



# Infor LN Manufacturing User Guide for Repetitive Manufacturing

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## About this Guide

### Document summary

#### How to read this document

This document was assembled from online Help topics. As a result, references to other sections in the manual are presented as shown in the following example:

To locate the referred section, please refer to the Table of Contents or use the Index at the end of the document.

Underlined terms indicate a link to a glossary definition. If you view this document online, you can click the underlined term to go to the glossary definition at the end of the document.

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## Chapter 1: Introduction

### Repetitive Manufacturing (RPT)

Repetitive Manufacturing is used for the production of standard products that are produced in large quantities in a continuous flow. RPT provides a simplified procedure for the production orders in Job Shop Control.

This type of manufacturing is typically used in these areas:

- Tier 1 and tier 2 automotive, either in stand-alone manufacturing, or as a supply line for larger assembly lines.
- The production of household appliances and consumer electronics.
- Medical supplies and semi-processed foods.
- Any manufacturing environment or parts of manufacturing environment with a continuous and steady demand.

Products suited for repetitive manufacturing have these characteristics:

- Standard (not customized)
- Inexpensive
- A limited number of variants
- May be complex
- A flat bill of material

The product of repetitive manufacture can be a sellable end-item, or a sub-assembly for use in a different manufacture process.

Repetitive products may have started out as items produced in job shop, with the method of production changing due to changes in demand or the number of variants making production by different means more effective.

### Production Model

Repetitive manufacturing is used when the production process is a continuous, and steady stream of demand. This demand must be met using minimal administrative effort, but with real-time insight and control of the process. In a repetitive manufacturing environment, products are manufactured based on predefined configurations that are specified in *production models*.

A production model contains all master data required for the production of an item in a specific *work cell*. An end item can have multiple models defined for manufacture, to differentiate between these models each has a unique key.

A production model is revision controlled, and must be activated by setting the status to **Approved** before production can start. You can make changes to a production model by copying an existing model. The copied model will have the status **New**, becoming the new revision upon activation and approval. Old production models are deactivated by setting the status to **Expired**.

**Note:** You can copy a production model to another item or another *work cell*.

A production model contains this data:

- Production model code

A production model can be used for planning and costing purposes. When multiple models for the production of a repetitive item are used, you must designate which models are used for this purpose. Note: Only active production models can be used for planning and production. The production model contains a calendar that is defaulted from the work cell that is used by the scheduling engine to manage production. A production model can be linked to a calendar.
- Applicable item and the dedicated work cell

Along with the item data, the warehouse where completed manufactured items are stored.

  - Select the item from the Item - Production (tiipd0101m000) session.
  - Select the work cell to be used for manufacturing from the Work Cells (tirpt0140m000) session. For each work cell, a production process is defined based on the work cell layout, you can manage this process in the Production Process (tirpt2110m000) session.
  - Select the type of production model. Note: For a multi-product production model various restrictions apply.
- Current revision

A revision number is mandatory for a production model, and is used to track the changes to the model. The revision number is generated automatically.
- Production rate

The time required for one cycle of production for one item, or production rate is stored in the production model.
- Run quantity

The order quantities used for material planning outside the scheduling horizon and order lead times used for material planning outside the scheduling horizon are maintained in the production model. The optimal, maximum and minimum run quantities that are used for planning and during the creation of the production run schedule are also maintained.
- Man capacity

Expressed in the number of shifts and man-hours allocation which are stored with the production model
- Material list

You can define the material list for a production model in the Materials (tirpt2120m000) session. The list contains the materials required for the production of the specific item. It is used for materials planning, the supplying of the work cell and material backflushing. The material list is date effective, and when updated a new revision of the production model is defined.

A production model *list of materials* defines the required quantities of each material, and the expected scrap percentage, the units of measure, and supply warehouses responsible for the materials. It is possible to define multiple supply lines for the same material, so each line has a position number.

Materials are supplied to the designated *point of usage* warehouse for the consolidated material demand for the active schedule lines in a specific period accounting, for the *safety stock* in the point of usage.

Each material line is linked to a *point of usage* that requires specific material for production. The materials are supplied from a warehouse to the point-of-usage independent from the material demand. The replenishment is based on a Kanban card.

### Multi-product production model

To use multi-product production models:

- The Multi-Product Production check box in the **Repetitive Manufacturing Parameters (tirpt0100m000)** session must be selected.

