

MODULE 5: PRODUCTION ORDERS

Module Overview

You use production orders to manage the conversion of raw materials into manufactured products. Raw materials include purchased items and subassemblies, and are also known as *components* or *component items*.

Production orders contain the following information:

- The type and quantity of products to manufacture
- The components that are required to produce the manufactured products
- The steps or routing operations that are required to convert the components into manufactured products.
- The work centers and machine centers where the routing operations occur. Work centers and machine centers are also known as *facilities* or *capacities*.

The information in a production order serves a different purpose, depending on the date of the order, as follows:

- Production orders that are scheduled for the future represent a known production demand for the component items and capacities that are required to produce them, and also provide a future supply of finished goods. Combined with forecasts and known sales demand, future production orders are important for production planning.
- Current production orders control daily manufacturing activities. They contain information on products that are currently in the manufacturing process. They also contain information on the component items and capacities that have just been consumed, or are about to be consumed.
- Past production orders contain a record of the products that were manufactured in the past, and the component items and capacities that were used to produce them.

To reflect these different states, production orders have different statuses. The "Production Order Status" lesson describes these statuses in detail.

To successfully use the manufacturing functionality in Microsoft Dynamics® NAV, you must learn to create, change, and plan/schedule production orders. These and related subjects are addressed in the other lessons in this module.

Before starting these lessons, set your work date to January 23, 2014. Please perform all lessons, demonstrations, and labs in sequence.

Objectives

The objectives are:

- Describe the different production order statuses.
- Explain how to create and schedule a production order.
- Describe the different types of changes that you can make to a production order and show how to make each change.
- Show how to use the **Replan Production Order** batch job.
- Explain additional production order topics, such as reservations, statistics, phantom BOMs, and manufacturing batch units of measure.
- Review the production order listings and reports.

Production Order Status

A production order can have one of the following five status codes:

- Simulated
- Planned
- Firm Planned
- Released
- Finished

Microsoft Dynamics NAV treats production orders differently depending on their status. There is also a chronology and a level of commitment that is implied by these statuses. Each status topic describes these subjects in more detail.

Simulated Production Order (SPO)

A simulated production order (SPO) is an example production order. You use SPOs mainly for costing and quoting purposes. They do not influence the master production schedule (MPS), material requirements planning (MRP), or manufacturing operations. For example, *you cannot manufacture products by using an SPO.* Therefore, SPOs do not consume materials or capacities.

You cannot use an SPO as a template because it does not exist as an SPO the moment that you change its status.

To view the list of existing SPOs, type “simulated prod. orders” in the **Search** box, and then select the related link.

Planned Production Order (PPO)

A planned production order (PPO) specifies information about a product that you expect to produce. There is no firm commitment to produce it.

Typically, the planning system generates a PPO as a suggested production order that includes quantity, release date, and due date. The planning system bases its suggestions on the replenishment system, reorder policies, and order modifiers that it encounters in the net requirements planning process. The planning system uses a delete and replace approach in this process. If the planning criteria results in the item’s selection for planning, the planning system deletes all existing PPOs for that item at the start of the process. If a PPO is still required, the planning system creates a replacement PPO.

You can create PPOs manually. However, because the planning system deletes them for planning processes that involve the same items, manual creation is generally not practical.

Planned production orders have the following additional characteristics:

- You can automatically create a PPO from a sales order.
- You can specify when a PPO is expected to start and finish.
- Unlike released production orders with posted entries, you can reschedule, change, and delete PPOs manually.
- PPOs provide input to capacity requirements planning for work centers and machine centers. A PPO represents the best estimate of the future load for these capacities.
- PPOs provide input to material requirements planning (MRP), because a PPO for a manufactured item generates demand for component items.

To view the list of existing planned production orders, type “planned prod. orders” in the **Search** box, and then select the related link.

Firm Planned Production Order (FPPO)

A firm planned production order (FPPO) acts as a placeholder in the planning schedule for a future job that you intend to release to the shop floor.

You can create FPPOs manually or from a sales order. The planning system can also generate them. Typically, you create FPPOs to account for known capacity and material requirements in the future.

When it is generated by the planning system, an FPPO is a suggested production order that includes quantity, release date, and due date. The planning system bases its suggestions on the replenishment system, reorder policies, and order modifiers that it encounters in the net requirements planning process.

FPPOs have the following characteristics:

- Unlike released production orders with posted entries, you can reschedule, change, and delete FPPOs manually.
- The planning system can automatically change and reschedule FPPOs. However, it does not delete them in later planning processes.
- FPPOs provide input to capacity requirements planning for work centers and machine centers. An FPPO represents the best estimate of the future load for these capacities.
- FPPOs provide input to material requirements planning (MRP), because an FPPO for a manufactured item generates demand for its component items.

To view the list of existing firm planned production orders, type “firm planned prod. orders” in the **Search** box, and then select the related link.

Released Production Order (RPO)

A *released production order* (RPO) is a production order that you have released for manufacturing. After you release a production order, you can post produced quantity and component consumption to it. This does not necessarily mean that component items are picked for the order or that any of its operations have started. It means that the order is between its release and its completion.

RPOs have the following characteristics:

- You can manually create an RPO.
- You can automatically create an RPO from a sales order. In a make-to-order (MTO) environment, it is not unusual to create a released production order immediately after sales order entry.
- The planning system does not automatically delete an RPO. However, it can suggest a change to the order (unless the order has started production). If the planning system suggests a change to an RPO, it marks the suggestion with a warning.
- You can manually record actual component consumption and production output with an RPO. In addition, automatic flushing of consumption and product output only occurs for RPOs.



Note: Component consumption and product output are described in more detail in “Production Order Processing” in this training material.

To view the list of existing released production orders, type “released prod. orders” in the **Search** box, and then select the related link.

Finished Production Order (FPO)

A *finished production order* (FPO) is typically one that was manufactured, although it may have been terminated. In either case, the order is considered closed and cannot be changed, posted, or deleted.

Finishing a production order helps complete the costing life cycle of a manufactured item. By finishing a production order, you can adjust and reconcile costing.

FPOs have the following characteristics:

- FPOs can track back to other orders, for example, sales, production, and purchase orders. This makes it possible to review related supply and demand events.
- You can use FPOs for statistical and historical reporting.
- You can use FPOs to investigate manufacturing problems, such as a high rate of customer return or cost overruns.

To view the list of existing finished production orders, type “finished prod. orders” in the **Search** box, and then select the related link.

Manual Production Orders

This lesson explains how to do the following:

- Manually create production orders.
- View production order components and routings.
- Schedule a production order.

It also briefly describes routing link codes as they relate to production orders.

Source Types

Source type refers to the **Source Type** field in the **General** FastTab of a production order.

The following three source types are available for a production order:

- **Item** – Used to create an inventory item. If it is connected to a sales order, there is one production order for each sales order line.
- **Family** – Used when a group of items must be manufactured together.
- **Sales header** – Used to create one production order for all the items on a sales order. This is useful in a large project environment where there is a long manufacturing lead time.

Demonstration: Create a Production Order

Scenario: Eduardo, the production planner at CRONUS International Ltd., must create a firm planned production order for 12 units of item 1000, Bicycle. The due date for the production order is February 01, 2014.

Demonstration Steps

1. Create a production order.
 - a. In the **Search** box, type “firm planned prod. orders”, and then select the related link.
 - b. On the **Home** tab of the **Firm Planned Prod. Orders** list page, click **New**, and then press **Enter**.
 - c. On the **General** FastTab of the production order card, in the **Description** field, type “Bicycle”. Notice that the **Source Type** field uses Item. This is by default.
 - d. In the **Source No.** field, select item 1000, Bicycle.

