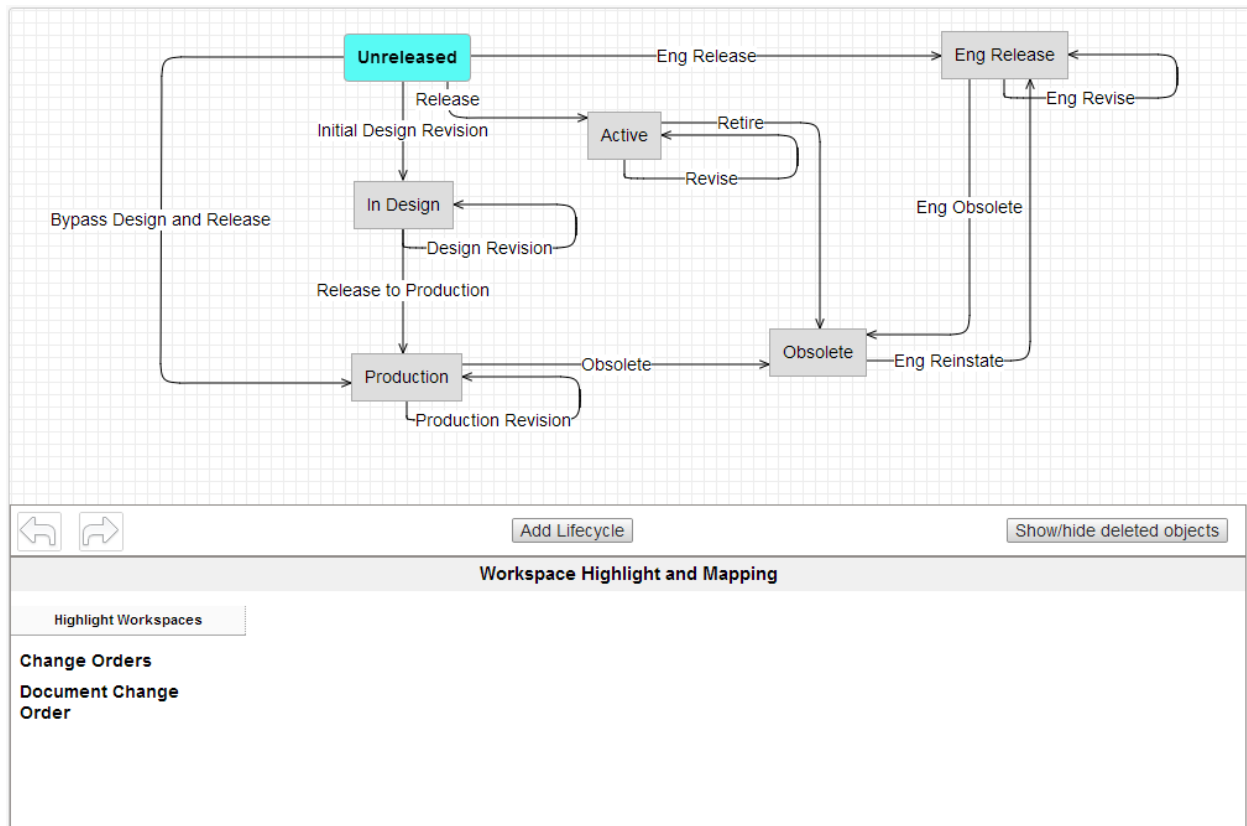


Figure 4 - The Lifecycle Editor

Note that there is only one Lifecycle map for the entire tenant. However, you may create different paths in the Lifecycle map, associated to different Revisioning Items, and therefore associated to specific type of Revision Controlled Items by association. Note that only the Transitions in the Lifecycle map are associated with the Revisioning Item.

Add a State to the Lifecycle Map

Let's say that I want to add a 'Ready for Prototyping' Lifecycle state and I want to allow the items in the 'Items and BOMs' workspace to take this state. What are the steps required to do that?

First, we'll need to add a Lifecycle State. Click on the 'Add Lifecycle' button in the middle of the screen brings up the 'New Lifecycle Creation' dialog

