MODULE 15: ADDITIONAL MANUFACTURING TOPICS

Module Overview

"Additional Manufacturing Topics" describes several advanced manufacturing features that are offered by Microsoft Dynamics® NAV. These include the following:

- Standard tasks
- Stop codes
- Additional scrap-related features
- Methods to define and record non-productive time
- Methods to reduce lead time
- Multilevel production orders
- Production families

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

Objectives

The objectives are:

- Describe standard tasks and how to use them.
- Explain stop codes and how to use them.
- Review the various options for recording scrap and the relationships between the options.
- Define non-productive time and show how to use it in a production order.
- Show how to reduce lead time.
- Describe how to make consumption journal entries and output journal entries for multilevel production orders.
- Define production families and show how to use them in a production order.

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Standard Tasks

Routing operations frequently require the following additional information for successful execution:

- Tooling requirements
- Required personnel
- Quality measures
- Comments or added description

You can record this information by selecting an operation on the **Lines** FastTab of the routing card, and then clicking the appropriate function on the **Operation** menu.
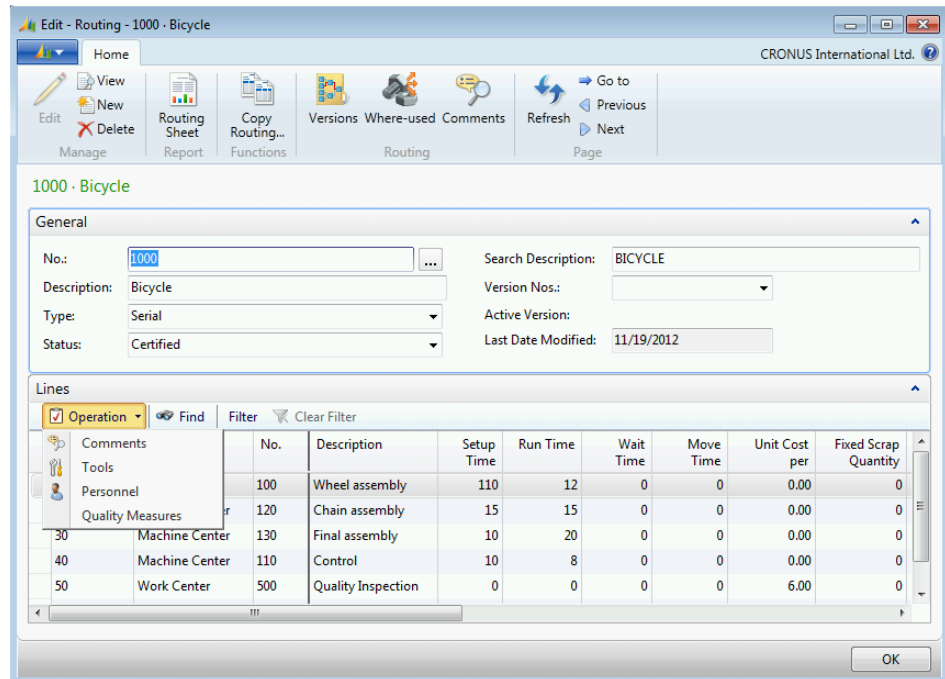

FIGURE 15.1:OPERATION MENU ON THE LINES FASTTAB OF THE ROUTING CARD

However, except for quality measures, the program does not help you standardize this added information. Person A can enter the same information for one operation differently than person B does for another operation. Even when users are consistent, repeatedly re-entering the same information is inefficient.

To make this task more consistent and efficient, you can set up standard tasks. You then can assign the standard tasks to routing operations. Any operation with the same standard task code then refers to the same information.

Demonstration: Create a Standard Task

Scenario: Oscar is the process engineer at CRONUS International Ltd. To save time and make the information that is assigned to routing operations more consistent, he decides to create standard tasks. His first standard task is for inspection operations of bicycles.

Demonstration Steps

1. Create the standard task.
    a. In the **Search** box, type "standard tasks", and then select the related setup link.
    b. On the first empty line of the **Standard Tasks** page, in the **Code** field, type "01".
    c. In the **Description** field, type "Inspection".

2. Add tooling requirements.
    a. On the **Home** tab, click **Tools**.
    b. On the **Standard Task Tools** page, in the **No.** field, type "1".
    c. In the **Description** field, type "No tools".
    d. Click **OK** to close the page.

3. Add required personnel.
    a. On the **Home** tab of the **Standard Tasks** page, click **Personnel**.
    b. On the **Standard Task Personnel** page, in the **No.** field, type "1".
    c. In the **Description** field, type "Main Inspector".
    d. On the next line, in the **No.** field, type "2".
    e. In the **Description** field, type "Spot Checker".
    f. Click **OK** to close the page.

4. Add quality measures.
    a. On the **Home** tab of the **Standard Tasks** page, click **Quality Measures**.
    b. On the **Standard Task Qlty Measures** page, in the **Qlty Measure Code** field, click the down-arrow, and then click **New**.
    c. On the **Quality Measures** page, in the **Code** field, type "A".
    d. In the **Description** field, type "Wheels".
    e. On a new line, in the **Code** field, type "B".
    f. In the **Description** field, type "Frame".
    g. On a new line, in the **Code** field, type "C".
    h. In the **Description** field, type "Saddle/Accessories".

    i.   Select the line for code A, Wheels, and then click **OK**. This returns you to the **Standard Task Qlty Measures** page and populates A in the **Qlty Measure Code** field of the first line.

    j.   In the **Min. Value** field, type "2".

    k.   In the **Max. Value** field, type "2".

    l.   On a new line, in the **Qlty Measure Code** field, select B, Frame.

    m.   In the **Min. Value** field, type "1".

    n.   In the **Max. Value** field, type "1".

    o.   On a new line, in the **Qlty Measure Code** field, select C, Saddle/Accessories.

    p.   In the **Min. Value** field, type "0".

    q.   In the **Max. Value** field, type "5".

FIGURE 15.2:STANDARD TASK QLTY MEASURES PAGE

    r.   Click **OK** to close the **Standard Task Qlty Measures** page.

📋   *Note:* Quality measures *typically represent important measures on a product, such as length or thickness. The measure must be between an upper and lower value with a specific mean tolerance. Otherwise, the quality inspector rejects the product.*

5.   Add a standard task description.

    a.   On the **Home** tab of the **Standard Tasks** page, click **Description**.

    b.   On the **Standard Task Descript. Sheet** page, in the **Text** field, type "Turn handlebars full left, then full right."

    c.   Click **OK** to close the **Standard Task Descript. Sheet** page.

> d. Click **OK** to close the **Standard Tasks** page.

📝 **Note:** *You can enter multiple lines of description for a standard task. The procedure can be how to carry out the task, or important notes to production personnel.*

Descriptions for standard tasks are printed on the routing sheet.

Demonstration: Add a Standard Task to a Routing

Scenario: Oscar, the process engineer at CRONUS, assigns the Inspection standard task to the Quality Inspection operation for routing 1000, Bicycle. Next, he creates a new production order for item 1000, Bicycle. Finally, he checks that the information that is associated with the Inspection standard task is linked to the correct production order routing line.