- e. In the **Quantity** field, type "12".
- f. Set the **Due Date** field to February 01, 2014.
- g. On the **Lines** FastTab, in the **Item No.** field, select 1000.
- h. In the **Quantity** field, type "12".

The screenshot displays the 'Firm Planned Prod. Order' card for item 101001 (Bicycle). The card is divided into two main sections: 'General' and 'Lines'.

General Section:

- No.:** 101001
- Description:** Bicycle
- Quantity:** 12
- Due Date:** 2/1/2014
- Source Type:** Item
- Source No.:** 1000
- Search Description:** BICYCLE
- Assigned User ID:** (empty)
- Last Date Modified:** 12/8/2012

Lines Section:

Item No.	Due Date	Description	Starting Date-Time	Ending Date-Time	Quantity	Unit of Measure Code	Unit Cost	Cost Amount
1000	2/1/2014	Bicycle	1/31/2014 8:00 AM	1/31/2014 11:00 PM	12	PCS	350.594	4,207.13

FIGURE 5.1:FIRM PLANNED PROD. ORDER CARD



Note: When a production order consists of one item, or is of source type Sales Header and is linked to a sales order, you do not have to manually create an order line in the order's **Lines** FastTab. The **Refresh Production Order** function on the **Home** tab can create the order line for you. The "Production Order Scheduling" topic in this lesson describes how to do this. The "Schedule a Production Order" demonstration provides an example.

2. Review the **Posting** FastTab.
 - a. Expand the **Posting** FastTab. Notice that the inventory and product posting groups are copied from the item card. This information is used for general ledger postings. If it is necessary, you can also enter department, project, and location codes.
 - b. Leave the production order card open.

Production Order Scheduling

To schedule a specific production order, click the **Refresh Production Order** function on the **Home** tab of the production order card. This opens the **Refresh Production Order** request page.

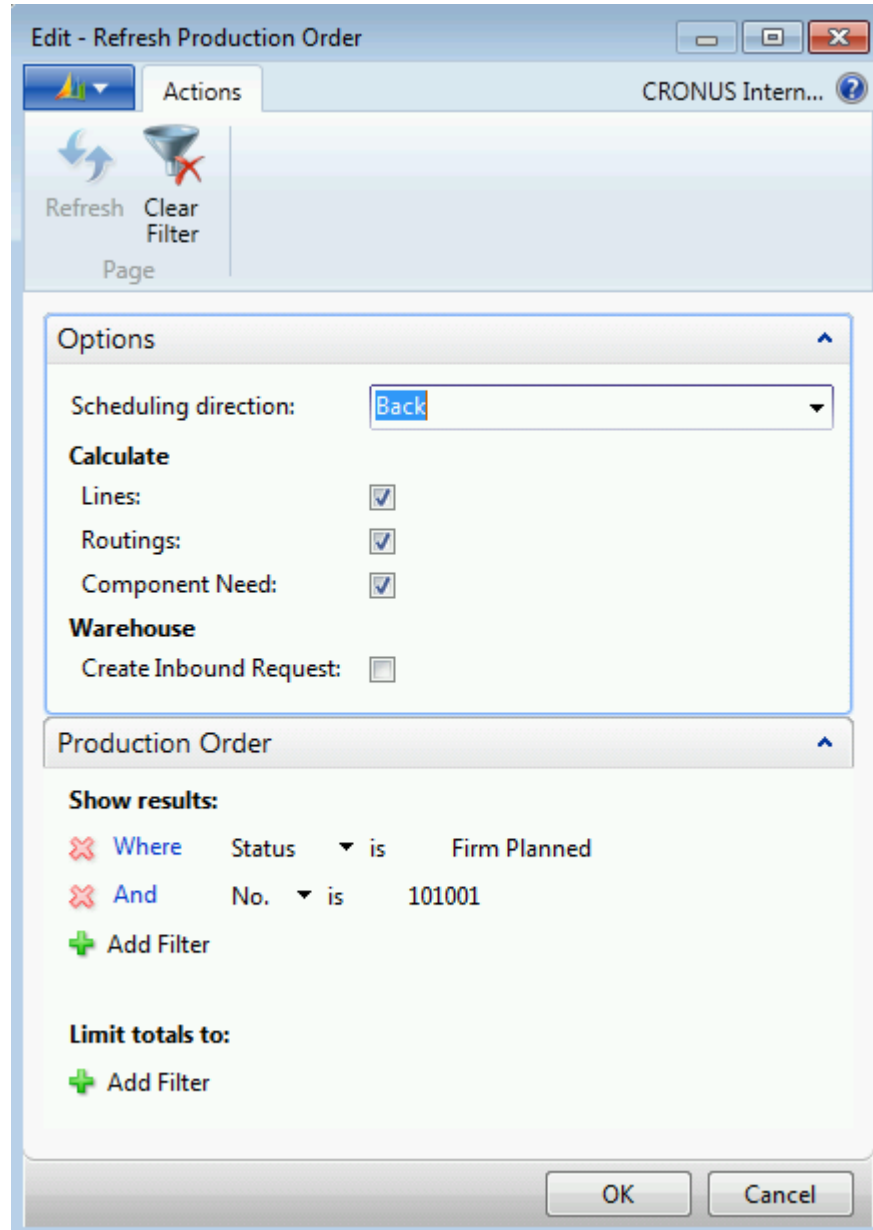



FIGURE 5.2: REFRESH PRODUCTION ORDER REQUEST PAGE

In the **Options** FastTab, under the Calculate heading, select the **Lines** check box to generate or replace the production order lines. To generate or replace routing operations for each order line, select the **Routings** check box. To generate or replace components for each order line, select the **Components** check box.

 **Note:** You cannot replace the production order lines, routing operations, or components by using the **Refresh Production Order** batch job if ledger entries exist for the order. Additionally, you cannot replace production order lines if there are reservations against them.

The other main function of the **Refresh Production Order** batch job is to forward schedule or backward schedule a production order. This includes scheduling the order lines, routing operations, and components based on either the starting date/time or the ending date/time for the order, or the starting date/time or ending date/time for each order line, if these differ.

Forward scheduling begins at a starting date/time and continues forward to the ending date/time. Backward scheduling begins at an ending date/time and continues backward to the required starting date/time. The program automatically schedules a production order to finish one day before its due date.

The scheduling of routing operations, if they exist, can involve many time elements.

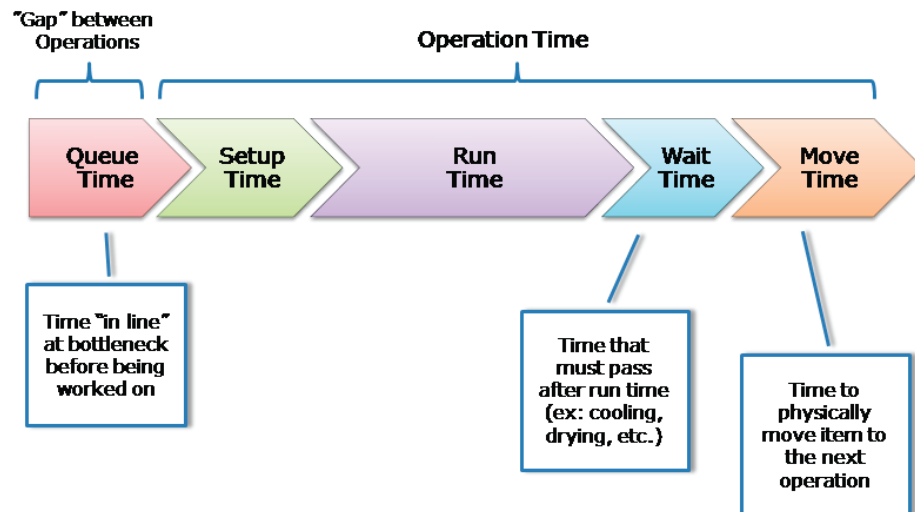


FIGURE 5.3: TIME ELEMENTS IN SCHEDULING ROUTING OPERATIONS

For a definition of each time element, refer to "Basic Capacities and Routings" in this training material.