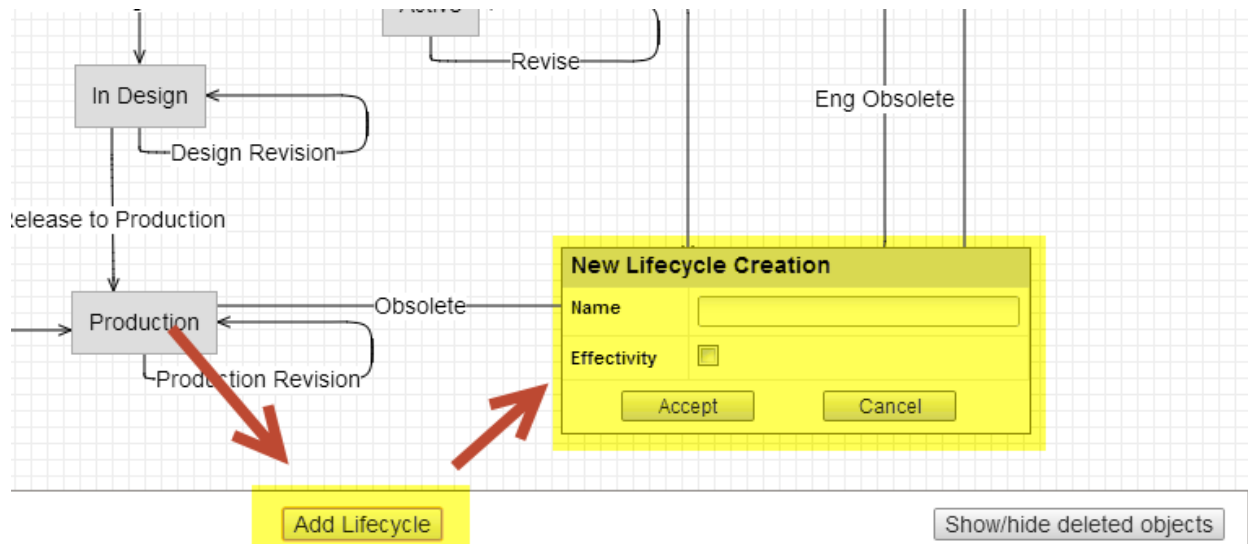


Figure 5 - Add Lifecycle State

Give the state a new Name, in our case 'Prototype', and decide whether this state will be subject to Effectivity or not.

This is worth some additional explanation. In PLM 360 ALL Revision Controlled items are subject to Effectivity. If the checkbox in the lifecycle state is not checked, the system will simply assume that the Effective Date of each item is the Release Date of the Revising Item that created it (in other words the final approval date of the Change Order). If the checkbox is checked, the system will still assume that, but will allow the user to select a future date as the effective date if he so wishes. Following figure shows an example of a Change Order with two items – one that is going into a state that does not support Effectivity and the other into a state that does

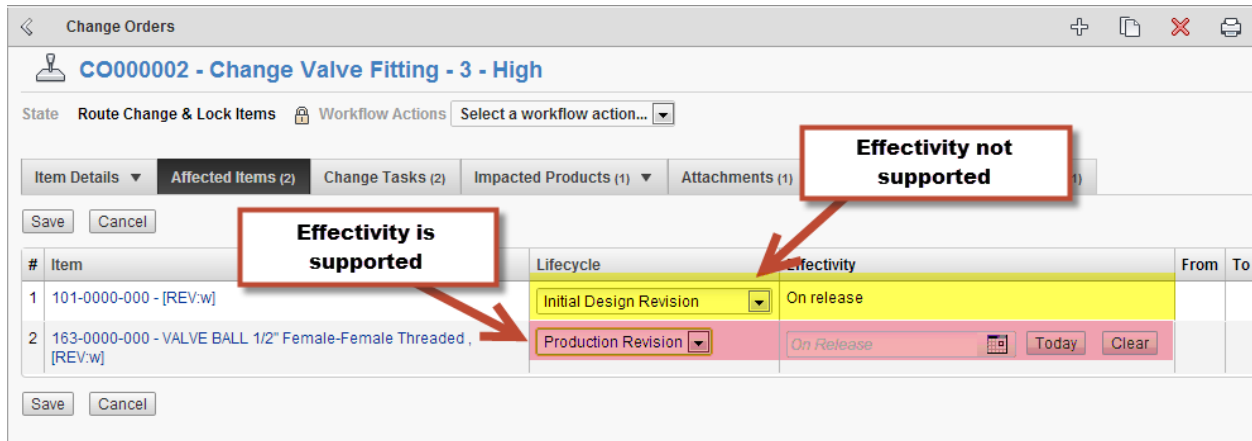


Figure 6 - Change Order screen with and without effectivity support

When a transition, like 'Initial Design Revision' in the example above, ends in a state that does not support Effectivity, you will see the words 'On Release' in the Effectivity column. The same thing happens when a transition, like 'Production Revision' in the example above, ends in a state that does support Effectivity. The difference is that in the latter you may select a future date of your choice. But note that you don't have to! If you select no date, the effective date will still be upon approval of the Change Order (same as the Release Date of the revision).

Assuming you follow the general rule of no change to 'Fit, Form, or Function' when releasing a new revision of an item, the only reason to use effectivity dates is if the BOM of an item changes, and one or more of its components will simply not be available for any reason until a future date.

Add Transitions to and from the new Lifecycle State

Now that we have created a new Lifecycle State, we are ready to add transitions to and from this new state. When you hover over any of the sides of a Lifecycle state in the map, a little bubble shows up

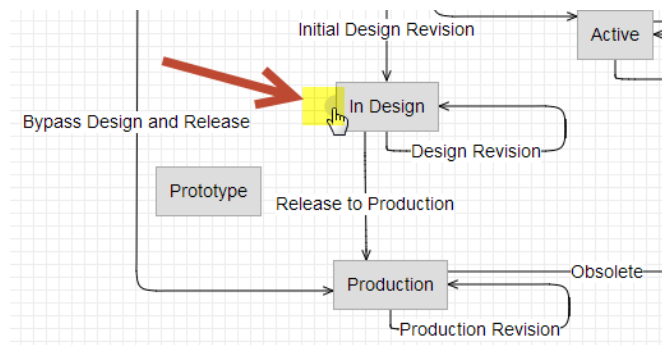
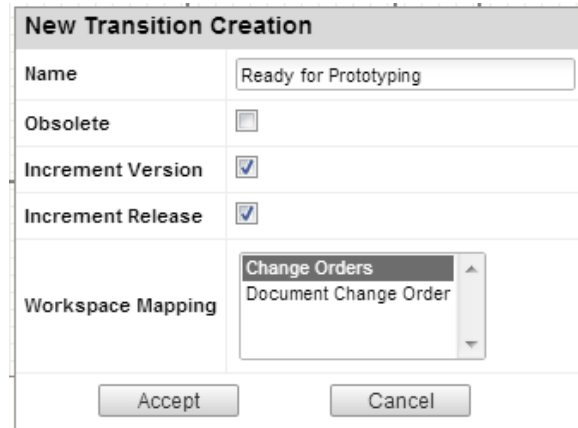


Figure 7 - Transitions 'Bubble'

Simply drag a line from the bubble to the new state and the 'New Transition Creation' dialog will pop up.