You can define a production model with multiple end products that are produced in different quantities. A list of products is added to the single-item model containing the information about the different items the model is set up for, and their quantities.

In this type of production model the main tool used for production is the information carrier to identify the model for planning and costing. In the Work List (tirpt4602m000) session, the number of realized cycles of the tool is reported instead of the quantity of item completed as with a single-item model.

#### Note:

- The planning, scheduling and costing is done on the end product, not the tool.
- Work station based reporting and transfer quantity data are not available in the multi-product repetitive environment.
- You cannot *reject* produced items in the multi-product repetitive environment.
- Process inspections are not possible in a multi-product repetitive environment.

## Repetitive Production Scheduling

A production schedule is built from multiple runs of schedule lines, based on the *item order plan* in Enterprise Planning. The original start date and *end item* of all the schedules lines from one run is the same. The runs are distributed over the available *work cells* based on the work cell's calendar in combination with the need by date of the schedule line.

Depending on the settings in the Repetitive Manufacturing Parameters (tirpt0100m000) session, scheduling can be fully automated, or manually adjusted.

Repetitive manufacturing uses schedule lines to plan manufacture of items. Planning and scheduling happens on several levels to manage all aspects of repetitive manufacture:

- Material planning and *lead time* is required. In a *repetitive manufacturing* environment, *material planning* is a combination of an infinite planning and a finite scheduling. The main objective of the planning is material availability.



The main objective of scheduling is an efficient production schedule. Material planning calculations are based on the item ordering data. Materials are supplied dependent on the consolidated material demand of the activated production schedule lines in a specific time period. *Safety stock* at the *point of usage* is considered when calculating demand, with the materials being supplied directly from the central warehouse to the *work cell* based on the run schedule.

As reporting item completion happens as often as possible in repetitive manufacturing, you must define the triggers for the backflushing of material in the Repetitive Manufacturing Parameters (tirpt0100m000) session.

- To optimize production efficiency and create a production run schedule. The scheduling horizon is defined in the item planning parameters as a number of days. For demand that is outside the scheduling horizon, infinite material planning is used. For demand that falls within the scheduling horizon, production scheduling is used based on the data in the related production model.
- Sequencing is used the production to match the delivery sequence to minimizing the warehouse handling.

### Production scheduling

After an item order plan is generated in Enterprise Planning a production schedule can be generated in the Repetitive Manufacturing planning engine.

Depending of the schedule horizon of the item order plan, two different types of supply are generated.

- If the supply is within the schedule horizon new or changed run schedule lines are created.
- If the supply is outside the schedule horizon and within the order horizon new or changed planned orders are created.

The list of materials, which is defined in the *production model* of the *repetitive item* that is planned, is used to generate the dependent demand for the materials.

Exception messages are used to report any errors that occur during generation of production run schedule. Error in the planning, rescheduling, and cancellation messages for **Active** run schedule lines are generated when conflict in planning must be resolved. In the Work Cell Planning (tirpt4102m210) session it is possible to manually adjust the generated production schedule: add and change new schedule lines, and adjust the status of existing lines. After rescheduling is completed, the production run schedule is rebuilt with the changes you specified from the input start date based on the availability of the related *work cell*.

After the schedule is complete, schedule lines must be released to trigger the start of production. This can be done either in the Release Production Schedule Lines (tirpt4202m100), Work Cell Group Planning (tirpt4602m200) or the Work Cell Planning (tirpt4102m210) sessions by selecting the relevant schedule lines and using the relevant command.

Once the schedule lines are released, production can begin.

### Example

Item A is a manufactured item.

To produce item A, one item B is required.

Item B is a purchased item.

There are several independent demands for item A.

- Planned production orders are generated in Enterprise Planning based on the item ordering date.

In this example two planned production orders are generated because:

- The demands are cumulated within the order interval.
- The quantity is based on the order increment (1\*1000)
- The start date of the planned order is based on the *lead time* and the availability in the calendar linked to the required *work cell*.
- If the start date of the planned order is within the schedule horizon, the planned order is replaced by a schedule based on the date in the item's *production model*.
- For item A, there are four planned schedule lines with the following characteristics:
  - 250 pieces per line, this is the maximum line quantity defined in the production model.
  - The lines are scheduled forward from the start date of the planned order.
  - The work cell responsible for production. Dependent on the availability and the existing work cell load, the schedule lines can be spread across several work cells.
- There are six dependent demands for item B.
- Planned purchase orders based on item B's ordering date are generated in Enterprise Planning.
- To complete the order for item A, three planned purchase orders are generated
  - To cumulate demands within the order interval.
  - The quantity is based on the order increment (500).
  - The start date of the planned order is based on the lead time on the item purchase date.

