



Walt Disney World Swan and Dolphin Resort
Orlando, Florida

Automating Your Engineering Change Process with Autodesk® Productstream™

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MA33-1 According to top analysts in the manufacturing market, automating your engineering change order (ECO) process provides one of the biggest bangs for the buck in terms of getting a solid return on your software investment. See how Autodesk Productstream's built-in ECO process can keep the red pen away from you and the stack of paper ECOs off your desk.

About the Speaker:

Brian is the former president and CEO of truEInnovations, original developers of the Autodesk Vault. He now works for Autodesk as a product manager in the Manufacturing Solutions Division's Data Management Solutions product line. This product line includes Autodesk Vault and Autodesk Productstream. Brian's main focus is product direction and the product release roadmap.

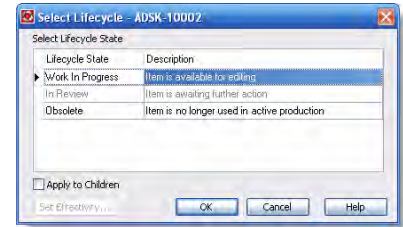
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Item Lifecycle States

Lifecycle states determine how an item can be used. Lifecycle states can be set in two different manners:

1. Manually
2. By approving a change order

The lifecycle state of an item determines the operations that are permissible to be performed on the item and its associated files. It also determines who can view the item and its associated files using the web client Productstream Explorer.



The Table 1 lists the four different lifecycle states and what operations can be performed on the item in the lifecycle state.

Table 1 Item Lifecycle States

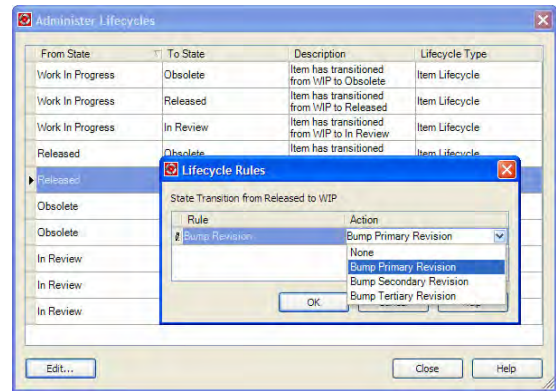
Lifecycle State	Description	Can files be edited?	Can item be updated to a newer revision?	Other aspects
Work In Progress	Item can be edited	Yes	Yes	New items are automatically assigned to this state
In Review	Item is in review awaiting further action	No	No	
Released	Items are available for production	No	No	
Obsolete	Item is no longer in production	No	No	Item cannot be used in a BOM

The item can be changed from one lifecycle state to another depending on the current state. Furthermore, Productstream can be configured to automatically change the revision of an item when it transitions lifecycle state. The allowable changes are listed in Table 2 below.

Table 2 Allowable State Transitions

Current State	Allowable Transition States
Work In Progress	In Review Released Obsolete
In Review	Work In Progress Released Obsolete
Released	Work In Progress Obsolete
Obsolete	Work In Progress

The default behavior is to create a new revision when an item changes state from Released to Work In Progress. This option can be changed by using the Administration Tool. The 'Rules...' command is found in the Item tab and brings up the dialog shown to the left.



Lifecycle States and Change Order

Organizations will likely use the change order to change the lifecycle state of one of more items. Some examples are listed below:

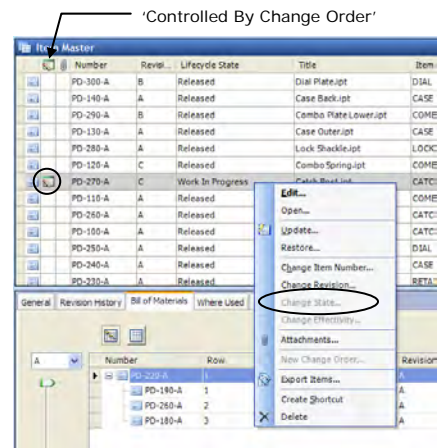
- New Product Introduction: Release a new product to production.
- Engineering Change Order: Release a new revision of part or a replacement part to production.

