ProcessForce User's Guide

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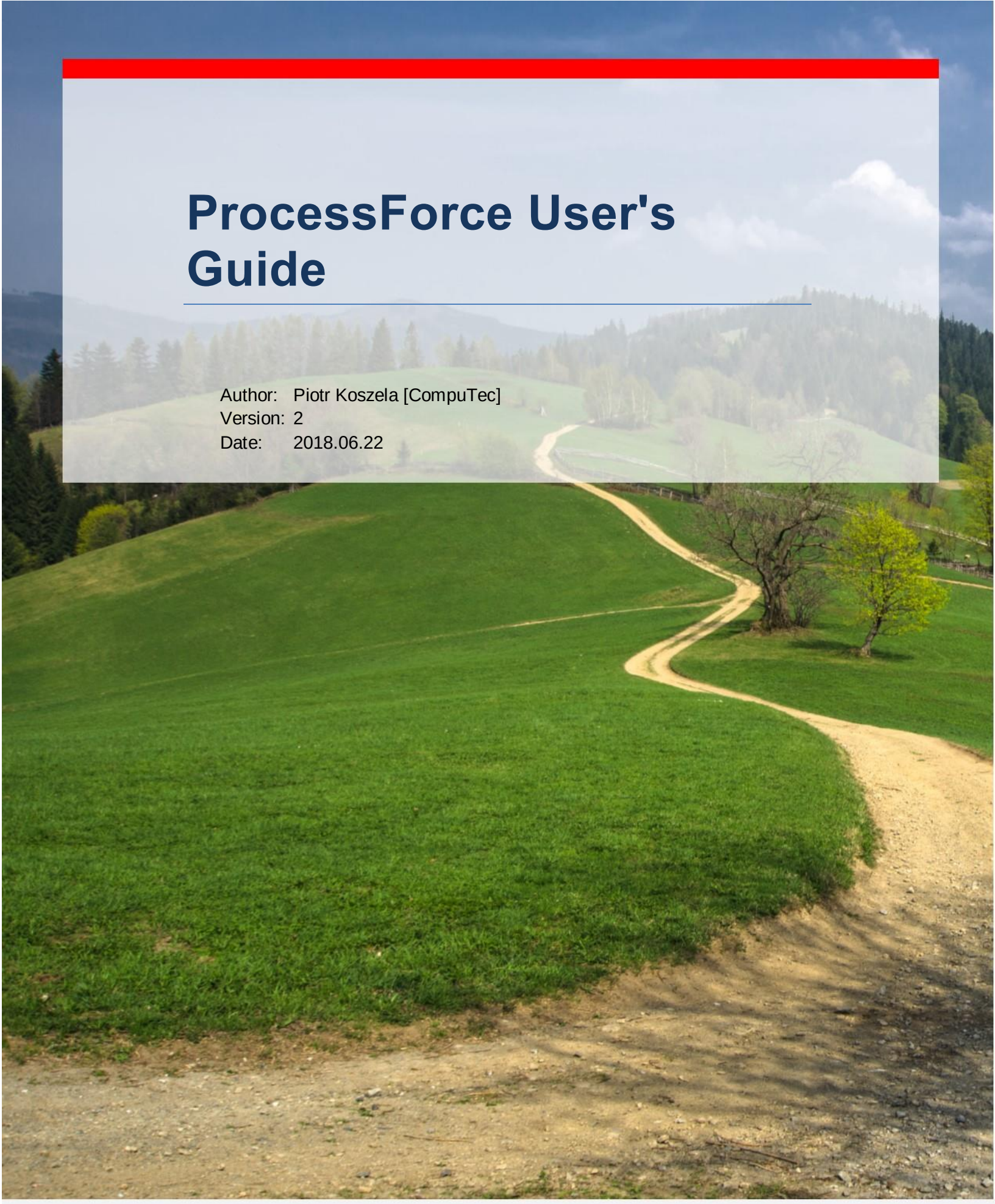

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How to Guide – ProcessForce Formulations and Bill of Materials

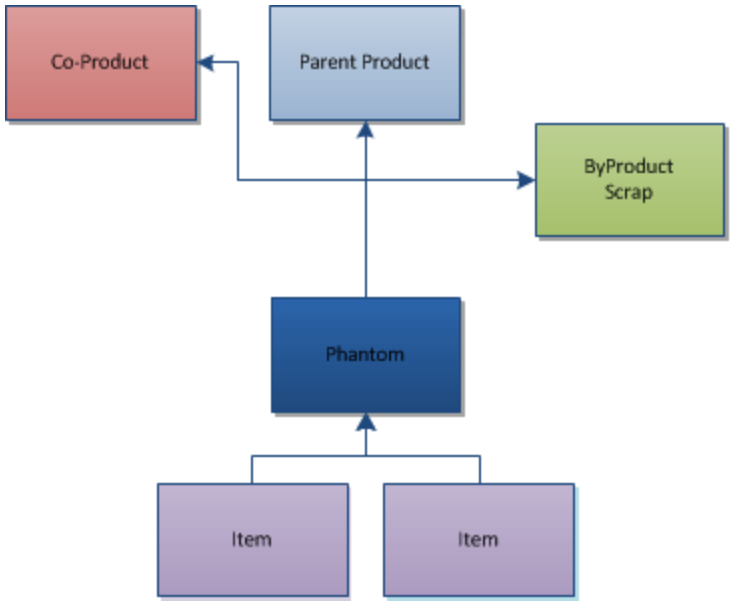
Path
Production > Bill of Materials > Bill of Material

The Bill of Materials Form allows the user to define the relationship between parent and child items. This functions supports the following:

- Items
- CoProducts
- ByProducts
- Scrap
- Intermediates (currently called Phantoms)
- Phantoms (future release)
- Make vs. Buy
- Manual vs. Backflushing
- Factors, Yield values and Scrap percentages
- Quantities
- UoM
- Formulas

Related pages:

- Bill of Materials
  - Bill of Material Form Header
  - Items Tab
  - CoProducts Tab
  - Scrap Tab
  - WIP Items Tab
  - Attachments Tab
  - Planned Yield percent
  - Yield Analysis
  - Multi-level Bill of Materials
    - Semi-finished Items
    - Phantom Item
- Formula
- Mass Item Replacement
- Production Process
  - Yield – Time calculation



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1.1 Bill of Materials

Bill of Materials is a list of all materials used to produce a specific product. ProcessForce allows also to define other values important during production of a specific product: Coproducts, Scraps or Work in Progress Items.
ProcessForce also allows to create Revisions: different Bill of Materials for one Item.

Related pages:

- Bill of Material Form Header
- Items Tab
- CoProducts Tab
- Scrap Tab
- WIP Items Tab
- Attachments Tab
- Planned Yield percent
- Yield Analysis
- Multi-level Bill of Materials

Path
Production > Bill of Materials

1.1.1 Bill of Materials form header

Path

Production > Bill of Materials > Bill of Material > Header

This form allows a user to define a bill of materials for a final product or product to be used as a part of another Bill of Materials.

Multiple Bills of Material may be defined for a product based on the Revision Code, which is defined within the Stock Management → Item Details → Revision Tab.

The Quantity and UoM represent the product quantity of the parent item.

Factor is a method to add an additional variable which affects the parent and the component quantities, for example yield or scrap.

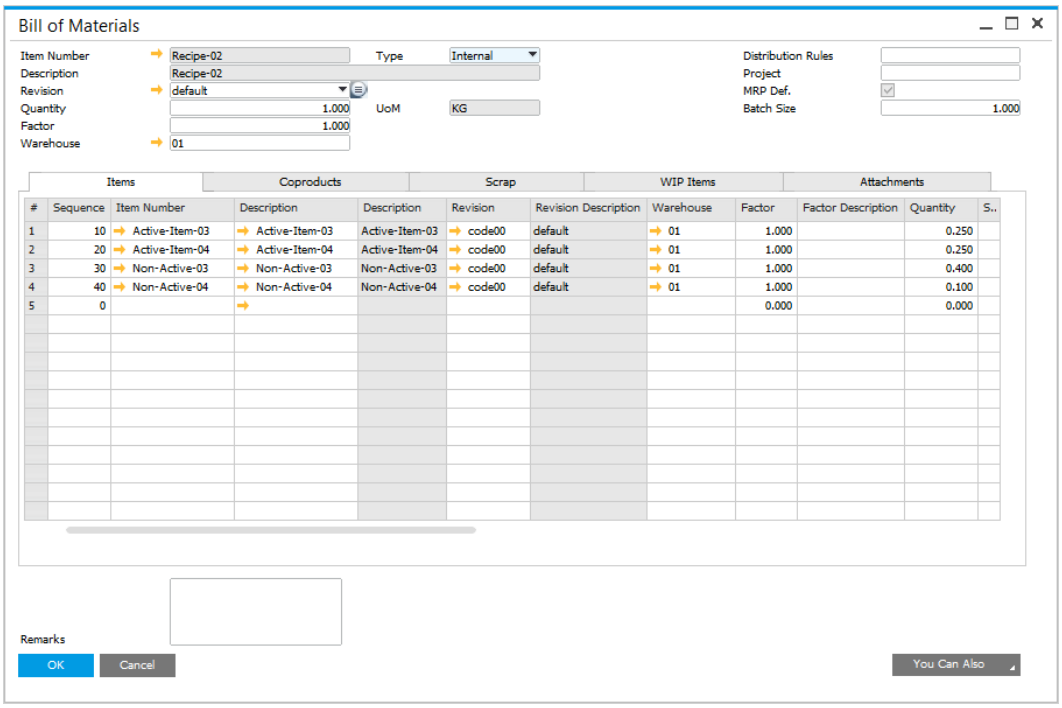
The warehouse represents where the product will be produced.

Type field determine if a product is Internal (produced in the company) or External (order from subcontractor).

If required, the user can enter a Distribution Rule and a Project.

MRP Def. field allows the user to confirm if this Bill of Materials is the default for MRP, and also which revision of the item is the default for MRP. If this field is not checked the ProcessForce Bill of Materials is not synchronized with the SAP Business One Bill of Materials.

Batch Size allows the user to define the batch size of production used to determine the cost of a product, where there are fixed times such as setup, fixed runtime, stock and queue.



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1.1.2 Items Tab

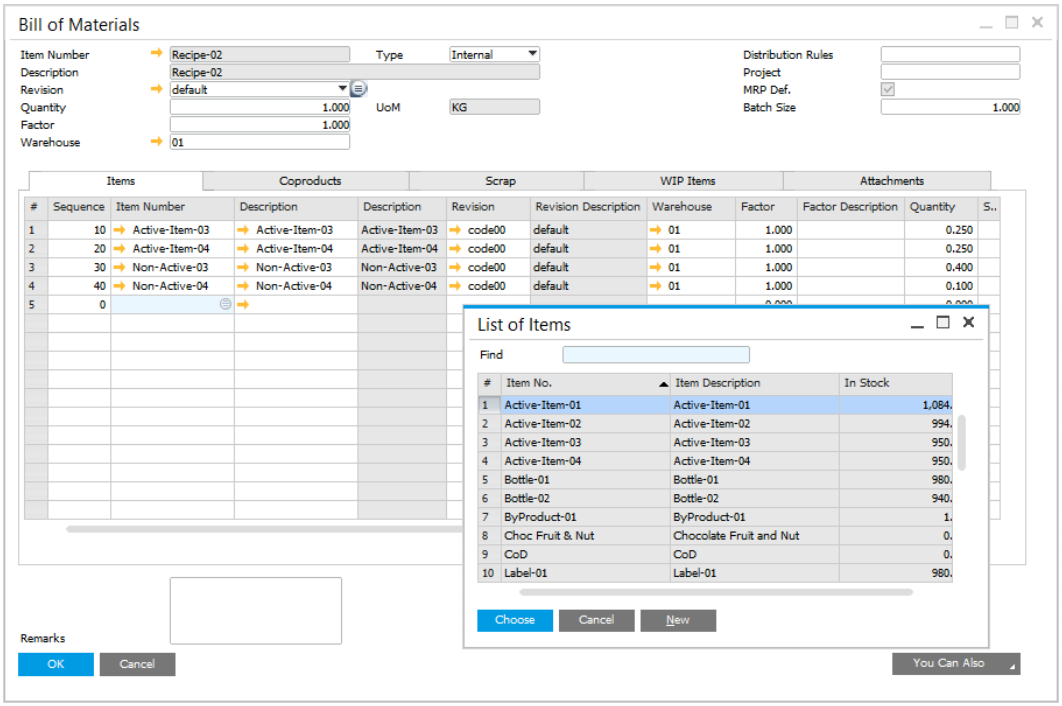
Path

Production > Bill of Materials > Bill of Material > Items Tab

This form allows the user to perform the following:

- Enter the components that are used in producing the parent product.
- Record the warehouse where the inventory is held. If the item is back flushed, this is the warehouse were inventory deductions occur.
- Define a factor and description. This factor is used as a variable to change the quantity.
- Enter a Quantity of the item in relation to the parent product.
- Add a Scrap% which affects the item quantity.
- The Result is a calculated value of the item and parent quantity relationship based on the defined Formula.

- Use the default Formula (as defined on the General Settings/ProcessForce Tab) or change the expression format to calculate the item quantity (result). See Formula for additional information.



- UoM is the unit of measure for the item, and the default value is defined within the Item Master Data/Inventory Tab (see image below)
- Type is a display only field, and defines the method supply and demand method i.e. make or buy. These values are defined within the Item Master Data/Planning Data Tab (see image below)
- Select the Issue Type for issuing and consuming inventory. The valid values are Manual or Backflush. The default value is defined within the Item Master Data/General Tab (see image below)
- For each line item Project codes may be added.

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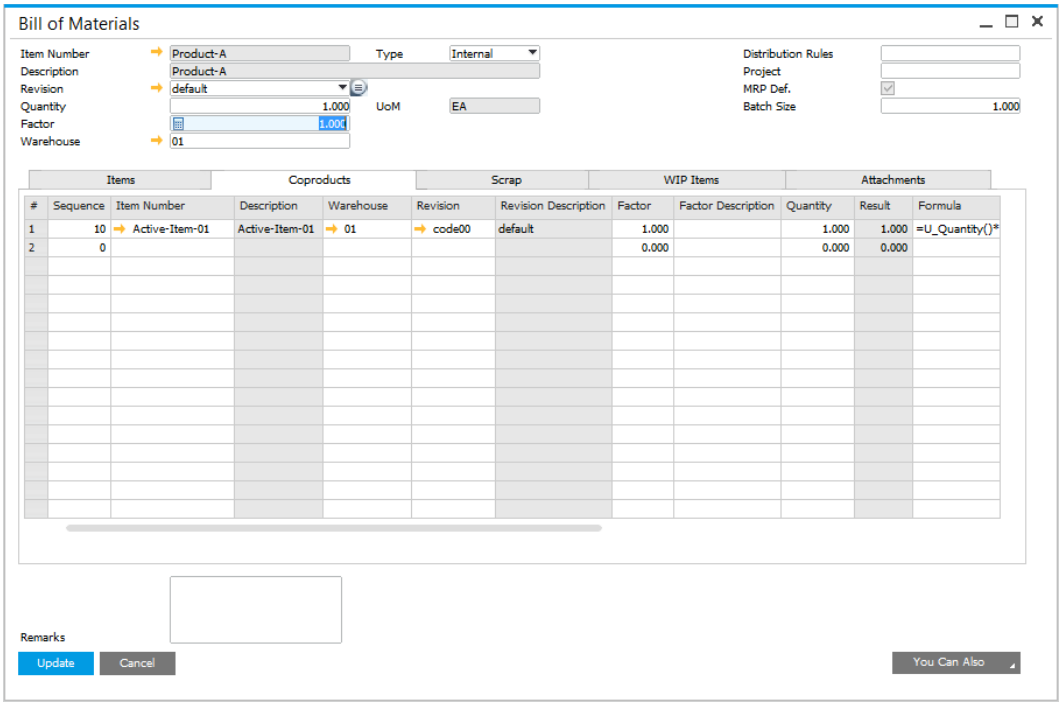
1.1.3 CoProducts Tab

Path

Production > Bill of Materials > Bill of Material > CoProducts Tab

This form allows the user to perform the following:

- Enter the components that are produced as a consequence of producing the parent product
- Record the warehouse where the inventory is held. If the item is backflushed, this is the warehouse where inventory deductions occur
- Define a factor and description. This factor is used as a variable to change the quantity
- Enter a Quantity of the Coproduct in relation to the parent product.
- The Result is a calculated value of the Coproduct and parent quantity relationship based on the defined Formula
- Use the default Formula (as defined on the General Settings/ProcessForce Tab) or change the expression format to calculate the Coproduct quantity (result). See Formula for additional information
- Enter the UoM, the default value defined within the Item Master Data/Inventory Data Tab
- Enter the Issue Type - Backflush or Manual. The default value defined within the Item Master Data/General Tab
- Enter the Project code for reporting and analysis purposes.