Demonstration Steps

1. Add the Inspection standard task to the Quality Inspection operation for routing 1000, Bicycle.
    a. In the **Search** box, type "routings", and then select the related link.
    b. On the **Routings** list page, double-click the line for routing 1000, Bicycle.
    c. On the **General** FastTab of the routing card, in the **Status** field, select Under Development.
    d. On the **Lines** FastTab, use the **Choose Columns** function to add the **Standard Task Code** field. Position it after the **Unit Cost per** field.
    e. On the line for operation 50, in the **Standard Task Code** field, select 01, Inspection.
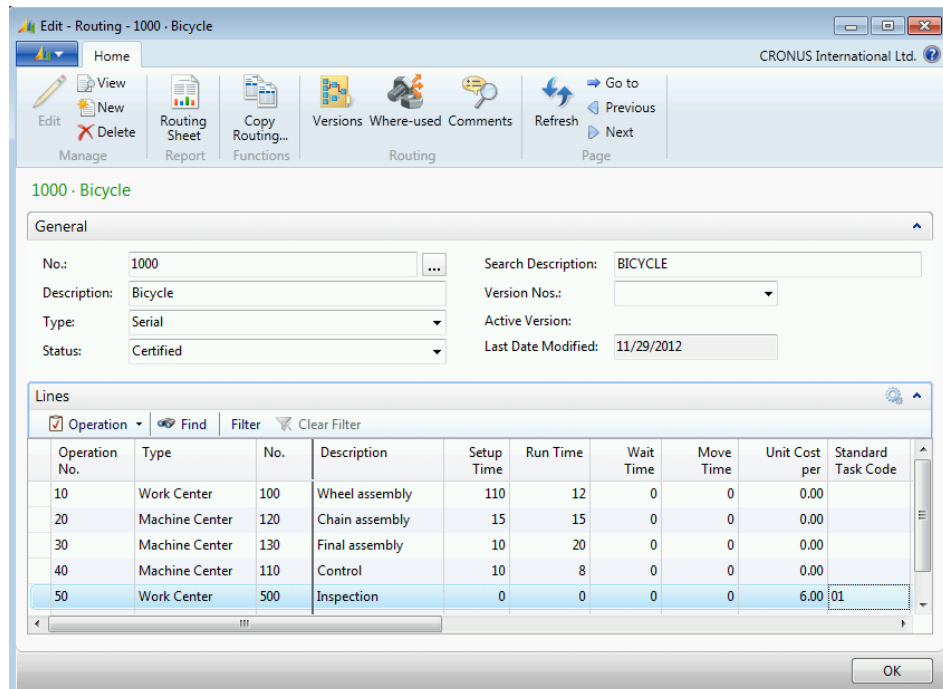   f. On the **General** FastTab, in the **Status** field, select Certified.

FIGURE 15.3:ROUTING LINE WITH A STANDARD TASK CODE

    g.   Click **OK** to close the routing card.

2.   Create a new production order for item 1000.

    a.   In the **Search** box, type "released prod. orders", and then select the related link.

    b.   On the **Home** tab of the **Released Prod. Orders** list page, click **New**, and then press **Enter**.

    c.   On the **General** FastTab of the production order card, in the **Source No.** field, type "1000".

    d.   In the **Quantity** field, type "2".

    e.   In the **Due Date** field, select January 27, 2014.

    f.   On the **Home** tab, click **Refresh Production Order**.

    g.   On the **Refresh Production Order** page, accept all defaults, and then click **OK**. After the batch job is finished, this returns you to the production order card.

3.   Verify that the information that is associated with the Inspection standard task is linked to the correct production order routing line.

    a.   On the **Lines** FastTab of the production order card, select the line for item 1000.

    b.   Click **Line**, and then click **Routing**.

    c.   On the **Prod. Order Routing** page, select the line for operation 50, Inspection.

    d.   On the **Home** tab, click **Quality Measures**. Notice that the values on the **Prod. Order Rtng Qlty Meas.** page are the same ones that you created in the "Create a Standard Task" demonstration.

    e.   Click **OK** to close the page.

    f.   Repeat steps d and e for the **Tools**, **Personnel**, and **Comments** functions on the **Home** tab of the **Prod. Order Routing** page. This confirms that all information from the Inspection standard task is successfully linked to the correct production order routing line.

    g.   Press **Esc** two times to close the open pages.

Stop Codes

Stop codes describe reasons for unplanned downtime at work centers and machine centers. Typical reasons for unplanned downtime include the following:

- Machine failure
- Material defects
- Lack of personnel

You use stop codes to enter and record periods when equipment is not being used. Enter stop codes in the capacity journal, and then post them to work center and machine center ledgers. Then you can analyze these ledger entries to explain and help prevent unplanned downtime.

Demonstration: Set Up Stop Codes

Scenario: To account for unplanned downtime, Eduardo, the production planner at CRONUS International Ltd., creates a set of stop codes.

Demonstration Steps

1.   Create a list of stop codes.

    a.   In the **Search** box, type "stop codes", and then select the related setup link.

    b.   On the **Stop Codes** page, in the **Code** field, type "DOWN".

    c.   In the **Description** field, type "Machine Down".

    d.   On the next line, in the **Code** field, type "DEFECT".

    e.   In the **Description** field, type "Material Defect".

    f.   On the next line, in the **Code** field, type "ABSENCE".

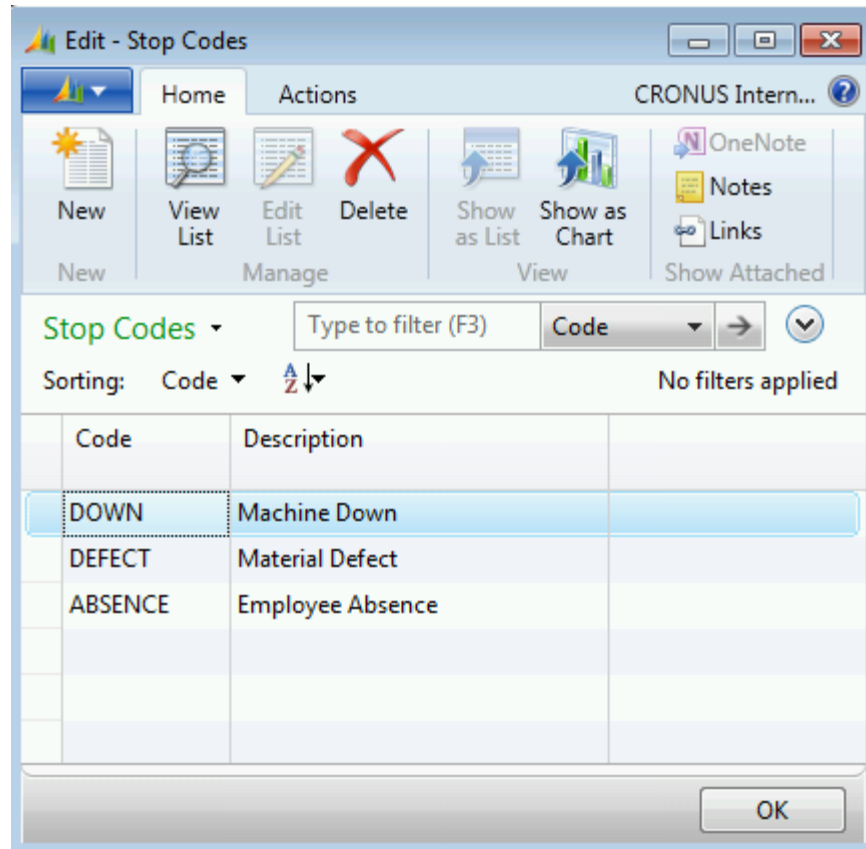   g.   In the **Description** field, type "Employee Absence".

