Operations

Manufacturing operations are special items that represent the operations in production orders. An operation item is never an ‘Inventory’ item, but can be a ‘Purchase’ item if outsourceable.

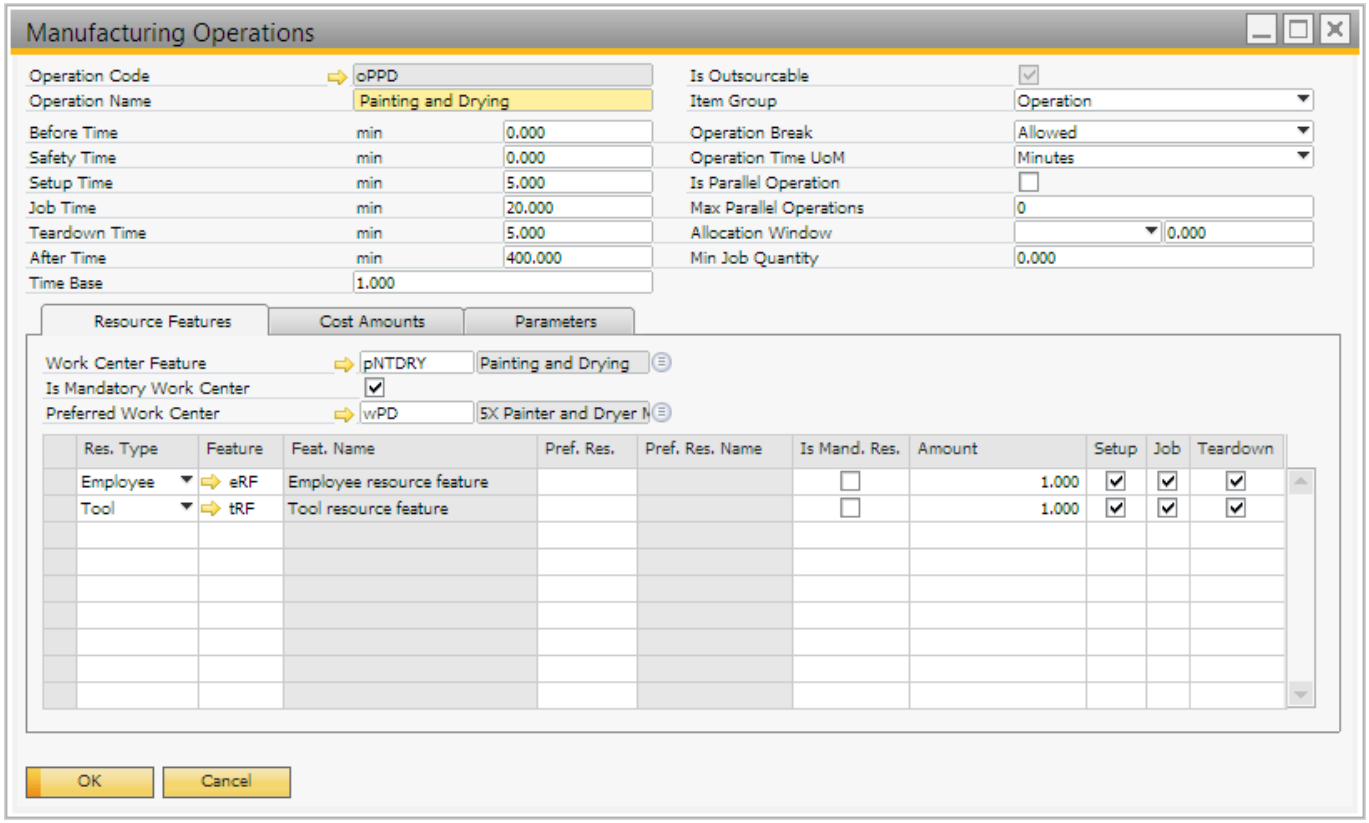
The operation will be more meaningful in the context of a Bill of Material (BoM) or Production Order. All the parameters (except ‘Is Outsourceable’) for an operation can be redefined in a BoM or Production Order.

Manufacturing Operations

On the Manufacturing Operations form the manufacturing details of an operation type item can be defined and new operations type items can be added. New operations should be created from the Manufacturing Operations screen and not directly from the Item Master Data.

Open the form via:

- Production module> Manufacturing operations.
- Right-click menu on the Item Master Data of an operation.



Header

Operation code
The code of the operation item.

Operation name
The name of the operation.

Time Values
The duration each operation step requires, displayed in the selected 'Operation Time UoM'.
The safety, setup, job and teardown time consume the capacity of the work center. Before and after times do not consume work center capacity but the job scheduling logic will take them into account when calculating the beginning of the jobs in the sequence of operations.