## Displaying data in Item/Channel Planning Chart

The following chart types are available:

- Demand chart
- Supply chart
- Inventory chart
- Demand, supply, and inventory chart
- Cost chart
- Cash flow chart
- Cost and cash flow chart

To display data:

- 1** Specify a plan company, a scenario, and a plan level.
- 2** Select a range of plan items.
- 3** Specify a channel (optional). If you specify a channel, LN displays a channel chart; otherwise, an item chart is shown.
- 4** Specify whether the values shown on the chart must be aggregated for the selected items or channels, and whether the values shown must be cumulative.
- 5** Specify the start date, the period length, and the maximum number of periods for the chart.
- 6** Choose a chart type
- 7** Click **Show Chart**

**Note:** To draw the chart, LN redivides the scenario into time periods, starting from the scenario's start date, and according to the value of the **Number of Periods in View** field. Therefore, the actual start date used for the chart can be earlier than the requested start date entered.

### Determining chart periods: example

Scenario start date: March 1 Scenario finish date: April 30 Chart start date: March 20 Period length: 14 days

The scenario is divided into the following chart periods:

Period	From	To
1	March 1	March 14
2	March 15	March 28
3	March 29	April 12
4	April 13	April 27
5	April 28	April 30

The requested start date for the chart is in period 2. Therefore, LN creates a chart that starts at the beginning of period 2, that is, on March 15.

This example shows that the last period can actually be shorter than the normal period length.

### If you cannot get the chart to work

The Help below is written for WindowsNT users. If your computer uses another operating system, the same principles apply, but the directory or folder names must be altered accordingly.

You must have the ERP Graphics program correctly installed on your computer before you can use this session:

- The GRAPHS32.OCX file must be in the C:\WINNT\Baan\bin folder (directory)
- That folder must be in PATH of your user variable settings (on the Environment tab of the System folder of the Control Panel).
- The GRAPHS32.OCX file must not also be in another folder on your computer. If you have previously used an older version of Baan Windows it might be in the C:\WINNT\System32 folder. In that case you must rename it (to GRAPHS32.OCX.bak, for instance), and you must also rename all the DLL files in that folder which have the same date as the GRAPHS32.OCX file.

## Example of a weighted average of the inventory level

The average projected inventory of a *plan item* is one of the performance indicators in the Resource Analysis and Optimization module of Enterprise Planning. LN computes it as a weighted average of the average inventory levels found for the various plan periods. The average is a weighted average in that it takes the length of each plan period into account.

**Example**

Inventory on hand = 10

Plan period	1	2	3
Length of plan period (days)	2	2	5
Projected (end) inventory	20	30	99
Average inventory level	15	25	64.5

In this example, the weighted average inventory level for all plan periods is computed as follows:

$$\frac{(15 \times 2) + (25 \times 2) + (64.5 \times 5)}{2 + 2 + 5} = \frac{402.5}{9} = 44.72$$

## Chapter 2: Repetitive Set-up

### Work Cell

A work cell is designed for the dedicated production of an item or group of items. Work stations are machines, work benches, or inspection points that are always linked to a work cell. A work cell, functions as a work center with a single manufacturing department type to handle hours and costs.

#### Work cell set up

To define a work cell in the Work Cells (tirpt0140m000) session, the following data is required:

- The address of the work center.
- The work stations of the work cell and the positions in relation to each other. A work cell consists of at least one work station. The stations are used to describe the lay-out of the work cell, and can be a machine, work bench or inspection point. Work stations are not interchangeable between work cells.

Work stations are defined in the Work Stations (tirpt0110m200) sessions. For each work station you must define:

- The description of the machine, tool, or workbench that is the work station.
- If the work station is a count point.
- The related point-of-usage warehouse.
- If the work station is an inspection point.
- If additional tools are used.
- A point of usage is a warehouse is linked to a specific work station where materials required for a part of the production are stored. This can only be a physical location close to the work station.
- The default *calendar code* and *availability type* combination, containing the production hours for the specific work cell.
- The man hours available to the work cell.