In a forward scheduling scenario, the ending date/time for the final operation determines the ending date/time for the order line. If this exceeds the ending date/time for the order's due date minus one day, the program adjusts the due date forward accordingly.

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In a backward scheduling scenario, the starting date/time for the first operation determines the starting date/time for the order line. If this comes before the starting date and time values for the order, the program accordingly adjusts those starting date and time values backward.

You can view the start and end date/times for each order line in the line's **Starting Date-Time** and **Ending Date-Time** fields. You can view the start and end date/times for the overall production order in the **Schedule** FastTab of the order card. The "Start and End Date/Times for a Production Order and a Production Order Line" image shows an example of all these date and time values.

The screenshot displays the 'Edit - Firm Planned Prod. Order - 101001 - Bicycle' window. The main form contains fields for 'No.' (101001), 'Description' (Bicycle), 'Quantity' (12), and 'Due Date' (2/1/2014). Below this is a 'Lines' table with the following data:

Item No.	Due Date	Description	Starting Date-Time	Ending Date-Time	Quantity	Unit of Measure Code	Unit Cost	Cost Amount
1000	2/1/2014	Bicycle	1/31/2014 8:00 AM	1/31/2014 11:00 PM	12	PCS	350.594	4,207.13

Below the table is a 'Schedule' section with the following values:

Starting Time:	8:00:00 AM	Ending Time:	11:00:00 PM
Starting Date:	1/31/2014	Ending Date:	1/31/2014

FIGURE 5.4: START AND END DATE/TIMES FOR A PRODUCTION ORDER AND A PRODUCTION ORDER LINE

To view the start and end date/times for each operation in a production order routing, you must view the routing. For an example, refer to the "Production Order Routing" topic in this lesson.

The scheduling of components is more complex and is described in detail in "Production Order Processing" in this training material. In the simplest model, the program schedules the components for the start of the production order based on lead times for purchased components and routings for produced components (subassemblies). The schedule for each component line is recorded in its **Due Date** field. For an example, refer to the "Production Order Components" topic in this lesson.

To schedule more than one production order, adjust the filter fields in the **Production Order** FastTab of the **Refresh Production Order** request page. For example, to schedule all firm planned production orders, set the **Status** filter field to Firm Planned and remove the filter for the **No.** field.

Demonstration: Schedule a Production Order

This is a continuation of the “Create a Production Order” demonstration.

Scenario: Eduardo, the production planner at CRONUS, now must schedule the production order that he just created.

Demonstration Steps

1. Schedule the production order.
 - a. On the **Home** tab of the production order, click **Refresh Production Order** to open the **Refresh Production Order** request page. This batch job concurrently plans and schedules the production order. This includes scheduling the required components and the routing operations at the same time. This feature is known as *simultaneous planning*.
 - b. On the **Options** FastTab, in the **Scheduling direction** field, select Back for backward scheduling.
 - c. Select the **Lines** check box. This recalculates the production order lines from the order header, and therefore replaces the order line that you manually created in the “Create a Production Order” demonstration.
 - d. Select the **Routings** check box. This replaces the routing operations for each order line by copying the operations from the active routing that is associated with the item that is specified for the order line.
 - e. Select the **Component Need** check box. This replaces the components for each order line by copying the components from the active production BOM associated with the item specified for the order line.
 - f. Click **OK** to run the batch job.

The batch job performs the following tasks:

- Replaces the production order line.
- Creates the routing operations for the order line by copying the operations from the active routing associated with item 1000, Bicycle.
- Backward schedules the routing operations so that the manufactured items are available on the production order due date. This changes all date/time values except the due date. In a backward scheduling scenario, this might affect the starting date/time values for both the production order line and the production order.
- Creates the component lines for the order line by copying the component lines for the active production BOM that is associated with item 1000, Bicycle.

- Schedules the components (all components) for the start of the production order based on lead times for purchased components and routings for produced components (subassemblies). Other options for scheduling the consumption of components are described in the “Routing Link Codes” topic in this lesson and in detail in “Production Order Processing” in this training material.

Production Order Routing

This is a continuation of the “Schedule a Production Order” demonstration.

Each production order line can have a list of routing operations that are required to produce the order line’s manufactured item. This list of operations first copies from the active routing that is associated with the manufactured item, and represents a point-in-time snapshot of that routing. From that point on, changes that you make to the production order routing are independent of the item routing. The reverse of this is also true.

To view the routing operations for the order line in the new production order, follow these steps.

1. Make sure that the production order from the “Schedule a Production Order” demonstration is still open.
2. On the **Lines** FastTab, select the order line.
3. Click **Line**, and then click **Routing**.

Operation No.	Type	No.	Description	Starting Date-Time	Ending Date-Time	Setup Time	Run Time	Wait Time	Move Time
10	Work Center	100	Wheel assembly	1/30/2014 10:35 AM	1/30/2014 2:49 PM	110	12	0	0
20	Machine Center	120	Chain assembly	1/30/2014 2:49 PM	1/31/2014 10:04 AM	15	15	0	0
30	Machine Center	130	Final assembly	1/31/2014 10:04 AM	1/31/2014 2:14 PM	10	20	0	0
40	Machine Center	110	Control	1/31/2014 2:14 PM	1/31/2014 4:00 PM	10	8	0	0

FIGURE 5.5:PROD. ORDER ROUTING PAGE

On the **Prod. Order Routing** page, notice that the value in the **Ending Date-Time** field for the final operation (operation 40) is set to equal the end of the final shift on the day before the production order due date.

Because you specified backward scheduling in the **Refresh Production Order** batch job, the program backward schedules the routing operations from this date/time.

The program uses each machine (work) center calendar to calculate the schedule by using the setup, run, wait, and move times for each operation. Queue time is not included in the determination of the start or end dates and times for an operation. It is calculated as the time between the end of one operation and the start of the next.

Click **OK** to close the **Prod. Order Routing** page.

Production Order Components

This is a continuation of the “Schedule a Production Order” demonstration.

Each production order line must have a list of components that are required to produce the order line’s manufactured item. This list of components first copies from the active production BOM that is associated with the manufactured item, and represents a point-in-time snapshot of that component list. From that point on, changes that you make to the production order components are independent of the item’s production BOM. The reverse of this is also true.

To view the components for the order line in the new production order, follow these steps.

1. Make sure that the production order from the “Production Order Routing” topic is still open.
2. On the **Lines** FastTab, select the order line.
3. Click **Line**, and then click **Components**.

Item No.	Due Date	Description	Quantity per	Unit of Measure Code	Flushing Method	Expected Quantity	Remaining Quantity	Substitution Available	Bin Code
1100	1/30/2014	Front Wheel	1	PCS	Manual	12	12	No	
1200	1/30/2014	Back Wheel	1	PCS	Manual	12	12	No	
1300	1/30/2014	Chain Assy	1	PCS	Manual	12	12	No	
1400	1/30/2014	Mudguard front	1	PCS	Manual	12	12	No	
1450	1/30/2014	Mudguard back	1	PCS	Manual	12	12	No	
1500	1/30/2014	Lamp	1	PCS	Manual	12	12	No	
1600	1/30/2014	Bell	1	PCS	Manual	12	12	No	
1700	1/30/2014	Brake	1	PCS	Manual	12	12	No	
1800	1/30/2014	Handlebars	1	PCS	Manual	12	12	No	
1850	1/30/2014	Saddle	1	PCS	Manual	12	12	No	
1900	1/30/2014	Frame	1	PCS	Manual	12	12	No	

FIGURE 5.6:PROD. ORDER COMPONENTS PAGE

On the **Prod. Order Components** page, notice that the due date for the component items is the start of the production order. Other options for scheduling the consumption of components are discussed in the “Routing Link Codes” topic in this lesson and in many other locations throughout this training material.