FIGURE 15.4:STOP CODES PAGE

> h. Click **OK** to close the page.

Demonstration: Use a Stop Code in the Capacity Journal

Scenario: Eduardo, the production planner at CRONUS, learns that machine center 110 went down for repairs from 1:00:00 PM to 4:00:00 PM on January 24, 2014. Because Eduardo and the process engineer analyze downtime, Eduardo records this work stoppage in the capacity journal.

Demonstration Steps

1. Create the capacity journal entry.
    a. In the **Search** box, type "capacity journals", and then select the related link.
    b. On the **Capacity Journal** page, in the **Posting Date** field, select January 24, 2014.
    c. In the **Document No.** field, type "12345".
    d. In the **Type** field, select Machine Center.
    e. In the **No.** field, type "110".
    f. In the **Starting Time** field, type "1:00:00 PM".

g. In the **Ending Time** field, type "4:00:00 PM".

h. In the **Stop Time** field, type "180".

i. In the **Cap. Unit of Measure Code** field, select MINUTES.

j. In the **Stop Code** field, select DOWN.

FIGURE 15.5:CAPACITY JOURNAL ENTRY WITH A STOP CODE

2. Post the journal entry.

a. On the **Home** tab, click **Post**.

b. On the request message, click **Yes**.

c. Click **OK** to close the confirmation message. Notice that the journal line is deleted.

d. Click **OK** to close the journal.

Scrap Codes

Scrap codes describe reasons for production order scrap, such as the following:

• Incorrect configuration of the equipment

• Defective material

• Operator error

You use scrap codes for machine centers only. Enter scrap codes in the output journal or the capacity journal, and then post them to the capacity ledger. Then you can analyze these ledger entries to explain and help prevent unplanned scrap.

Demonstration: Set Up Scrap Codes

Scenario: Oscar, the process engineer at CRONUS, wants to record the reasons for unplanned scrap. To do this, first he must set up scrap codes.

Demonstration Steps

1. Set up scrap codes.

    a. In the **Search** box, type "scrap codes", and then select the related setup link.

    b. On the **Scrap Codes** page, in the **Code** field, type "CONFIG".

    c. In the **Description** field, type "Incorrect Machine Configuration".

    d. On the next line, in the **Code** field, type "DEFECT".

    e. In the **Description** field, type "Defective Material".

    f. On the next line, in the **Code** field, type "OPERATOR".

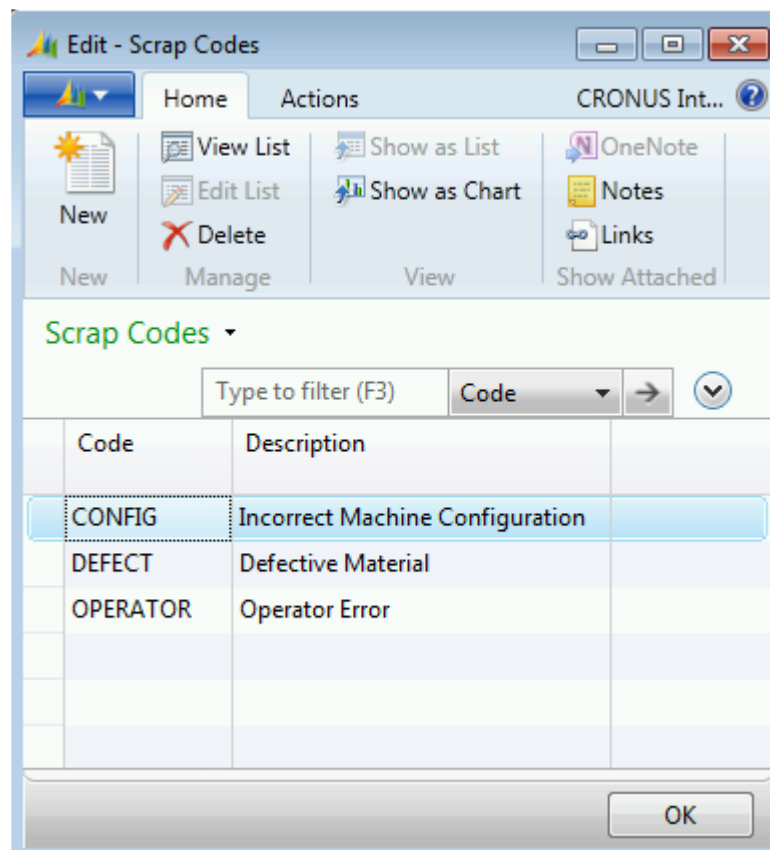   g. In the **Description** field, type "Operator Error".

FIGURE 15.6:SCRAP CODES PAGE

    h. Click **OK** to close the page.

Demonstration: Use a Scrap Code in the Output Journal

This is a continuation of the "Add a Standard Task to a Routing" demonstration.

Scenario: Oscar, the process engineer at CRONUS, hears that one front wheel must be scrapped due a defect in its rim. To support the later analysis of scrap data, he makes sure that the machine operator records the correct scrap information in the output journal.

Demonstration Steps

1. Use the output journal to post output for a production order.
   a. In the **Search** box, type "output journal", and then select the related link.
   b. On the **Output Journal** page, in the **Posting Date** field, select January 24, 2014.
   c. In the **Order No.** field, click the drop-down arrow, and then click **Advanced**.
   d. On the **Production Order List** page, select the line for the production order for two units of item 1000, Bicycle that you created in the "Add a Standard Task to a Routing" demonstration.
   e. Click **OK** to select the production order. This returns you to the journal.
   f. In the **Item No.** field, select 1100, Front Wheel.
   g. On the **Home** tab, click **Explode Routing**.
   h. Select the last three lines (for operations 30, 40, and 50), and then, on the **Home** tab, click **Delete**.
   i. On the request message, click **Yes**.
   j. On the journal line for operation number 10, in the **Run Time** field, type "5".
   k. On the journal line for operation number 20, in the **Run Time** field, type "16".
   l. Use the **Choose Columns** function to add the **Scrap Code** field. Position it after the **Output Quantity** field.
   m. On the line for operation number 20, in the **Scrap Code** field, select DEFECT.
   n. In the **Scrap Quantity** field, type "1".