#### Repair work centers

*Repair cells* are a specific type of work cell dedicated to the repair of rejected items. The main difference with a standard work cell is the lack of work stations. Each repair cell is dedicated to the repairs of items manufactured from a *production model* in a specific *work cell*. You can set up repair cells in the Repair Cells (tirpt0140m100) session.

You can send items *rejected* during an in progress inspection, to a repair cell for repairs after which they can be either returned to the schedule line, or sent to the warehouse if the schedule line was reported completed.

#### Note:

- The repair *lead time* of the repair cell affects the completion date for the schedule line where the rejected items originated.
- To configure and manage repair cells, the Repair Process check box in the **Repetitive Manufacturing Parameters (tirpt0100m000)** session must be selected.

## Work Cell setup

*Repetitive manufacturing* uses work cells to manufacture products.

You can define and manage work cells in the Work Cells (tirpt0140m000) session.

- 1** Specify work cell ID  
Specify a *work cell* ID.
- 2** Specify labor resources needed  
Specify the number of operators required for the work cell.
- 3** Select the operation rate code  
Specify the work cell *operation rate code* from the Operation Rate Codes (ticpr0150m000) session.
- 4** Select planning group  
Select the *plan group* to which the work cell is linked from the Work Cell Plan Groups (tirpt0142m000) session.
- 5** Select work cell address  
Select the work cell location from the Addresses (tccom4530m000) session.
- 6** Select production department  
Select the *production department* to which the work cell belongs to from the Production Departments (tirou2100m000) session.
- 7** Select employee hours  
Select the employees for the work cell from the Employees - People (bpmdm0101m000) session.
- 8** Specify the calendar  
To define a *calendar* for the work cell:
  - Select the *calendar code* from the Calendar Code (tcccp0110m000) session.
  - Select the *availability type* from the Calendar Availability Types (tcccp0150m000) session.
- 9** Link repair cell  
If the repair of a rejected product is possible during manufacturing, a *repair cell* can be linked to the work cell. You can define repair cells in the Repair Cells (tirpt0140m100) session.
- 10** Select detailed reporting  
If detailed reporting is required during the manufacture process, you can select the Report on Work Stations check box.  
  
Note: The Report on Work Stations check box must be selected in the **Repetitive Manufacturing Parameters (tirpt0100m000)** session to enable this option.

**11 Select work stations**

Select the work stations that make up the work cell from the Work Stations (tirpt0110m200) session.

## Production Model Control Setup

*A production model contains the information required to manufacture products in repetitive manufacturing.*

**1 Specify the item**

Select the item for which the production model is generated using the Item - Production (tiipd0101m000) session.

**2 Specify the work cell**

Select the work cell responsible for the manufacture of the product using the Work Cells (tirpt0140m000) session.

**3 Specify the number group**

Select the number group the production model uses using the First Free Numbers (tcmcs0150m000) session.

**4 Select the product model type****Single-Product**

- Production model type that manufactured a single end product.

- **Multi-Product**

Production model type that can manufacture two different end products in different quantities.

**5 Specify the effective and expiry dates**

Specify the period the production model is active.

**6 Specify use for planning/use for costing**

While several production models may be in use at the same time only one can be used for planning and costing purposes. The Use for Planning and Use for Costing check boxes are used to select the production model for these purposes.

Note: These check boxes can only be selected for one production model at a time.

**7 Specify detailed reporting**

If detailed reporting is required during the manufacturing process, you can select the Report on Work Stations check box.

Note: The Report on Work Stations check box must be selected in the **Repetitive Manufacturing Parameters (tirpt0100m000)** session for this option to be available.

**8 Define production process**

Define the production process for the model in the Production Process (tirpt2110m000) session.

**9 Define list of materials**

Define the list of materials needed to manufacture the product in the Materials (tirpt2120m000) session.

## Production Model Planning Setup

The planning tab of a *production model* contains the information required for planning, scheduling and completion of the production schedules defined.

