

# Process Costing



## LEARNING OBJECTIVES

*After completing this chapter, you should be able to answer the following questions:*

1

How is process costing different from job order costing?

2

Why are equivalent units of production used in process costing?

3

How are equivalent units of production determined using the weighted average and FIFO methods of process costing?

4

How are unit costs and inventory values determined using the weighted average and FIFO methods of process costing?

5

How can standard costs be used in a process costing system?

6

Why would a company use a hybrid costing system?

7

(Appendix) What alternative methods can be used to calculate equivalent units of production?

## INTRODUCING

<http://www.borsheimarts.com/lumina/about.htm>

**K**elly Borsheim started Lumina Candles & Art, a home-based business located in Cedar Creek, Texas, in the early 1990s. While working for a photo lab in college in the 1980s, Kelly had supplemented her income by selling fine art photography and shooting occasional wedding jobs. This led to an abiding interest in art, and she would later attend art school.

A friend, Jamshid, gave Kelly a beeswax honeycomb candle that she still has. Kelly decided to find out what it took to make one. She started making and selling only a few natural candles, later adding colors a few at a time to test the market.

Even though she was still working 60 hours a week at the photo lab, Kelly continued to develop the candle and art business. She left the photo industry in 1995 and, in the following year, another friend, Mark, showed Kelly how

the Internet worked. He also gave her a basic HTML lesson along with a list of sources for teaching herself how to do more. In May 1996, she launched her Web site. Although she still sells beeswax candles via local shows, she now relies mainly on the Internet for customers.

In making candles, Lumina uses two different processes. One process is used to make hand-rolled 100 percent beeswax candles and the other process is used to make solid beeswax candles, natural or scented, in molds. Either process produces a variety of shapes, sizes, and colors of candles.

The company must account for the direct material, direct labor, and manufacturing overhead for each production run of candles. The hand-rolled candle process is more labor intensive. Direct material includes beeswax, non-toxic and odorless aniline dyes, essential oils, and wicks.

SOURCE: Lumina Candles & Art Web site: <http://www.borsheimarts.com/lumina/about.htm>

At Lumina Candles & Art (Lumina), the primary products are manufactured in a continuous flow process, and each unit of output is identical to each other unit. Because Lumina production differs so dramatically from the products made by a company tailoring unique products to individual customer specifications as described in Chapter 5, the two companies' product costing systems also differ.

Job order costing is appropriate for companies making products or providing services in limited quantities that conform to customer specifications. In contrast, Lumina uses process costing to accumulate and assign costs to units of production. This costing method is also used by manufacturers of candy products, bricks, gasoline, paper, and food products, among many other types of firms.

Both job order and process costing systems accumulate costs by cost component in each production department. However, the two systems assign costs to departmental output differently. In a job order system, costs are assigned to specific jobs and then to the units composing the job. Process costing uses an averaging technique to assign the costs directly to the units produced during the period. In both costing systems, unit costs are transferred as goods are moved from one department to the next so that a total production cost can be accumulated.

This chapter presents process costing procedures and illustrates the weighted average and FIFO methods of calculating unit cost in a process costing system. These methods differ only in the treatment of beginning inventory units and costs. Once unit cost is determined, total costs are assigned to the units transferred out of a department and to that department's ending inventory. The chapter also illustrates a standard cost process costing system, which is an often-used simplification of the FIFO process costing system.

1

How is process costing different from job order costing?

## INTRODUCTION TO PROCESS COSTING

Assigning costs to units of production is an averaging process. In the easiest possible situation, a product's actual unit cost is found by dividing a period's departmental production costs by that period's departmental production quantity. This average is expressed by the following formula:

$$\text{Unit Cost} = \frac{\text{Sum of Production Costs}}{\text{Production Quantity}}$$

Peter Longmore describes the overall simplicity of the process costing process in the following excerpt:

*Process costing is applicable to production involving a continuous process resulting in a high volume of identical or almost identical units of output. While there are a number of complexities attached to process costing, the basic idea involves nothing more than calculating an average cost per unit. As such, the technique is divisible into 3 stages: (1) Measure the productive output in a period. (2) Measure the cost incurred in the period. (3) Calculate the average cost by spreading the total cost across the total output.<sup>1</sup>*

### The Numerator

The formula numerator is obtained by accumulating departmental costs incurred in a single period. Because most companies make more than one type of product, costs must be accumulated by product within each department. Costs can be accumulated by using different Work in Process Inventory accounts for each product and for each department through which that product passes. Alternatively, costs can be accumulated using departmental Work in Process Inventory control accounts that are supported by detailed subsidiary ledgers containing specific product information.

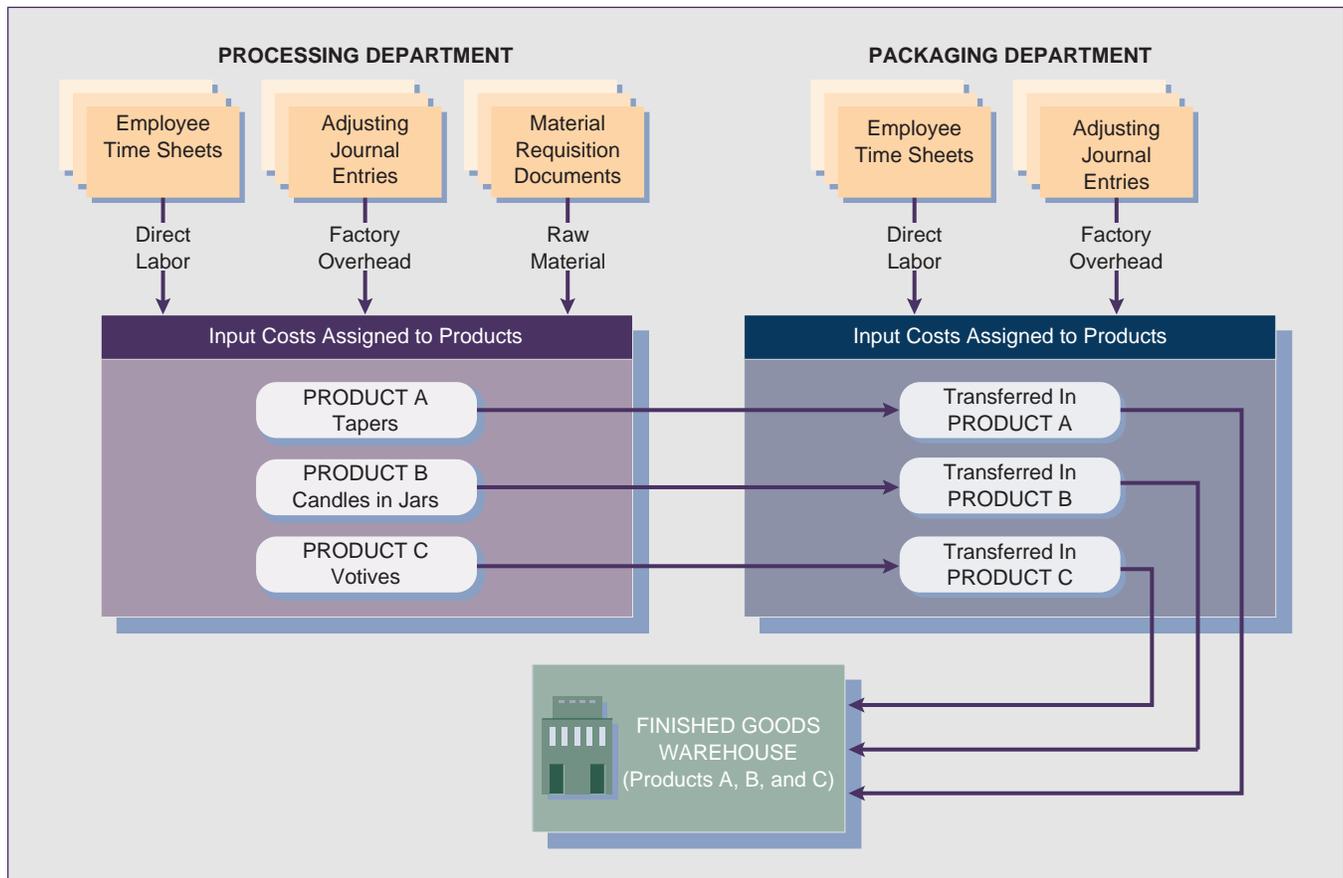
Cost accumulation in a process costing system differs from that in a job order costing system in two ways: (1) the *quantity* of production for which costs are accumulated at any one time, and (2) the *cost object* to which the costs are assigned. Suppose that Lumina occasionally contracts to hand-make four-foot candles for special religious occasions. For these orders, the company would use job order costing. The direct material and direct labor costs associated with each four-foot candle would be accumulated and assigned directly to the buyer's job. After each job is completed, the total material, labor, and allocated overhead costs are known and job cost can be determined.

In contrast, for its traditional candles, Lumina would use a process costing system to accumulate periodic costs for each department and each product. Because a variety of sizes, colors, and scents of candles are manufactured each period, the costs assignable to each type of product must be individually designated and attached to the specific production runs. These costs are then assigned to the units worked on during the period.

Exhibit 6–1 presents the source documents used to make initial cost assignments to production departments during a period. Costs are reassigned at the end of the period (usually each month) from the departments to the units produced. As goods are transferred from one department to the next, the related departmental production costs are also transferred. When products are complete, their costs are transferred from Work in Process Inventory to Finished Goods Inventory.

As in job order costing, the direct material and direct labor components of product cost present relatively few problems for cost accumulation and assignment.

<sup>1</sup> Peter Longmore, "Process Costing Demystified," *Accountancy* (October 1994), p. 88.

**EXHIBIT 6-1**

*Cost Flows and Cost Assignment*

Direct material cost can be measured from material requisition slips; direct labor can be determined from employee time sheets and wage rates for the period.

In contrast, overhead is indirectly assigned to output. If total overhead costs are relatively constant from period to period and production volume is relatively steady over time, actual overhead costs provide a fairly uniform production cost and may be used for product costing. If such conditions do not exist, using actual overhead for product costing would result in fluctuating unit costs and, therefore, predetermined application rates are more appropriate.

In both job order costing and process costing systems, firms may change the definitions of cost pools or adopt new schemes for assigning overhead costs to production. Such changes may be desirable as managers find new ways to structure production activities and develop new management methods. The changes in management practices create challenges for accountants in creating accounting systems that provide useful information to managers.