- Before time: The duration of the tasks to be done before allocating the work center for the operation. No work center is allocated for the before time period.
- Safety time: Duration of the time buffer. No PDC bookings can be created for the safety time.
- Setup time: Duration of the tasks to be done before the production starts.
- Job time: The actual production time for the amount of units defined in time base.
- Teardown time: The duration of the tasks after the production finished but before the work center is released.
- After time: The duration of the tasks to be done after releasing the work center. The work center is released and available for other operations.

Time Base
The number of the units of the operation the job time refers to.

Is outsourceable? (Y/N)
Indicates whether the operation is outsourceable or not. This option cannot be changed after the operation was created. If the operation is outsourceable the item is set as Purchased Item.

Item Group
The item group the operation belongs to. Item groups with 'Standard' valuation method can be selected. When changing the 'Item Group' either on the Item Master Data or on the Manufacturing Operations form, the 'Item Group' on the other form will be changed too.

Operation break
During manufacturing, an operation can be stopped and restarted or the work center can be changed. With the Operation Break setting the user can define whether these break types are allowed or not.

- Allowed: Intermissions and work center changes are allowed during the operation.
- Denied: No breaks are allowed during the operation.
- Allowed WC: Other operations may get in between the sequence of the operation, but the work center cannot be changed during the operation.
- Allowed NBP: The work center can be changed, but intermissions are not allowed during the operation, therefore other operations cannot get in between the sequence of the operation.
- Allowed WCNBP: Neither the change of the work center, nor intermissions are allowed. It is recommended to use this option instead of the old 'Denied' option.

> The 'Allowed WC', 'Allowed NBP' and 'Allowed WCNBP' operation break types are not allowed in multi-dimensional allocation environment and do not work with parallel operations.

Operation Time UoM
The unit of measurement of the operation time. Possible values: Days, Hours, Minutes, Seconds, Weeks.

Is Parallel Operation (Y/N)
Indicates whether an operation can be performed on multiple work centers at the same time or not. This way the overall duration of an actual manufacturing operation may be much shorter if enough resource capacities are available.

Max Parallel Operations
The maximum number of work centers where the operation can be performed if it is a parallel operation.

Allocation Window
Defines the horizon of the allocation. 'Weeks', 'Days', 'Hours', 'Minutes' and 'Seconds' can be selected as the time scale.

Min Job Quantity
The minimum quantity that must be produced during an allocation.

Resource Features tab

Work Center Feature
Select a work center feature for the operation. This is a mandatory field. The parameter is used extensively by the job scheduler; when the scheduler tries to find work center capacities for an operation, it will search for work centers that have the selected feature for the operation.

Is Mandatory Work Center (Y/N)
Indicates whether the operation must take place on the preferred work center or not.

Preferred Work Center
A preferred work center can be set. Every work center with the feature linked to the operation can be selected.

The work center set here will be preferred during the allocation process. If the work center is free, the operation will be allocated there. If the work center is busy, the system will calculate the delay the usage of this work center could cause. If this delay exceeds the maximum delay set on the *'MRP Max Delay For Pref. WC (s)'* option on Produmex Manufacturing settings, the operation will be allocated to another work center, otherwise the system will schedule it to the preferred work center.

When using the multi-dimensional allocation strategy, employee, tool and constraint requirements can be added to the operation too. Select a resource type then add the feature and a preferred resource. The 'Feature Name' and 'Resource Name' fields will be automatically filled. Only resources linked to the selected feature and features linked to the selected resource type can be added.

Indicate whether the resource is mandatory or not on the *'Is Mand. Res.'* cell.

On the 'Amount' field in an employee row indicate the employee capacity the operation uses. If the Amount is set to one, it means that the operation requires 100% of the employee capacity. Therefore the amount set for an employee cannot be greater than one.

On the amount field of a tool set the needed quantity of the tool during an operation.

Additional resources might not being used during the entire operation. On the Setup, Job and Teardown fields mark that the resource is required in which step of the operation. The setup, job and teardown time of a supplementary resource will be the same as the work center time of the respective step.

Cost Amounts tab

Cost types with parameters can be set on this tab for cost calculation purposes.

Cost Type
Select a 'Cost Type'. Multiple cost type rows can be defined for an operation. Define cost types on the 'Cost Type' form that can be reached via: Production > Cost Calculation > Cost Type.

- Setup Amount: The Setup Amount for the given operation from the cost amounts.
- Job Amount: The Job Amount for the given operation from the cost amounts.
- Teardown Amount: The Teardown Amount for the given operation from the cost amounts.
- Cycle Amount: The Cycle Amount for the given operation from the cost amounts.
- Quantity Amount: The Quantity Amount for the given operation from the cost amounts.
- Fix Amount: The Fix Amount for the given operation from the cost amounts.