- 1** Specify order plan quantity and lead time  
Specify the plan quantity and *lead time* that Enterprise Planning can use to *lot size* and plan the planned production schedules.
- 2** Check the production schedule horizon  
The Horizon field is defaulted from the Items - Planning (cprpd1100m000) session.
- 3** Specify the receiving warehouse  
Select the warehouse to which completed product is delivered from the Warehouses (tcmcs0503m000) session.
- 4** Specify the Minimal, maximal and optimal run quantity  
These quantity restrictions are used in the optimizing of the production schedules.
- 5** Specify the schedule line quantity  
Specify the total quantity of the schedule line.
- 6** Specify the transfer quantity  
Often end products are only shipped to the receiving warehouse when a container is full. The transfer quantity is the quantity required before shipping.
- 7** Specify rate and rate unit  
Specify the rate in hours or minutes at which products are manufactured.
- 8** Specify the labor recourse  
Define the number of employees required for each *work cell* for the manufacture of the *repetitive item*.

## Production Model Reject Setup

The repair tab of a *production model* contains the information required to manage rejected product in the production model.

- 1** Specify order plan quantity and lead time  
If the Repair Process check box in the **Repetitive Manufacturing Parameters (tirpt0100m000)** session is selected, you can select a *repair cell* from the Repair Cells (tirpt0140m100) session.
- 2** Specify the repair lead time  
Specify the *lead time* for the selected repair cell.  
Note: The repair lead time is only applicable when the Repair Process check box is selected in the **Repetitive Manufacturing Parameters (tirpt0100m000)** session.
- 3** Specify the quarantine warehouse and location



Select the warehouse in which the quarantined items are stored using the Warehouses (whwmd2500m000) session.

The designation of the quarantine warehouse is defaulted from the Receiving Warehouse field, but does not have to be the same. Unless you manually specify a different warehouse for quarantine the receiving warehouse is also used for quarantine.

The quarantine location is a part of the warehouse, defined in the Warehouses (whwmd2500m000) session, specifically assigned to store quarantined items.

## Chapter 3: Repetitive Operation

### Repetitive Manufacturing Shop Floor

A repetitive production environment consists of the following elements:

- *Production department*  
Grouping work centers and work cells, in the same way as an assembly line groups line stations and buffers, this entity is only present in the logistical hierarchy. The costing and financials of the linked work centers and cells are directly linked to the enterprise unit the production department is linked to.  
A production department has:
  - A calendar
  - Anonymous labor resources (the backflush employee)
  - A calculation office
- *Work cell*  
Each work cell is dedicated to the production of an item or a group of items, and consists of at least one work station. A work station is a machine, work bench, or an inspection point and is always lined to a work cell. Work stations are not interchangeable between cells.
- *Calendar*  
In a repetitive manufacture environment, the utilization of the work cell is an important performance indicator. Calendars provide an insight into the availability of work cells and labor resources for specified periods.

### Progress Reporting in Repetitive Manufacturing

Progress reporting in *repetitive manufacturing* is done using these sessions:

- Work List (tirpt4602m000)
- Report Shift (tirpt4636m200)

#### Work list reporting

Reporting from the Work List (tirpt4602m000) session is done during a *shift*, in 'real time'. You can configure the **Work List (tirpt4602m000)** session to accommodate your preferred procedures using the Work List Settings (tirpt0141m000) session; you can define parameters for schedule line completion, quantity reporting and rejects processing.

After you specify the *work cell*, the current shift is selected and the production schedule lines for this time period are shown. You can view the status, due date, start and end dates and quantities of items for each line.

You can maintain completed and rejected quantities in the Report/Progress/Inventory part of the **Work List (tirpt4602m000)** session by reporting additional quantities completed on the selected schedule line. Every time a quantity is reported completed on a schedule line, the bookings for the shift are automatically updated to the work cell cost document.

During a shift the actual work cell hours are calculated by LN based on the work cell status. The labor hours are based on the quantities reported completed in combination with the labor resources and TAKT time defined in the *production model*. After all quantities are booked, you can report a schedule line complete.

### Shift reporting in Repetitive Manufacturing

The Report Shift (tirpt4636m200) session is used to manage and report the final results at the end of each shift.

In this session you have the option to amend preliminary bookings from the **Work List (tirpt4602m000)** session. If all data is correct, you can complete the shift, and update the related cost document.

You report a shift completed by specifying a work cell and selecting the applicable shift. Once the shift is selected, an overview of the estimated work cell hours, labor hours, and quantities are displayed based on the production schedule lines planned for the shift along with the quantities and hours already booked.