## The Denominator

The denominator in the unit cost formula represents total departmental production for the period. If all units were 100 percent complete at the end of each accounting period, units could simply be counted to obtain the denominator. But in most production processes, Work in Process (WIP) Inventory exists, which consists of partially completed units. Any partially completed ending inventory of the current period becomes the partially completed beginning inventory of the next period. Process costing assigns costs to both fully and partially completed units by mathematically converting partially completed units to equivalent whole units.

Units in beginning WIP Inventory were started last period, but will be completed during the current period. This two-period production sequence means that some costs for these units were incurred last period and additional costs will be incurred in the current period. Additionally, the partially completed units in ending WIP Inventory were started in the current period, but will not be completed until next period. Therefore, current period production efforts on ending WIP Inventory units cause some costs to be incurred in this period and more costs will need to be incurred next period.

Physical inspection of the units in ending inventory is needed to determine the proportion of ending WIP Inventory that was completed during the current period. The mathematical complement to this proportion represents the work that needs to be completed next period. Inspection at the end of last period provided information on the proportion of work that needed to be completed this period on beginning inventory.

2

Why are equivalent units of production used in process costing?

### Equivalent Units of Production

The physical flow of units through a department and the manufacturing effort expended in a department during a period normally occur in the following order:

- units started in the previous period and finished in the present period,
- units started in the present period and finished in the present period, and
- units started in the present period and not finished in the present period.

Because of these mixed manufacturing efforts, production cannot be measured by counting whole units. Accountants use a concept known as equivalent units of production to measure the quantity of production achieved during a period.

**Equivalent units of production (EUP)** are an approximation of the number of whole units of output that could have been produced during a period from the actual effort expended during that period. EUPs are calculated by multiplying the number of actual but incomplete units produced by the respective percentage degree of completion. The following simple example indicates how equivalent units are calculated.

Assume the cooking department of a company had no beginning inventory in November. During November, the department worked on 220,000 units: 200,000 units were completed and 20,000 units were 40 percent complete at the end of the period. The EUP for the period are 208,000  $[(200,000 \times 100\%) + (20,000 \times 40\%)]$ .

### equivalent units of production

## WEIGHTED AVERAGE AND FIFO PROCESS COSTING METHODS

3

How are equivalent units of production determined using the weighted average and FIFO methods of process costing?

The two methods of accounting for cost flows in process costing are (1) weighted average and (2) FIFO. These methods relate to the manner in which cost flows are assumed to occur in the production process. In a very general way, these process costing approaches can be related to the cost flow methods used in financial accounting.

In a retail business, the weighted average method is used to determine an average cost per unit of inventory. This cost is computed by dividing the total cost of goods available by total units available. Total cost and total units are found by adding purchases to beginning inventory. Costs and units of the current period are not distinguished in any way from those on hand at the end of the prior period. In contrast, the FIFO method of accounting for merchandise inventory separates goods by when they were purchased and at what cost. The costs of beginning inventory are the first costs sent to Cost of Goods Sold; units remaining in the ending inventory are assigned costs based on the most recent purchase prices.

The use of these methods for costing the production of a manufacturing firm is similar to their use by a retailer. The **weighted average method** computes a single average cost per unit of the combined beginning inventory and current period production. The **FIFO method** separates beginning inventory and current period production and their costs so that a current period cost per unit can be calculated. The denominator used in the cost formula to determine unit cost differs depending on which of the two methods is used.<sup>2</sup>

In almost all cases, some direct material must be introduced at the start of a production process or there would be no need for labor or overhead to be incurred. For example, to make its various products, Lumina introduces wax at the start of a process. Any material added at the start of production is 100 percent complete throughout the process *regardless* of the percentage of completion of labor and overhead.

Most production processes require multiple direct materials. Additional materials may be added at any point or even continuously during processing. A material, such as a box, may even be added at the end of processing. During the production process, the product is 0 percent complete as to the box although other materials may be complete and some labor and overhead may have been incurred.

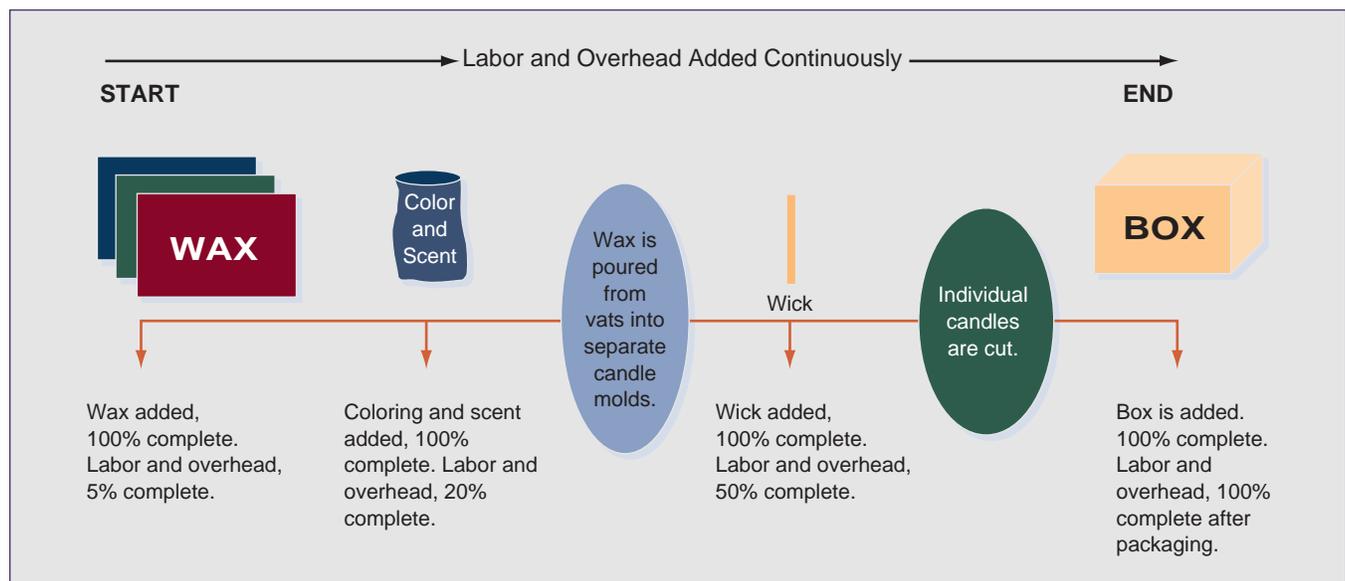
The production flow for candles shown in Exhibit 6–2 visually illustrates the need for separate EUP computations for each cost component. The material “wax” is 100 percent complete at any point in the process after the start of production; no additional wax is added later in production. When enough labor and overhead have been added to melt the wax and reach the 20 percent completion point, additional materials (coloring and scent) are added. Prior to 20 percent completion, these materials were 0 percent complete; after the 20 percent point, these materials are 100 percent complete. The wick is added at the 50 percent completion point, and the candles are packaged when processing is 99 percent finished, after

## weighted average method

## FIFO method

### EXHIBIT 6-2

Candle Manufacturing Process—  
Production Department



<sup>2</sup> Note that the term *denominator* is used here rather than equivalent units of production. Based on its definition, EUPs are related to current period productive activity. Thus, for any given set of production facts, there is only one true measure of equivalent units produced—regardless of the cost flow assumption used—and that measure is FIFO EUP. However, this fact has been obscured over time due to continued references to the “EUP” computation for weighted average. Thus, the term *EUP* has taken on a generic use to mean “the denominator used to compute the unit cost of production for a period in a process costing system.” We use EUP in this generic manner throughout the discussion of process costing.

which the candles are 100 percent complete. Thus, boxes are 0 percent complete throughout production; when the candles are packaged, the product is complete and is transferred to the finished goods warehouse or directly to customers.

If 8,000 candles are assumed to be 75 percent complete as to labor and overhead at the end of a period, those candles would be 100 percent complete as to wax, coloring and scent, and wicks, and 0 percent complete as to boxes. The EUP calculations would indicate that there are 8,000 EUPs for wax, coloring and scent, and wicks, and 0 EUPs for boxes. The labor and overhead (conversion) components of cost would have an equivalency of 6,000 candles, because the product is 75 percent complete and labor and overhead are added continuously during the process.<sup>3</sup>

When overhead is applied on a direct labor basis, or when direct labor and overhead are added to the product at the same rate, a single percentage of completion estimate can be made and used for both conversion cost components. However, because cost drivers other than direct labor are increasingly being used to apply overhead costs, single computations for “conversion EUP” will be made less often. For example, the cost driver for the utilities portion of overhead cost may be machine hours; the cost driver for the materials handling portion of overhead cost may be pounds of material. The increased use of multiple cost pools and/or activity-based costing concepts makes it less likely that the degrees of completion for the direct labor and overhead components of processing will be equal. The accompanying News Note (page 225) discusses a European view of process costing.

The calculation of equivalent units of production requires that a process cost flow method be specified. A detailed example of the calculations of equivalent units of production and cost assignment for each of the cost flow methods is presented in the next section.

## EUP CALCULATIONS AND COST ASSIGNMENTS

4

How are unit costs and inventory values determined using the weighted average and FIFO methods of process costing?

**total units to account for**

One purpose of any costing system is to determine a product cost for use on financial statements. When goods are transferred from Work in Process Inventory to Finished Goods Inventory (or another department), a cost must be assigned to those goods. In addition, at the end of any period, a value must be assigned to goods that are only partially complete and still remain in Work in Process Inventory. Exhibit 6–3 on page 226 outlines the steps necessary in a process costing system to determine the costs assignable to the units completed and to those still in ending inventory at the end of a period. Each of these steps is discussed, and then a complete example is provided for both weighted average and FIFO costing.

The first step is to calculate the total physical units for which the department is responsible or the **total units to account for**. This amount is equal to the total number of whole and partial units worked on in the department during the current period: beginning inventory units plus units started.

Second, determine what happened to the units to account for during the period. This step also requires the use of physical units. Units may fit into one of two categories: (1) completed and transferred or (2) partially completed and remaining in ending Work in Process Inventory.<sup>4</sup>

<sup>3</sup> Although the same number of equivalent units results for wax, coloring and scent, and wicks, and for labor and overhead, separate calculations of unit cost may be desirable for each component. These separate calculations would give managers more information for planning and control purposes. Managers must weigh the costs of making separate calculations against the benefits from having the additional information. For illustrative purposes, however, single computations will be made when cost components are at equal percentages of completion.