For more information about cost calculation please see: Cost and Price Calculations

Parameters tab

When the *'Use Operation Parameters'* setting is enabled on the PDC tab of the Produmex Manufacturing settings, an additional 'Parameter' tab is displayed on the form.

On this tab parameters for shopfloor Quality Controlling can be set. Parameters types can be set up on the *OperationParameterTypes* UDT.

BoM Order Operation Details

Open the form from the Bill of Materials by clicking on the operation icon on the Row type field.

On this form the operation details can be modified and specialized for the particular BoM. The BoM Order Operation Details inherits data from the operation item's Manufacturing Operations form.

Header

Operation code
The code of the operation item.

Operation name
The name of the operation.

Time Values
The duration each operation step requires, displayed in the selected 'Operation Time UoM'.
The safety, setup, job and teardown time consume the capacity of the work center. Before and after times do not consume work center capacity but the job scheduling logic will take them into account when calculating the beginning of the jobs in the sequence of operations.

- Before time: The duration of the tasks to be done before allocating the work center for the operation. No work center is allocated for the before time period.
- Safety time: Duration of the time buffer. No PDC bookings can be created for the safety time.
- Setup time: Duration of the tasks to be done before the production starts.
- Job time: The actual production time for the amount of units defined in time base.
- Teardown time: The duration of the tasks after the production finished but before the work center is released.
- After time: The duration of the tasks to be done after releasing the work center. The work center is released and available for other operations.

Time Base
The number of the units of the operation the job time refers to.

Is outsourceable? (Y/N)
Indicates whether the operation is outsourceable or not. This option cannot be changed after the operation was created. If the operation is outsourceable the item is set as Purchased Item.

Item Group
The item group the operation belongs to. Item groups with 'Standard' valuation method can be selected. When changing the 'Item Group' either on the Item Master Data or on the Manufacturing Operations form, the 'Item Group' on the other form will be changed too.

Operation break
During manufacturing, an operation can be stopped and restarted or the work center can be changed. With the Operation Break setting the user can define whether these break types are allowed or not.

- Allowed: Intermissions and work center changes are allowed during the operation.
- Denied: No breaks are allowed during the operation.
- Allowed WC: Other operations may get in between the sequence of the operation, but the work center cannot be changed during the operation.
- Allowed NBP: The work center can be changed, but intermissions are not allowed during the operation, therefore other operations cannot get in between the sequence of the operation.
- Allowed WCNBP: Neither the change of the work center, nor intermissions are allowed. It is recommended to use this option instead of the old 'Denied' option.

> The 'Allowed WC', 'Allowed NBP' and 'Allowed WCNBP' operation break types are not allowed in multi-dimensional allocation environment and do not work with parallel operations.

Operation Time UoM

The unit of measurement of the operation time. Possible values: Days, Hours, Minutes, Seconds, Weeks.

Is Parallel Operation (Y/N)
Indicates whether an operation can be performed on multiple work centers at the same time or not. This way the overall duration of an actual manufacturing operation may be much shorter if enough resource capacities are available.

Max Parallel Operations
The maximum number of work centers where the operation can be performed if it is a parallel operation.

Allocation Window
Defines the horizon of the allocation. 'Weeks', 'Days', 'Hours', 'Minutes' and 'Seconds' can be selected as the time scale.

Min Job Quantity
The minimum quantity that must be produced during an allocation.

Main Product Code and Name
The item code and name of the main product.

Is Overlapping Operation
Indicates whether the operation can overlap the previous operation or not. When an operation is an overlapping operation, it can be started right after the previous operation is started, otherwise the earliest start date of an operation is the due date of the previous operation.

Overlapping Quantity
The quantity produced after the following overlapping operation can be started.

Resource Requirements tab

Work Center Feature
Select a work center feature for the operation. This is a mandatory field. The parameter is used extensively by the job scheduler; when the scheduler tries to find work center capacities for an operation, it will search for work centers that have the selected feature for the operation.

Is Mandatory Work Center (Y/N)
Indicates whether the operation must take place on the preferred work center or not.

Preferred Work Center
A preferred work center can be set. Every work center with the feature linked to the operation can be selected.

The work center set here will be preferred during the allocation process. If the work center is free, the operation will be allocated there. If the work center is busy, the system will calculate the delay the usage of this work center could cause. If this delay exceeds the maximum delay set on the *'MRP Max Delay For Pref. WC (s)'* option on Produmex Manufacturing settings, the operation will be allocated to

another work center, otherwise the system will schedule it to the preferred work center.