Set-up, run, and down times can be reported using the options available in the **Work List (tirpt4602m000)** session, or calculated based on the quantities reported. The time booked may be less than the time available for the shift. This may occur due to booking discrepancies and can be corrected by the shift supervisor before the shift is reported complete after booking the set-up time and down time for the work cell.

If the hours are still less than the shift time after correction, the remainder of available hours is booked as wait time. Labor hours are booked similarly, however the exception is that the wait time for labor hours must be entered manually by the shift supervisor.

When a shift is closed, the related work cell cost documents can also be closed.

#### Note:

- A shift may contain multiple bookings, for example if backflushing occurs for each transport quantity the quantity, completed is booked every time the transport quantity is reached.
- Hours are books as generic labor for the work cell, not for each employee.
- If additional material quantities are used, you must manually book the quantities to the *point of usage*, that is linked to the material in the work cell cost document.

### Work cell cost document reporting

A work cell cost document stores the cumulative results for a specific work cell over a period of time. These actions lead to bookings:

- Reporting end item quantities completed
- Reporting end item quantities rejected
- Report labor hours and machine hours
- Backflushing materials
- Reporting additional materials directly on the work cell cost document.

Once the period specified in the cost documented has past, the document can be closed. You can use the Close Cost Document (tirpt7201m100) session to select the cost documents you want to report closed.

### Work station progress reporting

When additional detail is required in progress reporting, you can implement reporting for each work station. You can report completed and rejected quantities for each work station if the following parameters are selected:

- The Report on Work Stations check box in the **Repetitive Manufacturing Parameters (tirpt0100m000)** session must be selected.
- The Report on Work Stations check box selected in the **Production Model (tirpt2100m100)** session is selected.

If the previous parameters are selected for the production model, these options are available:

- Work station is count point  
If the Work Station Is Count Point check box in the **Schedule Line Work Stations (tirpt4111m000)** session is selected during scheduling, quantities of product completed and rejected are reported based on the active schedule lines of the selected work station. Reporting quantities rejected on a count point leads to an update of the work cell schedule line.
- Work station is inspection point  
Each inspection point includes an inspection schedule defined based on the specified inspection protocol. There are two quality inspections option for Repetitive Manufacture:
  - A basic in-process inspection protocol  
The process inspection protocol is similar to the process variables functionality in Job Shop Control. You can set up inspections by specifying process variables in the Process Variables (tirpt4112m000) session, and view the results in the Inspection Results (tirpt4112m100) session.
  - An item inspection protocol using the Quality Management module  
Quality

**Note:** The work cell layout must accommodate reporting for each work station.

## Chapter 4: Repetitive Analysis

### O.E.E. calculation

A method of calculating the overall effectiveness of a production environment, you can use to measure and optimize the efficiency of both individual machines and whole plants.

You can measure, compare and contrast the overall effectiveness of individual or groups of identical machines performing a similar function.

#### Example

Three different schedules produce three different parts over an eight hour shift that includes two ten minute breaks and a five minute hand over period.