When an item is placed on a change order, the only way to change the lifecycle state is by approving or canceling the change order.

When an item is on an active change order an icon appears in the 'Controlled by Change Order' column in the item master. Note that the 'Change State...' command is disabled when the item is controlled by the change order.

If a change order is cancelled or closed the lifecycle state change lock is removed and the icon no longer appears in the column.

If a change order is approved, the action that closes the change order (Set Effectivity) will set the lifecycle state of the item(s) on the change order to the 'Released' state.



Change Order Procedures

The following sections give details on:

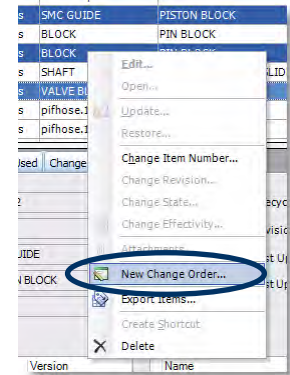
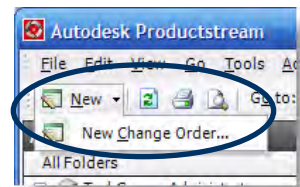
1. Creating a new change order
2. Responding to change orders

Creating a New Change Order

In order to create a change order, the user must have Productstream Editor or Reviewer privileges. This user can create a new change order in one of two ways:

1. Displaying the change order list and selecting the 'New Change Order' command. This method is the fastest way to create a change order when the user knows what items are to be applied from the item master.
2. Selecting one or more items from the item master and select the 'New Change Order...' command from the context menu. This method allows the user to search the item master for the items to be added to the change order.

Regardless of which method is used, the user can modify the items controlled by the change order by editing the 'Associated Items' table.

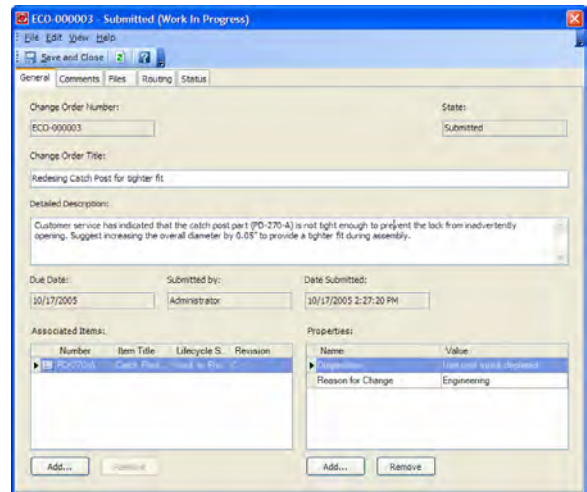


The change order form is then displayed. At this point the user will fill out the necessary information on the General, Files and Routing Tab. The change order is saved by selecting 'Save and Close.' Note that the user does not need to completely fill out the form. The change order can be edited later by the user that originally created it.

The General Tab

This tab contains the basic information of the change order:

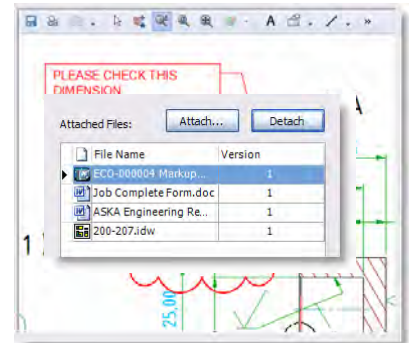
1. Change order number
2. Title: A short title for the change order such as 'Redesign bushing to provide tighter fit.'
3. Detailed description: This can be used to state the reason for the change, what needs to be done, the effect of the change, etc.
4. Due Date: The date the change order needs to be completed.
5. Associated Items: A list of all items affected by the change order.
6. Properties: Specific information for the change order as defined by the company. Example include: Reason for Change, Disposition, etc.



The Files Tab

If an item is added to the change order that has associated design (CAD) files, they will be automatically added to the change order. Any number of other files of any type can be additionally added during the creation of the change order. The files must be stored in the vault in order to be added to the change order.