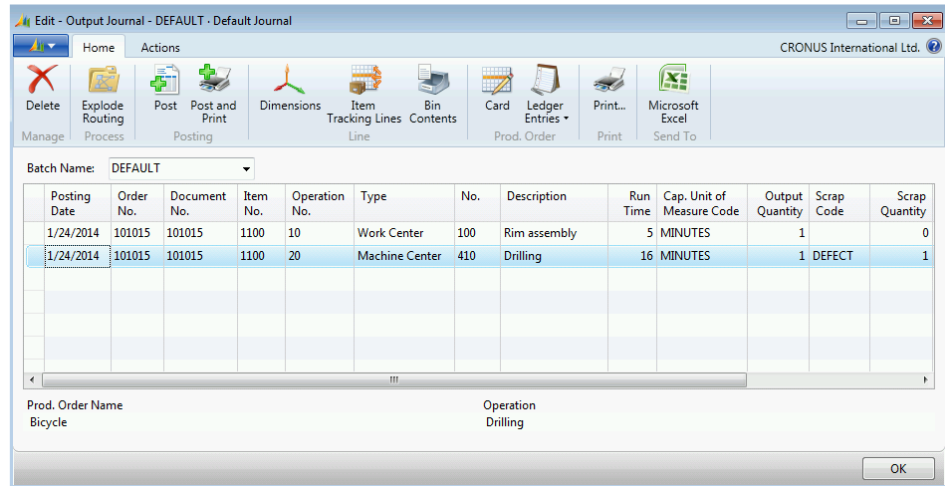**FIGURE 15.7:OUTPUT JOURNAL ENTRY THAT USES A SCRAP CODE**

2. Post the journal entry.

   a. On the **Home** tab, click **Post**.

   b. On the request message, click **Yes**.

   c. Click **OK** to close the confirmation message.

   d. Click **OK** to close the journal.

3. Review the capacity ledger entries.

   a. In the **Search** box, type "released prod. orders", and then select the related link.

   b. On the **Released Prod. Orders** list page, double-click the line for the production order of two units of item 1000 that you created in the "Add a Standard Task to a Routing" demonstration.

   c. On the **Navigate** tab of the production order card, click **Entries**, and then click **Capacity Ledger Entries**.

   d. On the **Capacity Ledger Entries** page, use the **Choose Columns** function to add the **Scrap Code** field. Position the **Scrap Code** and **Scrap Quantity** fields after the **Output Quantity** field. Notice that the scrap values that you entered in the capacity journal carry through to the capacity ledger.

FIGURE 15.8:CAPACITY LEDGER ENTRY WITH A SCRAP CODE

> e.   Press **Esc** two times to close the open pages.

Scrap

Scrap can be defined in one of the following ways:

- **In the Scrap % field on the item card** – This specifies the percentage of the item that you expect to scrap in the production process. If the item is a component, then the scrap percentage represents scrapped consumption when picking from inventory. If the item is a parent item, then the scrap percentage represents scrapped output before putting the parent item away in inventory. This means that you must start with more of all the components that make up the parent item.

- **In the Scrap % field on a production BOM line** – This specifies the percentage of a component that is scrapped in the production process when the component is used as part of that BOM. This increases the requirement for the component.

- **In the Scrap % field on a machine center card** – This specifies the expected percentage of scrap of the parent item for an operation on the machine center. This value is copied to the **Scrap %** field of any routing line that references the machine center.

- **In the Scrap % field on a routing line** – This specifies the expected percentage of scrap of the parent item for a routing operation. This increases the requirements for all components that are used in the operation. If you do not use routing link codes, the increase applies to all components on the BOM.

- **In the Fixed Scrap Quantity field on a machine center card** – This specifies the absolute part of the expected scrap of the parent item for an operation on this machine center. This value is copied to the **Fixed Scrap Quantity** field of any routing line that references the machine center.

- **In the Fixed Scrap Quantity field on a routing line** – This specifies the absolute part of the expected scrap of the parent item for a routing operation. This increases the requirements for all components that are used in the operation. If you do not use routing link codes, the increase applies to all components on the BOM.

Microsoft Dynamics NAV uses all types of scrap when calculating requirements and costs. As noted, scrap that is specified for a routing line applies to all the components that are used in an operation. If you do not use routing link codes, the scrap requirement applies to all components on the BOM. To learn more about routing link codes, refer to "Basic Capacities and Routings" in this training material.

The program calculates scrap as follows:

- If scrap for the parent item is 10 percent, then the required quantity for all components increases by 10 percent.

- If BOM scrap for a component is 15 percent, then the required quantity for that component increases by an additional 15 percent.

- The required component quantity after calculating scrap for the parent item scrap and the BOM scrap is known as *input to work on*.

- Routing scrap is calculated by multiplying the input to work on by the routing scrap percent, starting with the last operation.

- Fixed scrap is added to the total scrap.

- The process then repeats through all operations, working backward from the last operation to the first.

The result is the total planned number of components that are required to build the parent item. For example, consider the following scenario:

- Parent item scrap = 10 percent

- BOM scrap for component B = 15 percent

- Scrap on one routing operation is as follows:
  - Percentage = 25
  - Fixed = 2

- Routing link codes are not used

- The quantity for component B before scrap = 1

To build ten parent items, the program calculates the required quantity for component B as follows:

- Initial component quantity = 10

- Add in parent item scrap = 10 x 1.10 = 11

- Add in BOM scrap = 11 x 1.15 = 12.65. This is the input to work on.

- Add in scrap from routing scrap percent = 12.65 x 1.25 = 15.8125

- Add in routing fixed scrap = 15.8125 + 2 = 17.8125

To build ten parent items, you must start with 17.8125 units of component B.