New Transition Creation	
Name	Ready for Prototyping
Obsolete	<input type="checkbox"/>
Increment Version	<input checked="" type="checkbox"/>
Increment Release	<input checked="" type="checkbox"/>
Workspace Mapping	Change Orders Document Change Order
Accept Cancel	

Figure 8 - New Transition Creation dialog

There are some choices you need to make here

- Name – this is the visible name for this transition that you see in the Change Order dialog as in 'Figure 6 - Change Order screen with and without effectivity support'
- Obsolete – check this box if you want items in this state to be marked as Obsolete.
- Increment Version – a Version in PLM 360 is a numeric value that identifies each release. As a best practice, it is always good to increment the Version
- Increment Release – a Release in PLM 360 is an Alphabetic character. All characters of the alphabet are used sequentially.

NOTE: A Revision in PLM is either the Release character, if it exists, or the Version number.

- Workspace Mapping – select which Revisioning Item should allow this Transition.

This is what the completed Lifecycle map looks like

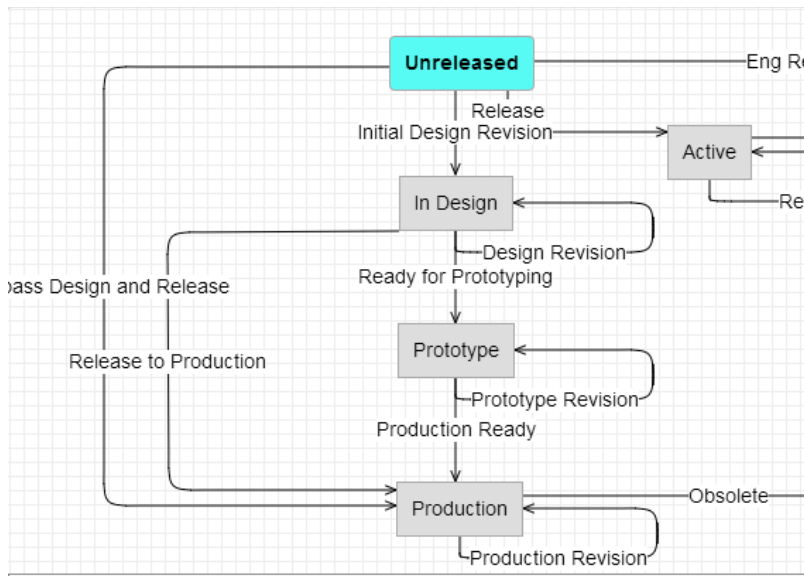


Figure 9 - Completed Lifecycle Map with Prototyping

Selecting Revisioning Scheme

We mentioned in the previous section that selecting ‘Increment Release’ essentially mean that you will get a sequential single character to represent the revision. In fact, there is one other revisioning scheme supported by PLM 360 – manual revision numbers.

In the ‘Administration’ → ‘System Configuration’ → ‘General Setting’, scroll to the section called ‘Revision Controlled Setting’ and you will be able to choose whether the Revision Number Generation will be ‘Automatic’ or ‘Manual’. In Manual mode, the user will have to select a revision identifier for each item he is releasing in a Change Order.

Note that this setting is for the entire tenant.

Change/Release Management

Revision Control

Items in PLM 360 may be subject to revision control. All revision controlled items can only be revised through a Workflow associated with a Revisioning item. This is consistent with CMII requirements. You can think of it as a Change Order (and, in fact, the revisioning item is in the Change Orders workspace in the base tenant).

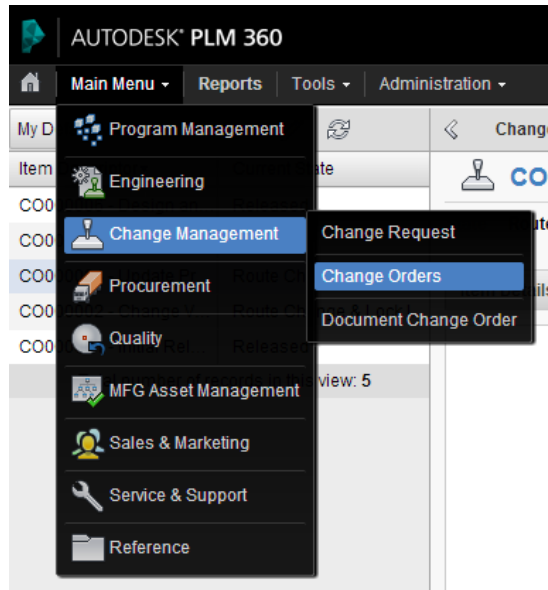


Figure 10 - The Change Orders workspace

Affected Items

A somewhat less known feature of PLM 360 is that the Affected Items list of a Change Order may have custom properties of its' own! One common use case for this is adding a Disposition tag on the revision. To see the customization, go to 'Administration' → 'Workspace Manager' and expand the 'Change Order' workspace (or your own Revisioning Workspace). Select the 'Managed Items Tab' to configure