The user can mark up 2D DWF files attached to the change order to create any number of markups. If the CAD files are stored in the vault with 'Auto' published DWF files, the user can directly markup the DWF file without the need to manually attach it.

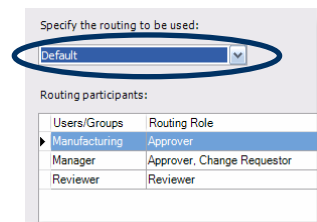


The Routing Tab

A routing list is a set of users that are assigned to the change order. These users will have different roles. These roles are unique to the change order and do not apply to any other aspect of Productstream. A particular user's role may change from one change order to the next. The roles determine the level of permission and functions that the user can perform on a change order.

The system administrator can predefine a set of routings for different processes: For example:

- Less users for fast track processes
- More users from strict sign-offs

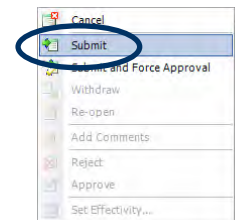


The user selects the appropriate routing from the drop down list.

Submitting a Change Order

As previously noted, the user can save and close the change order and subsequently edit it. These actions leave the change order in an 'Open' state. No one is notified of the change order and cannot take any action on it.

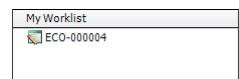
Once the user is satisfied that the change order is ready for processing, the use the respond command 'Submit' to move the change order from the 'Open' state of the 'Submitted' state. This action will notify the users on the routing list that there is a new change order that needs their attention. They can then view the change order and act on it in different ways depending on their role.



Notification

Users that are assigned a role on the change order are notified in different ways of the action they need to take. Users are only notified if the change order enters a state where they have some action to take.

1. My Worklist Notification: This displays a list of active change orders that the user is assigned to. This list is displayed in the left hand navigation pane of Productstream. Selecting on a specific change order will display the change order in the change order list and preview pane (if active).

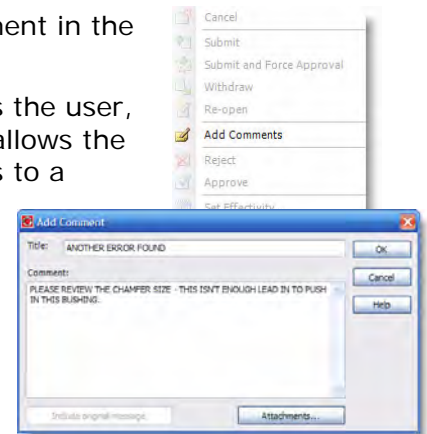


Reviewer

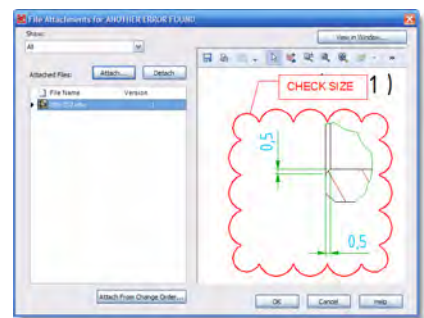
A reviewer can create a new comment or respond to an existing comment in the Comments tab of the change order form.

This tab is a simple threaded discussion for the change order. It tracks the user, date and state of the change order when the comment was added. It allows the user to enter a brief title and detailed comment. When the user replies to a comment they can choose to include the original text much like replying to an email.

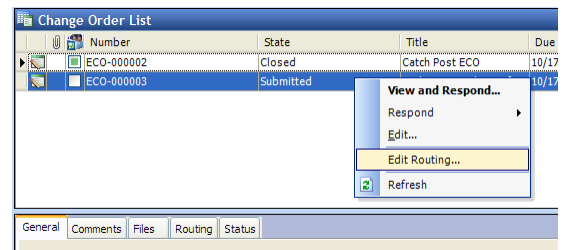
In addition to text comments, the user can attach any file to the comment. These files might already be attached to the change order. Any file stored in the vault can be attached to a comment.