The values in the **Expected Quantity** field are set based on the calculation: *Quantity of manufactured item * Quantity per component*. The **Quantity Per** field contains the quantity per component value.

Click **OK** to close the **Prod. Order Components** page.

Routing Link Codes

You use *routing link codes* to link a component that is defined on a production order BOM to an operation on the production order routing. This lets you identify the routing operation that consumes the component.

If routing link codes are not used, the program typically records component consumption at the start or the finish of the production order. Routing link codes support just-in-time (JIT) functionality and are typically used in long processes.

 **Note:** *JIT functionality is desirable because it helps reduce inventory requirements. This results in a lower cash requirement or more working capital.*

Routing links are described in detail in “Production Order Processing” in this training material.

Production Order Changes

There are many ways to change a production order. These include changing the following:

- Production order status
- Date and time values
- Quantities
- Routing lines
- Component lines
- Item substitutions

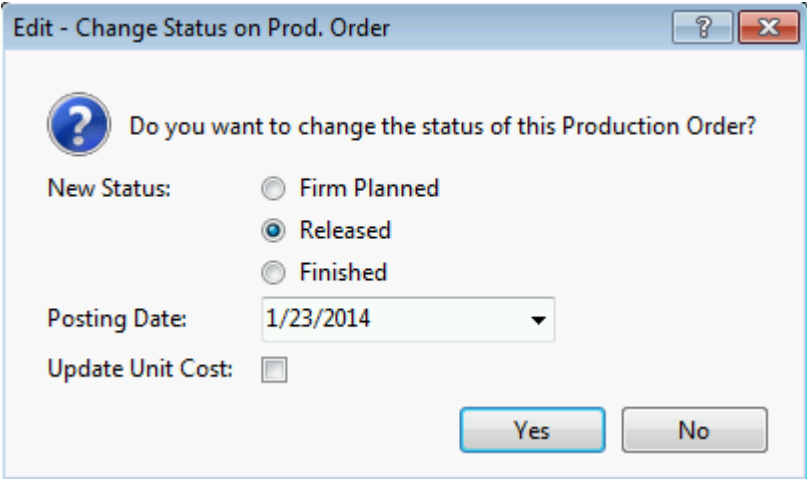
Typically, changes to production orders are the responsibility of production planners because they have the necessary overview of all production information.

Status Changes

Typically, the status of a production order changes as it progresses from planning to release.

There are two methods to change production order statuses.

To change the status of a specific production order, click the **Change Status** function on the **Home** tab of the production order card. This results in the **Change Status on Prod. Order** request message, as follows:



The screenshot shows a dialog box titled "Edit - Change Status on Prod. Order". It contains a question mark icon and the text "Do you want to change the status of this Production Order?". Below this, there are three radio button options for "New Status": "Firm Planned", "Released" (which is selected), and "Finished". There is a "Posting Date" field with a dropdown arrow showing "1/23/2014". Below that is a checkbox for "Update Unit Cost" which is currently unchecked. At the bottom right, there are two buttons: "Yes" and "No".

FIGURE 5.7:CHANGE STATUS ON PROD. ORDER REQUEST MESSAGE

To change the status of the production order, select the new status, and then click **Yes**.

The **Posting Date** field specifies the date to use when the program automatically posts capacity or component consumption. The program uses this date when it forward flushes a released production order or when it backward flushes a finished production order.

The **Update Unit Cost** check box specifies whether to update the unit cost of the manufactured item. The unit cost of the item also updates in any production orders or sales orders for which the manufactured item is reserved.

To concurrently change the statuses of multiple production orders, use the **Change Production Order Status** batch job. To run this batch job, follow these steps.

1. In the **Search** box, type "change production order status", and then select the related link.
2. On the **Change Production Order Status** page, use the **Status Filter**, **Must Start Before**, and **Ends Before** fields to filter the production orders that you want to view. For example, by selecting Firm Planned in the **Status Filter** field, the program shows only production orders with a status of Firm Planned, as shown in the "Change Production Order Status Page" image.

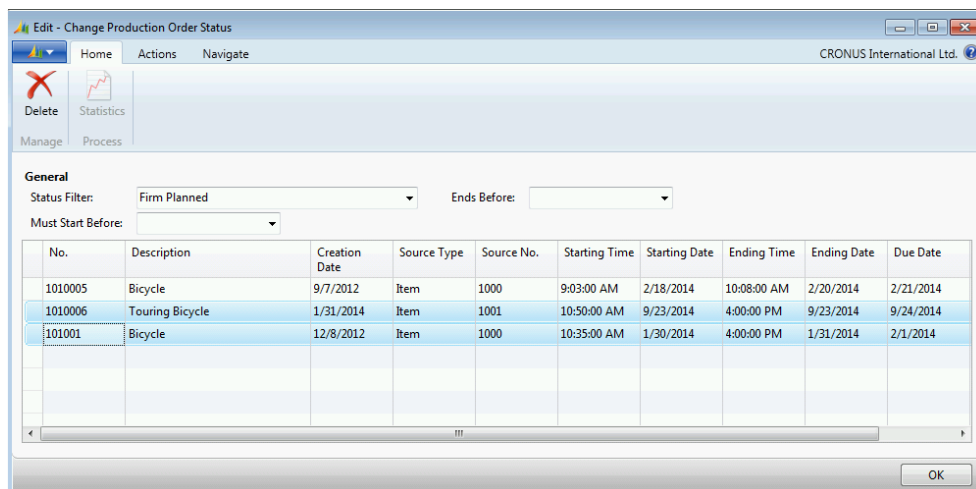


FIGURE 5.8:CHANGE PRODUCTION ORDER STATUS PAGE

3. Select the production orders that you want to update by using standard row selection techniques. In the "Change Production Order Status Page" image, the bottom two production orders are selected.
4. On the **Actions** tab, click **Change Status**.

The request message that appears is the same one that appears for the **Change Status** function on a specific production order. The same change options are offered. The difference is that the changes apply to all the selected production orders instead of one order.

Be aware that the following restrictions apply when you change production order statuses:

- You cannot change a simulated production order to a status of Planned.
- You cannot change a planned production order to a status of Simulated.
- You can change the status of a production order to Finished only if it is currently released.
- You cannot change the status of a finished production order.

Date/Time Changes

If you change the **Due Date** field in the production order header, this automatically recalculates the date and time fields in the **Schedule** FastTab of the production order card. It also changes the **Due Date**, **Starting Date-Time**, and **Ending Date-Time** fields for each order line. If a routing already exists for the order line, the **Starting Date-Time** and **Ending Date-Time** fields for each routing operation also recalculate. Dates and times always recalculate to make sure that the production order finishes one day before its due date.

Changes to any of these date/time fields automatically trigger a recalculation of all other dates. The scheduling direction depends on the field that you change. See the following examples:

- If you change the **Starting Date** field of the production order header (shown on the order card's **Schedule** FastTab), or if you change the **Starting Date-Time** field of the order line, the program forward schedules the order and/or order line based on the new starting date/time.
- If you change the **Ending Date** field of the production order header, or you change the **Ending Date-Time** field of the order line, the program backward schedules the order and/or order line based on the new ending date/time.
- If you change the **Starting Date-Time** field of an operation, the program forward schedules that operation and all later operations, and backward schedules all previous operations. If you change the **Ending Date-Time** field of an operation, the program backward schedules that operation and all previous operations, and forward schedules all later operations. In either case, the net result of the rescheduling then changes the date/time fields for the related order line. You cannot change date/time values for routing operations that are posted as finished.