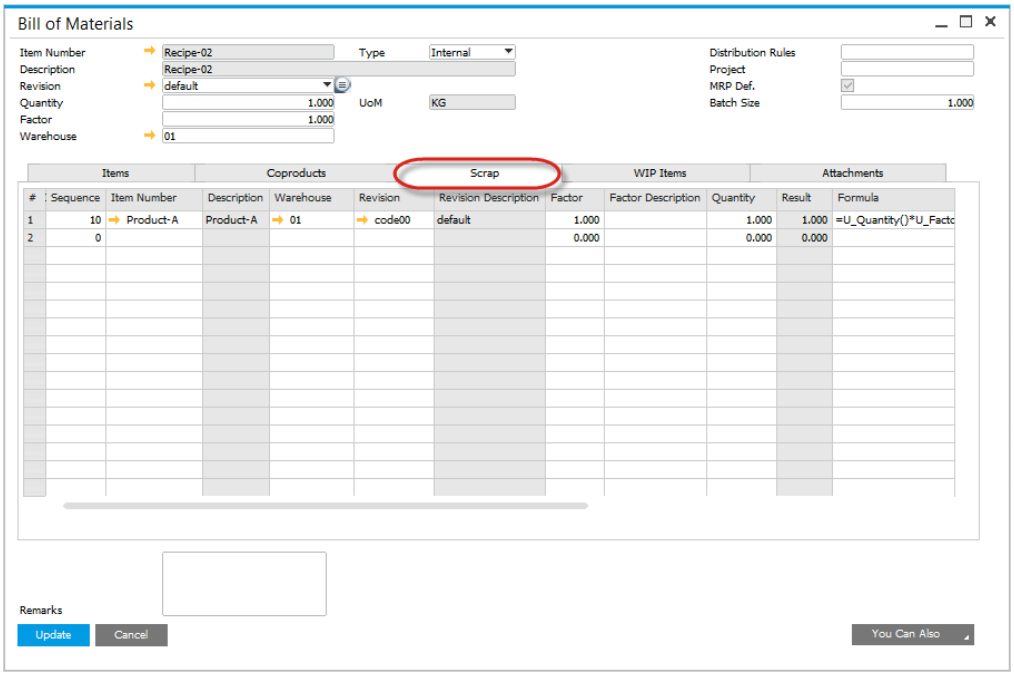


1.1.4 Scrap Tab

Path
Production > Bill of Materials > Bill of Materials > Scrap Tab

This form allows the user to perform the following:

- Enter the products that are created as a consequence of producing the parent product.
- Record the warehouse where the inventory is held. If the item is back flushed, this is the warehouse where the inventory will be placed from a Production receipt.
- Define a factor and description. This factor is used as a variable to change the quantity.
- Enter a Quantity of the scrap in relation to the parent product.
- The Result is a calculated value of the scrap and parent quantity relationship based on the defined Formula.
- Use the default Formula (as defined on the General Settings/ProcessForce Tab) or change the expression format to calculate the scrap quantity (result). See Formula for additional information.
- Enter the UoM, the default value is defined within the Item Master Data/Inventory Data Tab
- Select the scrap Type:-
    - The valid options are Scrap and ByProduct.
    - Both types of scrap create inventory transactions.
    - ByProducts can be re-used within production or sold to customers.
    - Scrap cannot be re-used.
- Select the Issue Type, Backflush or Manual. The default value is defined within the Item Master Data/General Tab.
- Enter the Project code for reporting and analysis purposes.
- Set Distribution Rule.
- Type in Remarks to a specific Scrap.



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1.1.5 WIP Items Tab

Path

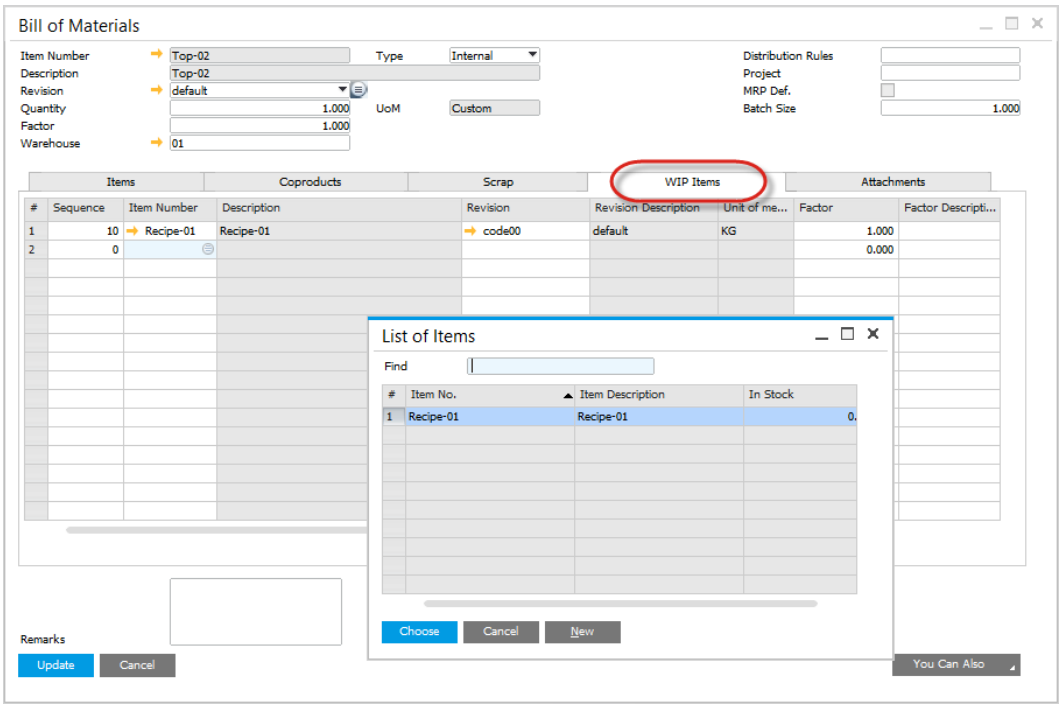
Production > Bill of Materials > Bill of Materials > WIP Items

Production > Manufacturing Order > Manufacturing Order WIP Items

WIP Item tab (Work in Process Item) in ProcessForce shows what Phantom Items were used on a specific Bill of Materials / Manufacturing Order.

You can also:

- define a factor and description. This factor is used as a variable to change the quantity
- enter a Quantity of the intermediate product in relation to the parent product: the result is a calculated value of the intermediate product and parent quantity relationship based on the defined Formula.
- Use the default Formula (as defined on the General Settings > ProcessForce tab) or change the expression format to calculate the Coproduct quantity (result). See Formula for additional information.



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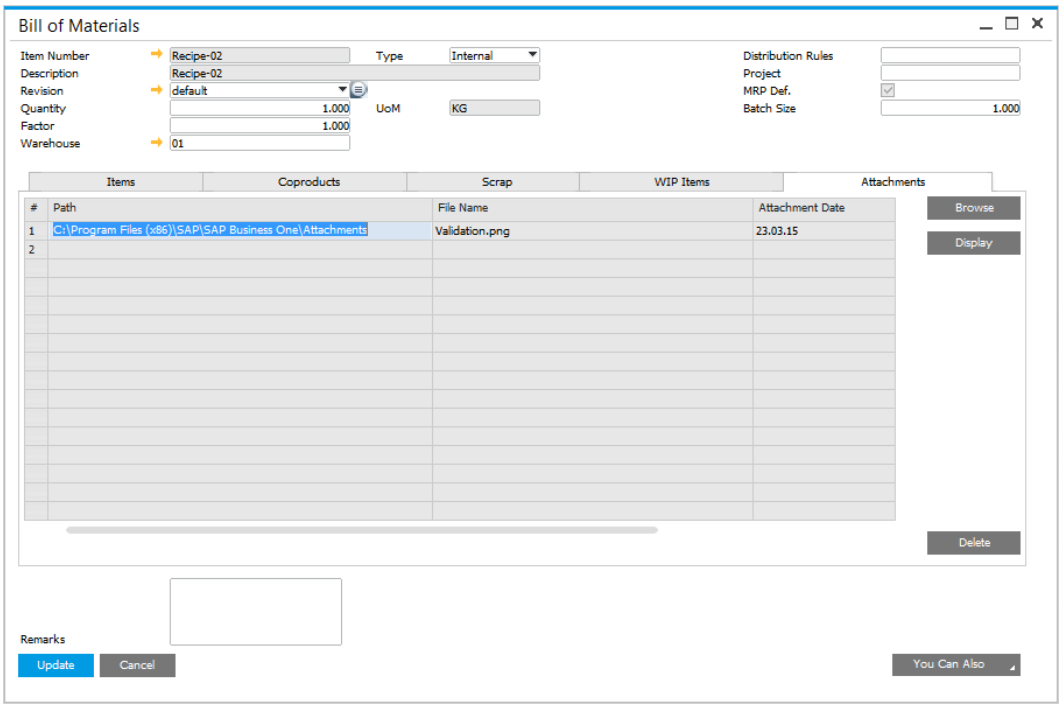
1.1.6 Attachments Tab

Attachments are added in the same manner as in SAP Business One:



1.1.7 Planned Yield percent

The concept of planned Yield is to:

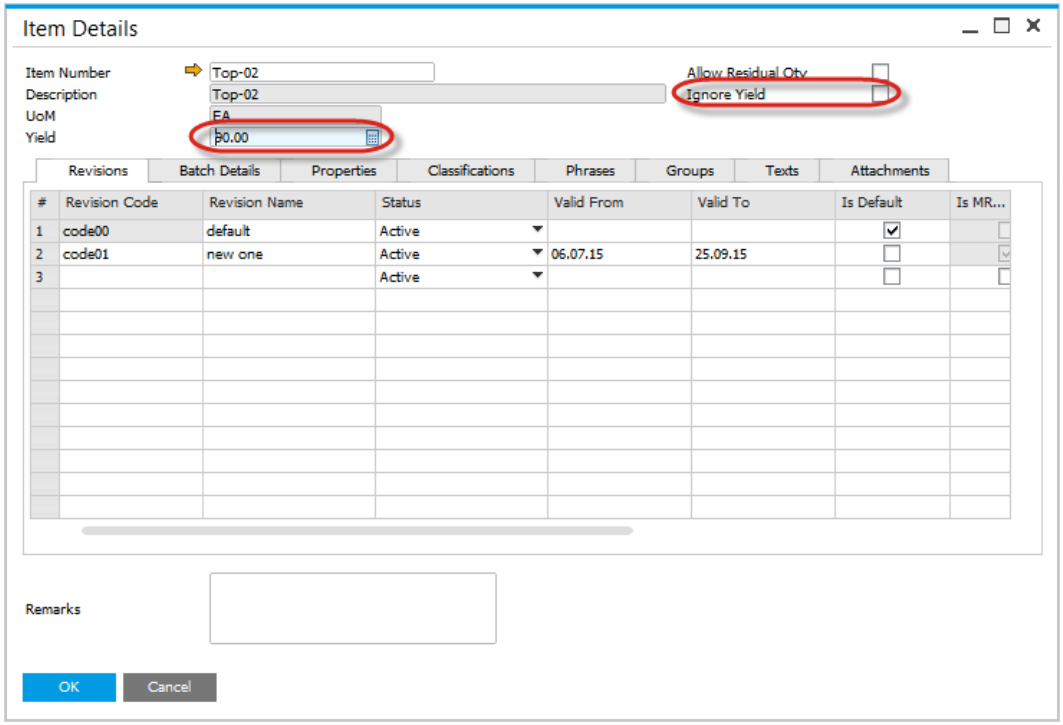
- Increase the amount of raw materials issued to production to cater for the material loss
- Increase the production time used to produce the full quantity.

On this page:

- Item Details
- Bill of Materials
- Production Process
- Changing the Bill of Material Planned Yield
- Manufacturing Order
- Planned vs Actual Yield
- Changing the Manufacturing Order Planned Yield

Item Details

Within the Item Details form, for the parent item in the bill of materials, within the Yield % field the planned yield value



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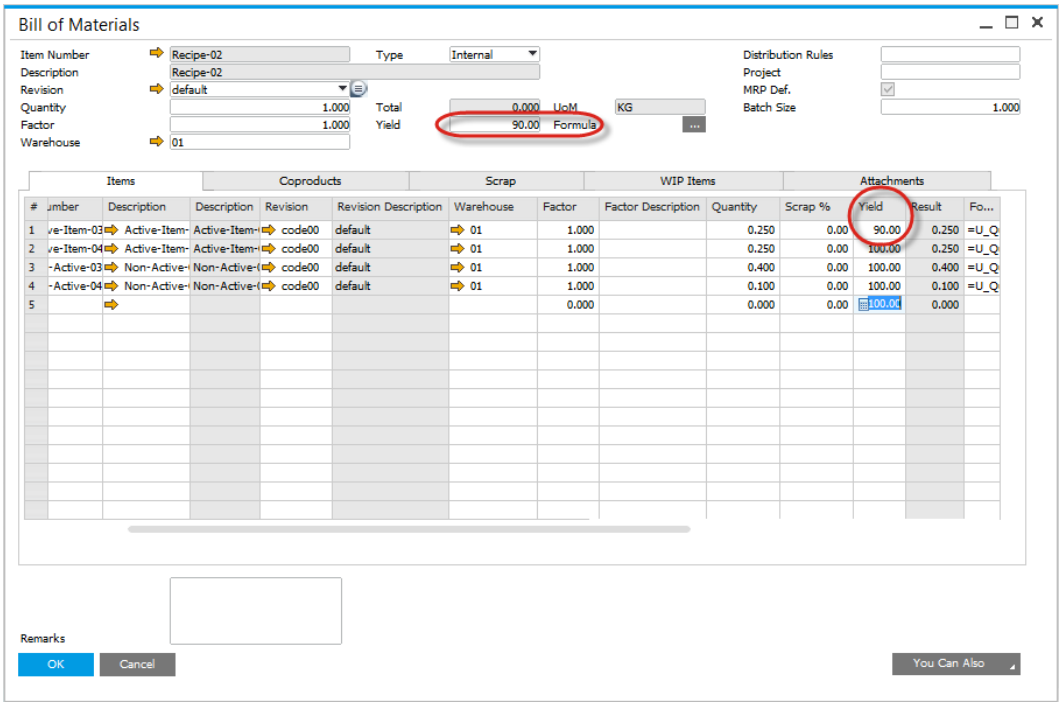
Bill of Materials

The default planned yield is copied to the Bill of Materials header and also the value is added to each item added to the Bill of Materials.

If using planned yield it is recommended to modify the default Item, CoProduct and Scrap formulas to include the yield % calculation.

The result is an increase in the material quantity required to be consumed in production.

If using Scrap%, this will be a cumulative value to the material quantity.



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Production Process

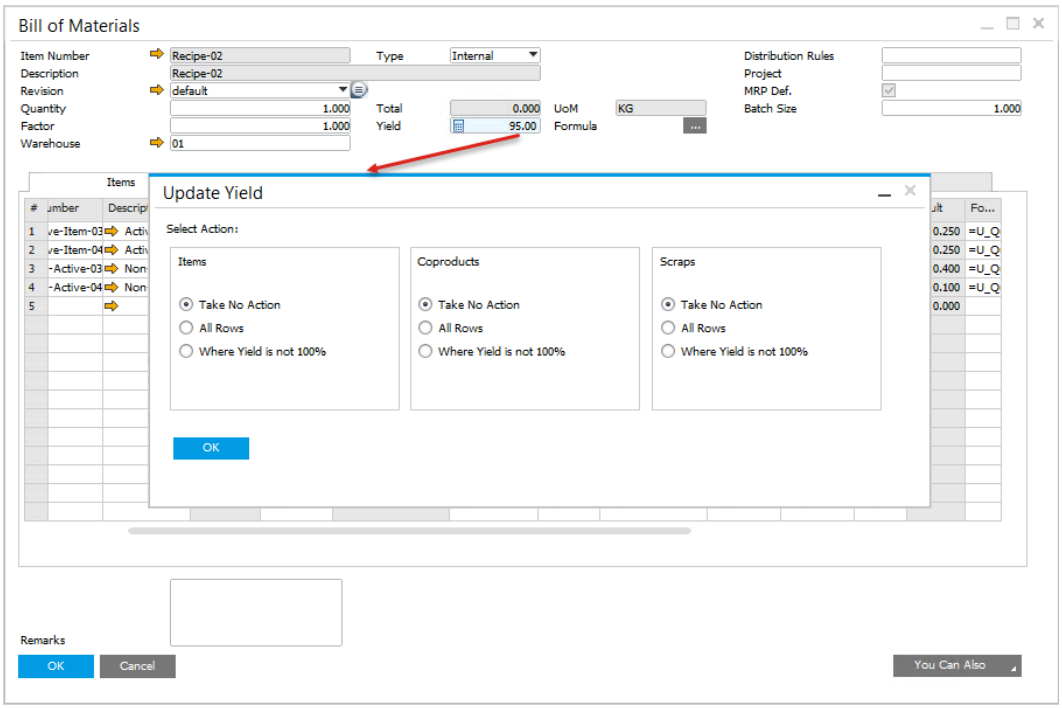
To ignore the increase in production time for the operation/resource, check the Ignore Yield check box.