Similar to the files tab, if the user attaches a 2D DWF file or a CAD file that has an associated auto-published 2D DWF file, they can create a new markup. These mark ups are not added to the file list but tracked by viewing the different comments. This allows any user in the routing to create markup files and associate them with the change order.



Finally, a reviewer can modify the routing to add any Productstream user with Editor or Reviewer privileges as another Reviewer. If a Reviewer needs someone else in the organization to review the change order they can simply add them to the routing. When this is done the newly added Reviewer is notified using the methods previously described.

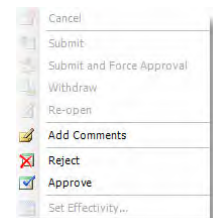


Approver

The approver can perform all of the commands that the Reviewer can and in addition either 'Approve' or 'Reject' the change order.

Approving a change order will change the change order state from 'Submitted' to 'Approved' depending on how the routing is defined. This is covered in detail in the Administration / Routing section.

Rejecting a change order automatically changes the change order state from 'Submitted' to 'Rejected.' From this point the change order can be either re-opened or cancelled.

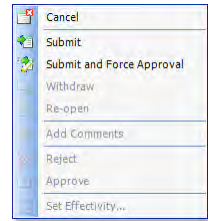


Change Requestor

The Change Requestor can perform all of the commands that the Reviewer can. They can also perform all commands with the exception of Approve or Reject.

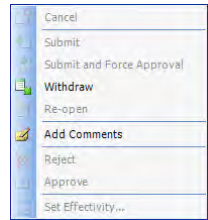
In the 'Open' state the Change Requestor can act on the change order to:

- Cancel: Sets the change order to 'Canceled' and removes any items associated with the change order from lifecycle state control of the change order.
- Submit: Sets the change order state to 'Submitted.'
- Submit and Force Approval: This bypasses the 'Submitted' state and changes the state to 'Approved.'



In the 'Submitted' state the Change Requestor can act on the change order:

- Withdraw: Re-sets the change order state to 'Open.'
- Add Comments



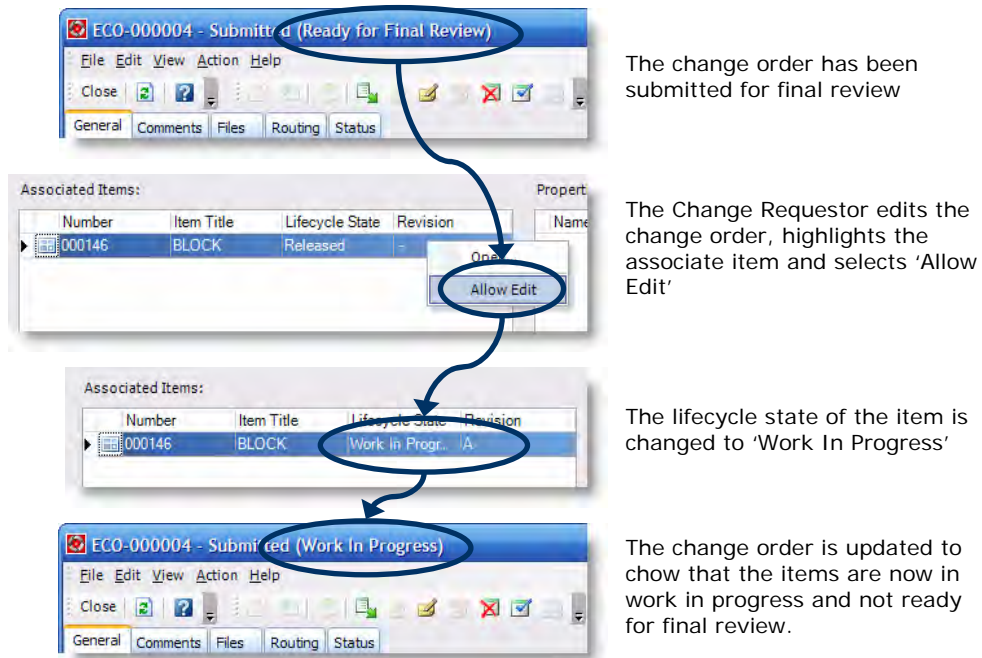
In the 'Approved' state the Change Requestor can act on the change order to set its effectivity. This is covered later in the Effectivity section of the document. If the change order has been rejected, the Change Requestor can either cancel or re-open the change order.