- If changes to an order line result in a starting date/time or ending date/time that falls outside the existing starting or ending date/time for the order, the order date/time values change to match. If the ending date/time for the order changes, its due date is set to one day after the ending date/time.

In summary, Microsoft Dynamics NAV provides significant flexibility to change production order dates and times. At the same time, the program synchronizes all date and time fields to make sure that they are consistent.

Quantity Changes

If you change the **Quantity** field in the order header, you must run the **Refresh Production Order** function and select all three **Calculate** check boxes (**Lines**, **Routings**, and **Component Need**) to update the order lines, routings, and components for the order.

If you change the **Quantity** field in the order line, the program automatically recalculates the quantity values for each component and reschedules the routing lines to reflect the changed quantity. The **Quantity** field in the order header does not change.



Note: If ledger entries exist for the order, you cannot use the **Refresh Production Order** function to recalculate the order lines, routing, or components. In this situation, the only way to synchronize the **Quantity** field in the order header to the **Quantity** field in the order line is to manually change both of them.

Routing Changes

You might have to change a production order's routing before manufacturing an item. This is usually true in an MTO environment, where you produce items to customer specifications. You can start by using the standard item routing, and then change the operations afterward.



Note: Changes to a production routing could require replanning production orders for any lower level assemblies that are created for the parent production order. For more information, refer to the "Production Order Planning" lesson.

Demonstration: Change a Routing

This is a continuation of the “Schedule a Production Order” demonstration.

Scenario: After Eduardo, the production planner at CRONUS, creates and schedules the production order for 12 units of item 1000, Bicycle, he decides to use machine center 440, Inspection, for the final operation instead of machine center 110, Control. To implement this decision, Eduardo must change the production order routing.

Demonstration Steps

1. Delete the operation that uses machine center 110, Control, from the production order routing of the production order that you created in the “Create a Production Order” demonstration.
 - a. Close all open pages.
 - b. In the **Search** box, type “firm planned prod. orders”, and then select the related link.
 - c. On the **Firm Planned Prod. Orders** list page, double-click the line for the production order of 12 units of item 1000, Bicycle, that you created in the “Create a Production Order” demonstration.
 - d. On the **Lines** FastTab of the production order card, select the order line for item 1000.
 - e. Click **Line**, and then click **Routing**.
 - f. On the **Prod. Order Routing** page, right-click the line for operation 40, machine center 110, and then click **Delete Line**.
 - g. On the request message, click **Yes** to confirm the deletion.
 - h. The program displays another request message. This includes a warning about other routing lines that refer to the operation that you just deleted. Click **No** to close the request message.



Note: *This warning is a good reminder that there are frequently relationships between the operations. Because you replace this operation in the next step, you can safely ignore the warning.*

2. Add the operation for machine center 440, Inspection.
 - a. On the first blank line on the routing operation list, in the **Operation No.** field, type “40”.
 - b. In the **Type** field, select Machine Center.
 - c. In the **No.** field, type “440”.
 - d. In the **Setup Time** field, type “10”.
 - e. In the **Run Time** field, type “27”.
 - f. Click **OK** to close the **Prod. Order Routing** page.

Changes to Required Components

Similar to changing a routing, you might have to change a production order's components before manufacturing an item. This is usually the case in an MTO environment, where items are produced to customer specifications.

You can start by using the standard production BOM, and then change the components afterward.



Note: Changes to production components could require replanning production orders for any lower level assemblies that are created for the parent production order. For more information, refer to the "Production Order Planning" lesson in this training material.

Demonstration: Change Required Components

This is a continuation of the "Change a Routing" demonstration.

Scenario: After Eduardo, the production planner at CRONUS, creates and schedules the production order for 12 units of item 1000, Bicycle, he learns that the customer does not want bells on the bicycles. To meet this request, Eduardo must delete item 1600, Bell, from the production order BOM.

Demonstration Steps

1. Delete item 1600, Bell, from the production order BOM.
 - a. Make sure that the production order that you changed in the "Change a Routing" demonstration is still open.
 - b. On the **Lines** FastTab, select the order line for item 1000.
 - c. Click **Line**, and then click **Components**.
 - d. On the component list of the **Prod. Order Components** page, right-click the line for item 1600, Bell, and then click **Delete Line**.
 - e. On the request message, click **Yes** to confirm the deletion.

2. Add a new component for item 1968-S, MEXICO Swivel Chair, black. This is for demonstration purposes only, as a bicycle is unlikely to have a swivel chair as one of its components.
 - a. In the **Item No.** field of the first blank line on the component list, type "1968-S".
 - b. In the **Quantity Per** field, type "1".
 - c. Click **OK** to close the **Prod. Order Components** page.
 - d. Click **OK** to close the production order card.

Item Substitutions

You can use item substitutions with production order components. This is similar to a sales order substitution. You use the same setup of item substitutions in both situations.

Demonstration: Use Item Substitutions

This is a continuation of the “Change Required Components” demonstration.

Scenario: Eduardo, the production planner at CRONUS, decides to substitute another item for item 1968-S in the component list for the production order of 12 units of item 1000, Bicycle.

Demonstration Steps

1. Check the available item substitutes for item 1968-S.
 - a. In the **Search** box, type “items”, and then select the related link.
 - b. On the **Items** list page, add the **Substitutes Exist** field by using the **Choose Columns** function. Position the field after the **Description** field.
 - c. In the upper right-hand corner of the items list, change the default filter field to **Substitutes Exist**.
 - d. In the filter box, type “Yes”, and then press **Enter** or **Tab**. The list adjusts to show only those items with item substitutions. Notice that item 1968-S, the MEXICO Swivel Chair, is located on the list.

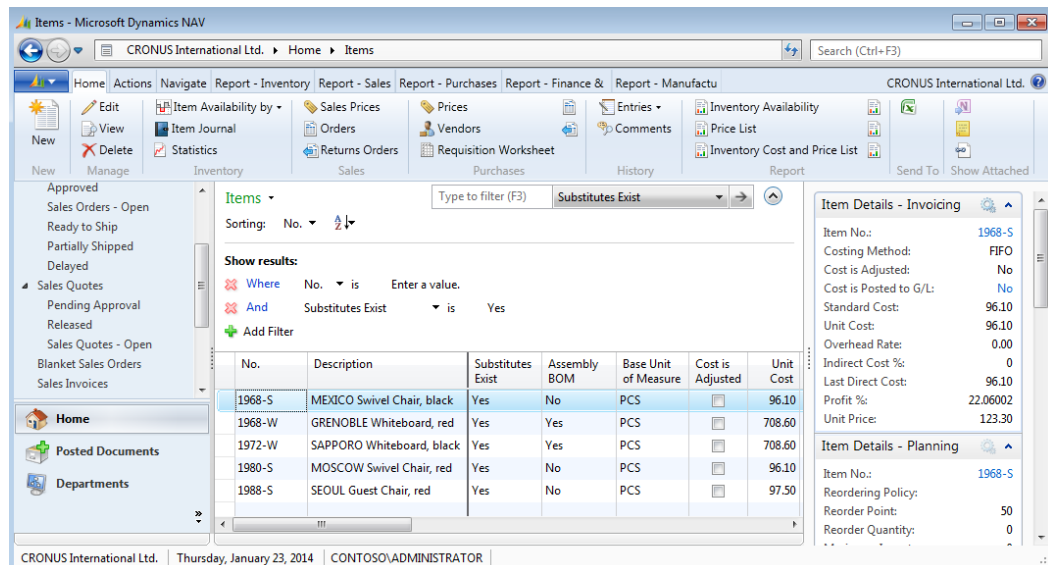


FIGURE 5.9: ITEMS LIST PAGE WITH SUBSTITUTES EXIST COLUMN

2. Substitute item 1980-S for item 1968-S.
 - a. In the **Search** box, type “firm planned prod. orders”, and then select the related link.
 - b. On the **Firm Planned Prod. Orders** list page, double-click the line for the order of 12 units of item 1000, Bicycle, that you created in the “Create a Production Order” demonstration.
 - c. On the **Lines** FastTab of the production order card, select the order line for item 1000.
 - d. Click **Line**, and then click **Components**.
 - e. On the **Prod. Order Components** page, select the line for item 1968-S. Notice the value of Yes in the **Substitution Available** field.
 - f. On the **Home** tab, click **Select Item Substitution**. This opens the **Item Substitution Entries** page.