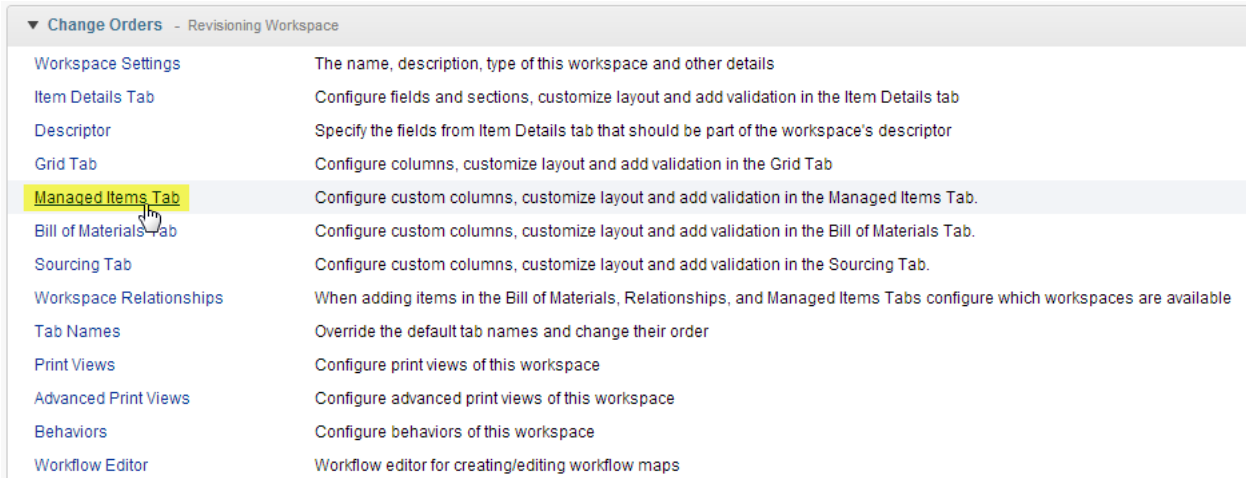


Figure 11 - Customizing the Affected Items

Your tenant may or may not have the disposition custom field. This is simply a Single Selection Picklist with the user defined values as seen below. Of course, this is only a starting point and you may change it however you like. You may also add any other custom fields to this tab.

The screenshot shows the 'Editing a Field' dialog box with the 'Disposition' field selected. The 'Picklist Settings' tab is open, displaying the following configuration:

- Field name:** Disposition
- Field ID:** DISPOSITION
- Field description:** (Empty)
- Data Type:** Pick List
- Visible on preview:**
- Pick List Options:** Disposition
- Pick List Type:** A list of values you define
- Picklist Values Table:**

Picklist Values	Delete
No Impact	<input type="checkbox"/>
Return to Supplier	<input type="checkbox"/>
Rework	<input type="checkbox"/>
Scrap	<input type="checkbox"/>
Use Until Depleted	<input type="checkbox"/>

Figure 12 - Disposition Field

Approval Lists

The default Change Order process included with most tenants also includes an approval process that allows you to select from a set of Approval Lists or individual Approvers. This is out of scope for this class, but I wanted to point out that this is highly configurable and you may choose to implement a completely different method for approvals.

Workflow

The revisioning item (or change order) has a fully customizable workflow associated with it. An example of this workflow is seen in the next image.

There are a couple of noteworthy tags in the workflow that are important to understand. In particular the Lock State and the Managed State. Once the Locked State is reached, the change order itself, as well as any associated items ('Affected Items') can no longer change. This is useful to ensure that when a Change Control Board (CCB) approves a change, they will

all be approving exactly the same state of the item, and will be comfortable knowing that this is what will get released.

Once all approvals are complete and the Managed State is reached, the new revisions are locked. This is when the new revision numbers will become valid for all 'Affected Items'.