The change requestor is the only user that can edit the change order. This allows the change order to be modified by adding or removing items, changing the title, etc. The changes are made and the change order saved using the 'Save and Close' command.

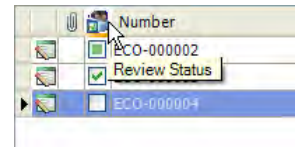
As mentioned earlier, adding an item to a change order prohibits manually changing the items lifecycle state. In order to change the lifecycle state of an item on a change order the Change Requestor must edit the change order, select an item and use the 'Allow Edit' command to change the lifecycle state.

Allow edit toggles the items lifecycle state between 'Work in Progress' and 'In Review.' This way the Change Requestor can change the lifecycle state to 'Work in Progress' so that other users can access the files for updating. Once the edits have been made the Change Requestor can then toggle the lifecycle state to 'In Review' thereby locking the files from any further edits.

For example, the diagram below shows the lifecycle state being changed from 'Released' to 'Work In Progress':



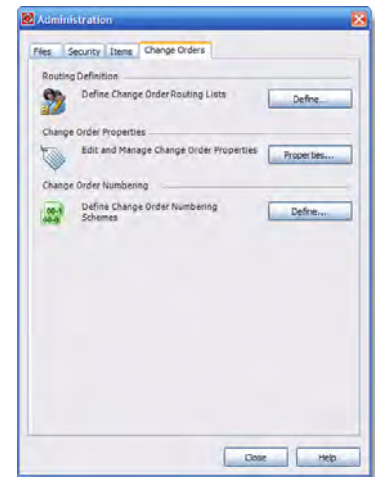
The user can quickly identify that the change order is ready for final review by the 'Review Status' icon shown in the change order list.



Administration

The system administrator can use the Administration interface to customize and setup change order functionality. There are three main areas:

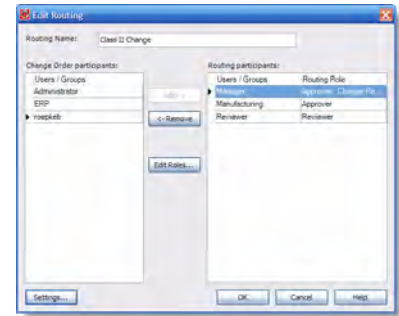
1. **Routing Definition:** Create and modify any number of pre-defined routing lists.
2. **Change Order Properties:** Create and modify properties that can be added to the change order. Similar to item properties.
3. **Change Order Numbering:** Create and modify simple change order numbering schemes.



Routing

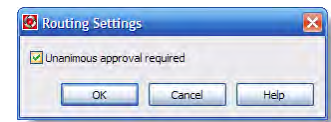
Named routings lists can be created and modified. A routing lists the users that can perform actions on the change order. Different routings can be setup to specify different processes: For example:

- New Product Introduction: A list of users that approves a new product can be manufactured.
- Engineering Change Order: A list of users that approve a design change.



The Change Order participants list is populated with all users with Productstream Creator or Reviewer roles. When a user is added to the Routing participants they are assigned the Reviewer role by default. The 'Edit Roles...' command is used to change the role of a user selected in the Routing participant list. A change order must have at least one user with the 'Approver' role before the routing can be created.

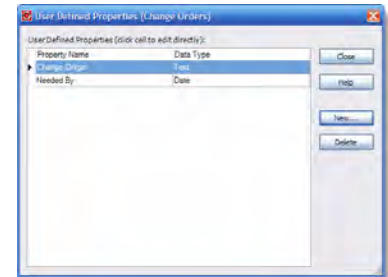
The settings button is used to specify how a change order is approved or rejected. The default is that any one of a group of Approvers must perform the Approve action to approve the change order. Using the 'Settings...' button the routing can be defined such that all Approvers must perform the Approve action to approve the change order. If any one of the Approvers rejects the change order then the change order state is set to 'Rejected.'