The screenshot shows the 'Item Substitution Entries' window. At the top, there are 'Home' and 'Actions' tabs, and the company name 'CRONUS International Ltd.' is displayed. Below the tabs, there are icons for 'Condition' and 'Process'. The 'General' section contains a 'Variant Code' dropdown menu and a 'Shipment Date' field set to '1/28/2014'. The main area is a table with the following data:

Substitute No.	Description	Inventory	Quantity Avail. on Shpt. Date	Co...
1980-S	MOSCOW Swivel Chair, red	100	194	No
1988-S	MOSCOW Swivel Chair, red	167	167	No

At the bottom of the window, there are 'OK' and 'Cancel' buttons.

FIGURE 5.10:ITEM SUBSTITUTION ENTRIES PAGE

- g. There are two possible substitutes for item 1968-S: items 1980-S and 1988-S. Select the line for item 1980-S, and then click **OK**. Notice that item 1980-S now takes the place of item 1968-S in the component list.

3. The use of items 1968-S and 1980-S was for demonstration purposes only. Now delete item 1980-S from the component list.
 - a. Right-click the line for item 1980-S, and then click **Delete Line**.
 - b. On the request message, click **Yes** to accept the deletion.
 - c. Click **OK** to close the **Prod. Order Components** page.
 - d. Click **OK** to close the production order card.

Production Order Planning

Production order planning refers to computer-assisted processes that help production planners decide what to manufacture and when.

Microsoft Dynamics NAV provides the following three planning tools to provide this assistance:

- The planning worksheet
- Order planning
- The **Replan** function on the production order card

The *planning worksheet* offers the program's full planning capabilities. It is described in "Planning" and "Additional Planning" in this training material.

Order planning refers to a simple manual planning tool that is an alternative to the planning worksheet when more advanced planning capabilities are not required. Order planning is described in "Sales Order Interface and Order Planning" in this training material.

The **Replan** function, located on the **Home** tab of the production order card, is an even more limited planning tool that helps you create and replan production orders for lower-level assemblies that are required by the current production order.

When you click the **Replan** function, the resulting request page presents two options.

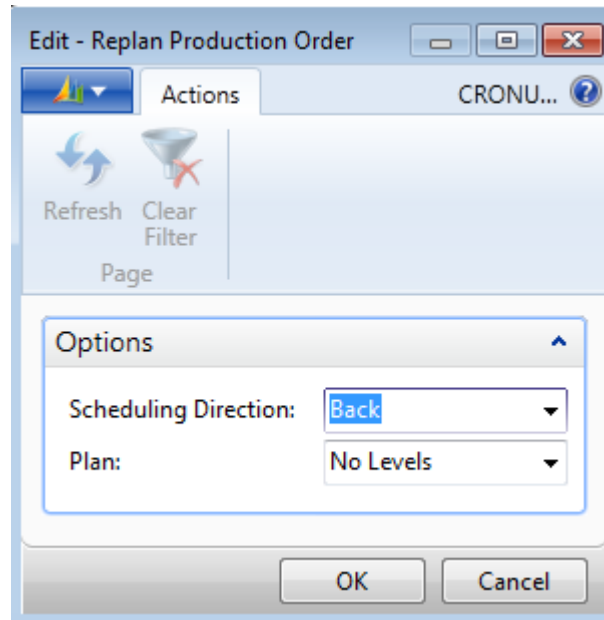


FIGURE 5.11:REPLAN PRODUCTION ORDER REQUEST PAGE

The **Scheduling Direction** option field specifies whether you want to replan forward from the starting date/time or backward from the ending date/time.

The **Plan** option field specifies the number of BOM levels that you want to replan. The options are as follows:

- **No Levels** – Use this option to calculate a multilevel or multiline production order. All items and subassemblies must be MTO and new requirements are added to the existing production order as additional line items.
- **One Level** – Use this option to create and plan production orders one level down in the current production order's BOM. If the current production order is for an item that is MTO, and the first level subassemblies are make-to-stock (MTS), then the program creates new and separate production orders for that level.
- **All Levels** – Use this option to create separate production orders for all levels of the current production order BOM. By using the order tracking functionality, you can easily view which parent production order is the source of demand for lower-level production orders.

When the **Replan** function creates lower-level production orders, the order number copies from the parent production order heading to the lower-level production order headings. This is another link or connection between production orders.

Although the **Replan** function provides a convenient method of creating and planning lower-level production orders, it is not intended as a substitute for the more advanced planning tools. Although it can create production orders for the required lower-level assemblies, it does not include time phasing, and this is essential to accurate planning. A good use of this batch job is for a multilevel production order in which the parent item and sub-assemblies are on the same production order and the ending date/time is adjusted for the parent item. In this situation, the batch job enables you to adjust the dates for the lower-level assemblies.

Demonstration: Replan a Production Order

Eduardo, the production planner at CRONUS, receives a requirement for a large production order of 500 units of item 1000, Bicycle. To create supporting production orders for lower-level assemblies, he uses the **Replan** function on the parent production order card.

Demonstration Steps

1. Create the production order for 500 units of item 1000, Bicycle.
 - a. Close all open pages.
 - b. In the **Search** box, type "firm planned prod. orders", and then select the related link.
 - c. On the **Home** tab of the **Firm Planned Prod. Orders** list page, click **New**, and then press **Enter**.
 - d. On the **General** FastTab of the production order card, in the **Description** field, type "Bicycle".
 - e. In the **Source No.** field, select item 1000, Bicycle.
 - f. In **Quantity** field, type "500".
 - g. Set the **Due Date** field to February 28, 2014.
 - h. On the **Home** tab, click **Refresh Production Order**.
 - i. On the **Refresh Production Order** request page, accept all defaults, and then click **OK** to start the batch job.
 - j. On the **Lines** FastTab of the production order card, scroll to the first line to confirm that you created one order line for 500 units of item 1000.

2. Run the **Replan** function.
 - a. On the **Home** tab of the production order card, click **Replan**.
 - b. On the **Options** FastTab of the **Replan Production Order** request page, in the **Scheduling Direction** field, select **Back**.
 - c. In the **Plan** field, select **All Levels**.
 - d. Click **OK** to start the batch job. Notice that the program displays an update message that indicates that it is creating other production orders.
3. View the new production orders for the lower-level assemblies in the parent production order.
 - a. Click **OK** to close the production order card. This returns you to the **Firm Planned Prod. Orders** list page.

Notice the new production orders for lower-level assemblies such as the Front Wheel and Back Wheel items. These are created from the first BOM level in the parent production order. Also notice the new production orders for items such as the Front Hub and Back Hub. These are created from next level down in the BOM because they are component assemblies in the BOMs for the Front Wheel and Back Wheel.

Lab: Create a Firm Planned Production Order and Change It

Scenario

Eduardo, the production planner at CRONUS, must create a new production order for 10 units of item 1001, Touring Bicycle, due on January 28, 2014. He backward schedules this and confirms that he can start the order on January 27, 2014.