<sup>4</sup> A third category (spoilage/breakage) does exist. It is assumed at this point that such happenings do not occur. Chapter 7 covers accounting for spoilage in process costing situations.



### Costing Is a Three-Step Process

Besides control and budgeting, costing is essential to the managerial accounting activities in a company. Costing relates to how many expenses were used up by a product, a product group, a particular activity, or a set of business activities.

... Profits that are disclosed in financial statements are of the most aggregate nature. While segmental profits can provide detailed information for the external analyst, management often wants to identify the factors contributing to company profits with much greater accuracy. Deriving product cost and comparing it with the prices charged is such a detailed analysis. The difference of these two, called contribution, gives insights into the profitability of the company's various activities.

First, one has to separate product cost from period cost. Second, direct product costs are allocated to the individual products, whereas indirect costs are allocated to cost centers. Third, indirect costs are attributed from the center to the products according to their usage. The sum of direct and allocated indirect cost forms the product cost.

Costing has a strong tradition in manufacturing. Thus, costing procedures typically recognize selling, general and administrative expenses (SG&A) as period costs that are not attributable to individual products or product groups. Product costs are principally expenses for material, labor, and machinery (in the form of depreciation). Other product costs might include expenses as various as light, heating, insurance, waste, and so on.

Having separated product from period cost, one can tackle the second step of allocating direct cost to a product or any other cost object subject to managerial analysis. Direct costs are expenses incurred uniquely for a particular product.

This is quite obviously the case for material bills, but international differences exist in the treatment of labor. While Anglo-American systems treat labor other than supervisory, as a direct cost, continental European practice often regards all labor cost as indirect. This is due to the different regulatory practices, reflecting the lower flexibility that continental labor law permits. For convenience reasons, direct material also includes a surcharge for the administrative cost of material handling.

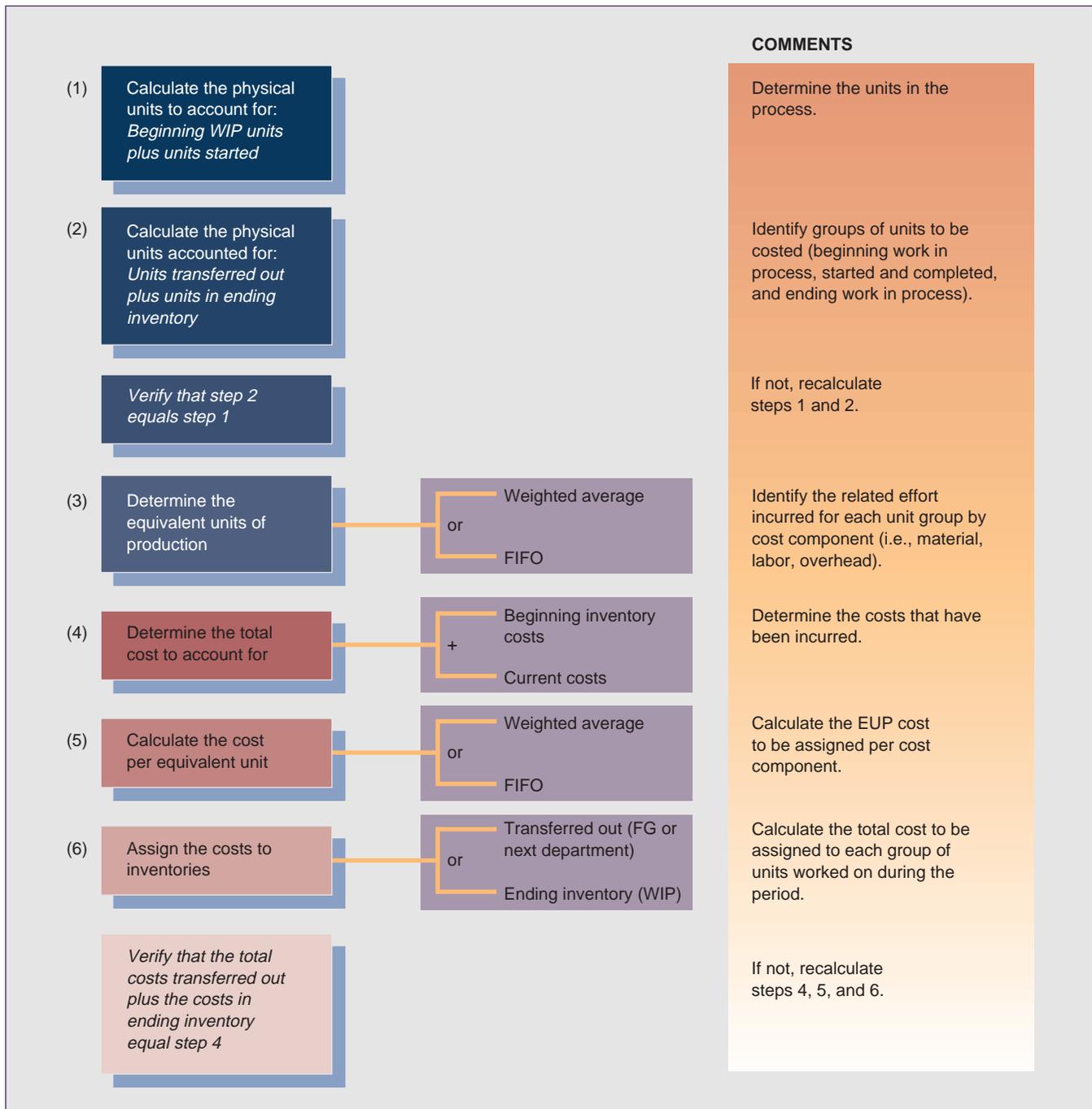
The third step of costing—attribution of indirect cost—is the most important for achieving accuracy. All indirect costs, sometimes referred to as overhead, are first allocated to cost pools. Cost pools can be areas of decision making (responsibility centers), service departments, or simple physical entities such as machines. A cost pool absorbs all those costs that vary with a certain cost driver (activity measure); it is this cost driver that reflects the services rendered to a product.

SOURCE: Chris Higson, "Counting the Cost," *Financial Times* (November 17, 1995), *Mastering Management—Part 4(4)*, p. iv. Reprinted with permission from *Financial Times*.

At this point, verify that the total units for which the department was accountable are equal to the total units that were accounted for. If these amounts are not equal, any additional computations will be incorrect.

Third, use either the weighted average or FIFO method to determine the equivalent units of production for each cost component. If all materials are at the same degree of completion, a single materials computation can be made. If multiple materials are used and are placed into production at different points, multiple EUP calculations may be necessary for materials. If overhead is based on direct labor or if these two factors are always at the same degree of completion, a single EUP can be computed for conversion. If neither condition exists, separate EUP schedules must be prepared for labor and overhead.<sup>5</sup>

<sup>5</sup> As discussed in Chapter 4, overhead can be applied to products using a variety of traditional (direct labor hours or machine hours) or nontraditional (such as number of machine setups, pounds of material moved, and/or number of material requisitions) bases. The number of equivalent unit computations that need to be made results from the number of different cost pools and overhead allocation bases established in a company. Some highly automated manufacturers may not have a direct labor category. The quantity of direct labor may be so nominal that it is included in a conversion category and not accounted for separately.



### EXHIBIT 6-3

#### Steps in Process Costing

#### total cost to account for

Fourth, find the **total cost to account for**, which includes the balance in Work in Process Inventory at the beginning of the period plus all current costs for direct material, direct labor, and overhead.

Fifth, compute the cost per equivalent unit for each cost component using either the weighted average or FIFO equivalent units of production calculated in step 3.

Sixth, use the costs computed in step 5 to assign costs from the production process to the units completed and transferred and to the units remaining in ending Work in Process Inventory.

The Decorative Waxes Company is used to demonstrate the steps involved in the computation of equivalent units of production and cost assignment for both

methods of process costing. The Decorative Waxes Company makes a variety of sizes and types of candles. One candle made by the Decorative Waxes Company is three inches wide and six inches tall. The company views the manufacturing process of this product as a single department with a single direct material: wax. The company treats the costs of coloring, scent, and wicks as overhead, and candles are not packaged. Because the wax is added at the start of processing, all inventories are 100 percent complete as to material as soon as processing has begun. Labor and overhead are assumed to be added at the same rate throughout the production process. Exhibit 6–4 presents information for April 2000 regarding the candle maker's production inventories and costs.

Although figures are given for both candles transferred and in ending inventory, providing both of these figures is not essential. The number of candles remaining in ending inventory on April 30 can be calculated by subtracting the candles that were completed and transferred during the period from the total candles to account for. Alternatively, the number of candles transferred can be computed as the total candles to account for minus the candles in ending inventory.

The Decorative Waxes Company information is used to illustrate each step listed in Exhibit 6–3.

## Weighted Average Method

### STEP 1: CALCULATE THE TOTAL UNITS TO ACCOUNT FOR

Candles in beginning inventory	25,000
Candles started during current period	<u>510,000</u>
Candles to account for	<u>535,000</u>

### STEP 2: CALCULATE THE TOTAL UNITS ACCOUNTED FOR

Candles completed and transferred	523,000
Candles in ending WIP inventory	<u>12,000</u>
Candles accounted for	<u>535,000</u>

The items detailed in this step indicate the categories to which costs will be assigned in the final step. The number of candles accounted for in step 2 equals the number of candles to account for in step 1.

### STEP 3: DETERMINE THE EQUIVALENT UNITS OF PRODUCTION

The weighted average EUP computation uses the number of whole candles in beginning inventory and the number of candles started and completed during the

Candles in beginning inventory (40% complete as to labor and overhead or conversion)	25,000	
Candles started during current period	510,000	
Candles completed and transferred to finished goods	523,000	
Candles in ending inventory (80% complete as to labor and overhead or conversion)	12,000	
Costs of beginning inventory:		
Direct material	\$ 42,650	
Direct labor	1,400	
Overhead	<u>15,752</u>	\$ 59,802
Current period costs:		
Direct material	\$433,500	
Direct labor	75,777	
Overhead	<u>263,913</u>	\$773,190

### EXHIBIT 6-4

*Production and Cost Information—April 1, 2000*

### units started and completed

period. (**Units started and completed** during a period equals the total units completed during the current period minus the units in beginning inventory.<sup>6</sup>) For the Decorative Waxes Company, the candles started and completed in April are 498,000 (523,000 – 25,000). Ending inventory is 100 percent complete as to material, because all material is added at the start of production. The ending inventory is 80 percent complete as to labor and overhead (conversion); one EUP computation can be made because these cost elements are assumed to be added at the same rate throughout the production process. The weighted average computation for equivalent units of production is as follows<sup>7</sup>:

	DM	Conversion (Labor & Overhead)
Beginning inventory (whole candles)	25,000	25,000
Candles started and completed	498,000	498,000
Ending inventory (whole candles × % complete)	<u>12,000</u>	<u>9,600</u>
Equivalent units of production	<u>535,000</u>	<u>532,600</u>

#### STEP 4: DETERMINE THE TOTAL COST TO ACCOUNT FOR

The total cost to account for equals beginning inventory cost plus current period costs. Note that information is provided in Exhibit 6–4 on the cost for each element of production—direct material, direct labor, and overhead. Production costs can be determined from the departmental Work in Process Inventory accounts and their subsidiary details. These costs come from transfers of direct material from the storeroom, incurrence of direct labor, and either actual or applied overhead amounts. The sum of direct labor and overhead costs is the conversion cost. For the Decorative Waxes Company, the total cost to account for is \$832,992.