When using the multi-dimensional allocation strategy, employee, tool and constraint requirements can be added to the operation too. Select a resource type then add the feature and a preferred resource. The 'Feature Name' and 'Resource Name' fields will be automatically filled. Only resources linked to the selected feature and features linked to the selected resource type can be added.

Indicate whether the resource is mandatory or not on the *'Is Mand. Res.'* cell.

On the 'Amount' field in an employee row indicate the employee capacity the operation uses. If the Amount is set to one, it means that the operation requires 100% of the employee capacity. Therefore the amount set for an employee cannot be greater than one.

On the amount field of a tool set the needed quantity of the tool during an operation.

Additional resources might not being used during the entire operation. On the Setup, Job and Teardown fields mark that the resource is required in which step of the operation. The setup, job and teardown time of a supplementary resource will be the same as the work center time of the respective step.

Outsourcing tab

Mark the operation as outsourced by ticking the 'Is Outsourced?' box. Add a lead time for the outsourcing on the 'Outsourcing Lead Time' textbox. The time scale of the lead time is in days. If set, this lead time will be taken into account during the scheduling instead of the lead time on the Item Master Data.

An operation can be fully or partially outsourced. Define the non-outsourceable quantity on the 'In House Quantity' field. The default value is the planned quantity unless the *'Null InHouse Quantity for Outsourcing'* is set to true on the Master Data Tab of Produmex Manufacturing settings. If this setting is enabled, the default InHouse quantity is zero.

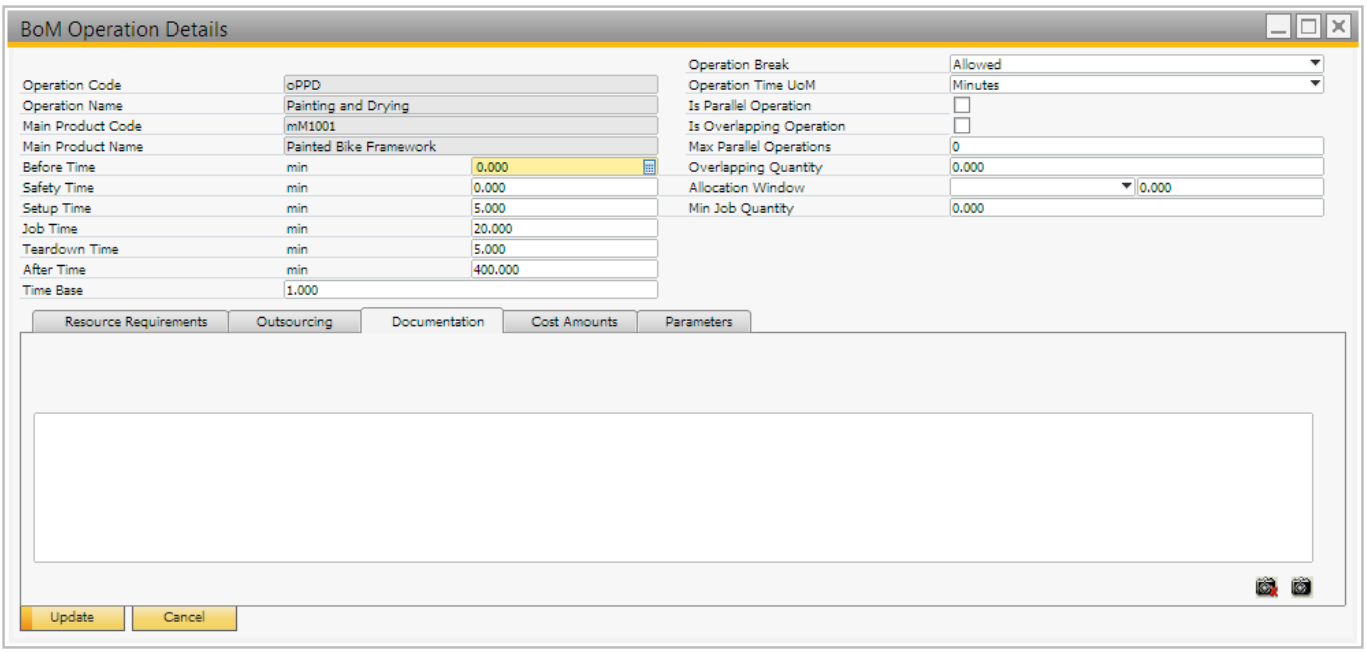
A new UoM for the outsourcing can be defined on the *'Outsourcing UoM'* field. The conversion rate between the inventory UoM and the Outsourcing UoM can be specified on the *'Items Per Outsourcing Unit'* field. The outsourcing UoM can be used when the unit of measurement the sub-contractor uses differs from the UoM the company uses. If an outsourcing UoM is set, it will be the UoM in the purchase order.