Shortly after he finishes this task, he is asked to increase the order to 50 units. When he does this, the backward scheduling functionality pushes the order start date earlier than the current work date of January 23, 2014. He therefore forward schedules the order from January 23, 2014 to determine a more realistic finish date.

High Level Steps

1. Create the initial production order for 10 units of item 1001, Touring Bicycle.
2. Change the production order to 50 units and schedule the order.
3. Change the start date to January 23, 2014 to trigger a forward scheduling of the production order.

Detailed Steps

1. Create the initial production order for 10 units of item 1001, Touring Bicycle.
 - a. In the **Search** box, type "firm planned prod. orders", and then select the related link.
 - b. On the **Home** tab of the **Firm Planned Prod. Orders** page, click **New**, and then press **Enter**.
 - c. On the **General** FastTab of the production order card, in the **Description** field, type "Touring Bicycle".
 - d. In the **Source No.** field, type "1001" to select the Touring Bicycle.
 - e. In **Quantity** field, type "10".
 - f. Set the **Due Date** field to January 28, 2014.
 - g. On the **Home** tab, click **Refresh Production Order**.
 - h. On the **Refresh Production Order** request page, accept all defaults, and then click **OK** to start the batch job. When the batch job is finished, and you return to the production order card, notice that the starting date for the production order is January 27, 2014.

2. Change the production order to 50 units and schedule the order.
 - a. On the **General** FastTab of the production order card, change the **Quantity** field from 10 to 50.
 - b. On the **Home** tab, click **Refresh Production Order**.
 - c. On the **Refresh Production Order** request page, accept all defaults, and then click **OK** to reschedule the production order. When you return to the production order card, notice that the start date has now been pushed back to January 20, 2014. This is three days earlier than the current work date of January 23, 2014.

3. Change the start date to January 23, 2014 to trigger a forward scheduling of the production order.
 - a. Expand the **Schedule** FastTab on the production order card.
 - b. On the **Schedule** FastTab, set the **Starting Date** field to January 23, 2014, and then press **Enter** or **Tab**.
 - c. Notice that the starting for the order is now January 24, 2014, and that the ending date is February 11, 2014. The due date for the order is set one day later, on February 12, 2014. Eduardo now knows that it will take until February 12, 2014 to deliver the increased order.
 - d. Click **OK** to close the production order card.



Note: Scheduling an order by changing its starting or ending date does not require the **Refresh Production Order** batch job because all dates recalculate automatically.

Additional Production Order Topics

Additional topics for production orders include the following:

- Item reservation
- Production orders with phantom BOMs
- Production orders with manufacturing batch unit of measure
- Production order statistics

Inventory Reservation

In some instances, you have to reserve components for a production order. You can do this manually for a specific production order, or you can set it up to occur automatically. For detailed information about inventory reservations, refer to the *Inventory Management in Microsoft Dynamics NAV 2013 (HOL)* course.

Demonstration: Reserve a Component for a Production Order

This is a continuation of the “Replan a Production Order” demonstration.

Scenario: Eduardo is concerned about the supply of item 1710, Hand rear wheel Brake, that is required to fulfill the production order for item 1700 that was created by the **Replan** function. To address this concern, he decides to reserve the required supply of item 1710 for the new production order.

Demonstration Steps

1. Reserve item 1710 on behalf of the production order for item 1700 that was created by the **Replan** function.
 - a. In the **Search** box, type “firm planned prod. orders”, and then select the related link.
 - b. On the **Firm Planned Prod. Orders** list page, double-click the line for the production order for item 1700, Brake.
 - c. On the **Lines** FastTab of the production order card, click **Line**, and then click **Components**.
 - d. On the **Prod. Order Components** page, select the line for item 1710.
 - e. On the **Home** tab, click **Reserve**.
 - f. On the **Home** tab of the **Reservation** page, click **Auto Reserve**. Notice that many of the quantity fields on the header and in the table update to reflect the reservation.
2. Review the reservation.
 - a. Click **OK** to close the **Reservation** page.
 - b. On the **Prod. Order Components** page, make sure that the line for item 1710 is still selected.
 - c. On the **Home** tab, click **Order Tracking**. The **Order Tracking** page shows the reservation.
 - d. Press **Esc** three times to return to the **Firm Planned Prod. Orders** list page.

Production Orders with Phantom BOMs

A *phantom BOM* is a BOM that is used for a non-stocked subassembly. In Microsoft Dynamics NAV, a phantom BOM is a production BOM that is used as a component in another production BOM. The main benefit of phantom BOMs is to simplify the product structure because they enable the MRP process to account for the components without having to create an item card or a separate production order for the subassembly. For more information about phantom BOMs, refer to “Production Bill of Materials (BOM)” in this training material.

When you create a production order that contains a phantom BOM component, and then run the **Refresh Production Order** batch job, the program explodes the phantom BOM into its components.

For example, if you create a firm planned production order for a bicycle with a phantom BOM pedal subassembly, and then you run the **Refresh Production Order** batch job for order, the phantom BOM explodes into its pedal and pedal screw components. These components calculate as Level 1 components of the bicycle, not as a subassembly.

Production Orders with Manufacturing Batch Unit of Measure

If an item is stocked in one unit of measure, but is produced in another, you can create a production order that uses a manufacturing batch unit of measure to calculate the correct quantity of the components.

Demonstration: Calculate a Manufacturing Batch Unit of Measure

Scenario: Eduardo, the production planner at CRONUS, decides to manufacture item 1150, Front Hubs, in boxes of 10 instead of pieces. To implement this, he must set up the BOX unit of measure for item 1150. He must also remember to select BOX as the unit of measure on all production order lines from that point forward.

Demonstration Steps

1. Create a new production order for item 1150.
 - a. In the **Search** box, type “firm planned prod. orders”, and then select the related link.
 - b. On the **Home** tab of the **Firm Planned Prod. Orders** list page, click **New**, and then press **Enter**.
 - c. On the **General** FastTab of the production order card, in the **Description** field, type “Front Hub”.
 - d. In the **Source No.** field, type “1150”.
 - e. In **Quantity** field, type “10”.
 - f. Set the **Due Date** field to February 01, 2014.
 - g. On the **Home** tab, click **Refresh Production Order**.
 - h. On the **Refresh Production Order** request page, accept all defaults, and then click **OK** to start the batch job.

2. Review the existing component requirements.
 - a. On the **Lines** FastTab of the production order card, click **Line**, and then click **Components** to open the **Prod. Order Components** page. Notice that the **Quantity per** field equals 1, and that the **Expected Quantity** field equals 10.5. The .5 accounts for scrap.
 - b. Click **OK** to close the page and return to the production order card.

3. Create the new unit of measure for item 1150 and select it for the production order line.
 - a. On the **Lines** FastTab, in the **Unit of Measure Code** field, click the down arrow, and then click **Advanced**.
 - b. On the **Item Units of Measure** page, on the **Home** tab, click **New**.
 - c. In the **Code** field, select BOX.
 - d. In the **Qty. per Unit of Measure** field, type "10".
 - e. Make sure that the BOX unit of measure is still selected, and then click **OK**. This returns you to the production order card. On the **Lines** FastTab, notice that BOX now is selected in the **Unit of Measure Code** field for the order line.
 - f. Press **Enter** or **Tab**. Notice the recalculation of the **Starting Date-Time** field on the order line. This is because you effectively increased the required quantity of hubs from 10 to 100. When the program recalculates the time that is required for each routing operation, it considers this increased quantity and lengthens the total production time.

4. Review the new component requirements.
 - a. Click **Line**, and then click **Components** to open the **Prod. Order Components** page. Notice that the **Quantity per** field now equals 10 and that the **Expected Quantity** field now equals 105.
 - b. Click **OK** to close the page and return to the production order card.
 - c. Click **OK** to close the production order card.