	DM	DL	OH	Total
Beginning inventory costs	\$ 42,650	\$ 1,400	\$ 15,752	\$ 59,802
Current period costs	<u>433,500</u>	<u>75,777</u>	<u>263,913</u>	<u>773,190</u>
To account for	<u>\$476,150</u>	<u>\$77,177</u>	<u>\$279,665</u>	<u>\$832,992</u>

Total cost is assigned to the goods transferred to Finished Goods Inventory (or, alternatively, to the next department) and to ending Work in Process Inventory in relation to the whole units or equivalent whole units contained in each category.

#### STEP 5: CALCULATE THE COST PER EQUIVALENT UNIT OF PRODUCTION

A cost per equivalent unit of production must be computed for each cost component for which a separate calculation of EUP is made. Under the weighted average method, the costs of beginning inventory and the current period are summed for each cost component and averaged over that component's weighted average equivalent units of production. This calculation for unit cost for each cost component at the end of the period is shown below:

$$\begin{aligned} \text{Unit Cost} &= \frac{\text{Beginning Inventory Cost} + \text{Current Period Cost}}{\text{Weighted Average Equivalent Units of Production}} \\ &= \frac{\text{Total Cost Incurred}}{\text{Total Equivalent Units of Effort}} \end{aligned}$$

<sup>6</sup> Units started and completed can also be computed as the units started during the current period minus the units not finished (or the units in ending inventory).

<sup>7</sup> Different approaches exist to compute equivalent units of production and unit costs under weighted average and FIFO. The models presented in this chapter represent the computations that we have found to be the most readily understood and that best assist students in a clear and unambiguous reconciliation of these two methods. However, two other valid and commonly used approaches for computing and reconciling weighted average and FIFO equivalent units of production and unit costs are presented in the Appendix to this chapter.

This computation divides total cost by total units—the common weighted average approach that produces an average component cost per unit. Because labor and overhead are at the same degree of completion, their costs can be combined and shown as a single conversion cost per equivalent unit. The Decorative Waxes Company's weighted average calculations for cost per EUP for material and conversion are shown below:

	Direct Material	+ Conversion	= Total
Beginning inventory costs	\$ 42,650	\$ 17,152	\$ 59,802
Current period costs	<u>433,500</u>	<u>339,690</u>	<u>773,190</u>
Total cost per component	\$476,150	\$356,842	\$832,992
Divided by EUP (step 3)	535,000	532,600	
Cost per EUP	<u>\$0.89</u>	<u>\$0.67</u>	<u>\$1.56</u>

The amounts for the product cost components (material and conversion) are summed to find the total production cost for all whole candles completed during April. For the Decorative Waxes Company, this cost is \$1.56.

### STEP 6: ASSIGN COSTS TO INVENTORIES

This step assigns total production costs to units of product. Cost assignment in a department involves determining the cost of (1) the goods completed and transferred during the period and (2) the units in ending Work in Process Inventory.

Using the weighted average method, the cost of goods transferred is found by multiplying the total number of units transferred by a cost per unit that combines all the costs of the components or the total cost per EUP. Because this method is based on an averaging technique that combines both prior and current period work, it does not matter in which period the transferred units were started. All units and all costs have been commingled. The total cost transferred for the Decorative Waxes Company for April is \$815,880 ( $\$1.56 \times 523,000$ ).

Ending WIP Inventory cost is calculated based on the equivalent units of production for each cost component. The equivalent units of production for each component are multiplied by the component cost per unit computed in step 5. The cost of ending inventory using the weighted average method (using the previously determined equivalent units) is as follows:

Ending inventory	
Direct material ( $12,000 \times \$0.89$ )	\$10,680
Conversion ( $9,600 \times \$0.67$ )	<u>6,432</u>
Total cost of ending inventory	<u>\$17,112</u>

The total costs assigned to units transferred and units in ending inventory must equal the total cost to account for. For the Decorative Waxes Company, total cost to account for (step 4) was determined as \$832,992, which equals transferred cost (\$815,880) plus cost of ending Work in Process Inventory (\$17,112).

The steps just discussed can be combined into a **cost of production report**. This document details all manufacturing quantities and costs, shows the computation of cost per EUP, and indicates the cost assignment to goods produced during the period. Exhibit 6–5 shows the Decorative Waxes Company's cost of production report using the weighted average method.

**cost of production report**

### FIFO Method

Steps 1 and 2 are the same for the FIFO method as for the weighted average method because these two steps involve the use of physical units.

**EXHIBIT 6-5**

Cost of Production Report for  
the Month Ended April 30, 2000  
(Weighted Average Method)

PRODUCTION DATA	EQUIVALENT UNITS OF PRODUCTION		
	Whole Units	Direct Material	Conversion
Beginning inventory	25,000*	25,000	10,000
Candles started	<u>510,000</u>		
Candles to account for	<u>535,000</u>		
Beginning inventory completed	25,000	0	15,000
Started and completed	<u>498,000</u>	<u>498,000</u>	<u>498,000</u>
Candles completed	523,000		
Ending WIP inventory	12,000**	12,000	9,600
Candles accounted for	<u>535,000</u>	<u>535,000</u>	<u>532,600</u>
<b>COST DATA</b>			
	Total	Direct Material	Conversion
Costs in beginning inventory	\$ 59,802	\$ 42,650	\$ 17,152
Current period costs	<u>773,190</u>	<u>433,500</u>	<u>339,690</u>
Total cost to account for	<u>\$832,992</u>	<u>\$476,150</u>	<u>\$356,842</u>
Divided by EUP		535,000	532,600
Cost per EUP	<u>\$1.56</u>	<u>\$0.89</u>	<u>\$0.67</u>
<b>COST ASSIGNMENT</b>			
Transferred (523,000 × \$1.56)		\$815,880	
Ending inventory			
Direct material (12,000 × \$0.89)	\$10,680		
Conversion (12,000 × 80% × \$0.67)	<u>6,432</u>	<u>17,112</u>	
Total cost accounted for		<u>\$832,992</u>	

\*Fully complete as to material; 40% complete as to conversion.  
\*\*Fully complete as to material; 80% complete as to conversion.

**STEP 3: DETERMINE THE EQUIVALENT UNITS OF PRODUCTION**

Under FIFO, the work performed last period is *not* commingled with work of the current period. The EUP schedule for FIFO is

	DM	Conversion
Candles in beginning inventory completed in the current period	0	15,000
Candles started and completed	498,000	498,000
Ending inventory (whole candles × % complete)	<u>12,000</u>	<u>9,600</u>
Equivalent units of production	<u>510,000</u>	<u>522,600</u>

Under FIFO, only the work performed on the beginning inventory during the current period is shown in the EUP schedule; this work equals the whole units in beginning inventory times (1 – the percentage of work done in the prior period). No additional material is needed in April to complete the 25,000 candles in the beginning inventory. Because beginning inventory was 40 percent complete as to labor and overhead, the company needs to do 60 percent of the conversion work on the goods in the current period or the equivalent of 15,000 candles (25,000 × 60%).

Except for the different treatment of units in beginning inventory, the remaining figures in the FIFO EUP schedule are the same as for the weighted average method. Thus, the only EUP difference between the two methods is equal to the number of candles in beginning inventory times the percentage of work performed in the prior period, as shown below:

	DM	Conversion
FIFO EUP	510,000	522,600
Beginning inventory (25,000 units × % work done in prior period: 100% material, 40% conversion)	<u>25,000</u>	<u>10,000</u>
WA EUP	<u>535,000</u>	<u>532,600</u>

#### STEP 4: DETERMINE THE TOTAL COST TO ACCOUNT FOR

This step is the same as it was under the weighted average method; the total cost to account for is \$832,992.

#### STEP 5: CALCULATE THE COST PER EQUIVALENT UNIT OF PRODUCTION

Because cost determination is based on equivalent units of production, different results will be obtained for the weighted average and FIFO methods. The calculations for cost per equivalent unit reflect the difference in quantity that each method uses for beginning inventory. The EUP calculation for FIFO ignores work performed on beginning inventory during the prior period; therefore, the FIFO cost computation per EUP also ignores prior period costs and uses only costs incurred in the current period. The FIFO cost per EUP calculation is shown here:

	Direct Material	+ Conversion	= Total
Current period costs	\$433,500	\$339,690	\$773,190
Divided by EUP (step 3)	510,000	522,600	
Cost per EUP	<u>\$0.85</u>	<u>\$0.65</u>	<u>\$1.50</u>

It is useful to recognize the difference between the two total cost computations. The weighted average total cost of \$1.56 is the average total cost of each candle completed during April, regardless of when production was begun. The FIFO total cost of \$1.50 is the total cost of each candle produced (both started and completed) during the period. The \$0.06 difference is caused by the difference in treatment of beginning work in process costs.

#### STEP 6: ASSIGN COSTS TO INVENTORIES

The FIFO method assumes that the units in beginning inventory are the first units completed during the current period and, thus, are the first units transferred. The remaining units transferred during the period were both started and completed in the current period. As shown in the cost of production report in Exhibit 6-6, the two-step computation needed to determine the cost of goods transferred distinctly presents this FIFO logic.