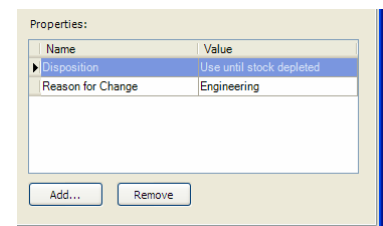
Properties

Any number of properties can be defined and added to a change order when it is created or edited. Similar to item properties, the properties can be of the following type:

1. Text
2. Number
3. Date
4. Boolean (Yes or No)
5. A list of values.

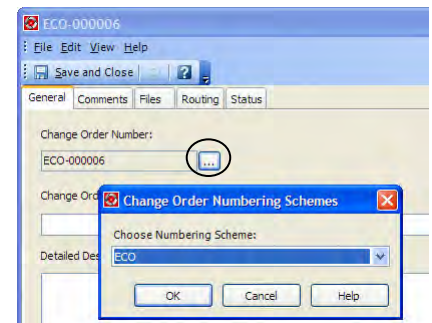


When the change order is created the user uses the 'Add...' and 'Remove' commands to modify the list of properties for a specific change order. The user can also create a new property using the 'Add...' command.

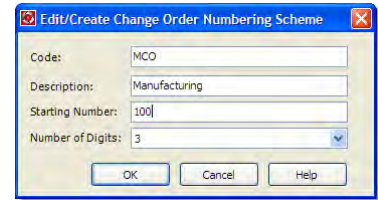


Numbering

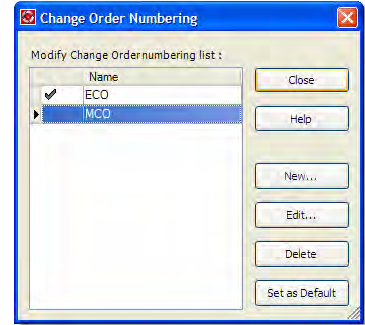
When a change order is created it is assigned a default change order number. The numbering scheme consists of a text prefix followed by a sequential number. The prefix can be changed using by selecting the modify change order number command as shown.



A prefix and can be added or modified. The starting value and number of digits (between 3 and 5) can be set for the sequential number following the prefix.

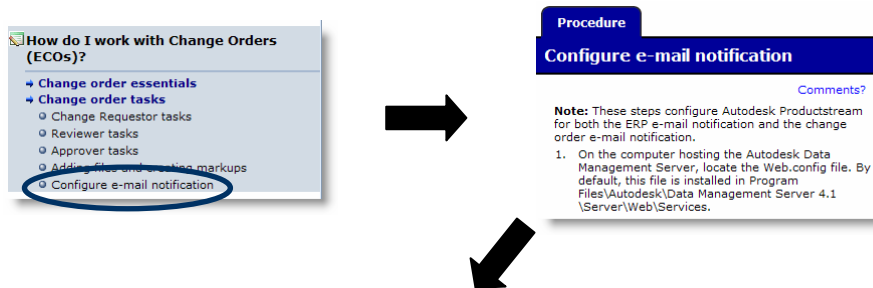


Any one of the numbering schemes can be set as the default for newly created



Email Notification

By default, the system will check and send notification emails once every 10 minutes (600 seconds). This value can be changed by editing the configuration file. The instructions on how to do this are available in the Help system as shown below.



```
Connectivity.Core.Job.EventMonitor.ProcessSignaledSubscriptions,Connectivity.Core.Job.EventMonitor" value="600"
```

The value can be set between 5 and 600 seconds

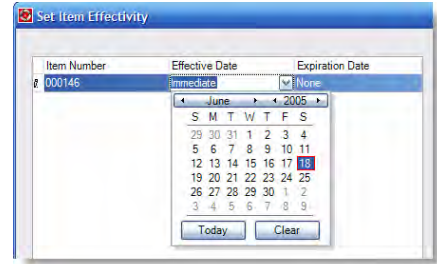
Effectivity

Effectivity defines when a particular released revision of an item becomes active as well as when that released revision expires. This is useful for managing how multiple revisions of an item are staged if the design changes are not going to be implemented immediately. An effective item is typically used to define one that manufacturing is currently using.