#### Shift Data

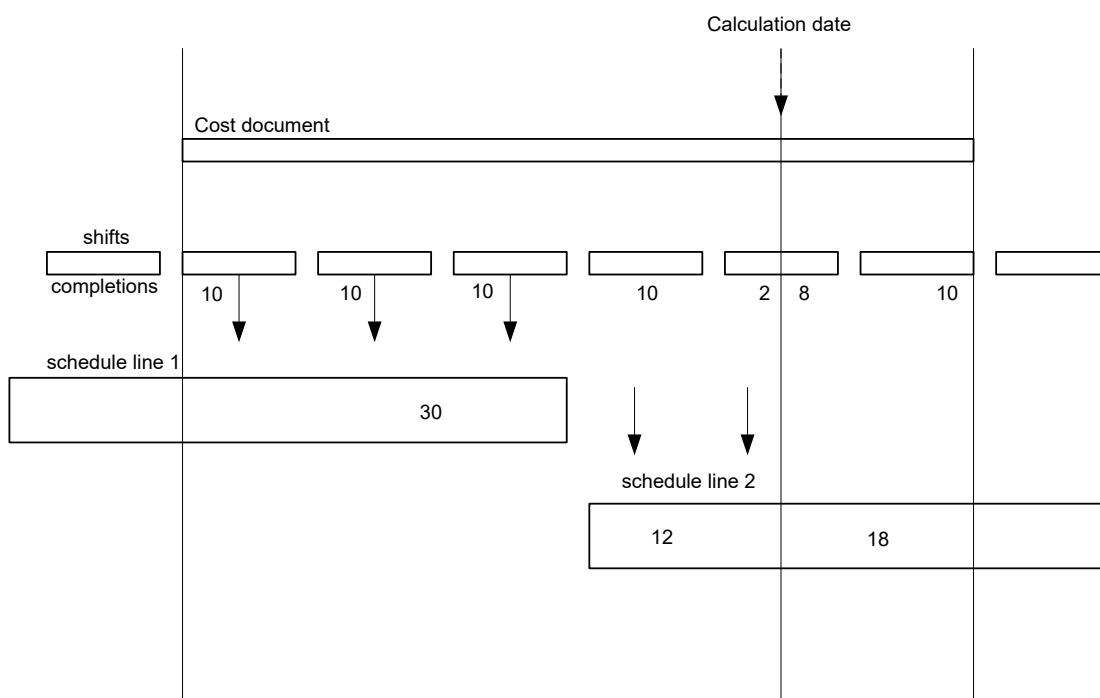
	Schedule A	Schedule B	Schedule C
Part Number Built	A123	B456	C789
Cycle	10 seconds	45 seconds	70 seconds
Good Units Produced	2240	450	229
Scrap Units Produced	50	25	11
Unplanned Downtime	32 minutes	18 minutes	22 minutes
Scheduled Time	480 minutes (8*60)	480 minutes (8*60)	480 minutes (8*60)
Planned Down Time	25 minutes total	25 minutes total	25 minutes total
O.E.E.	Schedule A	Schedule B	Schedule C
Net Available Time (NAT)	455 minutes (480-25)	455 minutes (480-25)	455 minutes (480-25)
Net Operating Time (NOT)	423 minutes (455-32)	437 minutes (455-18)	433 minutes (455-22)

O.E.E.	Schedule A	Schedule B	Schedule C
Ideal Operating Time (IOT)	381.67 minutes <div>((2290 units*10 sec onds)/60)</div>	356.25 minutes <div>(475 units*45 sec onds)/60)</div>	280 minutes <div>(240 units*70 sec onds)/60)</div>
Lost Operating Time (LOT)	8.33 minutes <div>((50 scrap units*10 seconds)/60)</div>	18.75 minutes <div>((25 scrap units*45 seconds)/60)</div>	12.83 minutes <div>((11 scrap units*70 seconds)/60)</div>
Availability	92.97% <div>(NOT/NAT)*100</div>	96.04% <div>(NOT/NAT)*100</div>	95.16% <div>(NOT/NAT)*100</div>
Performance	90.23% <div>(IOT/NOT)*100</div>	81.52% <div>(IOT/NOT)*100</div>	64.67% <div>(IOT/NOT)*100</div>
Quality	97.82% <div>((IOT-LOT)/IOT)*100</div>	94.74% <div>((IOT-LOT)/IOT)*100</div>	95.42% <div>((IOT-LOT)/IOT)*100</div>
O.E.E.	82.06% <div>Availability*Perfor mance*Quality</div>	74.17% <div>Availability*Perfor mance*Quality</div>	58.88% <div>Availability*Perfor mance*Quality</div>
Where multiple products, or shifts are involved, you must apply weighting factors to the calculated results to produce statistically valid results.			
Availability			
Schedule A	423 minutes		
Schedule B	437 minutes		
Schedule C	433 minutes		
Total Net Operating Time	1293 minutes		
Total Net Available Time	1365 minutes		
Weighted	1293/1365=94.73%		
Performance			
Schedule A	381.67 minutes		

Performance	
Schedule B	356.25 minutes
Schedule C	280 minutes
Total Ideal Operating Time	1017.92 minutes
Total Net Operating Time	1293 minutes
Weighted	$1017.92 / 1293 = 78.73\%$
Quality	
Schedule A	8.33 minutes
Schedule B	18.75 minutes
Schedule C	12.83 minutes
Total Lost Operating Time	39.91 minutes
Total IOT	1017.92 minutes
Weighted	$39.91 / 978 = 96.08\%$
The weighted Overall Equipment Effectiveness is:	
$94.73 * 78.73 * 96.08 = 71.66\%$	

## Calculation of Estimated Material and Hour Cost in Repetitive Manufacturing

Estimated material and hour cost are calculated based on the period defined in a work cell cost document. In the cost document interval schedule lines are planned, or active during shifts. The calculation date for the estimates can be any date and time in the cost document period.