The first part of the cost assignment for units transferred relates to the units that were in beginning inventory. These units had the cost of material and some labor and overhead costs applied at the start of the period. These costs were not included in the cost per EUP calculations in step 5. The costs to finish these units were incurred in the current period. To determine the total cost of producing the units in beginning inventory, the beginning inventory costs are added to the current period costs that were needed to complete the goods. Next, the cost of the units started and completed in the current period is computed using current period costs. This cost assignment process for the Decorative Waxes Company, which had a

**EXHIBIT 6-6**

Cost of Production Report for  
Month Ended April 30, 2000  
(FIFO Method)

PRODUCTION DATA	EQUIVALENT UNITS OF PRODUCTION		
	Whole Units	Direct Material	Conversion
Beginning inventory	25,000*		
Candles started	510,000		
Candles to account for	<u>535,000</u>		
Beginning inventory completed	25,000	0	15,000
Started and completed	498,000	498,000	498,000
Candles completed	523,000		
Ending inventory	12,000**	12,000	9,600
Candles accounted for	<u>535,000</u>	<u>510,000</u>	<u>522,600</u>
<b>COST DATA</b>			
	<b>Total</b>	<b>Direct Material</b>	<b>Conversion</b>
Costs in beginning inventory	\$ 59,802		
Current period costs	773,190	\$433,500	\$339,690
Total cost to account for	<u>\$832,992</u>		
Divided by EUP		510,000	522,600
Current period cost per EUP	<u>\$1.50</u>	<u>\$0.85</u>	<u>\$0.65</u>
<b>COST ASSIGNMENT</b>			
Transferred			
Beginning inventory costs	\$59,802		
Cost to complete:			
Conversion (15,000 × \$0.65)	<u>9,750</u>	\$ 69,552	
Started and completed (498,000 × \$1.50)		<u>747,000</u>	
Total cost transferred		\$816,552	
Ending inventory			
Direct material (12,000 × \$0.85)	\$10,200		
Conversion (9,600 × \$0.65)	<u>6,240</u>	16,440	
Total cost accounted for		<u>\$832,992</u>	

\*Fully complete as to material; 40% complete as to conversion.  
\*\*Fully complete as to material; 80% complete as to conversion.

beginning April inventory of 25,000 candles and transferred 523,000 candles during the month is as follows:

Transferred	
(1) Beginning inventory (prior period costs)	\$ 59,802
Completion of beginning inventory:	
Direct material (0 × \$0.85)	0
Conversion (25,000 × 60% × \$0.65)	<u>9,750</u>
Total cost of beginning inventory transferred	\$ 69,552
(2) Candles started and completed (498,000 × \$1.50)	<u>747,000</u>
Total cost transferred	<u>\$816,552</u>

The beginning inventory was 100 percent complete as to wax at the beginning of April; therefore, no additional costs for wax need to be added during the period. Conversion at the start of the month was only 40 percent complete, so 60 percent of the labor and overhead (or 15,000 equivalent units) is added during April at current period costs. The candles started and completed are costed at the total

current period FIFO cost of \$1.50, because these candles were fully manufactured during the current period.<sup>8</sup>

The process of calculating the FIFO cost of ending Work in Process Inventory is the same as under the weighted average method. Ending work in process cost using FIFO is as follows:

Ending inventory	
Direct material (12,000 × \$0.85)	\$10,200
Conversion (9,600 × \$0.65)	6,240
Total cost of ending inventory	<u>\$16,440</u>

The total cost of the candles transferred (\$816,552) plus the cost of the candles in ending inventory (\$16,440) equals the total cost to be accounted for (\$832,992).

Summary journal entries and T-accounts for the Decorative Waxes Company for April are given in Exhibit 6–7 on next page. It is assumed that 520,000 candles were sold on account for \$3.00 per candle and that a perpetual FIFO inventory system is in use. Assume that the Decorative Waxes Company began April with no Finished Goods Inventory. Weighted average amounts are shown where they would differ from FIFO.

## PROCESS COSTING IN A MULTIDEPARTMENT SETTING

Most companies have multiple, rather than single, department processing facilities. In a multidepartment-processing environment, goods are transferred from a predecessor department to a successor department. For example, if the candles at the Decorative Waxes Company were boxed by the dozen, the company's manufacturing activities could be viewed as occurring in two departments: Processing and Packaging.

Manufacturing costs *always* follow the physical flow of goods. Therefore, the costs of the completed units of predecessor departments are treated as input material costs in successor departments. Such a sequential treatment requires the use of an additional cost component element called "transferred-in" or "prior department cost." This element always has a percentage of completion factor of 100 percent, because the goods would not have been transferred out of the predecessor department if they had not been fully complete. The transferred-in element is handled the same as any other cost element in the calculations of EUP and cost per EUP.

A successor department might add additional raw materials to the units transferred in or might simply provide additional labor with the corresponding incurrence of overhead. Anything added in the successor department requires its own cost element column for calculating equivalent units of production and cost per equivalent unit (unless the additional elements have the same degree of completion, in which case they can be combined).

<sup>8</sup> Because of FIFO's two-step process to determine cost of units transferred, a question exists as to how to calculate a per-unit cost for the units that were in beginning inventory and those that were started and completed in the current period. The resolution of this question is found in the use of either the strict or the modified FIFO method.

If strict FIFO is used, beginning inventory units are transferred out at their total completed cost; the units started and completed during the current period are transferred at a separate and distinct current period cost. For the Decorative Candle Company, use of strict FIFO means that the 25,000 candles in beginning inventory are transferred at a cost per unit of \$2.78 (\$69,552 ÷ 25,000). The candles started and completed in April are transferred at the current period cost of \$1.50 (computed in step 5). If strict FIFO is used, the costs of these two groups should be reported separately and not added together to get a total transferred cost.

However, unless the difference between the unit costs of beginning inventory units and of units started and completed is significant, there is no need to maintain the distinction. The costs of the two groups can be combined and averaged over all of the units transferred in a process known as the modified FIFO method. For the Decorative Waxes Company, modified FIFO assigns an average cost of \$1.56 per candle (\$816,552 ÷ 523,000) to all candles transferred from the department. Modified FIFO allows the next department or Finished Goods Inventory to account for all units received during the period at the same cost per unit. This method is useful when products are processed through several departments so that the number of separate unit costs to be accounted for does not become excessive.

**EXHIBIT 6-7**

Process Costing Journal Entries  
and T-Accounts

1. Work in Process Inventory	433,500	
Raw Material Inventory		433,500
To record issuance of materials to production (Exhibit 6-4).		
2. Work in Process Inventory	75,777	
Wages Payable		75,777
To accrue wages for direct labor (Exhibit 6-4).		
3. Manufacturing Overhead	263,913	
Various accounts		263,913
To record actual overhead costs (Exhibit 6-4).		
4. Work in Process Inventory	263,913	
Manufacturing Overhead		263,913
To apply actual overhead to production.		
5. Finished Goods Inventory	816,552	
Work in Process Inventory		816,552
To transfer cost of completed candles to finished goods (Exhibit 6-6). (Entry would be for \$815,880 if weighted average were used—Exhibit 6-5.)		
6. Cost of Goods Sold	812,052	
Finished Goods Inventory		812,052
To transfer cost of goods sold, using strict FIFO:		
First 25,000 units	\$ 69,552	
Remaining 495,000 units at \$1.50	742,500	
	<u>\$812,052</u>	
(Entry would be for \$811,200 if weighted average were used: 520,000 × \$1.56.)		
7. Accounts Receivable	1,560,000	
Sales		1,560,000
To record sales on account (520,000 candles × \$3.00).		

**Work in Process Inventory**

Beginning balance	59,802	Cost of goods manufactured	816,552
Direct material	433,500		
Direct labor	75,777		
Applied overhead	263,913		
Ending balance	16,440		

**Finished Goods Inventory**

Beginning balance	0	Cost of goods sold	812,052
Cost of goods manufactured	816,552		
Ending balance (3,000 @ \$1.50)	4,500		

**Cost of Goods Sold**

April CGS	812,052
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*Hershey Kisses<sup>®</sup>, like most other food products, are manufactured in a plant that uses process costing. Costs for chocolate, melting, and shaping would be accumulated in the first department. The Kisses would then be transferred to a second department to be wrapped and bagged in packages of various sizes.*

Occasionally, successor departments might change the unit of measure used in predecessor departments. For example, when the Decorative Waxes Company produces candles, the measure in the Processing Department would be number of candles; the measure in the Packaging Department would be number of boxes of a dozen candles.

The demonstration problem at the end of the chapter provides a complete example of predecessor and successor department activities.

## PROCESS COSTING WITH STANDARD COSTS

Companies may prefer to use standard rather than actual historical costs for inventory valuation purposes. Actual costing requires that a new production cost be computed each production period. Once a production process is established, however, the “new” costs are often not materially different from the “old” costs, so standards for each cost element can be developed and used as predetermined cost benchmarks to simplify the costing process and eliminate periodic cost recomputations. Standards do need to be reviewed (and possibly revised) at a minimum of once per year to keep the amounts current.

Calculations for equivalent units of production for standard process costing are identical to those of FIFO process costing. Unlike the weighted average method, the emphasis of both standard costing and FIFO are on the measurement and control of current production and current period costs. The weighted average method commingles units and costs of the prior period with those of the current period. This commingling reduces the emphasis on current effort that standard costing is intended to represent and measure.

The use of standard costs allows material, labor, and overhead variances to be measured during the period. To show the differences between using actual and

5

How can standard costs be used in a process costing system?

standard process costing, the Decorative Waxes Company example is continued. The company's April production and standard cost information is given in Exhibit 6–8. The beginning inventory cost data have been restated from the original to reflect standard costs and to demonstrate the effect of consistent use of standard costs over successive periods. Beginning inventory consisted of 25,000 units that were fully complete as to material and 40 percent complete as to conversion. Therefore, the standard cost of beginning inventory is as follows:

Material (25,000 × 100% × \$0.86)	\$21,500
Labor (25,000 × 40% × \$0.15)	1,500
Overhead (25,000 × 40% × \$0.48)	4,800
Total	<u>\$27,800</u>

Exhibit 6–9 presents the cost of production report using the Decorative Waxes Company's standard cost information.<sup>9</sup>

When a standard cost system is used, inventories are stated at standard rather than actual costs. Summary journal entries for the Decorative Waxes Company's April production, assuming a standard cost FIFO process costing system and amounts from Exhibit 6–9, are as follows:

1. WIP Inventory is debited for \$438,600: the standard cost (\$428,280) of material used to complete 498,000 units that were started in April plus the standard cost (\$10,320) for the material used to produce ending work in process. Raw Material Inventory is credited for the actual cost of the material withdrawn during April (\$433,500).