Demonstration: Use Scrap in a Production Order

Demonstration Steps

1. Create a production order for item 1000, Bicycle.
   a. In the **Search** box, type "firm planned prod. orders", and then select the related link.
   b. On **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 **Source No.** field, type "1000".
   d. In the **Quantity** field, type "10".
   e. In the **Due Date** field, select February 3, 2014.
   f. On the **Home** tab, click **Refresh Production Order**.
   g. On the **Refresh Production Order** page, accept all defaults, and then click **OK**. After the batch job is finished, this returns you to the production order card. On the **Lines** FastTab, in the **Quantity** field, notice that the required quantity of the parent item, item 1000, is 10. So is the required quantity for the component items 1100 and 1200.
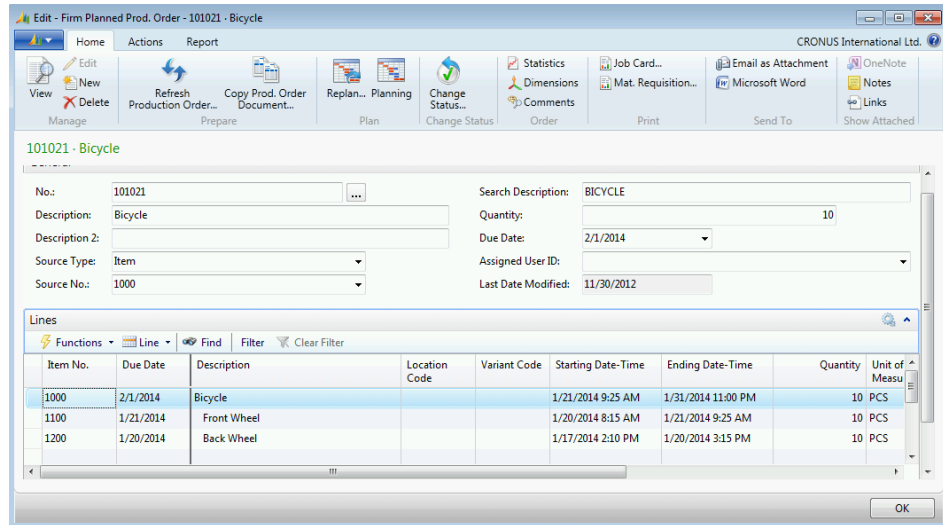
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FIGURE 15.9:COMPONENT REQUIREMENTS BEFORE SCRAP IS DEFINED

> h. Click **OK** to close the production order card.

📋   **Note:** *Production order lines are created for the two subassembly component items, 1100 and 1200, because the manufacturing policy for these items and for the parent item, is Make-to-Order (MTO). This is convenient for this demonstration because it means that you do not have to drill down into the production order BOM to see the component requirements for these items.*

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    2. Change the scrap percentage for item 1000.

        a. In the **Search** box, type "items", and then select the related link.

        b. On the **Items** list page, double-click the line for item 1000.

        c. On the item card, expand the **Replenishment** FastTab.

        d. In the **Scrap %** field, type "10".

        e. Click **OK** to close the item card.

    3. Refresh the production order.

        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 10 units of item 1000 that you created in step 1.

        c. On the **Home** tab of the production order card, click **Refresh Production Order**.

d. On the **Refresh Production Order** page, accept all defaults, and then click **OK**. After the batch job is finished, this returns you to the production order card. On the **Lines** FastTab, in the **Quantity** field, notice that the required quantity of item 1000 remains at 10. However, the required quantity of component items 1100 and 1200 is now 11. This reflects the 10 percent scrap that you specified for the parent item.

e. Click **OK** to close the production order card.

4. Change the scrap percentage for item 1100 on the production BOM for item 1000.

a. In the **Search** box, type "production bom", and then select the related link.

b. On the **Production BOM** list page, double-click the line for BOM 1000, Bicycle.

c. On the **General** FastTab of the **Production BOM** page, in the **Status** field, select Under Development.

d. On the **Lines** FastTab, on the line for item 1100, Front Wheel, in the **Scrap %** field, type "10".

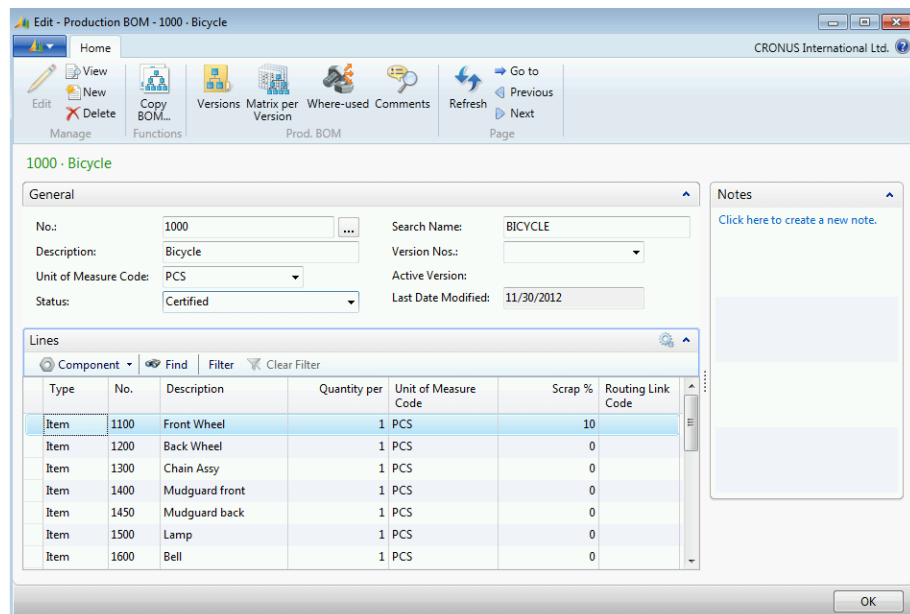e. On the **General** FastTab, in the **Status** field, select Certified.

FIGURE 15.10:PRODUCTION BOM LINE WITH COMPONENT SCRAP DEFINED

f. Click **OK** to close the **Production BOM** page.

5. Refresh the production order.

   a. Repeat the actions specified in step 3. Notice that the required quantity for component item 1100 increases another 10 percent to 12.1. This reflects the added BOM scrap for the component item. The required quantity for component item 1200 remains at 11.

6. Add a scrap percentage on one of the routing lines.

   a. In the **Search** box, type "routings", and then select the related link.

   b. On the **Routings** list page, double-click the line for routing 1000, Bicycle.

   c. On the **General** FastTab of the routing card, in the **Status** field, select Under Development.

   d. On the **Lines** FastTab, on the line for operation 10, in the **Scrap Factor %** field, type "10".

   e. On the **General** FastTab of the routing card, in the **Status** field, select Certified.
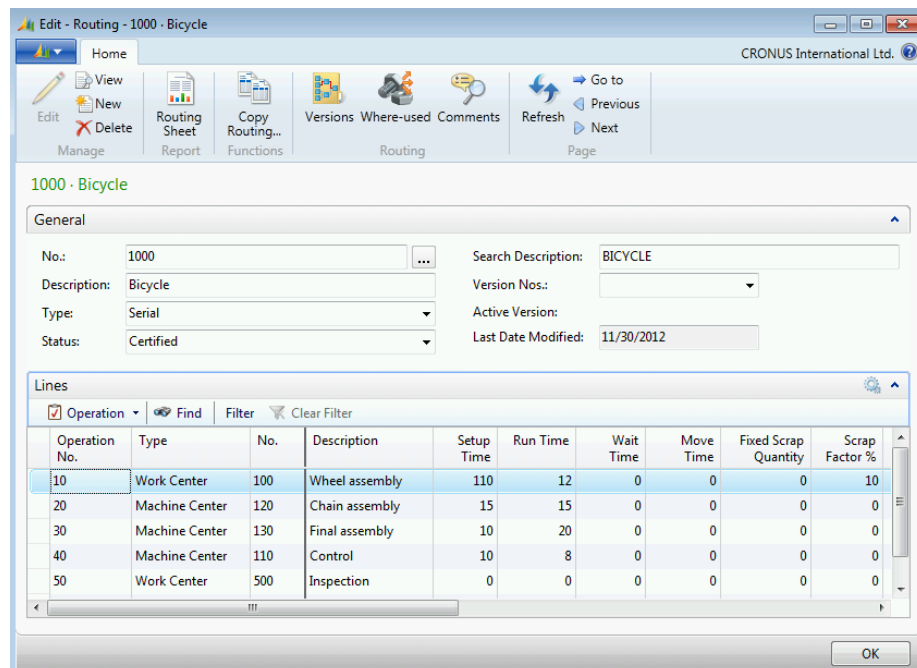
FIGURE 15.11:ROUTING LINE WITH SCRAP % DEFINED

   f. Click **OK** to close the routing card.