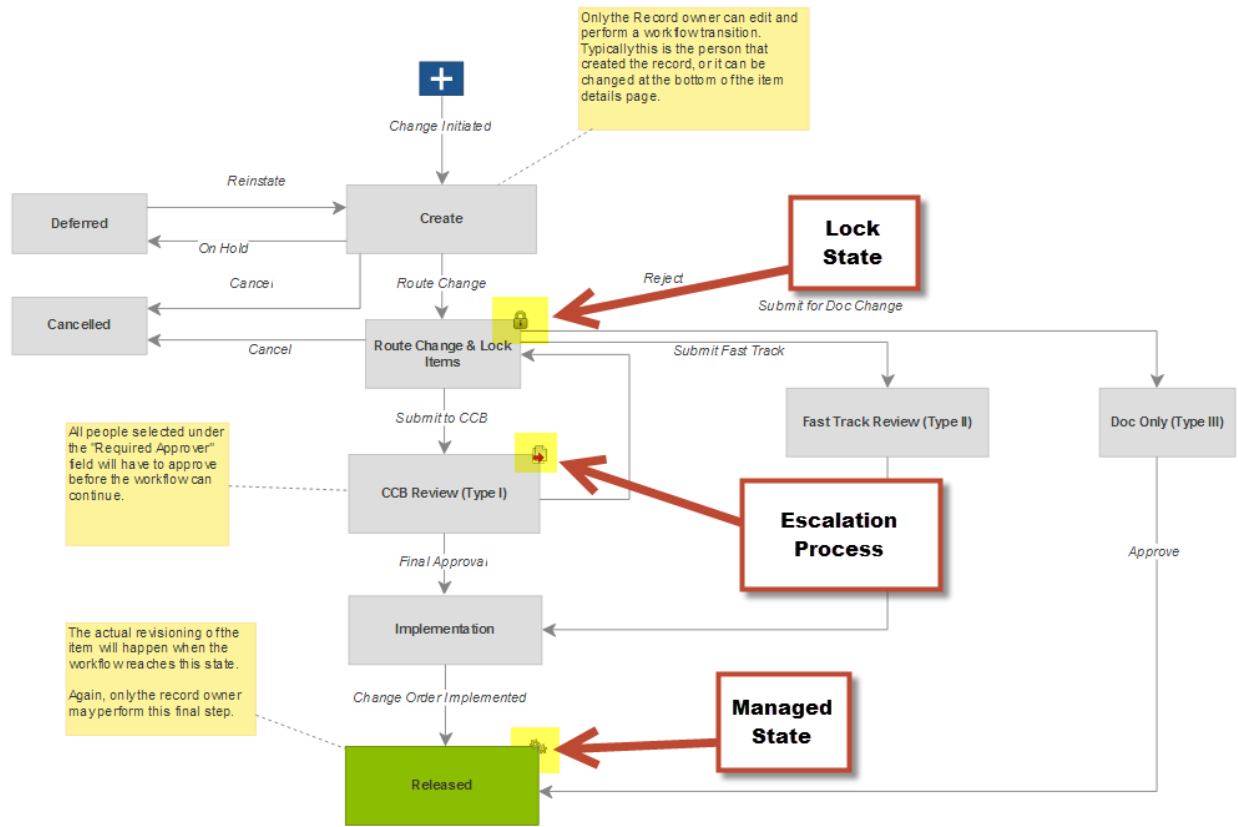


Figure 13 - Workflow associated with the Change Order workspace

Assess Changes

When you are asked to approve a Change Order, you will likely want to know what will be the effect of the Change Order on your BOM?! You can find this out directly from the Managed Items (sometimes called Affected Items) tab on the change order. When you click on the 'Compare' action, the system opens the item's BOM tab and immediately puts it in the 'Pending Changes' configuration with an 'As-Of Date' as specified by the Effectivity entry in the tab

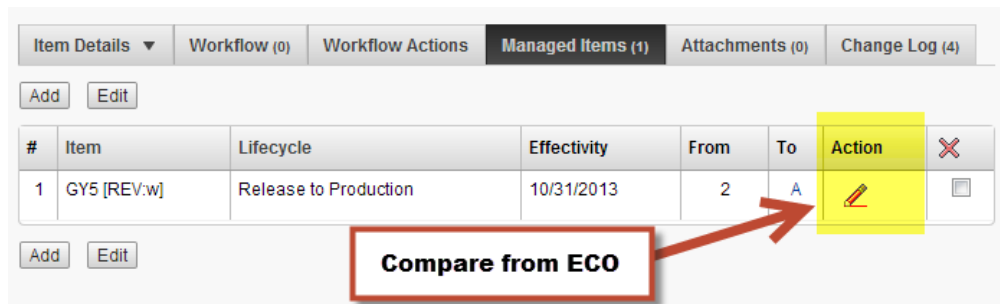


Figure 14 - Compare from ECO

But before you can click on the Compare action, you must first select a Lifecycle Transition and optionally Effectivity Date for each item on the list. Only then the Compare action will light up.

BOM Views

Introduction to BOM Views

What do your users want to see when they go to the BOM tab? If they have different roles in the organization, it is likely that you will get different answers from them to this simple question. Different users have different roles in the organization and are trying to accomplish different tasks. Product Engineers may want to see functional performance characteristics for components whereas Manufacturing Engineers may want to see manufacturing and assembly characteristics and Purchasing may want to see alternative suppliers and costs. With BOM Views, you may create a number of different Views of the BOM to answer the specific needs of each group of users in your company

BOM Views are specific to the workspace that you are viewing the BOMs in. Simply go to 'Administration' → 'Workspace Manager', select the workspace you want to edit the BOM Views in, and select the 'Bill of Materials tab'. You will see something like in the following Figure.