Work in Process Inventory	438,600	
Raw Material Inventory		433,500
Direct Material Variance		5,100
To record issuance of material at standard and variance from standard.		

### EXHIBIT 6–8

Production and Cost Data  
(Standard Costing)

Production Data		
Beginning inventory (100%, 40%)	25,000	
Units started	510,000	
Ending inventory (100%, 80%)	12,000	
Standard Cost of Production		
Direct material	\$0.86	
Direct labor	0.15	
Overhead	0.48	
Total	<u>\$1.49</u>	
Equivalent Units of Production (repeated from Exhibit 6–6):		
	<b>DM</b>	<b>Conversion</b>
BI (candles × % not complete at start of period)	0	15,000
Candles started and completed	498,000	498,000
EI (candles × % complete at end of period)	<u>12,000</u>	<u>9,600</u>
Equivalent units of production	<u>510,000</u>	<u>522,600</u>

<sup>9</sup> Total material, labor, and overhead variances are shown for the Decorative Waxes Company in Exhibit 6–9. More detailed variances are presented in Chapter 10 on standard costing. Additionally, variances from actual costs must be closed at the end of a period. If the variances are immaterial, they can be closed to Cost of Goods Sold; otherwise, they should be allocated among the appropriate inventory accounts and Cost of Goods Sold.

**EXHIBIT 6-9**

Cost of Production Report for  
Month Ended April 30, 2000  
(Standard Costing)

<b>COSTS TO BE ACCOUNTED FOR</b>				
	<b>Direct Material</b>	<b>Direct Labor</b>	<b>Overhead</b>	<b>Total</b>
<b>Total costs</b>				
BWIP (at standard)	\$ 21,500	\$ 1,500	\$ 4,800	\$ 27,800
Current period (actual)	<u>433,500</u>	<u>75,777</u>	<u>263,913</u>	<u>773,190</u>
(1) Total	<u>\$455,000</u>	<u>\$77,277</u>	<u>\$268,713</u>	<u>\$800,990</u>
<b>COST ASSIGNMENT (AT STANDARD)</b>				
<b>Transferred</b>				
BI cost*	\$ 21,500	\$ 1,500	\$ 4,800	\$ 27,800
<b>Cost to complete</b>				
DL (15,000 × \$0.15)		2,250		
OH (15,000 × \$0.48)			7,200	
Total cost to complete				9,450
<b>Started and completed</b>				
DM (498,000 × \$0.86)	428,280			
DL (498,000 × \$0.15)		74,700		
OH (498,000 × \$0.48)			239,040	
Total started and completed				742,020
<b>Ending inventory</b>				
DM (12,000 × \$0.86)	10,320			
DL (9,600 × \$0.15)		1,440		
OH (9,600 × \$0.48)			4,608	
Total WIP ending				16,368
(2) Total standard cost assigned	<u>\$460,100</u>	<u>\$79,890</u>	<u>\$255,648</u>	<u>\$795,638</u>
Variances from actual (1 – 2)*	<u>(5,100)</u>	<u>(2,613)</u>	<u>13,065</u>	<u>5,352</u>
Total costs accounted for	<u>\$455,000</u>	<u>\$77,277</u>	<u>\$268,713</u>	<u>\$800,990</u>

*NOTE:* Favorable variances are shown in parentheses.  
\*Beginning work in process is carried at standard costs rather than actual. Therefore, no portion of the variance is attributable to BWIP. Any variance that might have been associated with BWIP was measured and identified with the prior period.

2. WIP Inventory is debited for the standard cost of labor allowed based on the equivalent units produced in April. The EUPs for the month reflect the production necessary to complete the beginning inventory (15,000 candles) plus the candles started and completed (498,000) plus the work performed on the ending inventory candles (9,600) or a total of 522,600 EUP. Multiplying this equivalent production by the standard labor cost per candle of \$0.15 gives a total of \$78,390.

Work in Process Inventory	78,390	
Wages Payable		75,777
Direct Labor Variance		2,613
To accrue direct labor cost, assign it to WIP Inventory at standard, and record direct labor variance.		

3. Actual factory overhead incurred in April is \$263,913.

Manufacturing Overhead	263,913	
Various accounts		263,913
To record actual overhead cost for April.		

4. WIP Inventory is debited for the standard cost of overhead based on the EUPs produced in April. Because labor and overhead are consumed at the same rate,

equivalent production is the same as in entry 2: 522,600 EUPs. Multiplying the EUPs by the standard overhead application rate of \$0.48 per candle gives \$250,848.

Work in Process Inventory	250,848	
Manufacturing Overhead Variance	13,065	
Manufacturing Overhead		263,913
To apply overhead to WIP Inventory and record the overhead variance.		

5. Finished Goods Inventory is debited for the total standard cost (\$779,270) of all 523,000 candles completed during the month ( $\$1.49 \times 523,000$ ).

Finished Goods Inventory	779,270	
Work in Process Inventory		779,270
To transfer standard cost of completed candles to FG Inventory.		

A standard costing system eliminates the need to be concerned about differentiating between the per-unit cost of the beginning inventory units that were completed and the per-unit cost of the units started and completed in the current period. All units flowing out of a department are costed at the standard or “normal” production cost for each cost component: direct material, direct labor, and overhead. Thus, recordkeeping is simplified and variations from the norm are highlighted in the period of incurrence. Standard cost systems are discussed in depth in Chapter 10.

Standard costing not only simplifies the cost flows in a process costing system, but it also provides a useful tool to control costs. By developing standards, managers have a benchmark against which actual costs can be compared. Variances serve to identify differences between the benchmark (standard) cost and the actual cost. By striving to control variances, managers control costs. Managers should also compare their firm’s costs to costs incurred by other firms.

## HYBRID COSTING SYSTEMS

6

Why would a company use a hybrid costing system?

### hybrid costing system

Many companies are now able to customize what were previously mass-produced items. In such circumstances, neither job order nor process costing techniques are perfectly suited to attach costs to output. Thus, companies may choose to use a **hybrid costing system** that is appropriate for their particular processing situation. A hybrid costing system combines certain characteristics of a job order system and a process costing system. A hybrid system would be used, for example, in a manufacturing environment in which various product lines have different direct materials, but similar processing techniques.

To illustrate the need for hybrid systems, assume you order an automobile with the following options: leather seats, a Bose stereo system and compact disk player, cruise control, and pearlized paint. The costs of all options need to be traced specifically to your car, but the assembly processes for all the cars produced by the plant are similar. The job order costing feature of tracing direct materials to specific jobs is combined with the process costing feature of averaging labor and overhead costs over all homogeneous production to derive the total cost of the automobile you ordered. It would not be feasible to try to use a job order costing system to trace labor or overhead cost to your car individually, and it would be improper to average the costs of your options over all the cars produced during the period. The accompanying News Note reflects a build-to-order approach in the automobile industry.

## GENERAL BUSINESS

## NEWS NOTE



### Computer Techniques for Car Production

Toyota Motor Corp. announced in 1999 that it would soon begin producing the Camry Solara coupe to customer order in just five days, and it would do the same for other models starting later in that year. The announcement surprised an industry that typically requires 30 to 60 days to produce a custom order.

The Toyota announcement raises two questions. First, will the automobile industry, which now predominantly follows a “make to stock” model in North America, change to “make to order,” which is more common in Europe and in Japan? Second, will Toyota gain a significant competitive advantage by making this transition first?

This is a serious question, and the personal-computer industry shows why. By making and delivering personal computers to order, Dell Computer catapulted itself from a crowded field to become an industry leader. In just a few years, Dell picked up more than six percentage points in market share.

But until now, no major manufacturer was prepared to offer quick custom-order delivery. Some visionaries envisioned a 15-day car, but no one thought it was just around the corner. There is plenty of skepticism about whether Toyota can achieve a five-day car without making unacceptable compromises in flexibility and total delivery lead time. Toyota’s announcement, however, leaves little room for doubt about the company’s strategy. It was not a trial balloon but a confident statement of intent.

How much of a competitive advantage can Toyota gain from a five-day car? The Dell success story offers an interesting parallel, although Dell sells directly to customers while Toyota will continue to sell through dealers. Even so, Toyota can derive savings from a build-to-order strategy, as it can help dealers drive down retail inventories.

SOURCE: Jeffrey Bodenstab, “An Automaker Tries the Dell Way,” *The Wall Street Journal* (August 30, 1999), p. A26. Permission conveyed through the Copyright Clearance Center.

A hybrid costing system is appropriate for companies producing items such as furniture, clothing, or jam. In each instance, numerous kinds of raw materials could be used to create similar output. A table may be made from oak, teak, or mahogany; a blouse may be made from silk, cotton, or polyester; and jam may be made from peach, strawberries, or marmalade. The material cost for a batch run would need to be traced separately, but the production process of the batch is repetitive.

Hybrid costing systems allow accounting systems to portray more accurately the actual type of manufacturing activities in which companies are engaged. Job order costing and process costing are two ends of a continuum and, as is typically the case for any continuum, neither end is necessarily the norm. As flexible manufacturing increases, so will the use of hybrid costing systems.

<http://www.toyota.com>

<http://www.dell.com>

## REVISITING

### Lumina Candles & Art

**B**eeswax is one of nature’s useful and fragrant gifts. It takes about 160,000 bees to produce 60 pounds of honey that only yield about one pound of beeswax. Naturally fragrant beeswax is dripless, burns cleaner, and lasts longer than petroleum-based waxes. Beeswax candles also burn without creating smoke. To demonstrate how long

<http://www.borsheimarts.com/lumina.htm>

a beeswax candle can last, Kelly Borsheim timed an eight-inch pillar candle that, after 60 hours, still had greater than half remaining. At that point, she discontinued timing it.

Lumina Candles & Art is somewhat of a diversified home-based business. Not only does the company provide all the supplies and instructions needed to make beeswax

candles, but Kelly also creates award-winning artistic sculptures and paintings. In addition, Kelly provides art lessons in creating both sculpture and painting.

Kelly Borsheim is devoted to helping aspiring candle makers and artists succeed, not only in their production of beautiful works but also in their success as business

people. For example, the Lumina Candles & Art Web site provides a section entitled “Tips on How to Start Your Own Candle Business.” The Web site also includes other sections on effective management and marketing for candle and art business ventures.

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SOURCE: Lumina Candles & Art Web site: <http://www.borsheimarts.com/lumina.htm>

## CHAPTER SUMMARY

Process costing is an averaging method used to assign costs to output in manufacturing situations producing large quantities of homogeneous products. A process costing system may use either the weighted average or FIFO method to compute equivalent units of and assign costs to production. The difference between the two methods lies solely in the treatment of the work performed in the prior period on the beginning work in process inventory.