Add the potential outsourcing suppliers on the grid:

- *Supplier Code*: Enter the card code of the supplier to the supplier code cell.
- *Supplier Name*: The name of the supplier. The *Supplier Name* will be automatically filled after the *Supplier Code* is entered.
- *Planned Quantity*: The Planned Quantity defines the outsourced quantity. When outsourcing to more than one supplier, the *'Planned Qty'* defines the ratio of the outsourced operation the supplier covers.

Documentation tab

On this tab remarks and images can be added to the operation. Enter the text to the textbox. Click on the camera icon to add an image. Remove the image by clicking on the camera icon with the red x.



Cost Amounts

Cost types with parameters can be set on this tab for cost calculation purposes.

Cost Type
Select a 'Cost Type'. Multiple cost type rows can be defined for an operation. Define cost types on the 'Cost Type' form that can be reached via: Production > Cost Calculation > Cost Type.

- Setup Amount: The Setup Amount for the given operation from the cost amounts.
- Job Amount: The Job Amount for the given operation from the cost amounts.
- Teardown Amount: The Teardown Amount for the given operation from the cost amounts.
- Cycle Amount: The Cycle Amount for the given operation from the cost amounts.
- Quantity Amount: The Quantity Amount for the given operation from the cost amounts.
- Fix Amount: The Fix Amount for the given operation from the cost amounts.

For more information about cost calculation please see: Cost and Price Calculations

Parameters

When the *'Use Operation Parameters'* setting is enabled on the PDC tab of the Produmex Manufacturing settings, an additional 'Parameter' tab is displayed on the form.

On this tab parameters for shopfloor Quality Controlling can be set. Parameters types can be set up on the *OperationParameterTypes* UDT.

Production Order Operation Details

Open the form from the Production order by clicking on the operation icon on the Row type field. On this form the operation details can be modified and specialized further for the particular production order. The form inherits data from the BoM Operation Details.

Header

Operation code
The code of the operation item.

Operation name
The name of the operation.

Time Values
The duration each operation step requires, displayed in the selected 'Operation Time UoM'.
The safety, setup, job and teardown time consume the capacity of the work center. Before and after times do not consume work center capacity but the job scheduling logic will take them into account when calculating the beginning of the jobs in the sequence of operations.

- Before time: The duration of the tasks to be done before allocating the work center for the operation. No work center is allocated for the before time period.
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- Teardown time: The duration of the tasks after the production finished but before the work center is released.
- After time: The duration of the tasks to be done after releasing the work center. The work center is released and available for other operations.

Time Base
The number of the units of the operation the job time refers to.

Is outsourceable? (Y/N)
Indicates whether the operation is outsourceable or not. This option cannot be changed after the operation was created. If the operation is outsourceable the item is set as Purchased Item.

Item Group
The item group the operation belongs to. Item groups with 'Standard' valuation method can be selected. When changing the 'Item Group' either on the Item Master Data or on the Manufacturing Operations form, the 'Item Group' on the other form will be changed too.

Operation break
During manufacturing, an operation can be stopped and restarted or the work center can be changed. With the Operation Break setting the user can define whether these break types are allowed or not.

- Allowed: Intermissions and work center changes are allowed during the operation.
- Denied: No breaks are allowed during the operation.

- Allowed WC: Other operations may get in between the sequence of the operation, but the work center cannot be changed during the operation.
- Allowed NBP: The work center can be changed, but intermissions are not allowed during the operation, therefore other operations cannot get in between the sequence of the operation.
- Allowed WCNBP: Neither the change of the work center, nor intermissions are allowed. It is recommended to use this option instead of the old 'Denied' option.

> The 'Allowed WC', 'Allowed NBP' and 'Allowed WCNBP' operation break types are not allowed in multi-dimensional allocation environment and do not work with parallel operations.

Operation Time UoM
The unit of measurement of the operation time. Possible values: Days, Hours, Minutes, Seconds, Weeks.

Is Parallel Operation (Y/N)
Indicates whether an operation can be performed on multiple work centers at the same time or not. This way the overall duration of an actual manufacturing operation may be much shorter if enough resource capacities are available.

Max Parallel Operations
The maximum number of work centers where the operation can be performed if it is a parallel operation.

Allocation Window
Defines the horizon of the allocation. 'Weeks', 'Days', 'Hours', 'Minutes' and 'Seconds' can be selected as the time scale.

Min Job Quantity
The minimum quantity that must be produced during an allocation.

Is Overlapping Operation
Indicates whether the operation can overlap the previous operation or not. When an operation is an overlapping operation, it can be started right after the previous operation is started, otherwise the earliest start date of an operation is the due date of the previous operation.