NOTE: Currently the additional time based on yield has not been implemented into costing.

Changing the Bill of Material Planned Yield

If the Yield % value is changed, a window opens and provides a number of options:

- Take No Action: change the header only
- All Rows: copy the value and updates all rows
- Where Yield is not 100%: copy the value and update all rows where yield % is not 100%.



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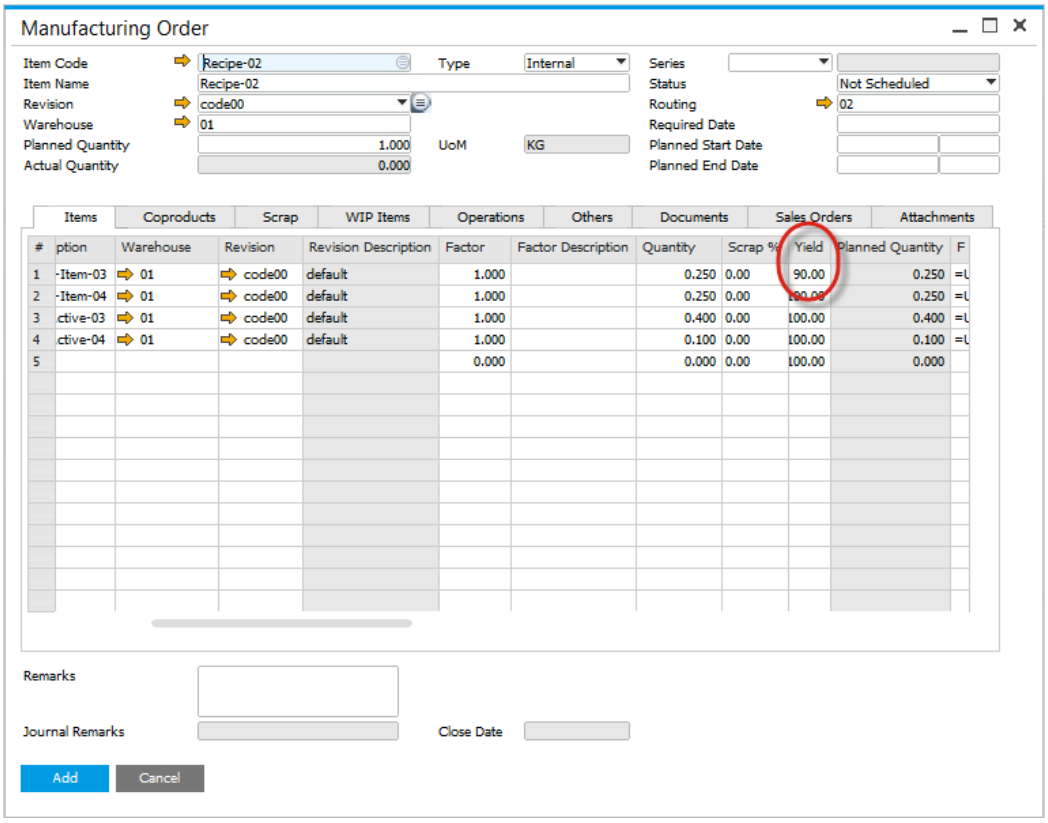
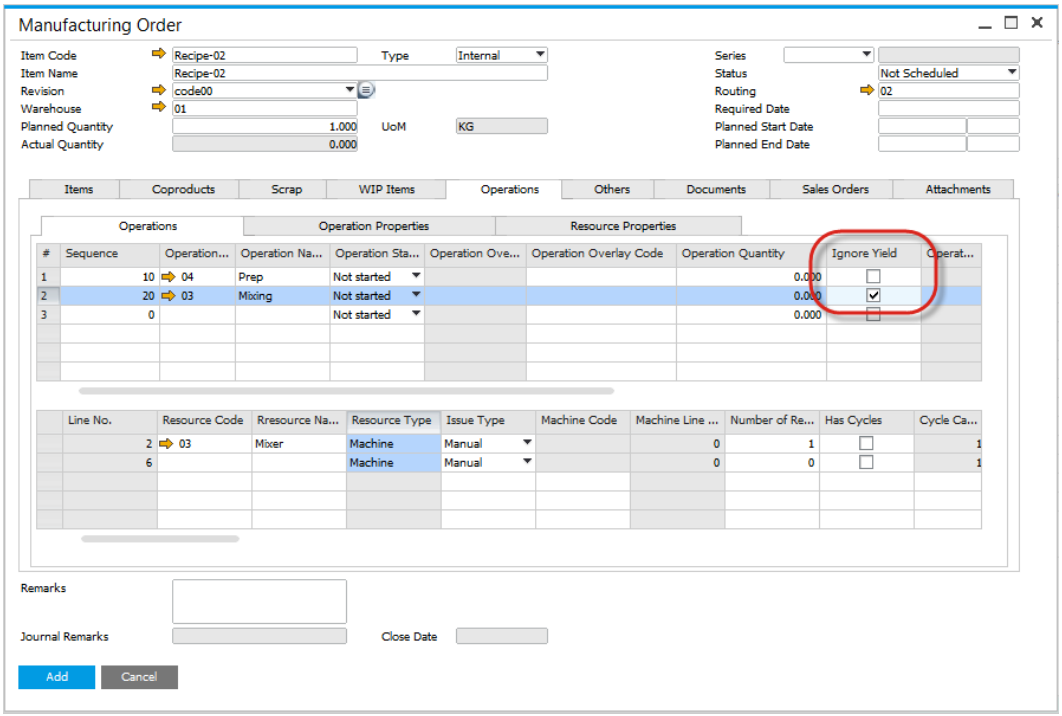
Manufacturing Order

When the Manufacturing Order is created, the Planned Quantity is increased by the planned Yield % to increase the amount of items to be issued and resource time required.



Checked the Ignore Yield check box to not increase the operation/resource total time.



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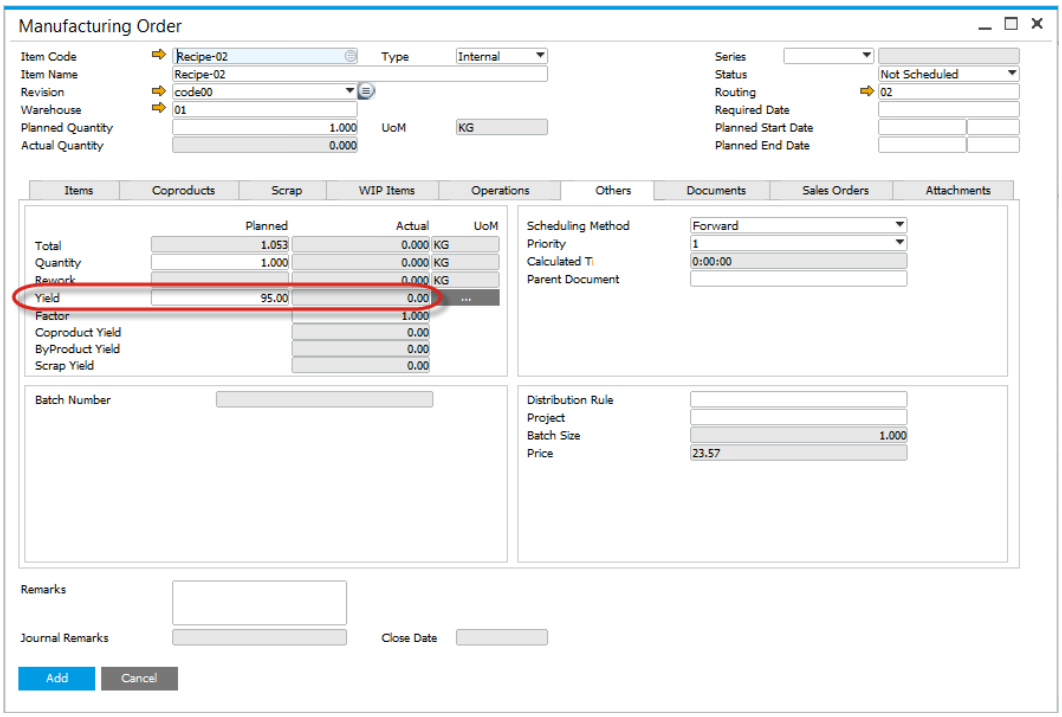
Planned vs Actual Yield

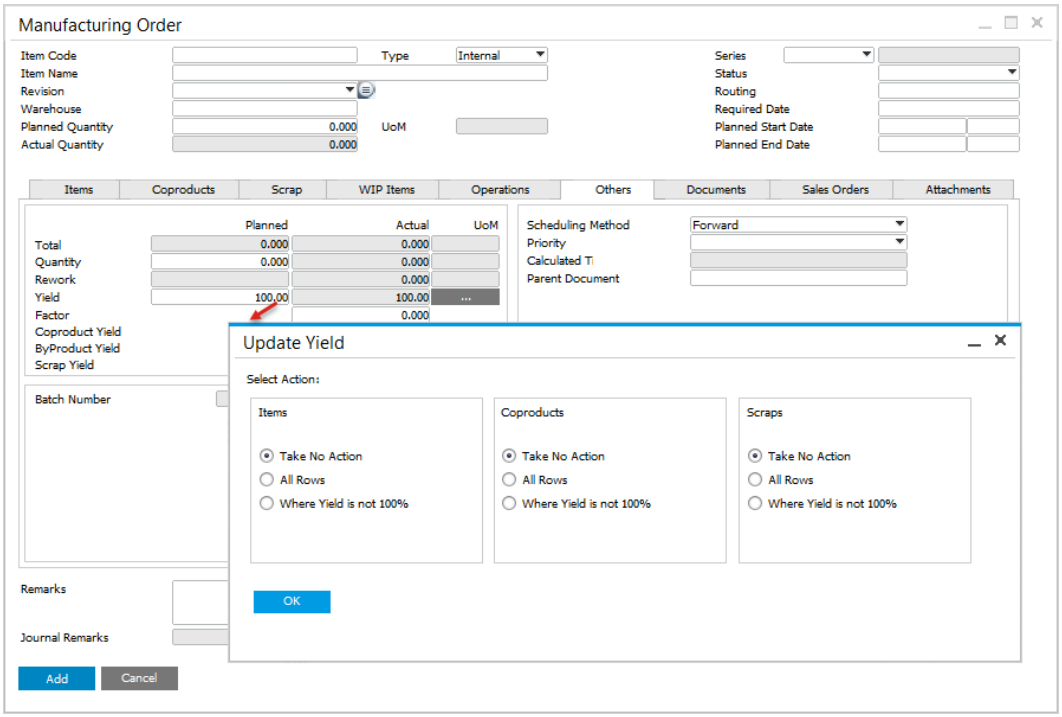
Based on the Yield Formula, the Actual Yield is calculated when materials receipts and issues are created.



Changing the Manufacturing Order Planned Yield

If the Yield% value is changed, a window opens and provides a number of options:

- Take No Action: change the header only
- All Rows: copy the value and updates all rows
- Where Yield is not 100%: copy the value and update all rows where yield % is not 100%.



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1.1.8 Yield Analysis

Introduction

The analysis of yield can be very simple, e.g. a comparison of Planned vs Actual quantity or complex, based on the comparison between the amount of a specific item used in production and a break down into Parent, Coproduct, Byproduct and Scrap actual quantity.

Below is a table illustrating some yield analysis examples:

On this page:

- Introduction
- Yield Formulas
- Yield Formula Formats

Related pages:

- Yield Settings

Yield Basis	Yield Calculation	Example
Item Parent	Item Parent	Item Parent Actual Quantity / Item Parent Planned Quantity * 100
Item Parent	Item Parent + CoProducts + Scrap	(Item Parent Actual Quantity + CoProducts Actual Quantity + Scrap Actual Quantity) / Item Parent Planned Quantity * 100

Yield Basis	Yield Calculation	Example
Item Parent	Item Parent + CoProducts - Scrap	(Item Parent Actual Quantity + CoProducts Actual Quantity - Scrap Actual Quantity) / Item Parent Planned Quantity * 100
Item Parent	Item Parent - CoProducts - Scrap	(Item Parent Actual Quantity - CoProducts Actual Quantity - Scrap Actual Quantity) / Item Parent Planned Quantity * 100
Item Parent	CoProducts + Scrap	(CoProducts Actual Quantity + Scrap Actual Quantity) / Item Parent Planned Quantity * 100
Item Parent	CoProducts - Scrap	(CoProducts Actual Quantity - Scrap Actual Quantity) / Item Parent Planned Quantity * 100
Specific Item	Item Parent	Item Parent Actual Quantity / Specific Item Actual Quantity * 100
Specific Item	Item Parent + CoProducts + Scrap	(Item Parent Actual Quantity + CoProducts Actual Quantity + Scrap Actual Quantity) / Specific Item Actual Quantity * 100
Specific Item	Item Parent + CoProducts - Scrap	(Item Parent Actual Quantity + CoProducts Actual Quantity - Scrap Actual Quantity) / Specific Item Actual Quantity * 100
Specific Item	Item Parent - CoProducts - Scrap	(Item Parent Actual Quantity - CoProducts Actual Quantity - Scrap Actual Quantity) / Specific Item Actual Quantity * 100
Specific Item	CoProducts + Scrap	(CoProducts Actual Quantity + Scrap Actual Quantity) / Specific Item Actual Quantity * 100
Specific Item	CoProducts - Scrap	(CoProducts Actual Quantity - Scrap Actual Quantity) / Specific Item Actual Quantity * 100
All Items	Item Parent	Item Parent Actual Quantity / All Item Actual Quantity * 100
All Items	Item Parent + CoProducts + Scrap	(Item Parent Actual Quantity + CoProducts Actual Quantity + Scrap Actual Quantity) / All Item Actual Quantity * 100
All Items	Item Parent + CoProducts - Scrap	(Item Parent Actual Quantity + CoProducts Actual Quantity - Scrap Actual Quantity) / All Item Actual Quantity * 100
All Items	Item Parent - CoProducts - Scrap	(Item Parent Actual Quantity - CoProducts Actual Quantity - Scrap Actual Quantity) / All Item Actual Quantity * 100

Yield Basis	Yield Calculation	Example
All Items	CoProducts + Scrap	(CoProducts Actual Quantity + Scrap Actual Quantity) / All Item Actual Quantity * 100
All Items	CoProducts - Scrap	(CoProducts Actual Quantity - Scrap Actual Quantity) / All Item Actual Quantity * 100

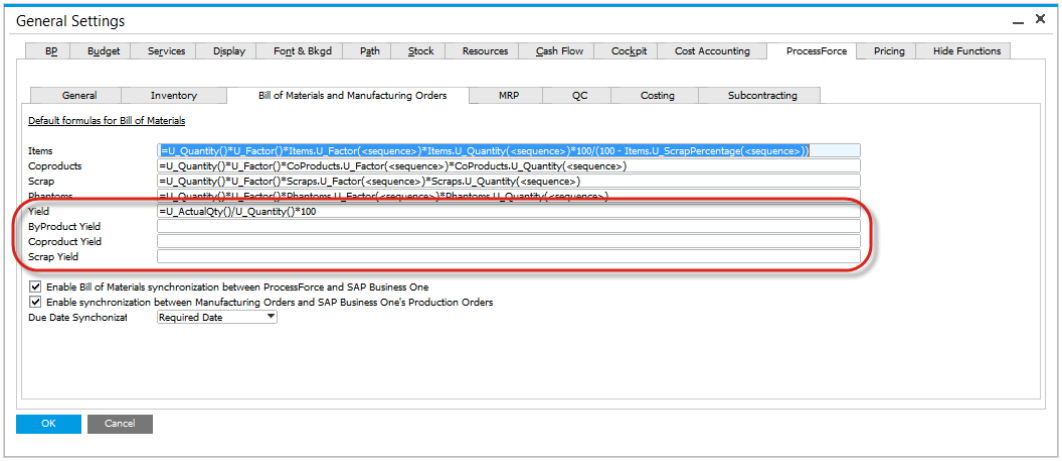
Yield Formulas

Please check the Yield settings for default formulas.