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Effectivity can be set two ways:

1. Manually: When an items lifecycle state is changed to 'Released' the date at which it becomes effective (and optionally expires) can be set. The user can also edit an item and change its effectivity dates.
2. Via a change order: The user sets the effectivity of the items on an approved change order in order to close the change order.

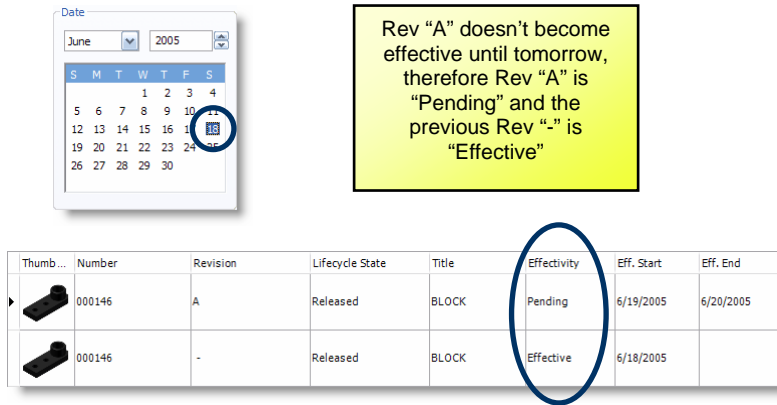


Effectivity only applies to released items. The table below lists the four types of effectivity and the rules for multiple revisions of the same item.

Table 3 Item Effectivity Values

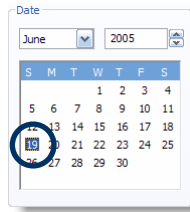
Effectivity Type	Rules for multiple item revisions
Effective	The effective revision is displayed in the BOM
Pending	The previously released effective revision appears in the BOM until the new revision becomes effective.
Superseded	A new revision supersedes the item revision
Expired	The previously released revision becomes effective again.

The following diagram outlines the rules for effectivity:



Day 1: A new revision of an item is released pending effective

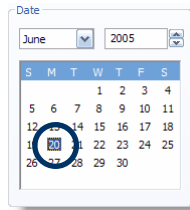
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On the next day, Rev "A" becomes "Effective" and the previous Rev "-" is "Superseded" by "A"

Thumb...	Number	Revision	Lifecycle State	Title	Effectivity	Eff. Start	Eff. End
	000146	A	Released	BLOCK	Effective	6/19/2005	6/20/2005
	000146	-	Released	BLOCK	Superseded	6/18/2005	

Day 2: Pending item revision becomes effective.

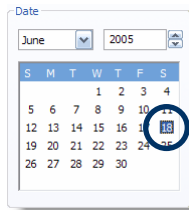


On the Effective End Date Rev "A" Expires and the previous Rev "-" Becomes effective again

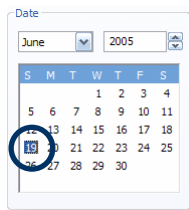
Thumb...	Number	Revision	Lifecycle State	Title	Effectivity	Eff. Start	Eff. End
	000146	A	Released	BLOCK	Expired	6/19/2005	6/20/2005
	000146	-	Released	BLOCK	Effective	6/18/2005	

Day 3: Effective item revision expires.

Effectivity affects how BOMs are displayed. A revision change does not require the parent to update or revise. Therefore a single revision of a parent can have multiple revisions of children over time. The particular revision of the child item displayed is dependant on when it is viewed.



Number	Row	Revision	Title
000147	1	-	LOCATOR ASSEMBLY
000109	1	-	SHAFT
000151	2	-	BUSHING
000150	3	-	PLATE
000146	4	-	BLOCK
000149	5	-	FASTENER
000148	6	-	FASTENER



Number	Row	Revision	Title
000147	1	-	LOCATOR ASSEMBLY
000109	1	-	SHAFT
000151	2	-	BUSHING
000150	3	-	PLATE
000146	4	A	BLOCK
000149	5	-	FASTENER
000148	6	-	FASTENER