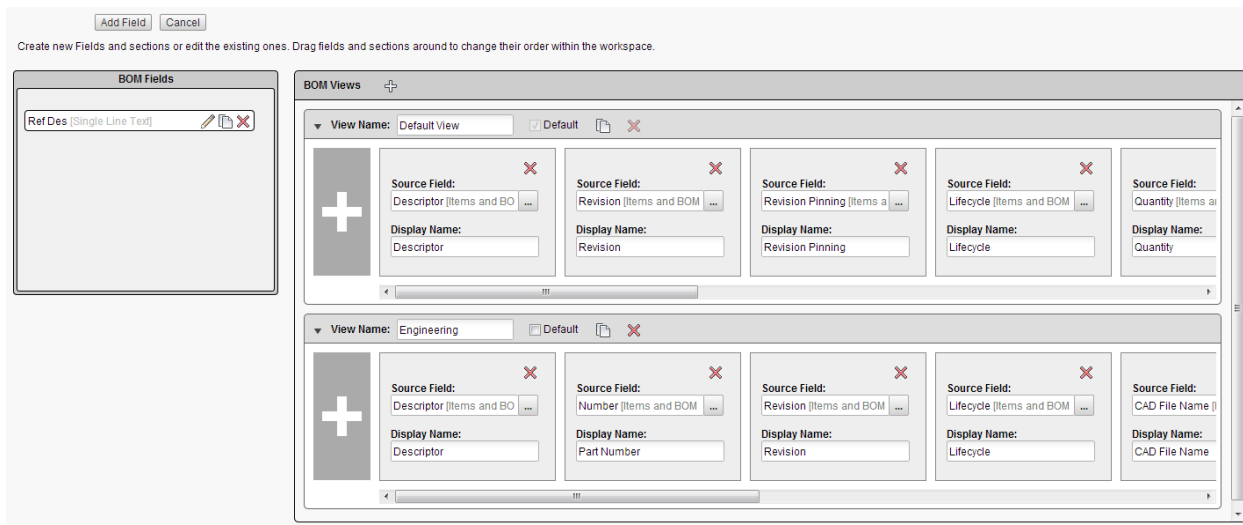


Figure 15 - Authoring the Bill of Materials tab

On the left side of the screen is the 'BOM Fields' section. In this section you will see all the custom fields created in the BOM tab of this workspace. This includes editable fields, like the 'Reference Designator' field that you see in the image, as well as non-editable fields such as Rollups that we will discuss later on.

On the right side of the screen is the 'BOM Views' section. You may define as many BOM Views as you need in this table for the various user needs you have in your organization. Note that all views are visible to all users and although you, as an administrator, may specify one view as 'Default', as soon as a user switches to a different view, that view becomes sticky on that machine and for that user.

Authoring the BOM Views

Similar to other Admin pages in the system, you may start editing data on the screen immediately. To the extent that changes have to be saved, a 'Save Layout' button will appear on the top left side of the screen and a message will pop up if you try to navigate away from this page without saving it.

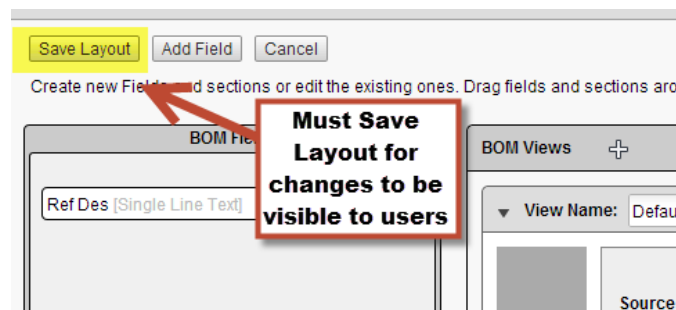


Figure 16 - The 'Save Layout' button

Each 'Ticket' in the BOM View represents a column of data that will be presented to the user. For example, in the following view

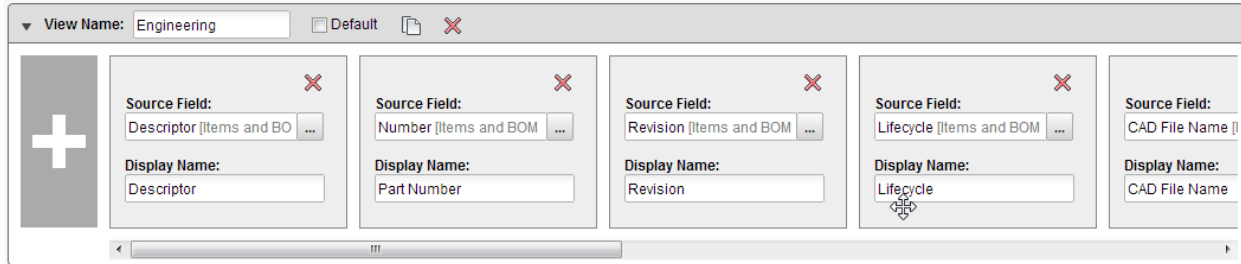


Figure 17 - A BOM View

The information that will be presented to the user includes the Descriptor, Number, Revision, Lifecycle, etc. When choosing to use this view, a user will see the following table in the actual BOM tab

The screenshot shows the BOM View interface with a table of data. A red callout box labeled 'User Selected View' points to the 'Engineering' view name in the top left corner. The table has the following columns: #, Descriptor, Part Number, Revision, Lifecycle, CAD File Name, and Quantity.

#	Descriptor	Part Number	Revision	Lifecycle	CAD File Name	Quantity
0.0	683-0000-000 - SBOM PIPING Pneumatic Assembly, Project 621 [REV:sA]	683-0000-000	A	Superseded	-	-
1.1	165-0000-000 - PIPE Threaded Ends Schedule 40S - 2 [REV:A]	165-0000-000	A	Production		8.1
1.2	162-0000-000 - FITTING Threaded Tee Malleable Iron Class 150 , [REV:A]	162-0000-000	A	Production		1.0
1.3	162-0001-000 - FITTING Coupling Class 125 4" to 1" , [REV:A]	162-0001-000	A	Production		1.0
1.4	162-0002-000 - FITTING Reducing Coupling Class 125 4" to 1/2" , [REV:A]	162-0002-000	A	Production		1.0

Figure 18 - An example of what a user will see when choosing this view

You can easily control the order of tickets in the BOM View by a simple drag and drop. For example, let's say we want to move the Lifecycle column to a couple of places up. Simply click on it, drag it to where you want it, and drop. Note the Drop Indicator which shows you where the ticket will be added when dropped.