7. Refresh the production order.

   a. Repeat the actions specified in step 3. Notice that the required quantities for items 1100 and 1200 both increase by 10 percent. This reflects the scrap that you specified for the routing line.

8. Add a fixed scrap quantity to one of the routing lines.

   a. In the **Search** box, type "routings", and then select the related link.

   b. On the **Routings** list page, double-click the line for routing 1000, Bicycle.

   c. On the **General** FastTab of the routing card, in the **Status** field, select Under Development.

   d. On the **Lines** FastTab, on the line for operation 10, in the **Fixed Scrap Quantity** field, type "3".

   e. On the **General** FastTab of the routing card, in the **Status** field, select Certified.

FIGURE 15.12:ROUTING LINE WITH FIXED SCRAP QUANTITY DEFINED

   f. Click **OK** to close the routing card.

9. Refresh the production order.

   a. Repeat the actions specified in step 3. Notice that the required quantities for items 1100 and 1200 are increased by a fixed quantity of three.

Non-productive Time

Non-productive time is all the time that is spent on a production order other than setup time and run time. Non-productive time consists of wait time, move time, and queue time, as shown in the "Non-Productive Elements of Lead Time" diagram.
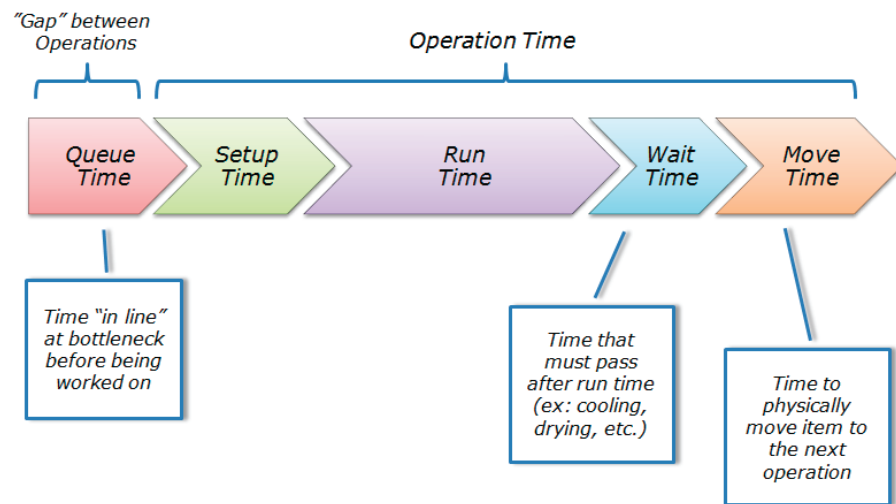

FIGURE 15.13:NON-PRODUCTIVE ELEMENTS OF LEAD TIME

Full descriptions of the three non-productive time elements are provided in the remaining topics in this lesson. These time elements introduce a lower level of scheduling than MPS and MRP. Scheduling on the lower level refers to the scheduling of individual production orders and their operations. Non-productive time elements can help you simulate the complexity of the shop floor.

📓 **Note:** *You can define the various types of throughput time in different units of measure. For example, you can define run time in hours and setup time in minutes. However, setting different units of measure for different types of throughput times has costing implications.*

Wait Time

Wait time is defined as the time that a production lot remains at a work center after an operation is finished until it is moved to the next operation. A common use for wait time is the drying process after painting. Instead of creating a new operation for the drying time, wait time is added to the painting operation. Wait time is frequently expressed as part of move time.

Move Time

Move time is the time that a production lot or batch spends in transit from one operation to the next. Typically, move time is used when the following is true:

- Facilities are not physically close to one another.
- Material handling equipment or personnel is constrained.

An example of move time is when one facility feeds a second facility with material and there is no material handling equipment between the two facilities. Periodically, a clerk comes to the first facility and transports materials to the second facility. In this example, you add move time to account for the time that is required to move the materials between the facilities.

Queue Time

Queue time is the time that production lots or batches wait at a work center or machine center before setup and processing. It occurs when a released production order arrives at a facility. However, the facility is already busy processing another operation. In other words, queue time is used to represent work in front of a facility instead of behind it. This can indicate a production line that is not in balance or that has bottlenecks.

If queue time is not used, the schedule that was generated for a production order might be too optimistic. This is because the system schedules each order as if it is the only order in the factory. Therefore, you can use queue time to improve the accuracy of order scheduling based on actual production times.

📋 **Note:** *Increases in queue time mean direct increases to manufacturing lead time and work-in-process inventory.*

Demonstration: Use Non-Productive Time in a Production Order

Scenario: Eduardo, the production planner at CRONUS, notices that many of his production orders are taking longer to process than planned. After analysis, he determines that schedules for the orders are not accounting for non-productive time. He therefore decides to implement non-productive time in scheduling.

Demonstration Steps

1. Create a new 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 **General** FastTab of the production order card, in the **Source No.** field, type "1100".

    d. In the **Quantity** field, type "1".

    e. In the **Due Date** field, select February 1, 2014.

    f. On the **Home** tab, click **Refresh Production Order**.

    g. On the **Refresh Production Order** page, accept all defaults, and then click **OK**. After the batch job is finished, this returns you to the production order card.

2. Review the production order routing lines.

    a. On the **Lines** FastTab of the production order card, select the single line for item 1100, Front Wheel.

    b. Click **Line**, and then click **Routing**.

    c. On the **Prod. Order Routing** page, notice that operation 20 has a starting time of 11:50:00 AM on January 31, 2014, and that this is the same as the ending time for operation number 10.

FIGURE 15.14:ROUTING WITHOUT SPECIFIED NON-PRODUCTIVE TIME

3. Change the queue time at a machine center.

    a. On the line for operation number 20, click the drop-down arrow in the **No.** field, and then click **Advanced**.

    b. On the **Home** tab of the **Machine Center List** page, click **Edit**.

    c. On the machine center card for machine center 410, expand the **Scheduling** FastTab.

    d. In the **Queue Time** field, type "30".

    e. In the **Queue Time Unit of Meas. Code** field, select MINUTES.