Overlapping Quantity
The quantity produced after the following overlapping operation can be started.

Planned Quantity
The planned quantity. *Non-modifiable field.*

Completed Quantity
The completed quantity. *Non-modifiable field.*

Rejected Quantity

The rejected quantity. *Non-modifiable field.*

Message
Operation error messages are displayed on this field. Double-click on the field to see further details.

Is Pinned
Tick the box to pin down the operation to a start date and time. The start date and time can be specified on the 'Pinned Start Date' and the 'Pinned Start Time' fields. When an operation is pinned, all other operations in the same production order are also shifted (either backward or forward) around the pinned operation.
Please note: The allocation strategy of production orders with pinned operations will be automatically set to 'Forward from Earliest Date'.

Resource Requirements

Work Center Feature
Select a work center feature for the operation. This is a mandatory field. The parameter is used extensively by the job scheduler; when the scheduler tries to find work center capacities for an operation, it will search for work centers that have the selected feature for the operation.

Is Mandatory Work Center (Y/N)
Indicates whether the operation must take place on the preferred work center or not.

Preferred Work Center
A preferred work center can be set. Every work center with the feature linked to the operation can be selected.

The work center set here will be preferred during the allocation process. If the work center is free, the operation will be allocated there. If the work center is busy, the system will calculate the delay the usage of this work center could cause. If this delay exceeds the maximum delay set on the *'MRP Max Delay For Pref. WC (s)'* option on Produmex Manufacturing settings, the operation will be allocated to another work center, otherwise the system will schedule it to the preferred work center.

When using the multi-dimensional allocation strategy, employee, tool and constraint requirements can be added to the operation too. Select a resource type then add the feature and a preferred resource. The 'Feature Name' and 'Resource Name' fields will be automatically filled. Only resources linked to the selected feature and features linked to the selected resource type can be added.

Indicate whether the resource is mandatory or not on the *'Is Mand. Res.'* cell.

On the 'Amount' field in an employee row indicate the employee capacity the operation uses. If the Amount is set to one, it means that the operation requires 100% of the employee capacity. Therefore the amount set for an employee cannot be greater than one.

On the amount field of a tool set the needed quantity of the tool during an operation.

Additional resources might not being used during the entire operation. On the Setup, Job and Teardown fields mark that the resource is required in which step of the operation. The setup, job and teardown time of a supplementary resource will be the same as the work center time of the respective step.

Dates

The planning dates of the operation can be overviewed on this tab. These values cannot be modified on the form.

Outsourcing

Mark the operation as outsourced by ticking the 'Is Outsourced?' box. Add a lead time for the outsourcing on the 'Outsourcing Lead Time' textbox. The time scale of the lead time is in days. If set, this lead time will be taken into account during the scheduling instead of the lead time on the Item Master Data.

An operation can be fully or partially outsourced. Define the non-outsourceable quantity on the 'In House Quantity' field. The default value is the planned quantity unless the *'Null InHouse Quantity for Outsourcing'* is set to true on the Master Data Tab of Produmex Manufacturing settings. If this setting is enabled, the default InHouse quantity is zero.

A new UoM for the outsourcing can be defined on the *'Outsourcing UoM'* field. The conversion rate between the inventory UoM and the Outsourcing UoM can be specified on the *'Items Per Outsourcing Unit'* field. The outsourcing UoM can be used when the unit of measurement the sub-contractor uses differs from the UoM the company uses. If an outsourcing UoM is set, it will be the UoM in the purchase order.

Add the potential outsourcing suppliers on the grid:

- *Supplier Code*: Enter the card code of the supplier to the supplier code cell.
- *Supplier Name*: The name of the supplier. The *Supplier Name* will be automatically filled after the *Supplier Code* is entered.
- *Planned Quantity*: The Planned Quantity defines the outsourced quantity. When outsourcing to more than one supplier, the *'Planned Qty'* defines the ratio of the outsourced operation the supplier covers.

On the *'In House Ratio'* field the ratio of the in house production is displayed. System calculated value, the user cannot modify it.
The supplier grid is extended with information regarding the outsourcing order. Additional columns:

- Supplier Ratio: The ratio of the supplier.
- Quantity in Order: The total ordered quantity.
- Quantity Received: The sum of the received quantity.
- Quantity Quoted: The quoted quantity.

Outsourcing purchase orders and purchase quotations are listed on an additional grid. These values are only form information, the user cannot modify them.

Use the 'New Purchase order' or 'New purchase quotations' buttons to create purchase orders or

quotations. For more information about the outsourcing process please see: Outsourcing

PDC Bookings

On this tab the production bookings from the terminal can be overviewed. Select a Time UoM for display.