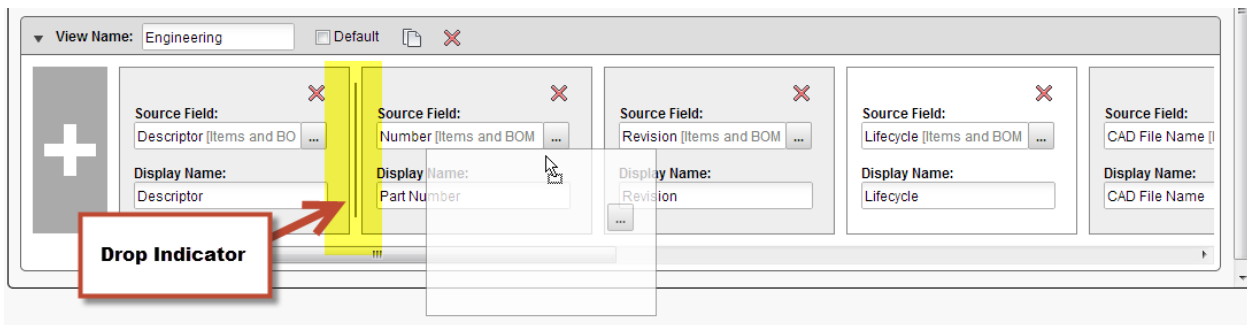


Figure 19 - Drag and Drop tickets

In a very similar way you may drag Custom BOM Fields from the left section to any of the views.

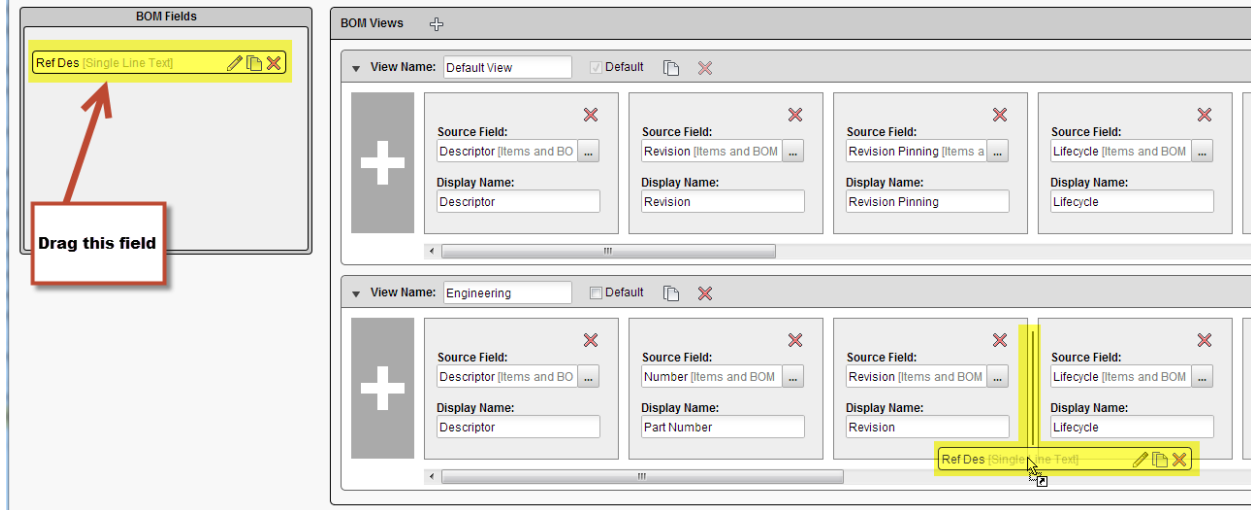


Figure 20 - Drag and Drop a BOM Field

However, you may not use this technique to drag-and-drop tickets between Views.

Another method of adding tickets to a View is by using the 'Add BOM Field' button at the far left of each view

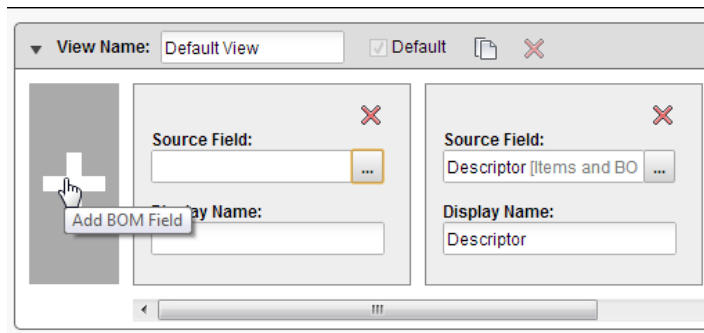


Figure 21 - Add BOM Field

An empty ticket will appear to the right of the button as seen in the figure. Click on the ... icon to select the source data for the new field. Available data sources include BOM Fields (built in and custom), Item Details fields, Sourcing fields, and System fields. More fields are added regularly, so look for more information in the 'What's New' section of new releases. For example, we recently added the 'Attachment' field that shows the number of attachment to each item and provides quick access to the attachment tab, and the 'Pending Change' badge that shows whether the Working Revision of a particular item is assigned to a Change Order.