FIGURE 15.15: WORK CENTER CARD WITH QUEUE TIME SPECIFIED

    f.   Press **OK** to close the machine center card.

    g.   Press **Esc** two times to return to the production order card.

    h.   On the **Home** tab of the production order card, click **Refresh Production Order**.

    i.   On the **Refresh Production Order** page, accept all defaults, and then click **OK**.

    j.   On the **Lines** FastTab of the production order card, select the single line for item 1100, Front Wheel.

    k.   Click **Line**, and then click **Routing**.

    l.   On the **Prod. Order Routing** page, notice that there is now a 30-minute gap between the ending time of operation number 10 and the starting time for operation number 20. Adding 30 minutes of queue time to the machine center has delayed the start of operation number 20 by 30 minutes. Because this production order is backward scheduled, this pushes the ending time for operation number 10 back to 11:20:00 AM instead of 11:50:00 AM. If you had forward scheduled the production order, then the delay would have affected the starting time of operation number 30 instead.

4.   Change the wait time to 10 minutes.

    a.   On the line for operation number 20, in the **Wait Time** field, type "10". Notice that the ending time for the operation immediately changes to 1:08:00 PM. This is 10 minutes later than the previous ending time for the operation. Also notice that the starting and ending times for all later operations change accordingly.

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5. Change the move time to 20 minutes.

   a. On the line for operation number 20, in the **Move Time** field, type "20", and then press **Enter**. Notice that the ending time for the operation immediately changes to 1:28:00 PM, and that the starting and ending times for all later operations change accordingly. Move time represents a different type of non-productive time than wait time, but its effect on the schedule is the same.

   b. Press **Esc** two times to return to the **Firm Planned Prod. Orders** list page.

Methods to Reduce Lead Time

The following methods can be used to reduce lead time:

- Parallel scheduling
- Send-ahead quantity
- Concurrent capacity

Parallel Scheduling

In Microsoft Dynamics NAV, *parallel scheduling* means to process two or more different operations on a production order at the same time. This reduces total production order lead time or throughput time. For some industries, it can also increase efficiency and reduce the complexity in the BOM structure.

 📓 **Note:** *The definition of parallel scheduling in Microsoft Dynamics NAV differs from the Association for Operations Management (APICS) definition. The APICS definition is as follows: "Parallel Scheduling is the use of two or more machines or job centers to perform identical operations on a lot of material. Duplicate tooling and setup are required."*

Demonstration: Use Parallel Scheduling in a Production Order

Scenario: Oscar, the process engineer at CRONUS, decides to implement parallel processing in the routing for item 1100, Front Wheel.

Demonstration Steps

1. Change routing 1100, Front Wheel, to use parallel processing.

   a. In the **Search** box, type "routings", and then select the related link.

    b.   On the **Routings** list page, double-click the line for routing 1100, Front Wheel.

    c.   On the **General** FastTab of the routing card, in the **Status** field, select **Under Development**.

    d.   In the **Type** field, select Parallel.

    e.   On the **Lines** FastTab, use the **Choose Columns** function to position the **Next Operation No.** field after the **Move Time** field.

    f.   On the line for operation number 10, in the **Next Operation No.** field, type "20|30".

    g.   On the line for operation number 20, in the **Next Operation No.** field, type "40".

    h.   On the **General** FastTab, in the **Status** field, select Certified.
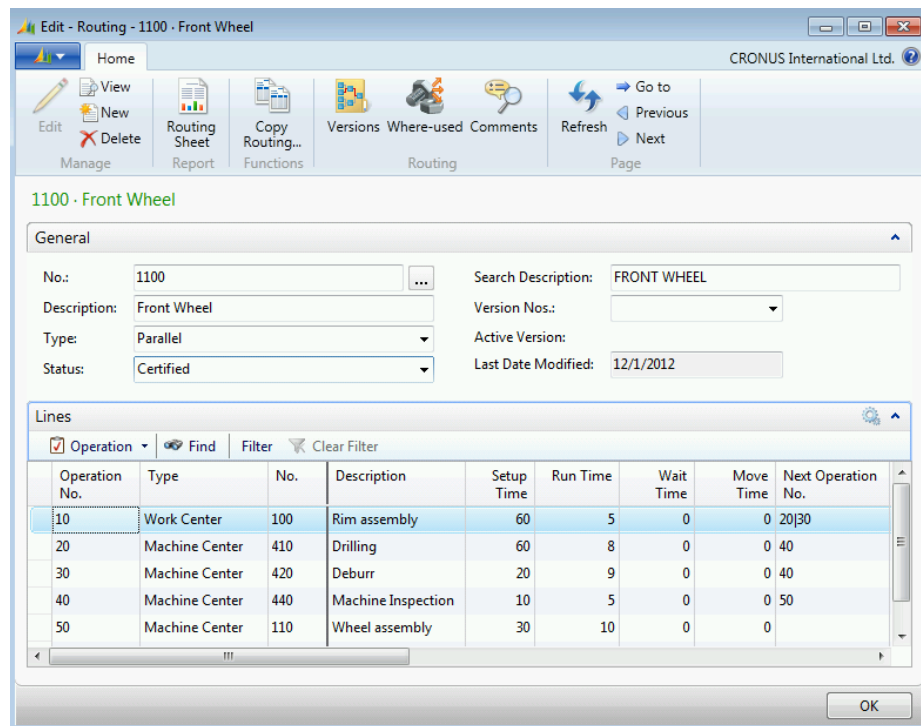
FIGURE 15.16:ROUTING THAT USES PARALLEL SCHEDULING

    i.   Click **OK** to close the routing card.

2.   Create a new production order for item 1100, Front Wheel.

    a.   In the **Search** box, type "firm planned prod. orders", and then select the related link.

    b.   On **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 **Source No.** field, type "1100".

    d.   In the **Quantity** field, type "2".

e. In the **Due Date** field, select February 5, 2014.

f. On the **Home** tab, click **Refresh Production Order**.

g. On the **Refresh Production Order** page, accept all defaults, and then click **OK**. After the batch job is finished, this returns you to the production order card.

3. Review the production order routing lines.

a. On the **Lines** FastTab of the production order card, select the single line for item 1100, Front Wheel.

b. Click **Line**, and then click **Routing**.

c. On the **Prod. Order Routing** page, notice that operations 20 and 30 overlap one another, and that both have exactly the same ending date/time (they share the same ending time, not the same starting time, because they are backward scheduled). In other words, the two operations are scheduled to run in parallel.

FIGURE 15.17:PRODUCTION ORDER ROUTING WITH PARALLEL OPERATIONS

d. Press **Esc** two times to return to the **Firm Planned Prod. Orders** list page.

Send-ahead Quantity

The send-ahead quantity feature lets you specify for each routing operation, a portion of the lot or batch that is sent to the next operation. The next operation starts when the send-ahead quantity is produced.

For example, suppose that operation 30 is the next operation after operation 20. Also suppose that operation 20 has a setup time of 15 minutes, a run time of five minutes for each piece, and that no time is specified for any of the other time elements. If you specify 10 pieces as the send-ahead quantity for operation 20, then you can calculate the starting date/time for operation 30 by using the following formula: *Starting date/time of operation 20 + setup time for operation 20 + (number of send-ahead pieces for operation 20 * run time for operation 20) = starting date/time for operation 30*. Therefore, you can start operation 30 in 15+(10*5), or 65 minutes after you start operation 20.