Part of the production for schedule line 1 takes place in the cost document interval, 30 units are produced in three shifts. The material and labor costs estimates are calculated, based on standard cost of the produced item.

The estimated costs for schedule line 1 are based only on actual produced quantity that falls in the cost document interval, because all production for schedule line 1 was completed before the calculation date.

Part of the production for schedule line 2 falls in the cost document interval, but production will continue after the cost document interval end. The calculation is performed while a shift is in progress. In the figure, one shift is completed and 2 units reported complete on an active shift before the calculation date. Based on the 12 units completed, the amount of materials and labor cost is estimated, using standard cost as the basis.

The above calculations account for the estimates based on the actual produced quantity. The expected production for the remaining shifts is calculated from the remaining available production hours and the production rate of the used production model.

The expected quantity of future production is 18 units. This quantity is used to calculate estimated costs based on expected production.

The total cost estimated for schedule line 2 is the sum of estimated cost based on actual production and the expected production.



## Calculating Wait Hours Example

The shift is 8 hours.

The default for hours type Wait is Registered Labor Hours = 8.

The total of all hours types is Registered Labor Hours = 4.

When 1 piece is reported complete in the work list for hours type Wait, the following new value is determined:

```
Registered Labor Hours = Registered Labor Hours + ( total Registered Labor Hours - total new  
Registered Labor Hours ) = 8 + 8 - 5 = 3 hours
```

## Chapter 5: Repetitive Costing

### Repetitive Manufacturing Cost Calculation

Due to the dynamic nature of the supply source of a repetitive item, you may need to recalculate the cost one or more times during the product's life cycle.

### Cost Documents

In repetitive manufacturing, the costs incurred during production are registered in a cost document that is linked to a work cell. Cost documents are valid for a specific period, typically a week, and are consecutive.

Cost documents are the equivalent of a financial period, and are usually not generated in the past. It is advisable not to generate cost documents too far into the future.

**Note:** A *shift* cannot be planned exceeding a cost document. The start and finish dates and times of a shift and cost document must align for clear costing results.

The cost document contains these bookings:

- Material Issue  
Used for materials
- WIP Transfer Issue  
Used for quantities of completed product
- WIP Quarantine Issue  
Used for quantities of product quarantined during production
- Operation Cost  
Used for labor hours and machine run hours
- General Hours  
Used for wait, set-up and down time

Item surcharges and work cell surcharges may be booked during the production, but this depends on the set up of the production environment.

After the document is closed, the efficiency variances, price variances and calculation office variances are calculated and booked.

You can only close a work cell cost document if these conditions are met:

- The end date was passed

- The status of the cost document is **Open**
- The previous cost document has the status **Closed**
- All shifts falling in the cost document period are reported completed
- All materials used during the shifts falling in the cost document period are backflushed
- All warehouse orders related to the backflushed materials are fully processed.

## Chapter 6: Repetitive Advanced Functions

### Repair in Repetitive Manufacturing

In environments with extensive machining and assembly processes, minor defects to products may be repaired off line, if found during production.

The product can be rejected during inspection and moved to a *repair cell*. Once the product is repaired, it is returned to the original work cell, or finished and send directly to a warehouse.

To support the repair process you must:

- Enable the repair process in the repetitive manufacturing parameters
- Have a repair cell defined
- Have the repair cell linked to the related work cell
- Define the repair cell in the production model for which it is used

### Process Inspections in Repetitive Manufacturing

Simple in process inspections can me done during the manufacture process. The object of such inspections is commonly the registering of the temperature or wear to the tool used in the process.

You must have the Report on Work Stations check box in the **Repetitive Manufacturing Parameters (tirpt0100m000)** session selected to implement process inspections. If this check box is selected, one of the work cell's work stations can be defined as an inspection point, and defining an inspection protocol in the production model.

A process inspection protocol contains multiple process variables with their target values, lower and upper limits defined.

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