Planned Job/ Planned Setup/ Planned Teardown
The time planned for each manufacturing step.

Booked Job/ Booked Setup/ Booked Teardown
The total booked time for each manufacturing step.

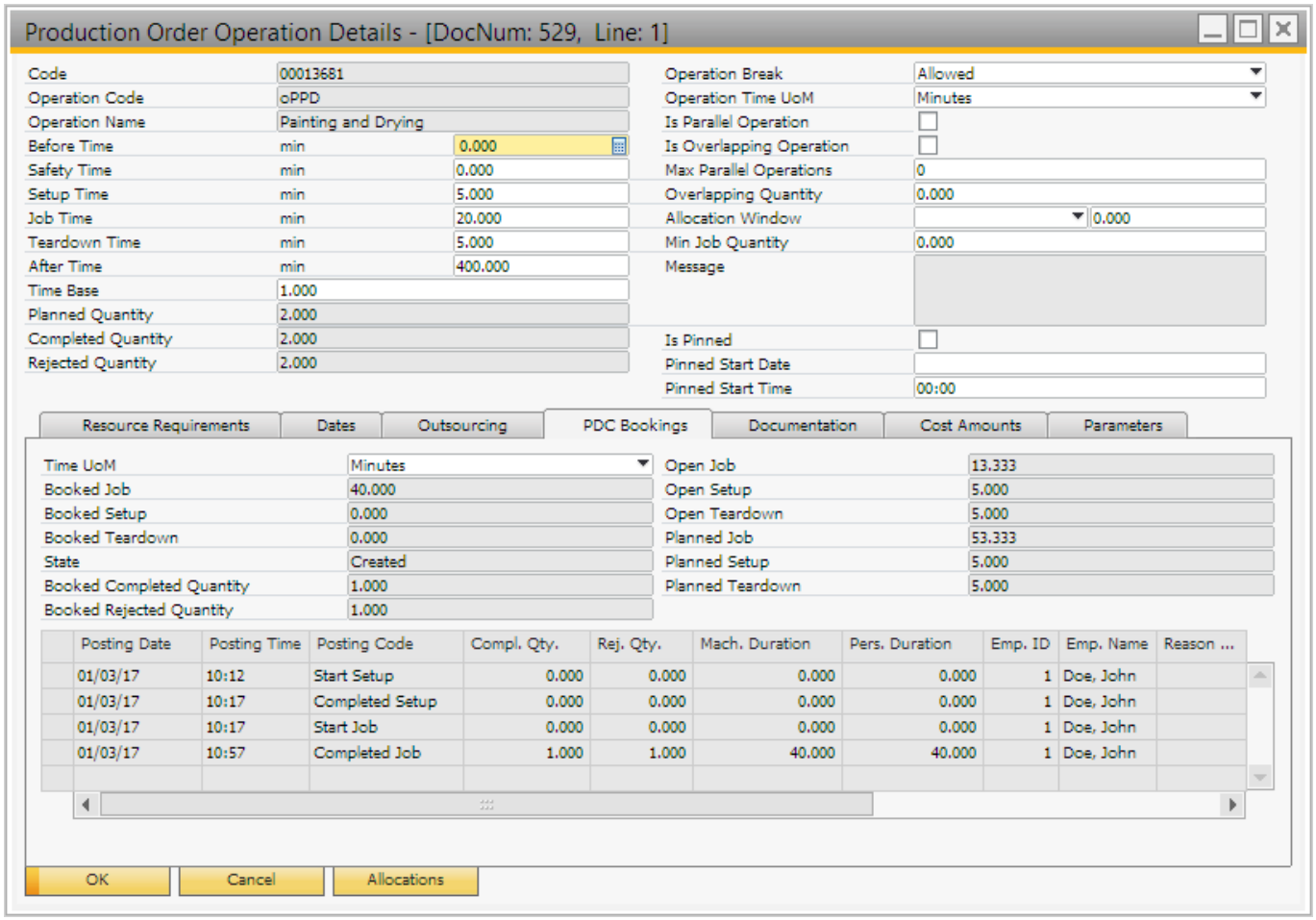
Open Job/ Open Setup/ Open Teardown
The open time for each manufacturing step.

State
The current status of the operation. Possible values: Created/ Started/ Finished.
When a production order is created, the operation status is set to *Created* by default. The operation status is changed to *Started* when a start PDC booking is processed for the operation. The status is changed to *Finished* in the following scenarios:

- When the employee marks the operation as 'Completed' during a Stop job booking on the terminal
- When a Close PDC booking is performed on the Simple PDC Shop-Floor Wizard or on the PDC Bookings Office Terminal

Booked Completed Quantity
The total booked quantity.