📋 **Note:** *Using the send-ahead quantity penalizes performance because production is not planned as a whole, but instead is split into batches. The planning engine then must plan for the batches.*

Concurrent Capacity

You can set up concurrent capacity on both the machine center card and the routing card. The meaning differs slightly in each case, as follows:

- *Concurrent capacity on the machine center card* specifies how many machines or persons work at the same time at the machine center. This determines how much available capacity can be planned at the same time for operations that are processed at the machine center. For example, if the **Concurrent Capacities** field is set to two, this means that two times as much available capacity can be planned at the same time than if you set the **Concurrent Capacities** field to one. You must not enter a value that is greater than the **Capacity** field on the machine center card.

- Concurrent capacity on a routing indicates how many machine center resources work on an operation at the same time. Increasing concurrent capacity for an operation decreases the manufacturing lead-time. For example, suppose that an operation requires four hours of run time. By using two machines at the machine center, you can reduce the processing time to two hours.

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Journal Entries for Multilevel Production Orders

Multilevel production orders are described in "Additional Planning Topics" in this training material. This lesson describes using the consumption journal and the output journal for multilevel production orders.

You record component usage in the consumption journal for multilevel production orders exactly as you would for any other order. The **Calc. Consumption** function brings in all the required components for subassembly production order lines. If you want to see the source order line numbers on the consumption journal, use the **Choose Columns** function to add the **Order Line No.** field.

When you record production for multilevel production orders in the output journal, you can let the program explode all the lines of the production order, and then enter the processing time and output quantities for each operation line. Or, if you want to record production separately for each order line, you can follow these steps.

1. Enter the first line of a production order. Explode the routing for that line, and then enter the processing time and output quantities for each operation.
2. Enter the second line of the same production order. Explode the routing for that line, and enter the processing time and output quantities for each operation.
3. Enter and explode the remaining lines on the production order in the same manner.

Families

A *production family* is a group of individual items that use similar manufacturing processes. In addition to production orders for groups of make-to-order (MTO) and assemble-to-order (ATO) items on a sales order, you can also create a production order for a family of items. One advantage of this approach is that it can optimize a company's material consumption. For example, consider the following scenario:

- A company uses a sheet of metal to produce large circles.
- Every time large circles are produced, there is a lot of scrap. Some scrap is used to produce small squares.
- Therefore, small squares are produced when large circles are produced, and the production order is for both large circles and small squares.

To create a family, you typically create a routing that is specific to the family.

You can then create a production order for a family by specifying the family as the source. To do this, you must create the production order manually.

Demonstration: Create a Production Order for a Family

Scenario: Because of the similarity in manufacturing front hubs and back hubs, Oscar, the process engineer at CRONUS, decides to create a Hub family. He then creates a production order for the family.

Demonstration Steps

1. Create the Hub family.
   a. In the **Search** box, type "families", and then select the related link.
   b. On the **Home** tab of the **Families** list page, click **New**.
   c. On the **General** FastTab of the **Family** page, in the **No.** field, type "101009".
   d. In the **Description** field, type "Hub Family".
   e. On the **Lines** FastTab, in the **Item No.** field, type "1150".
   f. In the **Quantity** field, type "1".
   g. On the next line, in the **Item No.** field, type "1250".
   h. In the **Quantity** field, type "1".

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FIGURE 15.18:FAMILY PAGE

        i.   Click **OK** to close the **Family** page.

> 📋   **Note:** *Typically, you would create a routing for the family, and then assign the routing number to the **Routing No.** field on the **Family** page. This was not done in this case only to shorten the demonstration.*

    2.   Create a production order for the Hub family.

        a.   In the **Search** box, type "firm planned prod. orders", and then select the related link.

        b.   On **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 **Source Type** field, select Family.

d. In the **Source No.** field, type "101009".

e. In the **Quantity** field, type "5".

f. In the **Due Date** field, select January 31, 2014.

g. On the **Home** tab, click **Refresh Production Order**.

h. On the **Refresh Production Order** page, accept all defaults, and then click **OK**. After the batch job is finished, it returns you to the production order card. Notice that there are two lines on the production order, one for each member of the Hub family.

FIGURE 15.19:PRODUCTION ORDER FOR THE HUB FAMILY

i. Click **OK** to close the production order card.

Module Review

The advanced features that are described in this module offer significant efficiency gains, improved information, and more accurate planning. However, not all companies require these features, and few companies require them all. Therefore, you should carefully examine the cost and benefits of each feature before you implement it in your company.

Test Your Knowledge

Test your knowledge with the following questions.

1. What is a standard task?

2. What is a stop code?

3. What are scrap codes?

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4. Which two scrap fields make up the input to work on?

( ) The Scrap % field on the BOM line and the Scrap % field on the routing line.

( ) The Scrap % field on the BOM line and the Fixed Scrap Quantity field on the routing line.

( ) The Scrap % field and the Fixed Scrap Quantity field on the machine center card.

( ) The Scrap % field on the item card and the Scrap % field on the BOM line.

5. Which of the following is not classified as non-productive time?

( ) Queue time

( ) Setup time

( ) Wait time

( ) Move time

6. What is parallel scheduling?

_____

_____

_____

_____

7. What is a production family?

_____

_____

_____

_____

Test Your Knowledge Solutions

Test Your Knowledge

1. What is a standard task?

    MODEL ANSWER:

    A standard task is a code that is associated with the following information:

    - Tooling requirements
    - Required personnel
    - Quality measures
    - Comments or added description

2. What is a stop code?

    MODEL ANSWER:

    Stop codes describe reasons for unplanned downtime at work centers and machine centers, such as the following:

    - Machine failure
    - Material defects
    - Lack of personnel

    You use stop codes to enter and record periods where equipment is not being used.

3. What are scrap codes?

    MODEL ANSWER:

    Scrap codes describe reasons for production order scrap, such as the following:

    - Incorrect configuration of the equipment
    - Defective material
    - Operator error

    You use scrap codes for machine centers only.

4. Which two scrap fields make up the input to work on?

   ( ) The Scrap % field on the BOM line and the Scrap % field on the routing line.

   ( ) The Scrap % field on the BOM line and the Fixed Scrap Quantity field on the routing line.

   ( ) The Scrap % field and the Fixed Scrap Quantity field on the machine center card.

   (√) The Scrap % field on the item card and the Scrap % field on the BOM line.

5. Which of the following is not classified as non-productive time?

   ( ) Queue time

   (√) Setup time

   ( ) Wait time

   ( ) Move time

6. What is parallel scheduling?

   MODEL ANSWER:

   In Microsoft Dynamics NAV, parallel scheduling means to process two or more different operations on a production order at the same time. This reduces total production order lead-time or throughput time.

7. What is a production family?

   MODEL ANSWER:

   A production family is a group of individual items that use similar manufacturing processes. In addition to production orders for groups of make-to-order (MTO) and assemble-to-order (ATO) items on a sales order, you can also create a production order for a family of items.