Under the weighted average method, work performed in the prior period is combined with current period work and the total costs are averaged over all units. Using the FIFO method, work performed in the last period on beginning work in process inventory is not commingled with current period work, nor are costs of beginning work in process added to current period costs to derive unit production cost. With FIFO, current period costs are divided by current period production to generate a unit production cost related entirely to work actually performed in the current period.

Six steps must be taken when deriving and assigning product cost under a process costing system:

1. Calculate the total number of physical units to account for.
2. Calculate the physical units accounted for by tracing the physical flow of units. This step involves identifying the groups to which costs are to be assigned (transferred out of or remaining in ending inventory).
3. Determine the number of equivalent units of production, either on the weighted average or FIFO basis, for each cost component. The cost components include transferred-in (if multidepartmental), direct material, direct labor, and overhead. In cases of multiple materials having different degrees of completion, each material is considered a separate cost component. If overhead is applied on a direct labor basis or is incurred at the same rate as direct labor, labor and overhead can be combined as one cost component and referred to as “conversion.”
4. Determine the total cost to account for, which is the sum of beginning inventory costs and all production costs incurred for the current period.
5. Calculate the cost per equivalent unit of production for each cost component.
6. Assign the costs to the units transferred and the units in ending work in process inventory. The method of cost assignment depends on whether weighted average or FIFO costing is used. The total of the costs assigned to units transferred and to units in ending work in process inventory must equal the total cost to account for.

The FIFO method of process costing can be combined with standard costs so that a “normal” production cost is assigned each period to equivalent units of output. This technique allows managers to quickly recognize and investigate significant deviations from normal production costs.

Hybrid costing systems allow companies to combine the characteristics of both job order and process costing systems. Direct material or direct labor that is related to a particular batch of goods can be traced to those specific goods using job order costing. Cost components that are common to numerous batches of output are accounted for using process costing techniques.

## APPENDIX

### Alternative Calculations of Weighted Average and FIFO Methods

7

What alternative methods can be used to calculate equivalent units of production?

Various methods are used to compute equivalent units of production under the weighted average and FIFO methods. One of the most common variations is the following EUP calculation for weighted average:

$$\begin{aligned} & \text{Units transferred (whole units)} \\ & + \text{Ending work in process (equivalent units)} \\ & = \underline{\text{Weighted average EUP}} \end{aligned}$$

Once the weighted average EUP figure is available, the FIFO equivalent units can be quickly derived by subtracting the equivalent units in beginning work in process inventory that had been produced in the previous period:

$$\begin{aligned} & \text{Weighted average EUP} \\ & - \underline{\text{Beginning work in process (equivalent units)}} \\ & = \underline{\text{FIFO EUP}} \end{aligned}$$

This computation is appropriate for the following reason: The weighted average method concentrates on the units that were completed during the period as well as the units that were started but not completed during the period. Unlike FIFO, the weighted average method does not exclude the equivalent units that were in beginning inventory. Thus, to convert from weighted average to FIFO, simply remove the equivalent units produced in the previous period from beginning work in process.

The Decorative Waxes Company's April production data presented in the chapter are repeated here to illustrate these alternative calculations for the weighted average and FIFO methods.

Candles in beginning work in process (100% complete as to material; 40% complete as to conversion costs)	25,000
Candles started during the month	510,000
Candles completed during the month	523,000
Candles in ending work in process (100% complete as to material; 80% complete as to conversion costs)	12,000

Using these data, the EUPs are computed as follows:

	DM	Conversion
Candles transferred	523,000	523,000
+ Ending work in process equivalent units (12,000 candles × 100% and 80% complete)	<u>12,000</u>	<u>9,600</u>
= <b>Weighted average EUP</b>	535,000	532,600
– Beginning work in process equivalent units produced in previous period (25,000 candles × 100% and 40% complete)	<u>(25,000)</u>	<u>(10,000)</u>
= <b>FIFO EUP</b>	<u>510,000</u>	<u>522,600</u>

The distinct relationship between the weighted average and FIFO costing models can also be used to derive the equivalent units of production calculations. This method begins with the total number of units to account for in the period. From this amount, the EUPs to be completed next period are subtracted to give the weighted average EUP. Next, as in the method shown above, the equivalent units completed in the prior period (the beginning Work in Process Inventory) are deducted to give the FIFO equivalent units of production. Using the Decorative Waxes Company data, these computations are as follows:

	DM	Conversion
Total units to account for	535,000	535,000
– EUP to be completed next period (ending inventory × % not completed: 12,000 × 0%; 12,000 × 20%)		(2,400)
= <b>Weighted average EUP</b>	<u>535,000</u>	<u>532,600</u>
– EUP completed in prior period (beginning inventory × % completed last period: 25,000 × 100%; 25,000 × 40%)	(25,000)	(10,000)
= <b>FIFO EUP</b>	<u><u>510,000</u></u>	<u><u>522,600</u></u>

These alternative calculations can either be used to confirm answers found by using beginning inventory units, units started and completed, and ending inventory units or as a shortcut to initially compute equivalent units of production.

## KEY TERMS

cost of production report (p. 229)  
 equivalent units of production (EUP)  
 (p. 222)  
 FIFO method (of process costing)  
 (p. 223)  
 hybrid costing system (p. 238)

total cost to account for (p. 226)  
 total units to account for (p. 224)  
 units started and completed (p. 228)  
 weighted average method (of process  
 costing) (p. 223)

## SOLUTION STRATEGIES

### Steps in Process Costing Computations

1. Compute the total units to account for (in physical units):

$$\begin{array}{l} \text{Beginning inventory in physical units} \\ + \text{Units started (or transferred in) during period} \end{array}$$

2. Compute units accounted for (in physical units):

$$\begin{array}{l} \text{Units completed and transferred} \\ + \text{Ending inventory in physical units} \end{array}$$

3. Compute equivalent units of production per cost component:
  - a. Weighted average

$$\begin{array}{l} \text{Beginning inventory in physical units} \\ + \text{Units started and completed*} \\ + (\text{Ending inventory} \times \% \text{ complete}) \end{array}$$

**b. FIFO**

$$\begin{aligned} & (\text{Beginning inventory} \times \% \text{ not complete at start of period}) \\ & + \text{Units started and completed}^* \\ & + (\text{Ending inventory} \times \% \text{ complete}) \end{aligned}$$

\*Units started and completed = (Units transferred – Units in beginning inventory).

**4. Compute total cost to account for:**

$$\begin{aligned} & \text{Costs in beginning inventory} \\ & + \text{Costs of current period} \end{aligned}$$

**5. Compute cost per equivalent unit per cost component:****a. Weighted average**

$$\begin{aligned} & \text{Cost of component in beginning inventory} \\ & + \text{Cost of component for current period} \\ & = \text{Total cost of component} \\ & \div \text{EUP for component} \end{aligned}$$

**b. FIFO**

$$\begin{aligned} & \text{Cost of component for current period} \\ & \div \text{EUP for component} \end{aligned}$$

**6. Assign costs to inventories:****a. Weighted average**

## (1) Transferred:

$$\text{Units transferred} \times (\text{Total cost per EUP for all components})$$

## (2) Ending inventory:

$$\text{EUP for each component} \times \text{Cost per EUP for each component}$$

**b. FIFO**

## (1) Transferred:

$$\begin{aligned} & \text{Beginning inventory costs} \\ & + (\text{Beginning inventory} \times \% \text{ not complete at beginning of period} \\ & \quad \text{for each component} \times \text{Cost per EUP for each component}) \\ & + (\text{Units started and completed} \times \text{Total cost per EUP for all} \\ & \quad \text{components}) \end{aligned}$$

## (2) Ending inventory:

$$\text{EUP for each component} \times \text{Cost per EUP for each component}$$

**DEMONSTRATION PROBLEM**

The Sporting Bag Company manufactures golf bags in a two-department process: Assembly and Finishing. The Assembly Department uses weighted average costing; the cost driver for overhead in this department is unrelated to direct labor. The Finishing Department adds the hardware to the assembled bags and uses FIFO costing. Overhead is applied to the bags in this department on a direct labor basis. During June, the following production data and costs have been gathered:

**ASSEMBLY DEPARTMENT: UNITS**

Beginning work in process (100% complete for material; 40% complete for labor; 30% complete for overhead)	250
Units started	8,800
Ending work in process (100% complete for material; 70% complete for labor; 90% complete for overhead)	400

**ASSEMBLY DEPARTMENT: COSTS**

	Material	Direct Labor	Overhead	Total
Beginning inventory	\$ 3,755	\$ 690	\$ 250	\$ 4,695
Current	100,320	63,606	27,681	191,607
Totals	<u>\$104,075</u>	<u>\$64,296</u>	<u>\$27,931</u>	<u>\$196,302</u>

**FINISHING DEPARTMENT: UNITS**

Beginning work in process (100% complete for transferred-in; 15% complete for material; 40% complete for conversion)	100
Units transferred in	8,650
Ending work in process (100% complete for transferred-in; 30% complete for material; 65% complete for conversion)	200

**FINISHING DEPARTMENT: COSTS**

	Transferred-In	Direct Material	Conversion	Total
Beginning inventory	\$ 2,176	\$ 30	\$ 95	\$ 2,301
Current	188,570	15,471	21,600	225,641
Totals	<u>\$190,746</u>	<u>\$15,501</u>	<u>\$21,695</u>	<u>\$227,942</u>

**Required:**

- Prepare a cost of production report for the Assembly Department.
- Prepare a cost of production report for the Finishing Department.

**Solution to Demonstration Problem**

	EQUIVALENT UNITS OF PRODUCTION			
	Whole Units	Direct Material	Direct Labor	Overhead
Beginning inventory	250	250	100	75
Units started	8,800			
Units to account for	<u>9,050</u>			
BWIP completed	250	0	150	175
Started and completed	8,400	8,400	8,400	8,400
Units completed	8,650			
Ending inventory	400	400	280	360
Units accounted for	<u>9,050</u>			
Weighted average EUP		<u>9,050</u>	<u>8,930</u>	<u>9,010</u>

**COST DATA**

	Whole Units	Direct Material	Direct Labor	Overhead
	<u>Total</u>			
BWIP costs	\$ 4,695	\$ 3,755	\$ 690	\$ 250
Current period costs	191,607	100,320	63,606	27,681
Total costs	<u>\$196,302</u>	<u>\$104,075</u>	<u>\$ 64,296</u>	<u>\$27,931</u>
Divided by EUP		9,050	8,930	9,010
Cost per EUP	<u>\$21.80</u>	<u>\$11.50</u>	<u>\$7.20</u>	<u>\$3.10</u>

**COST ASSIGNMENT**

Transferred out (8,650 × \$21.80)			\$188,570	
Ending inventory				
Direct material (400 × \$11.50)		\$4,600		
Direct labor (280 × \$7.20)		2,016		
Overhead (360 × \$3.10)		1,116	7,732	
Total cost accounted for			<u>\$196,302</u>	

b.