Production Order Statistics

There are many instances when you might want to review the costs that are associated with a production order. The **Production Order Statistics** page shows statistical information about the production order's direct material and capacity costs and overhead, and about its capacity need expressed in time.

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To view the production order statistics for a finished production order, follow these steps.


1. In **Search** box, type "finished prod. orders", and then select the related link.
2. On the **Finished Prod. Orders** list page, select production order 1011001.
3. On the **Home** tab, click **Statistics**.


	Standard Cost	Expected Cost	Actual Cost	Dev. %	Variance
Material Cost:	1,614.97	1,614.98	1,614.98	0	0.01
Capacity Cost:	138.00	204.00	204.00	48	66.00
Subcontracted Cost:	0.00	0.00	0.00	0	0.00
Capacity Overhead:	0.00	0.00	0.00	0	0.00
Manufacturing Overhead:	0.00	0.00	0.00	0	0.00
Total Cost:	1,752.97	1,818.98	1,818.98	4	66.01
Capacity Need:		420	420	0	

FIGURE 5.12: PRODUCTION ORDER STATISTICS PAGE

The page includes the following rows.

Row	Description
Material Cost	<p>Shows the material costs for all lines in the production order. These include the following:</p> <ul style="list-style-type: none"> • Standard cost of materials that are based on a standard production BOM • Expected cost of materials that are based on any changes that you made to material components for this production order • Actual cost of materials that are based on recording consumption for the production order <p>Production order variance is calculated as <i>actual cost - standard cost = variance</i>.</p> <p>Dev % (deviation percentage) is calculated as <i>variance/standard cost = deviation %</i></p>
Capacity Cost	<p>Shows the capacity costs for all lines in the production order. These include the following:</p> <ul style="list-style-type: none"> • Standard capacity costs that are based on a standard routing • Expected capacity costs that are based on any changes that are made to the internal operations on the routing for the production order • Actual capacity costs that are based on recorded output for the production order • Deviation in percent • Variance

Row	Description
<p>Subcontracted Cost</p>	<p>Shows the subcontracted costs for all lines in the production order. These include the following:</p> <ul style="list-style-type: none"> • Standard subcontractor costs based on a standard routing • Expected subcontractor costs based on any changes that are made to external operations on the routing for the production order • Actual subcontractor costs based on subcontractor purchase order receipts for the production order • Deviation in percent • Variance
<p>Capacity Overhead</p>	<p>Shows the capacity overhead costs for all lines in the production order. These include the following:</p> <ul style="list-style-type: none"> • Standard capacity overhead costs that are based on a standard routing • Expected capacity overhead costs that are based on any changes that were made to the internal or external operations on the routing for the production order • Actual capacity overhead costs that are based on recorded output for the production order • Deviation in percent • Variance <hr/> <p> Note: Capacity overhead includes indirect overhead costs, such as factory supervision, factory fixed expenses, and subcontractor overhead expenses</p>

Row	Description
<p>Manufacturing Overhead</p>	<p>Shows the manufacturing overhead costs for all lines in the production order. These include the following:</p> <ul style="list-style-type: none"> • Standard manufacturing overhead costs that are based on a standard production BOM • Expected manufacturing overhead costs that are based on any changes that are made to material components for the production order • Actual manufacturing overhead costs that are based on recorded consumption for the production order • Deviation in percent • Variance <hr/> <p> Note: <i>Manufacturing overhead can include indirect costs, such as freight or material handling charges.</i></p>
<p>Total Cost</p>	<p>Shows the total costs for all lines in the production order. These include the following:</p> <ul style="list-style-type: none"> • Standard costs that are based on a standard production BOM and routing • Expected total costs that are based on any changes that are made to the components or routing for the production order • Actual total costs that are based on recording consumption and output for the production order • The deviation in percent • Variance

Row	Description
Capacity Need	<p>Shows the total amount of capacity that is required (in minutes, hours, or days) for all lines in the production order. This includes the following:</p> <ul style="list-style-type: none"> • Expected capacity that is based on changes to the routing for the production order • Actual capacity that is based on recording output for the production order • Deviation

Production Order Reports

Microsoft Dynamics NAV provides access to the following four reports from the order card of a firm planned or released production order.

Report	Description
Prod. Order – Job Card	<p>Records actual operating times for a production order. Also provides a list of the work in progress. Shows or prints output, scrapped quantity, and production lead time, depending on the operation. In addition, the report displays material components that are required for each operation based on the routing link code. This makes the report useful for a JIT environment.</p> <p>To print or preview the report, click Job Card on the Home tab of the production order card.</p>
Prod. Order – Mat. Requisition	<p>Displays a list of component requirements for each production order in the report. This includes the required quantity, due date, and location code for each component. Also shows the status and output quantity for each order.</p> <p>To print or preview the report, click Mat. Requisition on the Home tab of the production order card.</p>

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Report	Description
Prod. Order – Shortage List	<p>Displays component items with insufficient quantities to produce the manufactured items on the production order. The list shows the inventory development plan from the current day until the set day, for example, whether orders are still open.</p> <p>To print or preview the report, click Shortage List on the Home tab of the order card for released production orders, and on the Actions tab of the order card for firm planned orders.</p>
Subcontractor – Dispatch List	<p>Displays the dispatch list for subcontractors. For more information about subcontracting, refer to “Subcontracting” in this training material.</p>

The program provides the following additional reports from the **Report** tabs of the various production order lists. The **Planned Production Orders** list page has no reports.

Report	Description
Prod. Order –Detailed Calc	<p>Displays a detailed listing of the costs for each operation and component for production orders that are selected in the report’s order filters.</p>
Prod. Order – Precalc. Time	<p>Displays a detailed listing of the production order requirements. This includes routings and components.</p>
Prod. Order – Comp. and Routing	<p>Displays information about components and operations in production orders. For released production orders, shows the remaining quantity if parts of the quantity are posted as output.</p>

Report	Description
Prod. Order – Picking List	Use this for material picking purposes. This report is available only from the Report tab of the production order list for released and finished production orders.
Prod. Order – List	Use this to review the status (due date, quantity completed, and so on) of production orders that are selected in the report's order filters.

Module Review

Production orders are a fundamental part of manufacturing in Microsoft Dynamics NAV. They participate in almost every aspect of the production process, from planning to processing and costing.

Mastering the production order concepts and techniques that are described in this module is an important prerequisite to the successful use of the program's manufacturing functionality.

Test Your Knowledge

Test your knowledge with the following questions.

1. What are the five production order statuses?

2. What are the three source types for production orders?

3. Which function do you use to schedule a production order?

- () Order Planning
- () Replan Production Order
- () Schedule Production Order
- () Refresh Production Order

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4. Which of the following is not an option in the Plan option field on the Replan Production Order request page?

No Levels

One Level

Two Levels

All Levels

5. When a phantom BOM is used on a production order BOM, and the Refresh Production Order batch job runs, what happens to the phantom BOM's components?

Test Your Knowledge Solutions

Test Your Knowledge

1. What are the five production order statuses?

MODEL ANSWER:

Simulated, Planned, Firm Planned, Released, and Finished

2. What are the three source types for production orders?

MODEL ANSWER:

Item, Family, and Sales Header

3. Which function do you use to schedule a production order?

- Order Planning
- Replan Production Order
- Schedule Production Order
- Refresh Production Order

4. Which of the following is not an option in the Plan option field on the Replan Production Order request page?

- No Levels
- One Level
- Two Levels
- All Levels

5. When a phantom BOM is used on a production order BOM, and the Refresh Production Order batch job runs, what happens to the phantom BOM's components?

MODEL ANSWER:

The program explodes the phantom BOM into its components and calculates the components.