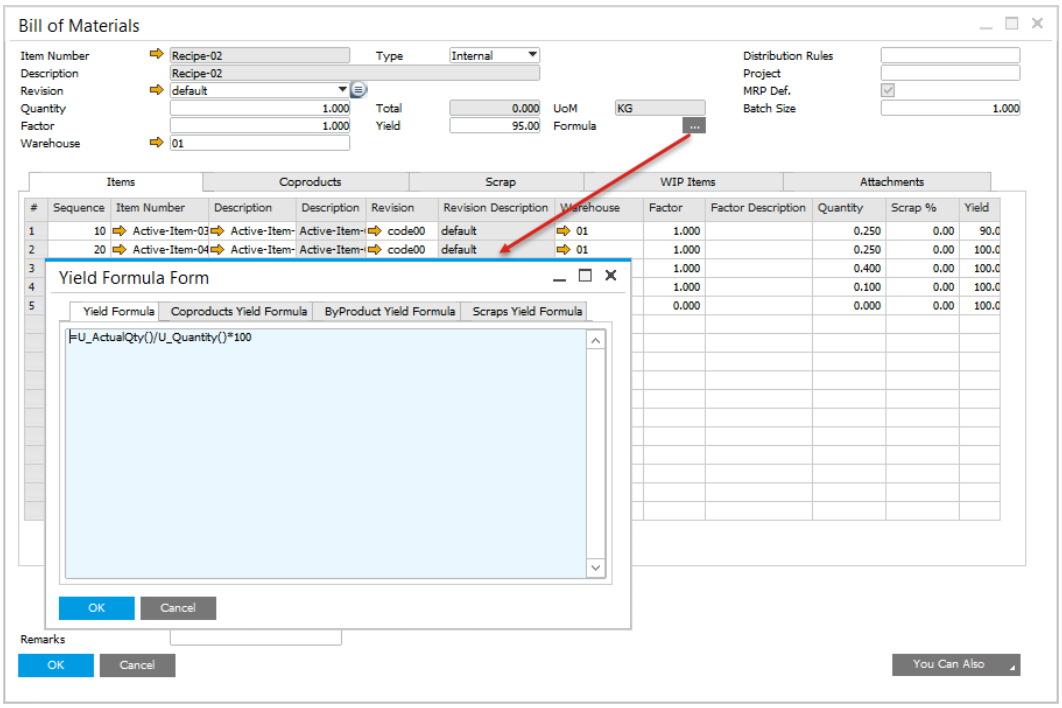
Within General Settings > ProcessForce Tab > Bill of Materials and Manufacturing Orders tab, four additional default formulas have been added

- Yield
- CoProduct Yield
- ByProduct Yield
- Scrap Yield

When a default yield formula is added, this is copied to the corresponding yield formula field within the Bill of Material form:

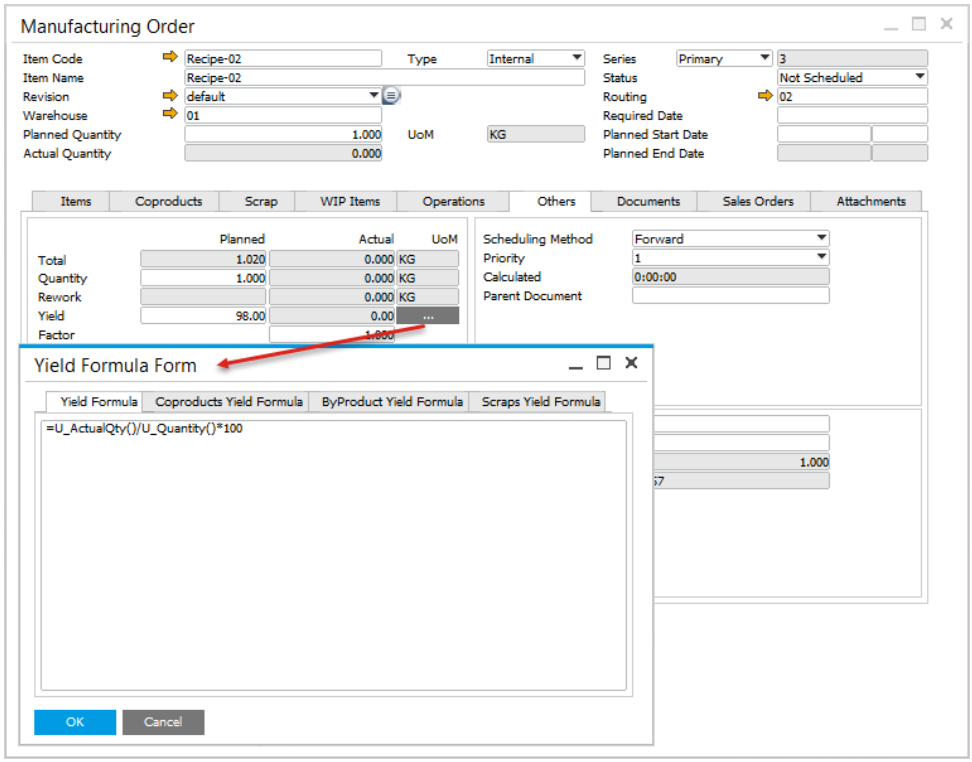


To view, create and edit the Yield Formula, click on the yellow button to open the Yield Formula Form:



The Yield Formulas defined within the Bill of Material form are also copied to the Manufacturing Order form, and displayed by clicking on the yellow button.

If required, the Yield Formulas can be edited.



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Yield Formula Formats

Below is an example of different Yield analysis formulas:

Yield Type	Default Description	Default Formula
Yield	Item Parent Actual Quantity / Item Parent Planned Quantity * 100	=U_ActualQty()/U_Quantity()*100
CoProduct	Total CoProduct Actual Quantity / Total CoProduct Planned Quantity * 100	=Coproducts.U_ActualQty.Sum()/if(Coproducts.U_Result.Sum()=0;1;Coproducts.U_Result.Sum())*100
ByProduct	Total ByProduct Actual Quantity / Total ByProduct Planned Quantity * 100	=Scraps.U_ActualQty.Sum(equals(Scraps.U_Type();"Usefull"))/if(Scraps.U_Result.Sum(equals(Scraps.U_Type();"Usefull"))=0;1;Scraps.U_Result.Sum(equals(Scraps.U_Type();"Usefull")))*100
Scrap	Total Scrap Actual Quantity / Total Scrap Planned Quantity * 100	=Scraps.U_ActualQty.Sum()/if(Scraps.U_Result.Sum()=0;1;Scraps.U_Result.Sum())*100

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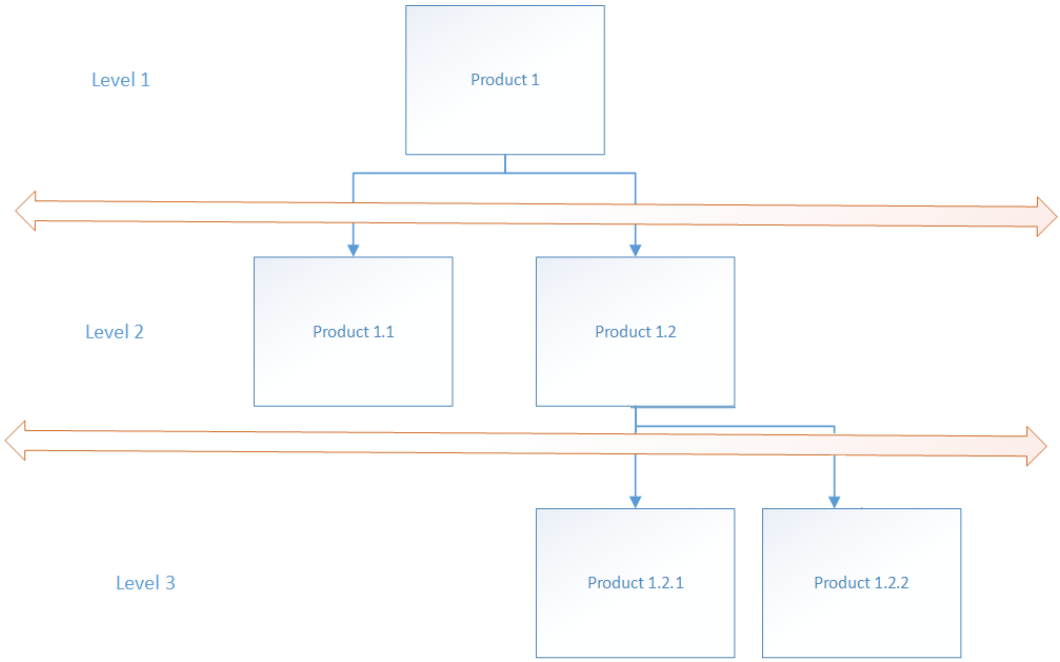
1.1.9 Multi-level Bill of Materials

Bill of Materials can have a multi-level structure. That means that an Item that is a part of the Bill of Materials can have its own Bill of Materials too. In the example below Product 1 is a final good. Its Bill of Materials consists of Product 1.1. and Product 1.2. Product 1.2 also has its Bill of Materials (in this case it contains two Items: 1.2.1, 1.2.2):

Related pages:

- Semi-finished Items
- Phantom Item



In ProcessForce there are two ways of dealing with this situation:

- **Semi-finished Items**: in this case Items in final good structure can have its own Bill of Materials for which another Manufacturing Order has to be created (apart from final good one). Items like this can also be produced separately (as a final good on a stand-alone Manufacturing Order) and stored.
- **Phantom Item**: it is also a Bill of Materials in a structure of another Bill of Materials but its production result cannot be stored nor produced separately: it is an element of production process of a final good. It does not require to create a separate Manufacturing Order, its components and Operations are added to a Manufacturing Order of a final good.

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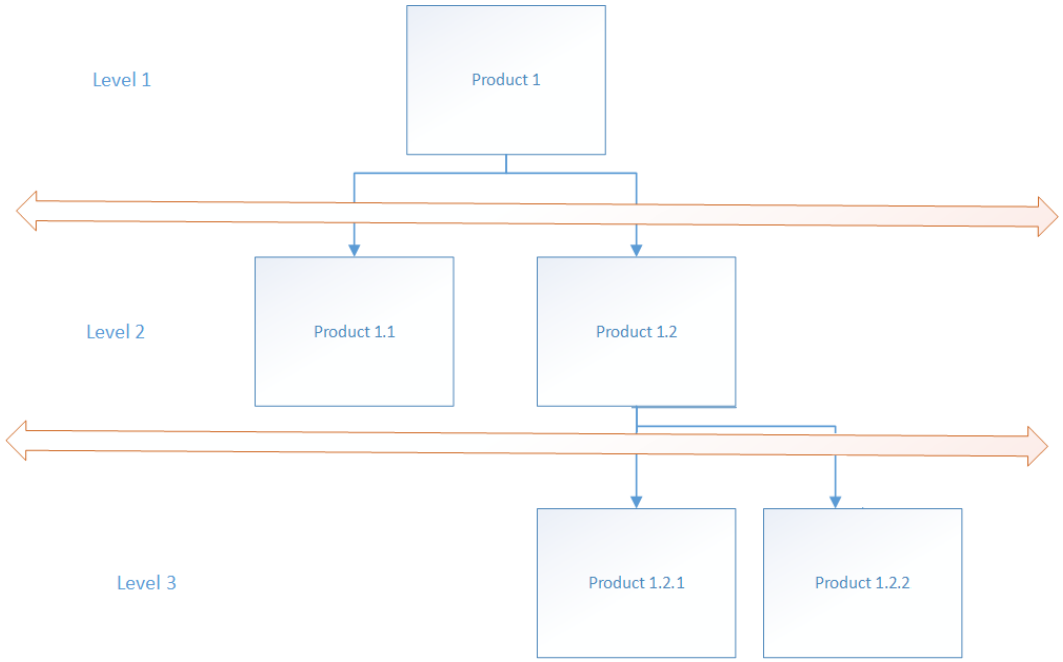
Semi-finished Items

Semi-finished Item is an Item that has its own Bill of Materials but is also a part of a finished product Bill of Materials. In the example below Product 1.2 is semi-finished: it has its own structure (Product 1.2.1 and 1.2.2). For this kind of Items another Manufacturing Order has to be created (apart from finished product one) when final product is produced. Items like this can also be produced separately (as its own final product) and stored.



Semi-finished Items Manufacturing Orders (linked to final product Manufacturing Order) can be managed from Semi-finished Product Scheduling Board.

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Phantom Item

A Phantom Item is a Bill of Materials template that can be a part of another Bill of Materials. It is not a Stock Item – it is never receipt to any Warehouse. It serves only as a marking point in a master Bill of Materials production process (Phantom Items do not create inventory nor financial transactions). Phantom Item is an alternative to Semi-Finished product. You can use Bill of Material Item on a master Bill of Materials but in this case a separate, linked Manufacturing Order is needed for each child BOM. Using Phantom on BOM does not create separate MOR: it explodes (adds its content) on Items Tab and on Operations tab (adds operations defined in Phantom Production Process).

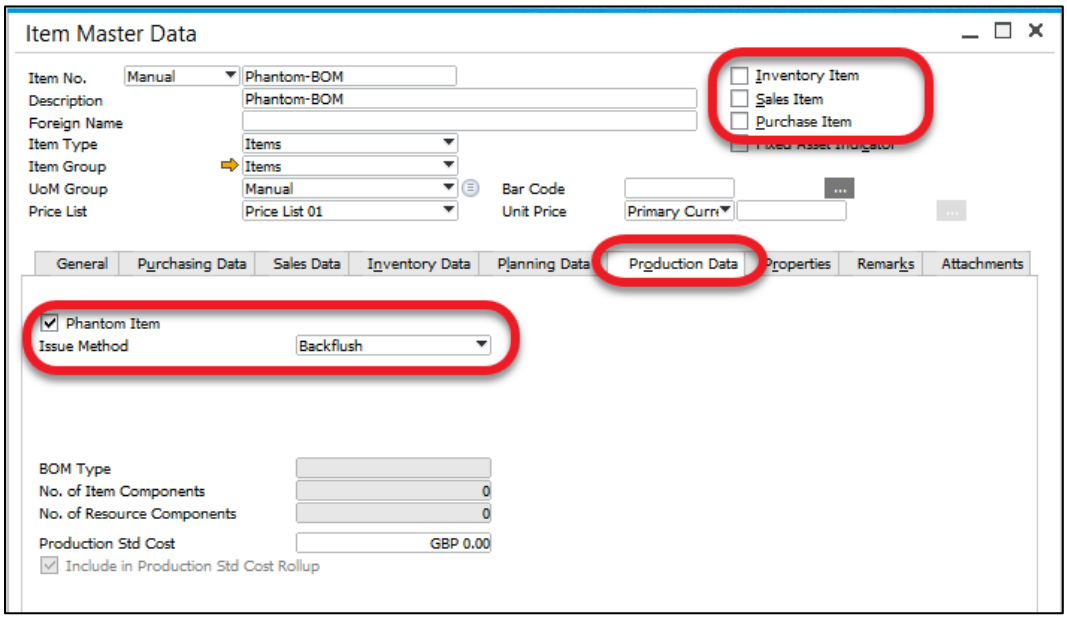
On this page

- Phantom Item
- Material Phantom

Phantom Item

Setting up

Path
Inventory > Item Master Data > Production Data tab



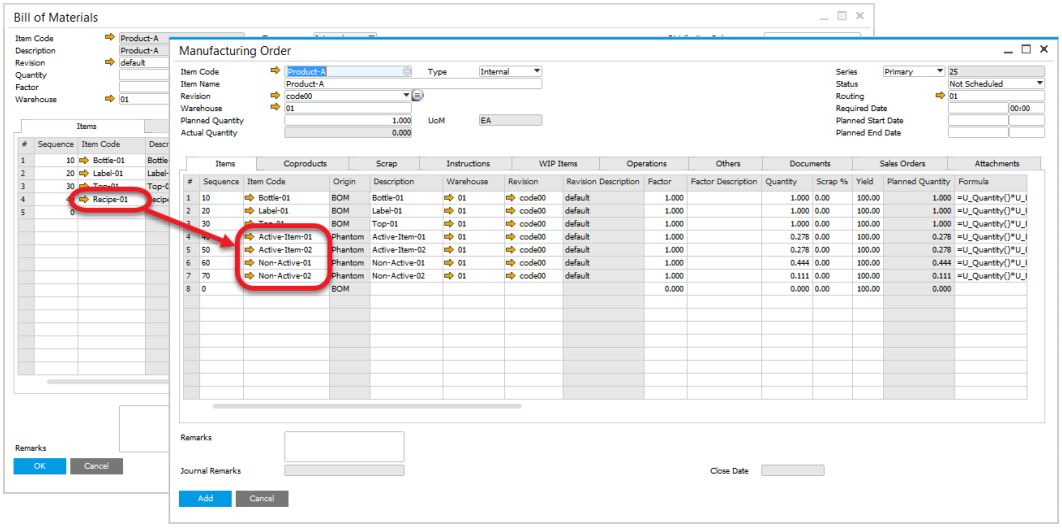
To use a specific Item as Phantom be sure to check the following settings:

- Phantom Item check box checked
- Inventory, Sales and Purchase Item fields un-checked
- Issue Method set up to Backflush

Also mind that a Phantom (as every Non-Inventory Item) cannot be managed either by Batches, or Serials (Item Master Data > General tab).