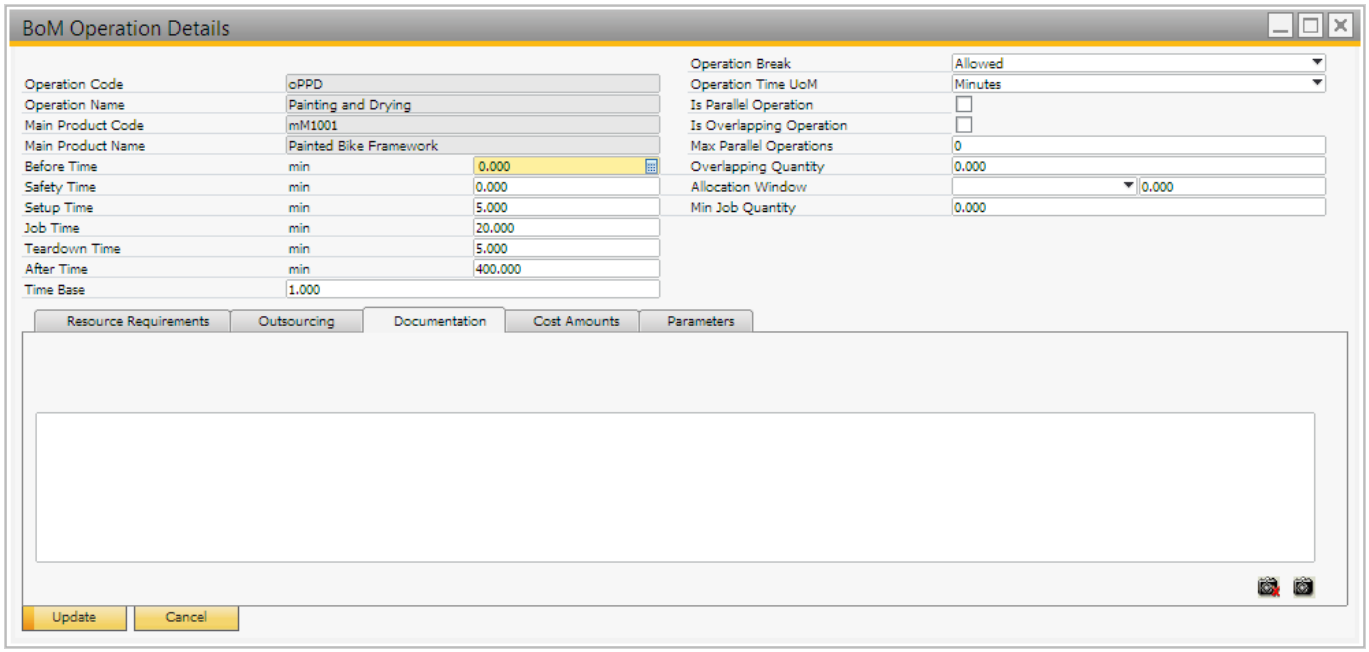
Booked Rejected Quantity
The total rejected quantity.



On the grid booking entries are listed.

Documentation

On this tab remarks and images can be added to the operation. Enter the text to the textbox. Click on the camera icon to add an image. Remove the image by clicking on the camera icon with the red x.



Cost Amounts

Cost types with parameters can be set on this tab for cost calculation purposes.

Cost Type
Select a 'Cost Type'. Multiple cost type rows can be defined for an operation. Define cost types on the 'Cost Type' form that can be reached via: Production > Cost Calculation > Cost Type.

- Setup Amount: The Setup Amount for the given operation from the cost amounts.
- Job Amount: The Job Amount for the given operation from the cost amounts.
- Teardown Amount: The Teardown Amount for the given operation from the cost amounts.
- Cycle Amount: The Cycle Amount for the given operation from the cost amounts.
- Quantity Amount: The Quantity Amount for the given operation from the cost amounts.
- Fix Amount: The Fix Amount for the given operation from the cost amounts.

For more information about cost calculation please see: Cost and Price Calculations

Parameters tab

When the *'Use Operation Parameters'* setting is enabled on the PDC tab of the Produmex Manufacturing settings, an additional 'Parameter' tab is displayed on the form.

On this tab parameters for shopfloor Quality Controlling can be set. Parameters types can be set up on the *OperationParameterTypes* UDT.

Click on the 'Update' button to apply the changes or click on the 'Cancel' button to close the form without any adjustments.

If the production order is 'Released' an additional 'Allocations' button is displayed on the form. Click

on this button to allocate work centers for the operation. The allocated work centers will be shown on the opening ‘Work Center Allocations’ form.