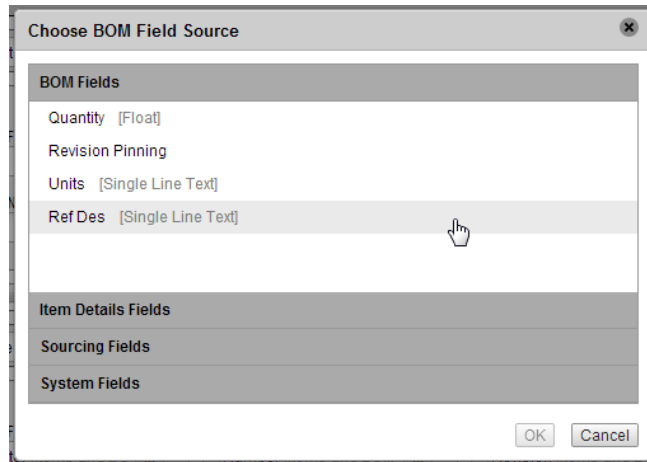


Figure 22 - Choose BOM Field Source dialog

Use the same technique to change the content of an existing ticket.

Once you have selected the data source, the system will auto-suggest a name for the column. Feel free to change the column name to whatever you want it to be

TIP – the cells in the BOM View will not include any Unit of Measure (UoM) identification. If you want users to know the UoM for a particular column, include the UoM in the column name.

Creating a New View

There are two ways by which to create a new View. Either click on the + sign next to the 'BOM Views' header, or on the Clone sign next to any existing BOM View.

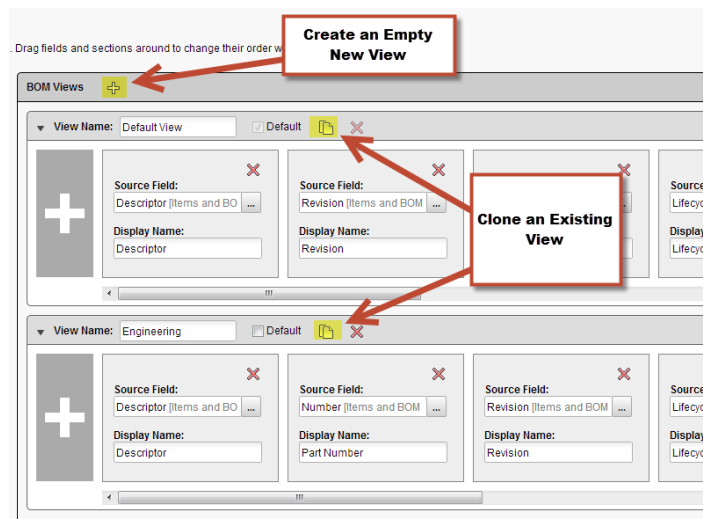


Figure 23 - Creating a View

Just make sure to give the new View a descriptive name, add the tickets you want, and Save Layout.

TIP – there are a couple of views that I highly recommend that you create. The first is a view that will allow you to export all the data you want into Excel, and that will include sufficient data to reimport the exported data. This is useful if you want to do a lot of editing of items. By exporting to excel you can do bulk editing and reimporting later on. If you want to reimport historical data (for example, if you want to mass-change historical revisions of items), it is important to include enough information in the excel export to be able to match the data in PLM 360. This includes

- Lifecycle State
- Revision identifier
- Revision date
- Effectivity date (if different from revision date)
- Revision pinning (if used)
- The fields you want to author

A second view I highly recommend that you create is one that you can use for BOM Compare. Since BOM compare only compares the BOM tab and not the Item Details tab, it is useful to have one view with as much Item Details data as you may need to see differences in items that you are releasing.

Creating Roll-Up fields

One particularly useful type of BOM Fields are Rollup fields. Rollup fields allow you to calculate a bottom-up value for the Open item based on the individual values of the children items in the BOM, recursively. Note that all calculations are done Bottom-Up starting with the leaves of the BOM (the lowest levels in the BOM hierarchy) and up. Each Rollup Field is based on a respective field (source field) that gives it the value to rollup. For example, a Weight field may be associated to every item in the BOM, and a respective Total-Weight field can be created to show the weight at every level of the BOM.

The only Source Field types supported for rollup at this point include:

- Float
- Integer
- Date
- Check Box

When creating a rollup field, you have to specify a Type for the rollup field from one of the above types. A Float type rollup field can rollup data from a Float or from an Integer source field. Other than that exception, each type of rollup field can only rollup data from fields of the same type.

The source fields can be in the BOM tab or in the Item Details page. For example, a Weight field is usually not specific to the context and therefore it will likely be in the Item Details page. However, the Rollup itself is specific to the BOM and therefore rollup fields can only exist in the BOM tab.

Figure 24 - Creating a Rollup field

To create a rollup field, simply select to create a ‘New Field’, give it one of the supported types, and click on the ‘Roll Up’ checkbox next to the Field Type entry (top arrow in the figure above). Then fill in the required parameters for size and display, and then select the Source data. Note that only compatible field types from the Item Details and BOM tab will show up.

Once this is done, you must select a custom formula to use in the rollup

Name	Description
Minimum	Find the lowest number in the BOM
Maximum	Find the highest number in the BOM
Sum with Adjustment	Calculate the sum of the child source fields and add the parent source field to the total
Sum with Override	If the parent item has a value in the source field, use it. Otherwise use the sum of the children

Figure 25 - Select a rollup function

For the supported list of custom formulas, refer to the respective section in the online help manual.