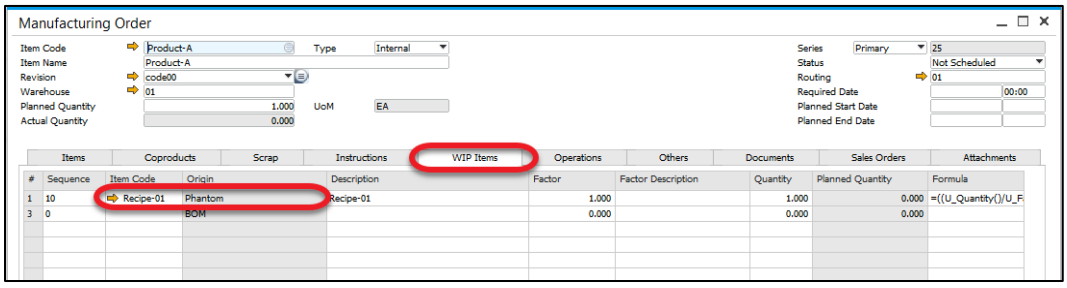
Example
We have a beverage – Product-A. One piece of it consists of a packaging (Bottle-01, Label-01, Top-01) and actual drink (Recipe-01), which is a separate Bill of Materials. Packaging elements can be bought or produced and taken from inventory during production. But drink (as a Phantom Item) can never be used on a separate Manufacturing Order (just for Recipe-01) nor goes into stock - it can only be produced during Product-A production process and be a part of it. It also means that drink is not received to Warehouse and then issued for Product-A

production process, but all the elements enter the manufacturing process together which result in Product-A:



As it can be seen on the screenshot above, the Phantom from master Bill of Materials exploded on connected a Manufacturing Order: every Item from Recipe-01 was added to Manufacturing Order > Items tab. Because of it there is no need to create a separate Manufacturing Order for Recipe-01 Bill of Materials (as we would have to do is it was a Semi-finished Product). Note that also Operations defined for the Phantom in its Production Process are added to Operations tab.

You can check what Phantom Item were used on a specific Manufacturing Order in WIP Items tab:



You can also add a Phantom manually to a Manufacturing Order. On adding a document after this, a communication form will pop up with information about Phantoms being present on a document and that it will be expanded automatically. It is required to confirm the communication before adding a document.

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Material Phantom

This function combines regular and Phantom Item approach: it is still an Inventory Item (for which it is possible to create a separate Manufacturing Order) but can be exploded on a master Bill of Materials to avoid creation of linked Manufacturing Order for Bill of Materials used on another BOM. Material Phantom can also be, unlike Phantoms, Sale or Purchase Item.

Example

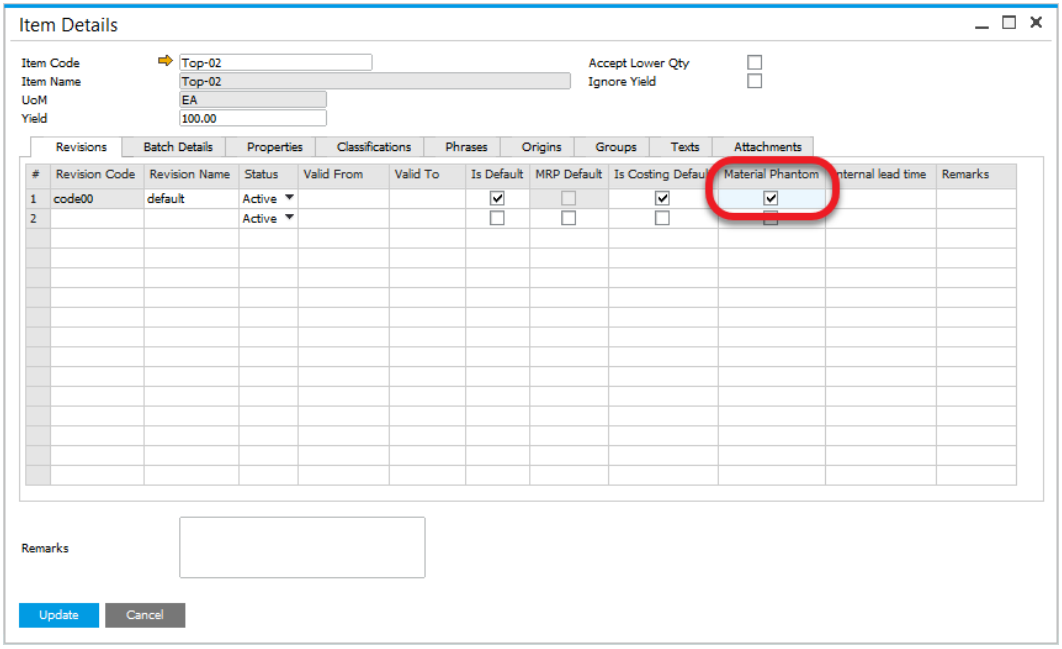
An Engine Item is usually produced during a Car Item production process in Company. To do this, Company uses Engine as Material Phantom on Car BOM (to avoid creating additional, linked Engine Manufacturing Order). Engine is not taken into inventory but is created during Car production process and is a part of Car final good. But in some cases Company wants to sell Engine separately. It is possible to create a separate Manufacturing Order for Engine in cases like this.

Setting up

Material Phantom option can be set up for a specific revisions in Item Details:

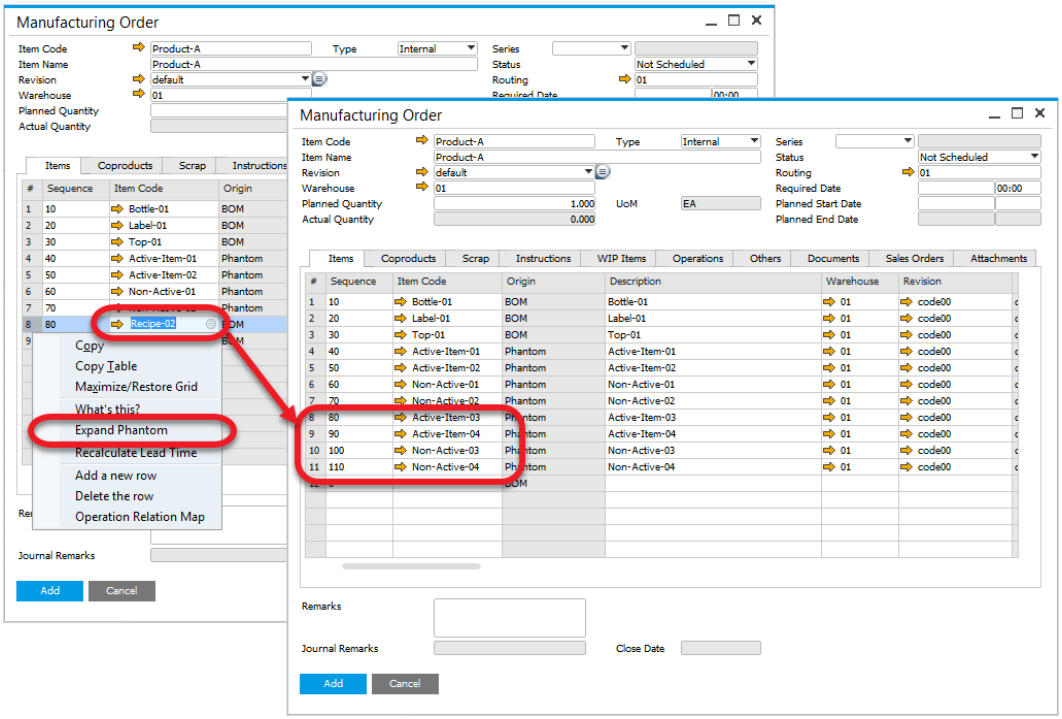
Path

Inventory > Item Details



Usage

On adding a Material Phantom Item to a Manufacturing Order you can explode it by using context menu on the Item:



The application also displays a system message when there is a Material Phantom Item that was not exploded (*There are phantoms. All phantoms will expand automatically. Do you want to continue?*). It is not possible to add a Manufacturing Order with Material Phantom Item that has not been exploded.

If a specific Item is required to be used on Bill of Materials as a regular Item (without its BOM, just as an Inventory Item) in some cases and as a Material Phantom (A BOM that will explode on a master BOM) in other, it is required to create two separate revisions that will differ from each other by Material Phantom check box checked and by the fact that non-Material Phantom revision will not have a BOM assign.

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External links

Phantom Item concept

1.2 Production Process

Production Process allows to assign a specific Routing to a production Item and to bind specific Item to Operations on a Routing.

On this page:

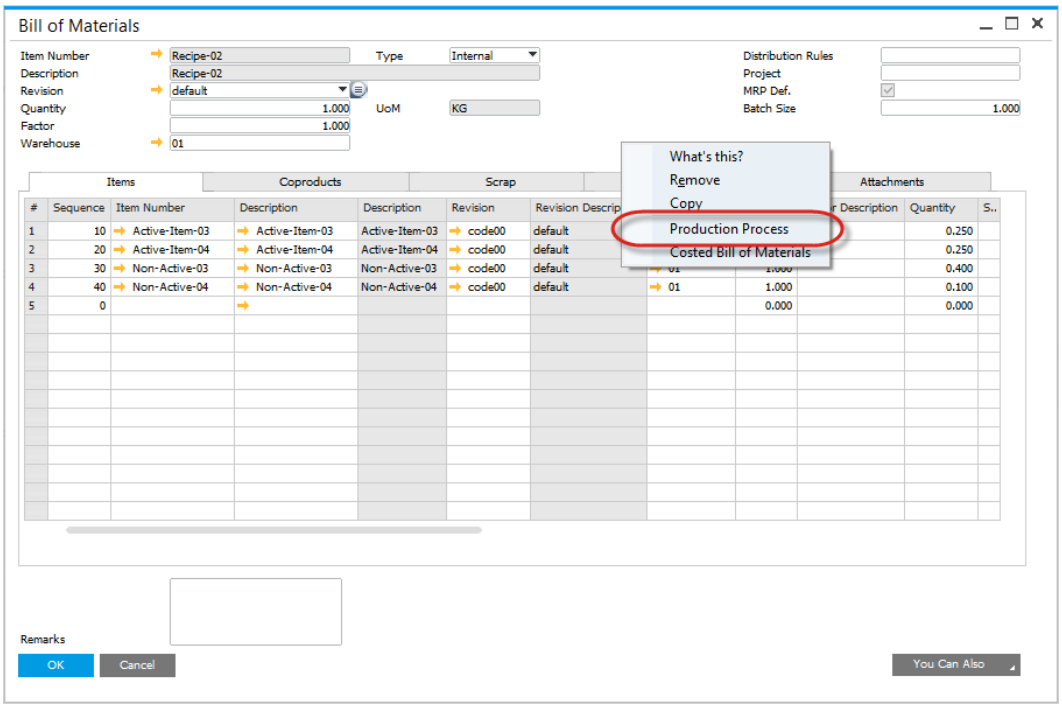
- Adding a Routing
- Default Routing and Alternatives
- Operation Overlay
- Resources
- Tooling
- Operation Bind
  - Manufacturing Order Operation Bind
- Instructions tab
- Validity Period

1.2.1 Adding a Routing

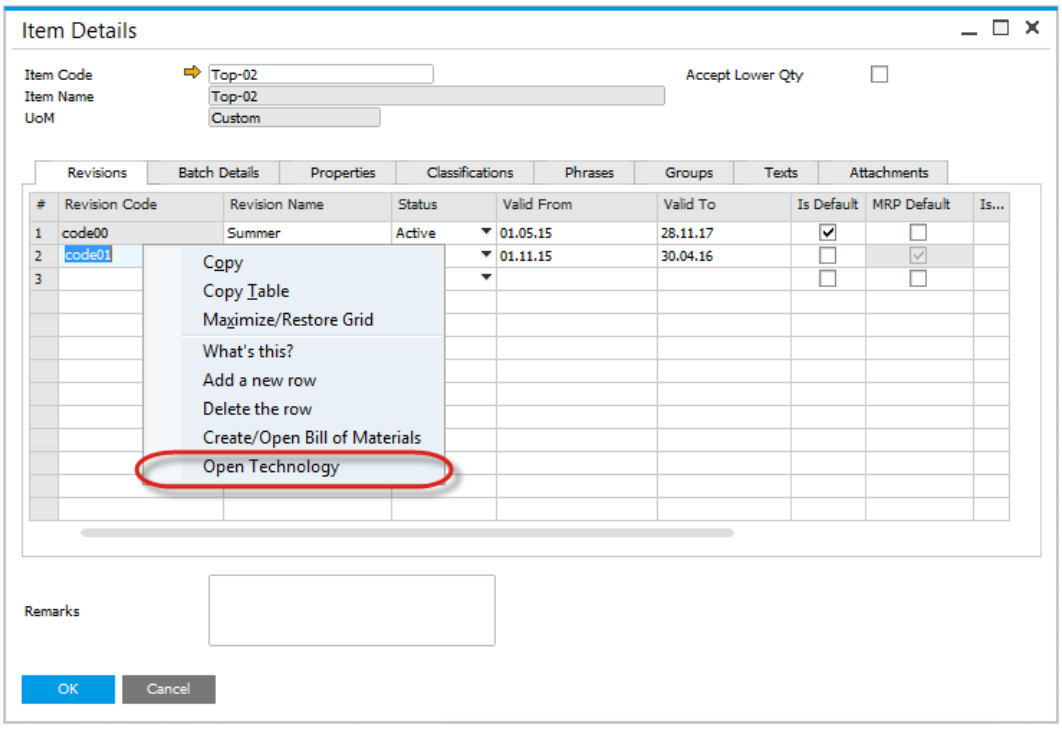
To add a Routing from within the Bill of Material form, right mouse button click menu, select the Production Process menu option. You can also reach the form by choosing the following path in the main menu:

Path

Production > Bill of Materials > Production Process



or in the context menu on Item Details form:

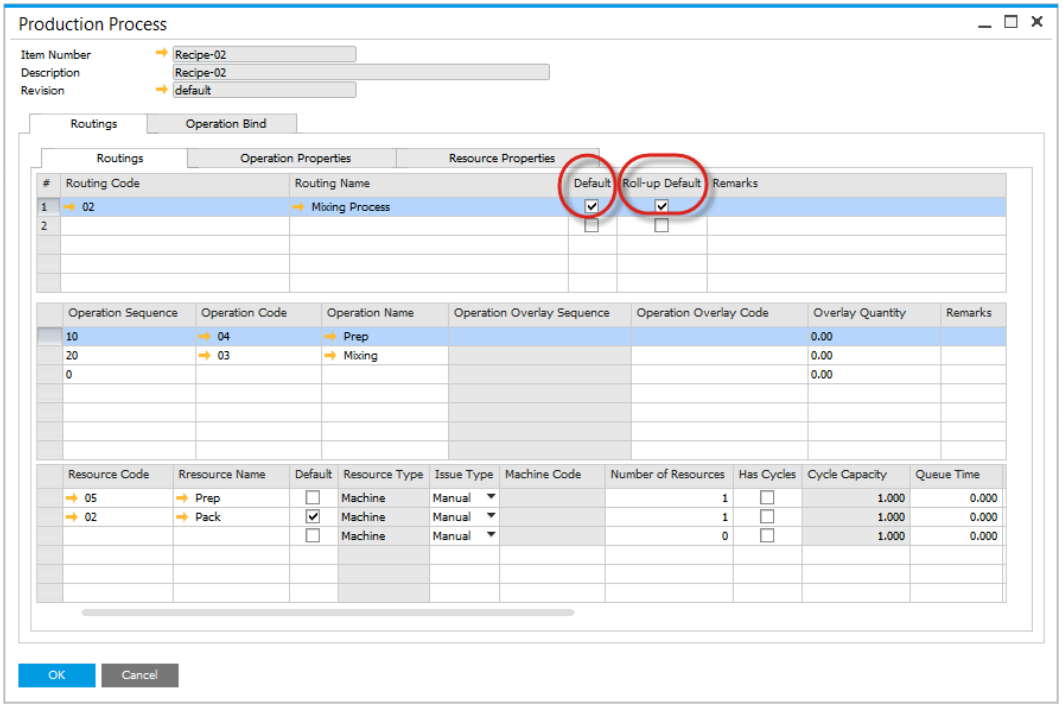


1.2.2 Default Routing and Alternatives

To add a Routing or multiple alternative Routings, select and enter a Routing Code from in the second column.

If the Routing is the default routing to be used with Manufacturing Orders, check the box in the "Default" column.

If the Routing is the default routing to be used for Product Costing, then check the box.



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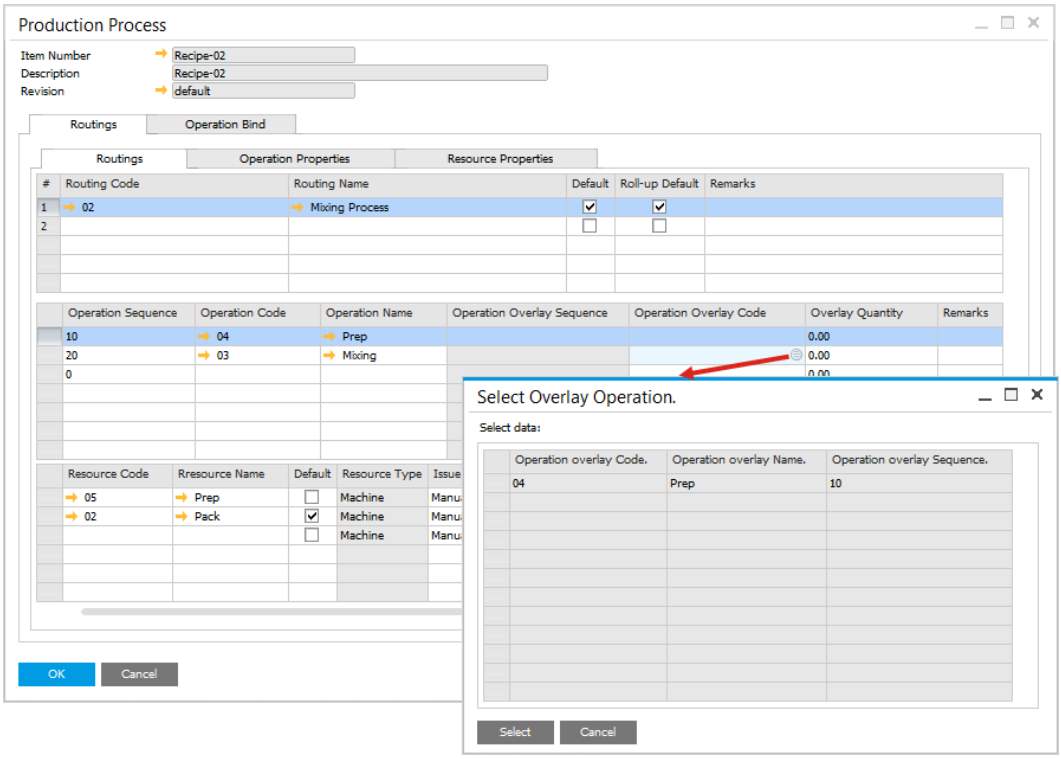
1.2.3 Operation Overlay

If the production process allows overlapping operations, the user can enter an Operation Overlay Code (Operation Code) and a Quantity after which next operation starts.



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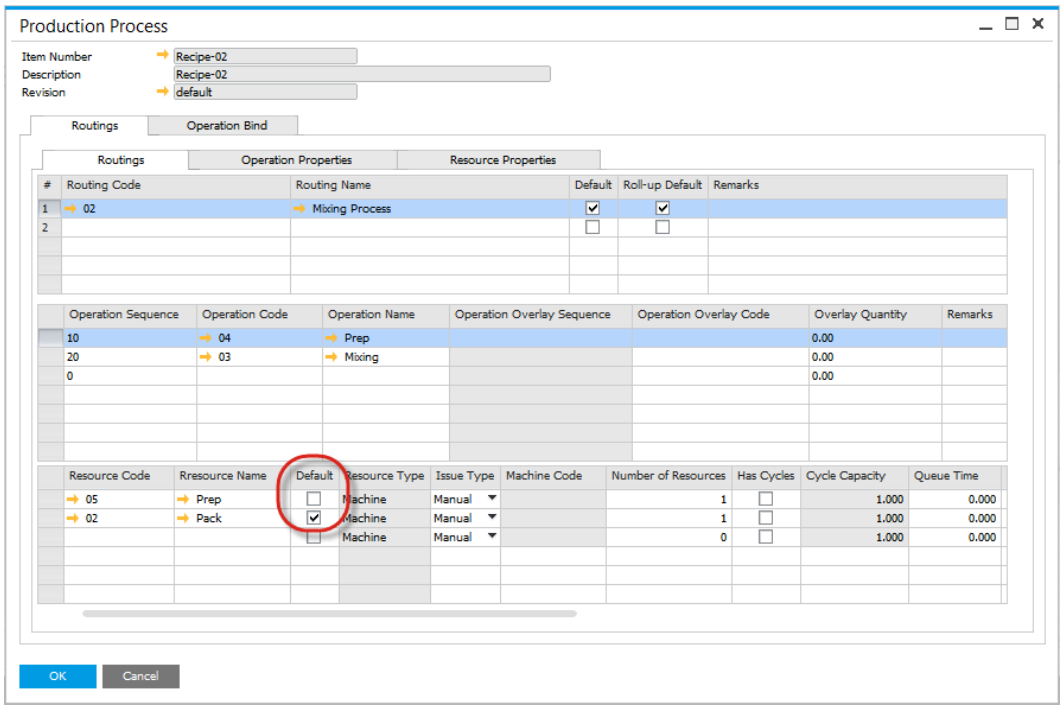
1.2.4 Resources

By Clicking on the Operation Code column, the Resources within the Operation are displayed within the third column.

If required for this specific combination of Item Number, Revision, Routing, Operation and Resource, the Time and Rate values can be changed, additional Resources added or existing Resources removed.

If there are alternative resources for the operation, add several Resources and select one as the 'Default'.



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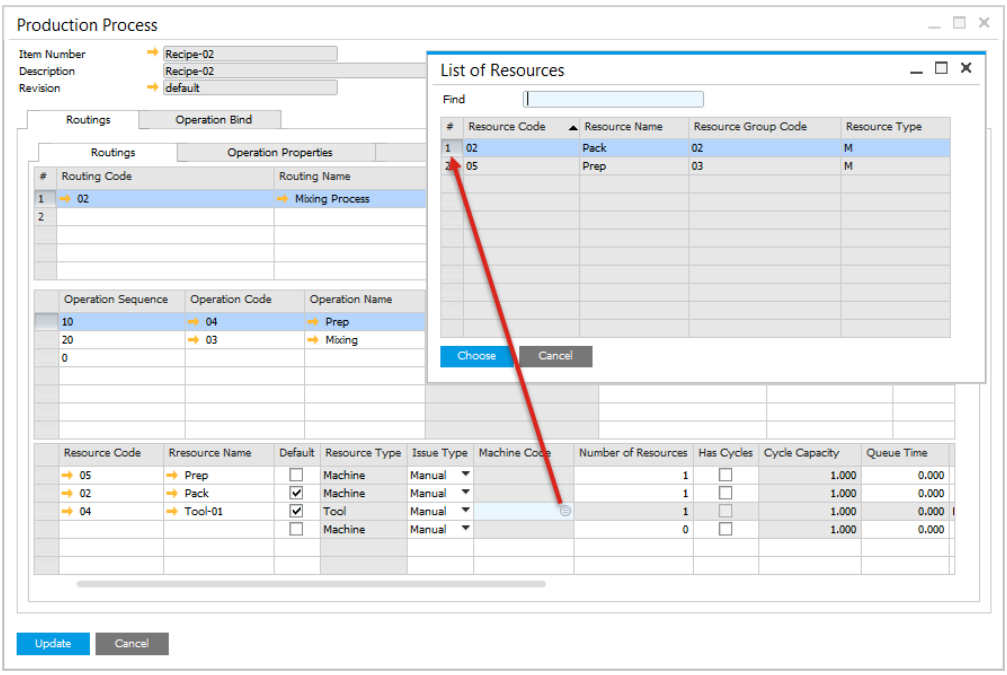
1.2.5 Tooling

When adding a Tool select the "Machine Code" which is referring to it.

This example illustrates which machine the tool can be used on, for making the specific product.



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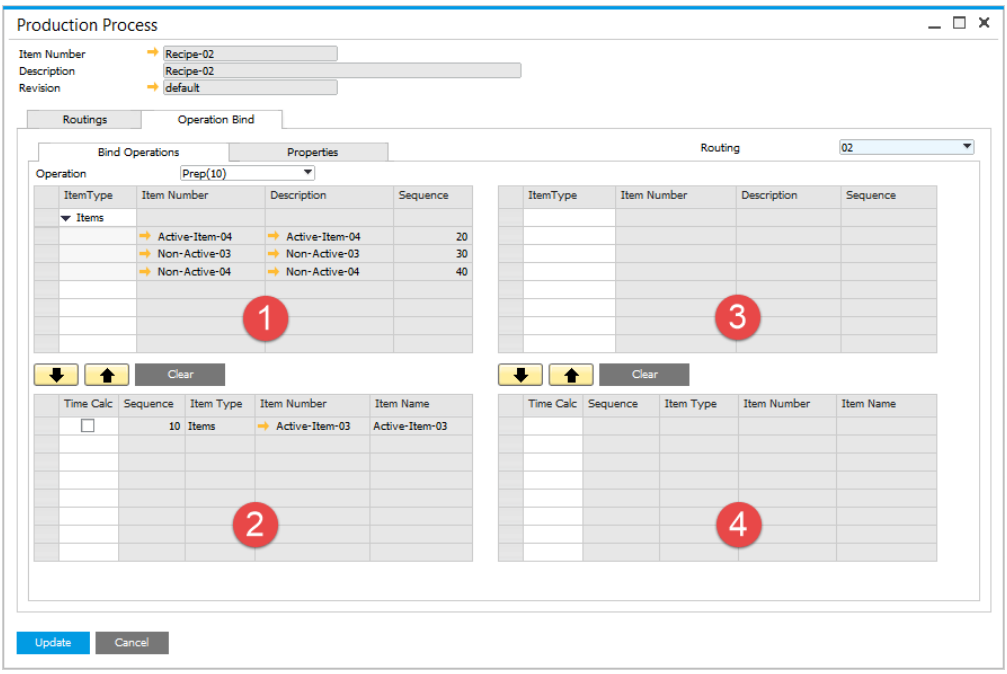
1.2.6 Operation Bind

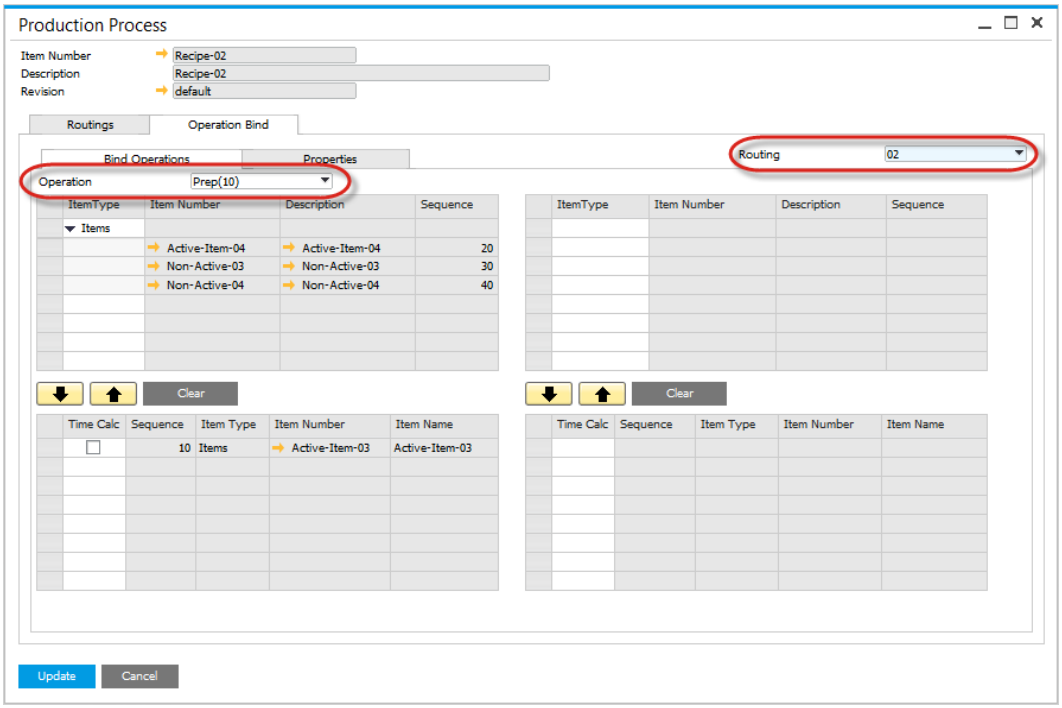
Operation Bind allows user to link Items with Operations.

The window is divided into four parts:

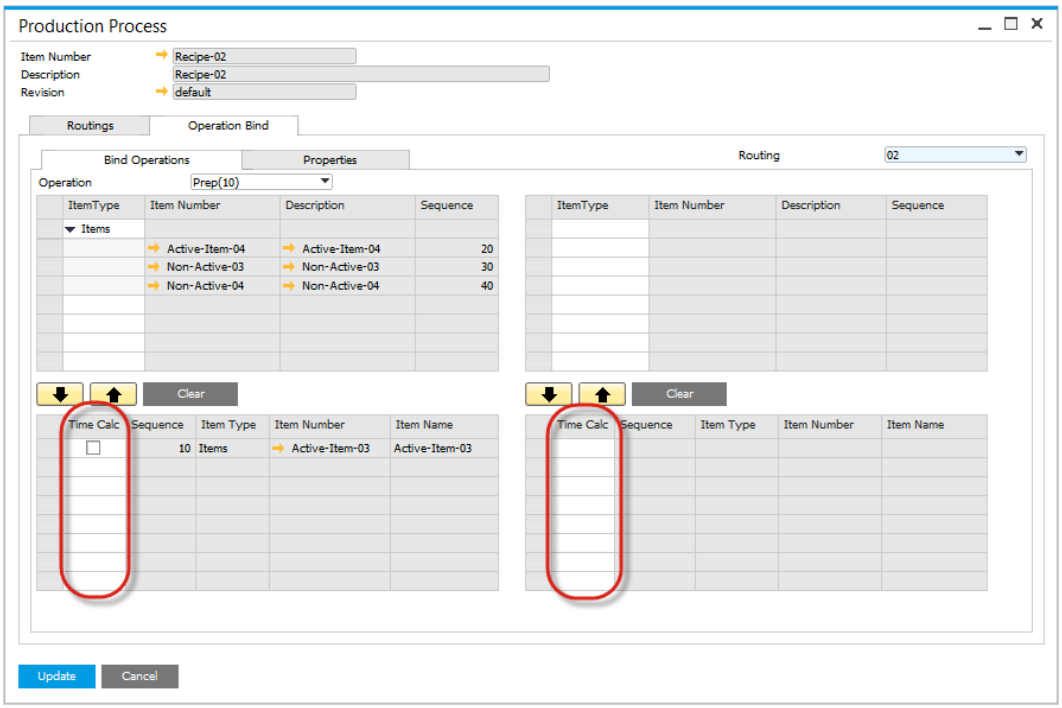


1. Items that are available to be linked with selected operation as an input to this operation.
2. Items that are already selected as an input for operation.
3. Items that are available to be linked with selected operation as an output of this operation.
4. Items that are already selected as an output of operation.

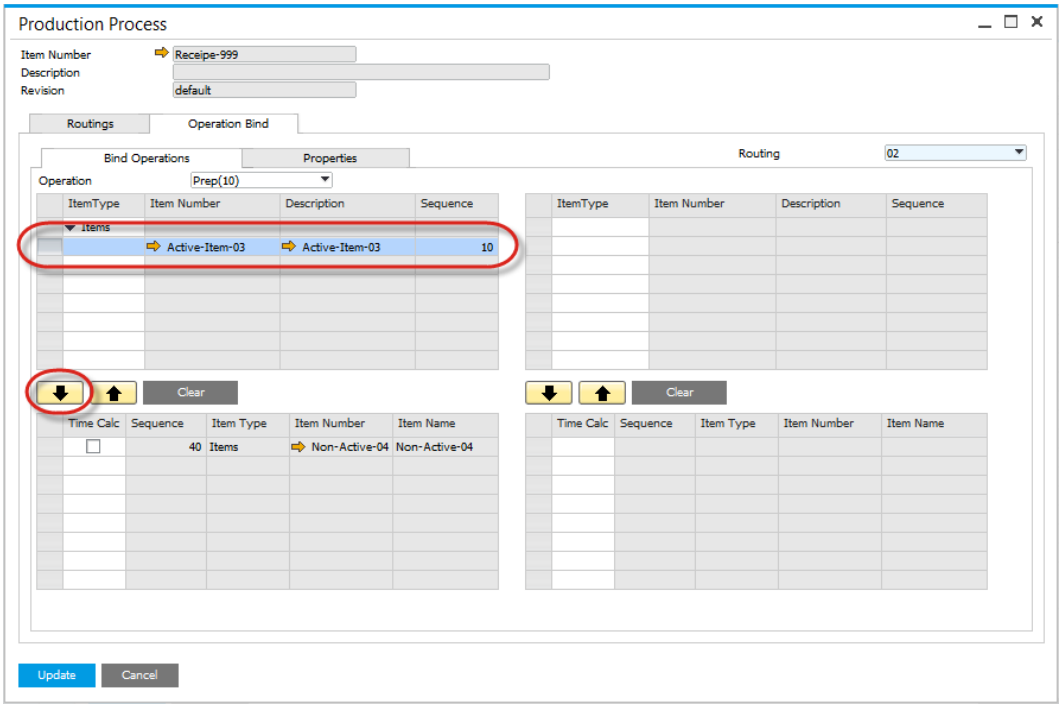
To bind an operation, a user have to choose a Routing from defined for this Process Routings and then Operation:



In Operation Binding you can also specify that you want to change quantity used to calculate selected operation time. In Process Force time for operation is calculated based on planned quantity of a final product. You can change this behavior for each of your operation by selecting Time Calc check box. Result quantity of selected item will be taken to calculate operation time.

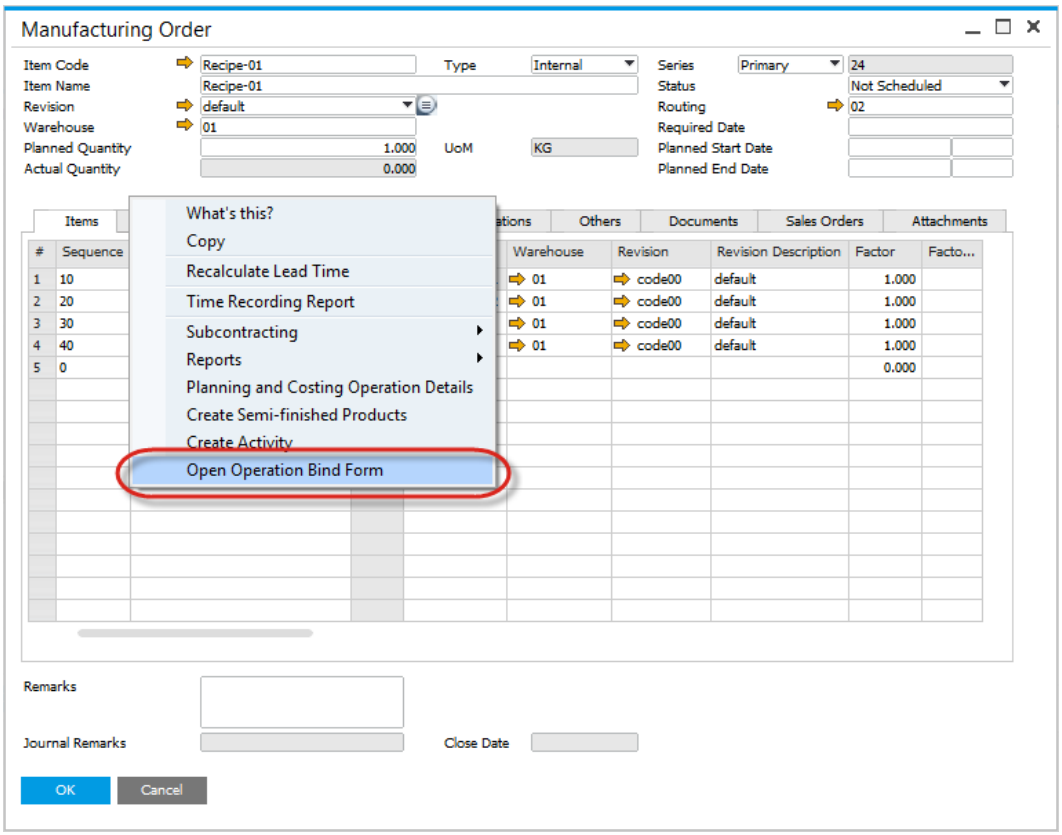


To bind Items to a specific Operation, click Item row and use the arrow to move it from upper to lower part of the form:

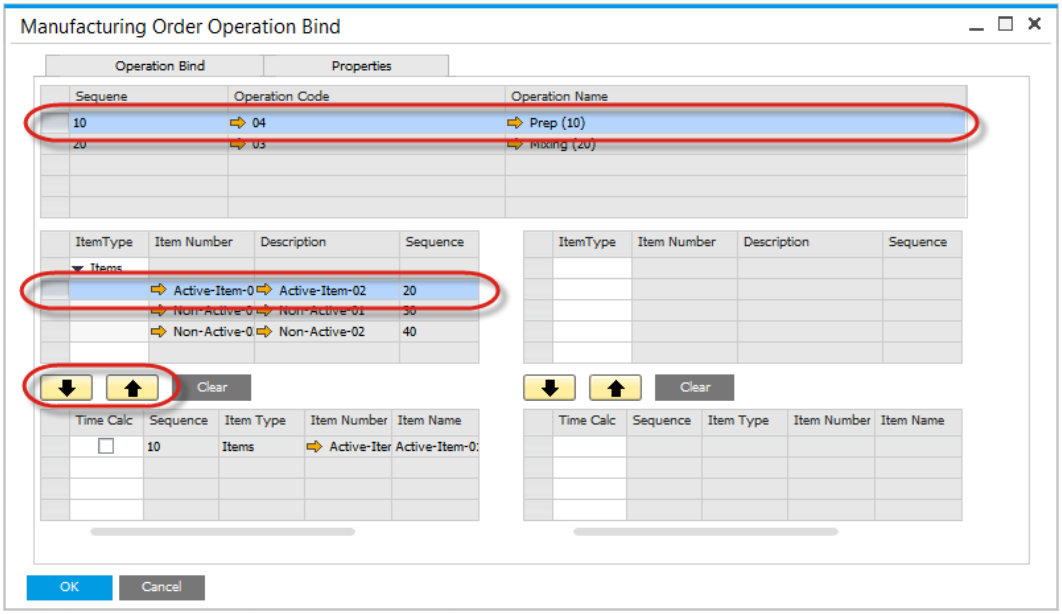


Manufacturing Order Operation Bind

Operation Bind can be defined or change individually for a specific Manufacturing Order. To do that click Open Operation Bind Form on the context menu on Manufacturing Order form.



Click an Operation row and Item row and use arrows to bind both elements:

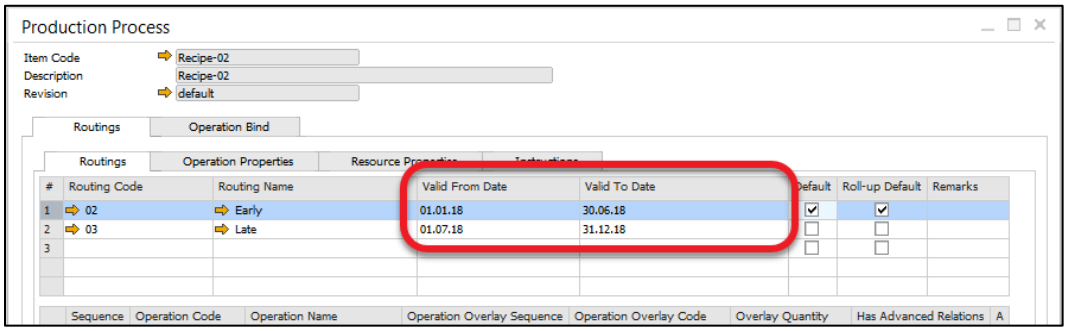


1.2.7 Instructions tab

Instructions tab is available from Production Process form, Routing tab. It is an editable text area that can hold any related text documentation.

1.2.8 Validity Period

It is possible to set a period of validity for a Routing on a Production Process:



Example usage

A specific company in the food industry for a specific Item has defined a single Bill of Materials, but different Routings based on the period of the year (which can be connected to temperature, humidity, etc.).

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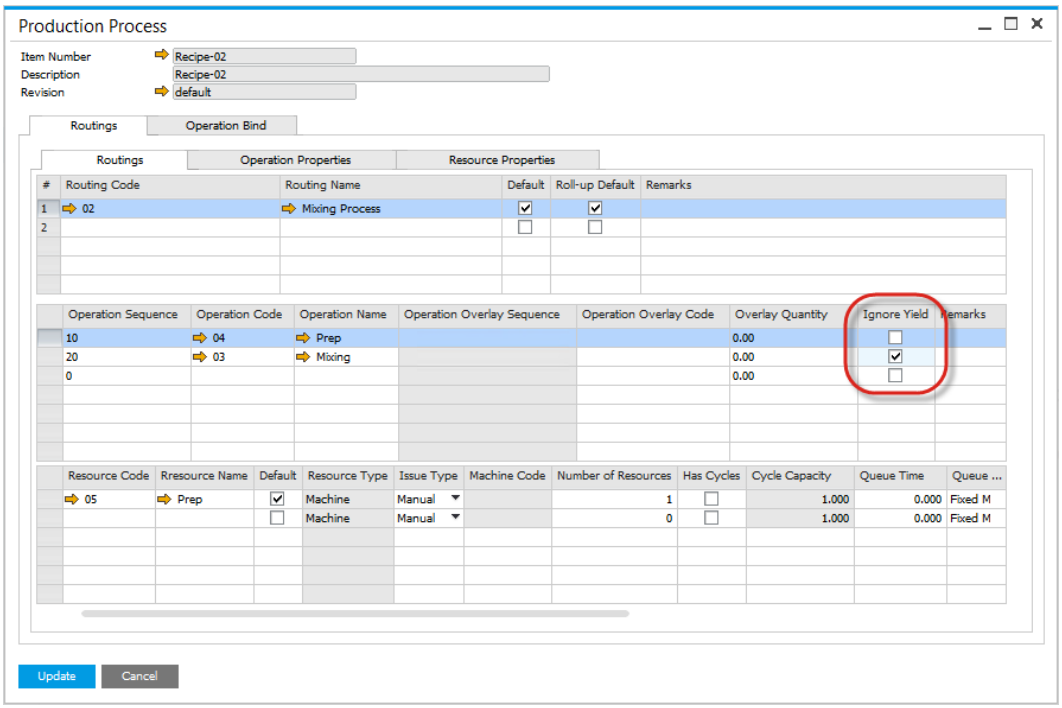
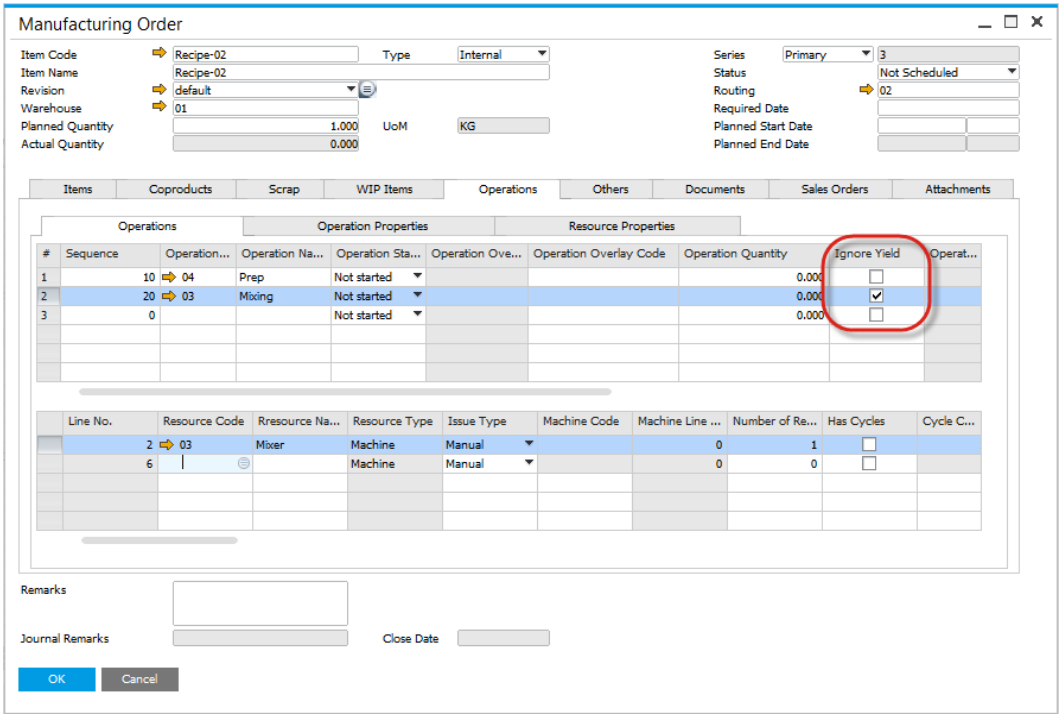
1.2.9 Yield – Time calculation

Depending on the production process, the yield may have an impact on the production time.

Checking the Ignore Yield check box will calculate the extra time required to produce the planned quantity within the manufacturing order.

The default setting will be copied to the manufacturing order.


Production Process
Item Number
Recipe-02
Description
Recipe-02
Revision
default
Routings
Operation Bind
Routings
Operation Properties
Resource Properties
| Routing Code | Routing Name | Default | Roll-up Default | Remarks
1 | 02 | Mixing Process
2
Operation Sequence | Operation Code | Operation Name | Operation Overlay Sequence | Operation Overlay Code | Overlay Quantity | Ignore Yield | Remarks
10 | 04 | Prep | 0.00
20 | 03 | Mixing | 0.00
0 | 0.00
Resource Code | Rresource Name | Default | Resource Type | Issue Type | Machine Code | Number of Resources | Has Cycles | Cycle Capacity | Queue Time | Queue ...
05 | Prep | Machine | Manual | 1 | 1.000 | 0.000 | Fixed M
Machine | Manual | 0 | 1.000 | 0.000 | Fixed M
Update
Cancel


Manufacturing Order
Item Code
Recipe-02
Type
Internal
Item Name
Recipe-02
Revision
default
Warehouse
01
Planned Quantity
1.000
UoM
KG
Actual Quantity
0.000
Series
Primary
3
Status
Not Scheduled
Routing
02
Required Date
Planned Start Date
Planned End Date
Items
Coproducts
Scrap
WIP Items
Operations
Others
Documents
Sales Orders
Attachments
Operations
Operation Properties
Resource Properties
| Sequence | Operation... | Operation Na... | Operation Sta... | Operation Ove... | Operation Overlay Code | Operation Quantity | Ignore Yield | Operat...
1 | 10 | 04 | Prep | Not started | 0.000
2 | 20 | 03 | Mixing | Not started | 0.000
3 | 0 | Not started | 0.000
Line No. | Resource Code | Rresource Na... | Resource Type | Issue Type | Machine Code | Machine Line ... | Number of Re... | Has Cycles | Cycle C...
2 | 03 | Mixer | Machine | Manual | 0 | 1 |
6 | Machine | Manual | 0 | 0 |
Remarks
Journal Remarks
Close Date
OK
Cancel

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1.3 Mass Item Replacement

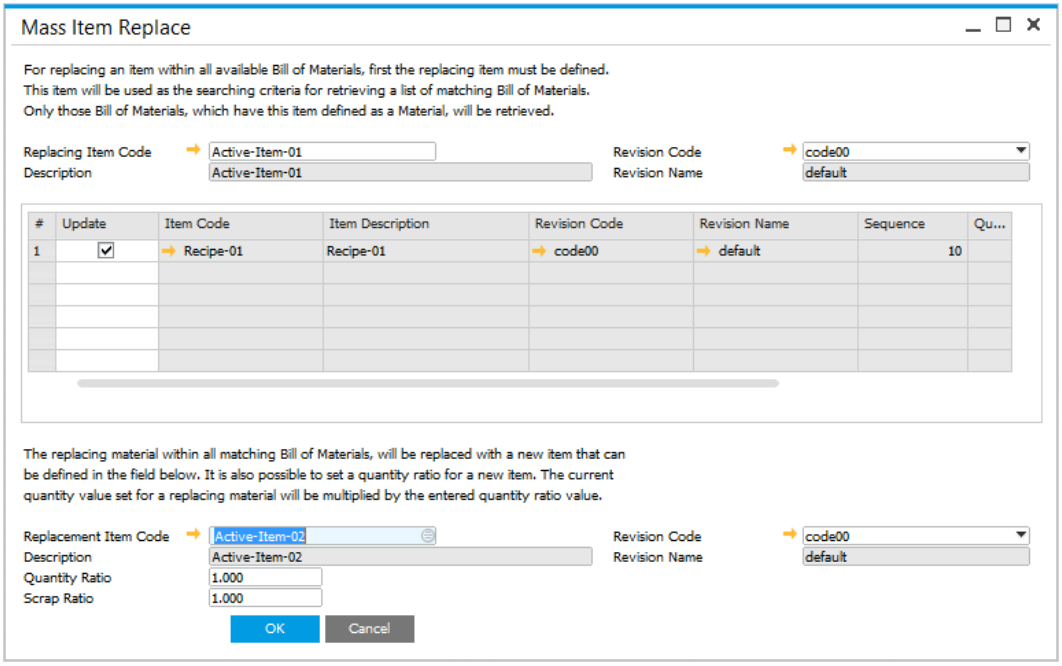
Path

Production > Bill of Materials > Mass Item Replacement

This form allows the user to quickly search, change and replace one Item with another.

The user selects the Item that needs replacing, chooses which Bill of Materials will be updated, by checking the update box, and then enter the replacement Item.

It is possible to set a quantity ratio. The current quantity value set for a replacing material will be multiplied by the entered quantity value (which is by default set as 1.000). The same can be done for scrap value by using Scrap Ratio field.



1.4 Formula

Overview

Formulas are a very flexible but simple method in calculating the quantity relationship between an item and its parent.

On installation a default formula is installed within the General Settings/ProcessForce/Bill of Materials and Manufacturing Tab.

This default formula can be changed to meet the needs of the user and will be used when entering Bill of Materials.

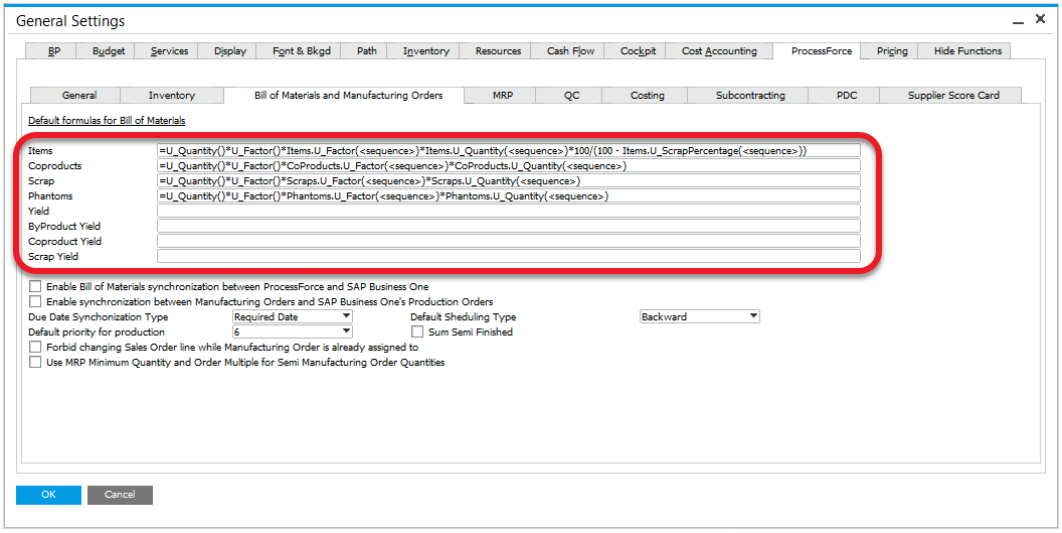
If user defined fields are added to the form, these can also be used within the formula.

All the expressions as per Microsoft Excel formulas can be used.

Values from other Tabs can be used within a formula to calculate a value. For example, a specific Item within the Bill of Materials has a 10% Scrap Percentage. A Scrap item master is added to the Scraps Tab. The amount of scrap produced will be the difference between the Item Result and the Item Quantity.

On this page:

- Overview
- Formula Nomenclature
- Formula Functions
- Using User-Defined Field in Formulas
- Yield Formulas



Default formulas:

Items:

```
=U_Quantity()*U_Factor()*Items.U_Factor(<sequence>)*Items.U_Quantit
y(<sequence>)*100/(100 - Items.U_ScrapPercentage(<sequence>))
```

Coproducts:

```
=U_Quantity()*U_Factor()*CoProducts.U_Factor(<sequence>)*CoProducts
.U_Quantity(<sequence>)
```

Scrap:

```
=U_Quantity()*U_Factor()*Scraps.U_Factor(<sequence>)*Scraps.U_Quant
ity(<sequence>)
```

Phantom:

```
=U_Quantity()*U_Factor()*Phantoms.U_Factor(<sequence>)*Phantoms.U_Q
uantity(<sequence>)
```

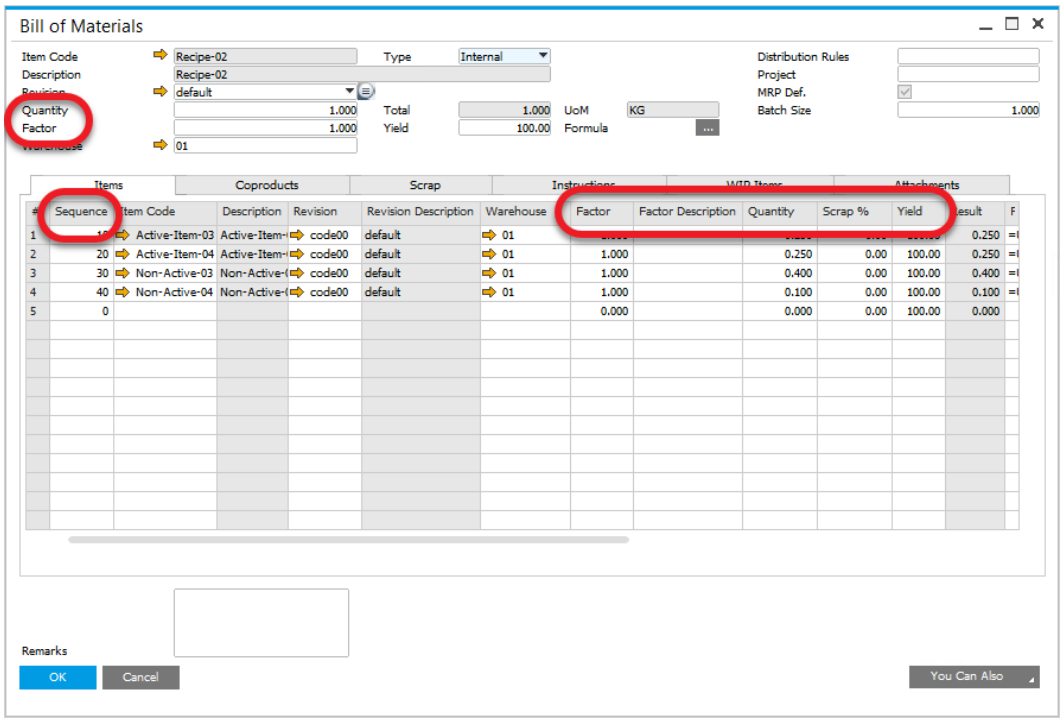
1.4.1 Formula Nomenclature

Items	CoProducts
Items.U_Factor(<sequence>) = Factor value within Items Tab Items.U_Quantity(<sequence>) = Quantity value within Items Tab Items.U_ScrapPercentage(<sequence>) = Scrap Percentage value within Items Tab Items.U_Results(<sequence>) = Results value within Items Tab	CoProducts.U_Factor(<sequence>) = Factor Value within CoProducts Tab CoProducts.U_Quantity(<sequence>) = Quantity value within CoProducts Tab CoProducts.U_Results(<sequence>) = Results value within CoProducts Tab

Scraps	Phantoms
Scraps.U_Factor(<sequence>) = Factor Value within Scraps Tab Scraps.U_Quantity(<sequence>) = Quantity Value within Scraps Tab	Phantoms.U_Factor(<sequence>) = Factor Value within Phantoms Tab Phantoms.U_Quantity(<sequence>) = Factor Value within Phantoms Tab

Scraps	Phantoms
Scraps.U_Results(<sequence>) = Results value within the Scraps Tab	Phantoms.U_Results(<sequence>) = Results value within Phantoms Tab

Other Variables
U_Factor() = Factor Value within form Header U_Quantity() = Quantity value within the form Header



1.4.2 Formula Functions

The following functions can be used within formulas:

Syntax	Description	As in Excel
ABS(*x*)	Returns the absolute value of *x*.	✓
ACOS(*x*)	Returns the arc cosine of *x*, in radians.	✓
ASIN(*x*)	Returns the arc sine of *x*, in radians.	✓

Syntax	Description	As in Excel
ATAN(*x*)	Returns the arc tangent of *x*, in radians.	
ATAN2(*x*;*y*)	Returns ATAN(*y*/*x*) taking signs of *x* and *y* into account.	
CEILING(*x*;*signif*)	Returns the nearest multiple of *signif* that is equal to or larger than *x* when *signif* is positive (that is, rounds towards plus infinity); and returns the nearest multiple of *signif* that is equal to or smaller than *x* when *signif* is negative (that is, rounds towards minus infinity). Returns NumError when *signif* is 0.0.	Almost
COS(*x*)	Returns the cosine of *x*, with *x* in radians.	
EXP(*x*)	Returns e^x, that is, e = 2.71828... raised to the power *x*.	
FLOOR(*x*;*signif*)	Returns the nearest multiple of *signif* that is equal to or smaller than *x* when *signif* is positive (that is, rounds towards minus infinity); and returns the nearest multiple of *signif* that is equal to or greater than *x* when *signif* is negative (that is, rounds towards plus infinity). Returns an NumError when *signif* is 0.0.	Almost
IF(*e1*;*e2*;*e3*)	Evaluates *e1*; if the result of *e1* is true, evaluates *e2* and returns the result; if the result of *e1* is false, evaluates *e3* and returns the result.	
LN(*x*)	Returns the natural (base e = 2.71828...) logarithm of *x*.	
LOG(*x*)	Returns the base 10 logarithm of *x*.	
LOG10(*x*)	Returns the base 10 logarithm of *x*.	
MOD(*x*;*y*)	Returns the signed remainder of *x* by *y*, that is, *x* - FLOOR(*x*/*y*;1) * *y*. Returns NumError if *y* is 0.0.	
PI()	Returns π = 3.14159..., the ratio of the circumference to the diameter of a circle	
RAND()	Returns a pseudo-random number *x* from a uniform distribution such that 0 <= x < 1	
ROUND(*x*;*d*)	Returns *x* rounded to *d* decimal digits. That is, rounds to nearest integer when *d* is 0, to nearest multiple of 0.1 when *d* is 1, to nearest multiple of 10 when *d* is -1, and	

Syntax	Description	As in Excel
	so on. In case of a tie, rounds away from zero. First *d* is truncated (towards zero) to obtain an integer.	
SIN(*x*)	Returns the sine of *x*, with *x* in radians.	
SQRT(*x*)	Returns the square root of *x*.	
TAN(*x*)	Returns the tangent of *x*, with *x* in radians.	
EQUALS(string;string)	Returns *true* if strings are equal	

1.4.3 Using User-Defined Field in Formulas

It is possible to incorporate User-Defined Fields (UDFs) into formulas.

We can use either header or row UDFs in formulas.

- Mind that the formula result is a numeric value. Therefore User-Defined Fields used in it have to be created with Type set to Numeric
- Bill of Materials structure is copied to a specific Manufacturing Order created from this Bill of Materials. Therefore to use UDFs in formulas it is required to create the same UDFs in Bill of Materials and Manufacturing Order in the corresponding places, e.g. the same UDFs in headers, the same UDFs in corresponding tables.

1.4.4 Yield Formulas

To be able to calculate Yield in Bill Of Material and Manufacturing Order you have to replace Default formulas in General Settings:

- **Items**

```
=U_Quantity()*U_Factor()*Items.U_Factor(<sequence>)*Items.U_Quantity(<sequence>)*100/(100 - Items.U_ScrapPercentage(<sequence>))*100/Items.U_Yield(<sequence>)
```

- **CoProducts**

  =U_Quantity()*U_Factor()*CoProducts.U_Factor(<sequence>)*CoProducts.U_Quantity(<sequence>)*100/CoProducts.U_Yield(<sequence>)

- **Scrap**

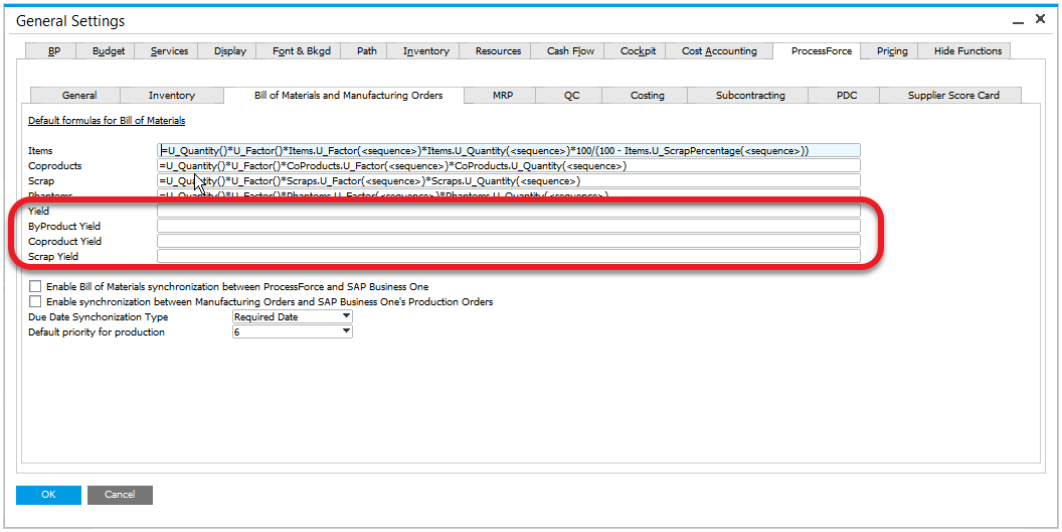
  =U_Quantity()*U_Factor()*Scraps.U_Factor(<sequence>)*Scraps.U_Quantity(<sequence>)*100/Scraps.U_Yield(<sequence>)

- **Phantoms**

  =U_Quantity()*U_Factor()*Phantoms.U_Factor(<sequence>)*Phantoms.U_Quantity(<sequence>)

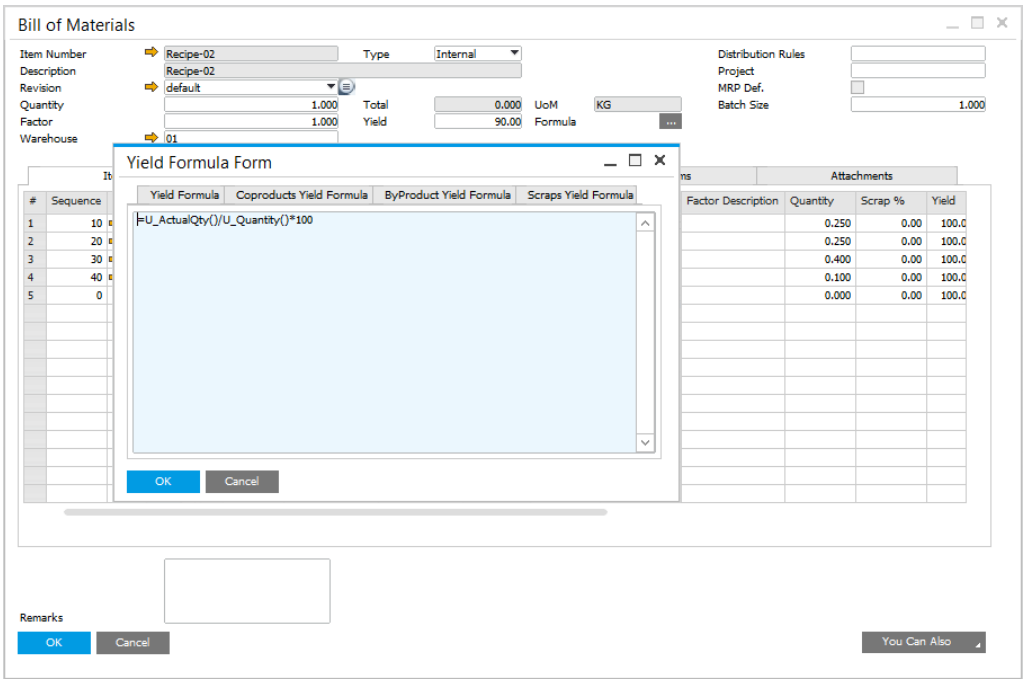
Four new formula fields have been added to calculate the actual yield within the Manufacturing Order:

- Yield – this relates to the actual yield of the parent item
- CoProduct – this relates to the yield of the coproducts (Coproduct Tab) produced in production
- ByProduct – this relates to the yield of the ByProducts (Scrap Tab) produced in production
- Scrap – this relates to the yield of the Scrap (Scrap Tab) produced in production.

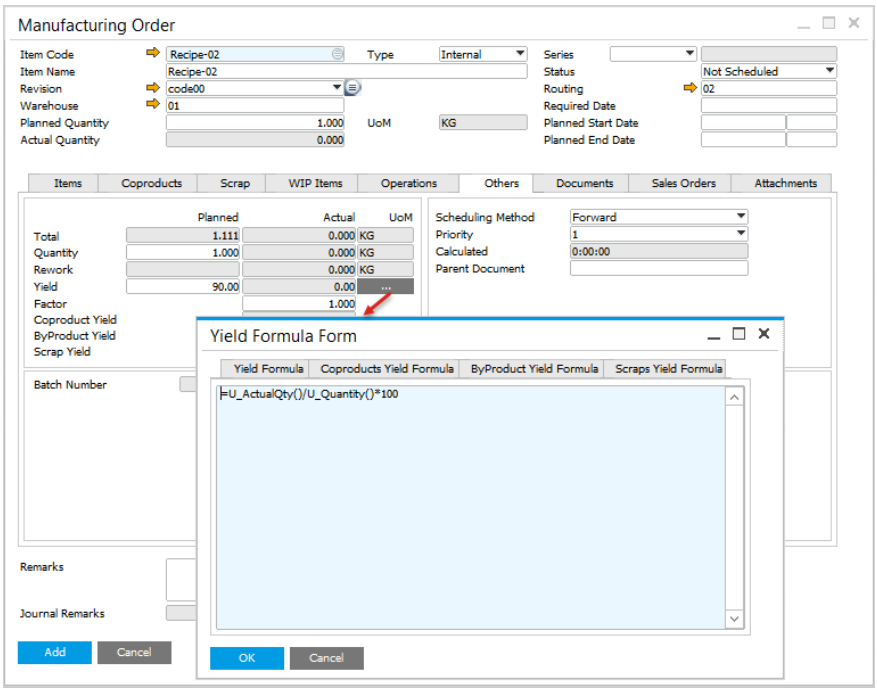


As with standard formula behavior, the standard formula is copied to the Bills of Materials form and can be displayed by clicking the yellow button.

If required the formula can be modified for a specific bill of materials.



The formulas from the Yield Formula form are also copied to the Manufacturing Order, and can be modified if required.



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