**EQUIVALENT UNITS OF PRODUCTION**

	Whole Units	Transferred-In	Direct Material	Conversion
Beginning inventory	100			
Units started	8,650			
Units to account for	<u>8,750</u>			
BWIP completed	100	0	85	60
Started and completed	8,450	8,450	8,450	8,450
Units completed	8,550			
Ending inventory	200	200	60	130
Units accounted for	<u>8,750</u>			
FIFO EUP		<u>8,650</u>	<u>8,595</u>	<u>8,640</u>

**COST DATA**

	Total			
BWIP costs	\$ 2,301			
Current period costs	225,641	\$188,570	\$15,471	\$21,600
Total costs	<u>\$227,942</u>			
Divided by EUP		8,650	8,595	8,640
Cost per EUP	<u>\$26.10</u>	<u>\$21.80</u>	<u>\$1.80</u>	<u>\$2.50</u>

**COST ASSIGNMENT**

Transferred out				
Beginning inventory cost		\$2,301		
Cost to complete:				
Transferred-in (0 × \$21.80)		0		
Direct material (85 × \$1.80)		153		
Conversion (60 × \$2.50)		150	\$ 2,604	
Started and completed (8,450 × \$26.10)			220,545	
Ending inventory				
Transferred-in (200 × \$21.80)		\$4,360		
Direct material (60 × \$1.80)		108		
Conversion (130 × \$2.50)		325	4,793	
Total cost accounted for			<u>\$227,942</u>	

## QUESTIONS

1. What are the typical characteristics of a company that should employ a process costing system?
2. Why is the process of assigning costs to products essentially an averaging process?
3. How are job order and process costing similar? How do they differ?
4. Why are equivalent units of production used as an output measure in process costing? In your answer, be sure to address the problems created by partially completed inventories.
5. What creates the difference between weighted average and FIFO equivalent units of production? Which EUP calculation more accurately portrays the actual flow of units through a manufacturing process and why?
6. Why is it necessary to calculate separate equivalent units of production for each cost component of a product? Are there times when separate EUP schedules are not necessary and, if so, why?
7. How are units “started and completed” in the current period calculated? Is this figure used in both weighted average and FIFO cost assignment? Why or why not?
8. In which of the six basic steps used in process costing are physical units used and in which are equivalent units of production used? Are there steps in which neither physical nor equivalent units are used? Why or why not?
9. How is the unit cost for each cost component assigned to the units produced during the current period under (a) the weighted average method and (b) the FIFO method?
10. What is the purpose of the cost of production report? How would such a report assist accountants in making journal entries for a period?
11. Would it be correct to subtract the cost computed for EWIP from the total costs to account for as a shortcut to determine the cost of goods transferred out? If you answered yes, is there a risk in doing this?
12. Why does the “Transferred Out” section of the FIFO method cost of production report include multiple computations, whereas the same section for the weighted average report only includes one computation?
13. How does process costing in a multidepartmental manufacturing environment differ from that of a single-department manufacturing environment? Why does this difference exist?
14. Why are the EUP calculations made for standard process costing the same as the EUP calculations for FIFO process costing?
15. How are inventories accounted for under a standard process costing system? What information is provided to management when inventories are accounted for in this manner?
16. What is a hybrid costing system? Under what circumstances is the use of such a system appropriate?
17. Find five companies, in different industries, on the Internet that you believe use process costing. Name these companies, provide their Web addresses, indicate what products they make, and discuss why you believe they use process costing.



## EXERCISES

18. (*EUP; weighted average*) Newton Quiches uses a weighted average process costing system. All material is added at the start of the production process. Direct labor and overhead are added at the same rate throughout the process. Newton’s records indicate the following production for October 2000:

Beginning inventory (70% complete as to conversion)	120,000 units
Started during October	170,000 units
Completed during October	260,000 units

Ending inventory for October is 20 percent complete as to conversion.

- a. What are the equivalent units of production for direct material?
  - b. What are the equivalent units of production for labor and overhead?
19. (*EUP; FIFO*) Assume that Newton Quiches in Exercise 18 uses the FIFO method of process costing.
- a. What are the equivalent units of production for direct material?
  - b. What are the equivalent units of production for labor and overhead?
20. (*EUP; weighted average & FIFO*) McArthur Corporation makes toy metal soldiers in a one-department production process. All metal is added at the beginning of the process. Paint for the figures and the plastic bags for packaging are considered indirect materials. The following information is available relative to September 2000 production activities:

Beginning inventory:	75,000 figures (60% complete as to labor; 85% complete as to overhead)
Started into production:	metal for 250,000 figures, which were cast during the month
Ending inventory:	30,000 figures (70% complete as to labor; 90% complete as to overhead)

- a. Compute the EUP for direct material, direct labor, and overhead using weighted average process costing.
  - b. Compute the EUP for direct material, direct labor, and overhead using FIFO process costing.
  - c. Reconcile the calculations in parts (a) and (b).
21. (*Cost per EUP; weighted average*) Flickering Figurines manufactures wax figurines. In October 2000, company production is 26,800 equivalent units for direct material, 24,400 equivalent units for labor, and 21,000 equivalent units for overhead. During October, direct material and conversion costs incurred are as follows:

Direct material	\$ 78,880
Direct labor	122,400
Overhead	42,600

Beginning inventory costs for October were \$14,920 for direct material, \$36,200 for labor, and \$9,900 for overhead. What is the weighted average cost per equivalent unit for the cost components for October?

22. (*Cost per EUP; FIFO*) Assume that Flickering Figurines in Exercise 21 had 3,600 EUP for direct material in October's beginning inventory, 4,000 EUP for direct labor, and 3,960 EUP for overhead. What was the FIFO cost per equivalent unit for direct material, labor, and overhead for October?
23. (*Cost per EUP; weighted average & FIFO*) Garden Edges manufactures concrete garden border sections. May 2001 production and cost information are as follows:

WA EUP:	Direct material	40,000 sections
	Direct labor	38,000 sections
	Overhead	37,500 sections
FIFO EUP:	Direct material	30,000 sections
	Direct labor	31,000 sections
	Overhead	33,000 sections
BI costs:	Direct material	\$ 5,300
	Direct labor	1,580
	Overhead	3,630
Current period costs:	Direct material	\$13,500
	Direct labor	8,680
	Overhead	21,120

All material is added at the beginning of processing.

- a. What is the total cost to account for?
- b. Using weighted average process costing, what is the cost per equivalent unit for each cost component?
- c. Using FIFO process costing, what is the cost per equivalent unit for each cost component?
- d. How many units were in beginning inventory and at what percentage of completion was each cost component?



24. (*EUP; cost per EUP; weighted average*) TakeThat manufactures canisters of mace. On August 1, 2001, the company had 4,800 units in beginning Work in Process Inventory that were 100 percent complete as to canisters, 60 percent complete as to other materials, 10 percent complete as to direct labor, and 20 percent complete as to overhead. During August, TakeThat started 22,500 units into the manufacturing process. Ending Work in Process Inventory included 3,600 units that were 100 percent complete as to canisters, 30 percent complete as to other materials, 25 percent complete as to direct labor, and 30 percent complete as to overhead.

Cost information for the month follows:

Beginning inventory:	Canisters	\$ 8,175
	Other direct materials	3,393
	Direct labor	1,212
	Overhead	1,038
August costs:	Canisters	\$39,600
	Other direct materials	20,148
	Direct labor	61,812
	Overhead	43,734

Prepare a schedule showing TakeThat's August 2001 computation of weighted average equivalent units of production and cost per equivalent unit.



25. (*EUP; cost per EUP; FIFO*) ReallyRoll makes skateboards and uses a FIFO process costing system. The company began April 2001 with 1,000 boards in process that were 70 percent complete as to material and 85 percent complete as to conversion. During the month, 3,800 additional boards were started. On April 30, 800 boards were still in process (60 percent complete as to material and 70 percent complete as to conversion). Cost information for April 2001 is as follows:

Beginning inventory costs:	Direct material	\$13,181
	Conversion	6,732
Current period costs:	Direct material	\$71,064
	Conversion	29,309

- a. Calculate EUP for each cost component using the FIFO method.
- b. Calculate cost per EUP for each cost component.

26. (*Cost assignment; weighted average*) Thomson Co. uses weighted average process costing. The company's cost accountant has determined the following production and cost per EUP information for January 2001:

Units transferred out during month	256,000
Units in ending inventory (100% complete as to direct material; 80% complete as to direct labor; 95% complete as to overhead)	37,000
Direct material cost per EUP	\$3.75
Direct labor cost per EUP	\$4.96
Overhead cost per EUP	\$5.10

- a. What is the cost of the goods transferred during January?
- b. What is the cost of the goods in ending inventory at January 31, 2001?
- c. What is the total cost to account for during January?

27. (*Cost assignment; FIFO*) In November 2000, Walker Corporation computed its costs per equivalent unit under FIFO process costing as follows:

Raw material	\$12.75
Packaging	1.50
Direct labor	6.42
Overhead	3.87

The raw material is added at the start of processing. Packaging is added at the end of the production process immediately before the units are transferred to the finished goods warehouse.

Beginning inventory cost was \$513,405 and consisted of:

- \$344,520 raw material cost for 27,000 EUP,
- \$95,931 direct labor cost for 14,850 EUP, and
- \$72,954 overhead cost for 18,900 EUP.

Walker transferred a total of 185,000 units to finished goods during November, which left 16,000 units in ending inventory. The EI units were 20 percent complete as to direct labor and 35 percent complete as to overhead.

- What percentage complete were the beginning inventory units as to raw material? Packaging? Direct labor? Overhead?
  - What was the total cost of the completed beginning inventory units?
  - What was the cost of the units started and completed in November?
  - What was the cost of November's ending inventory?
28. (*EUP; cost per EUP; cost assignment; FIFO & weighted average*) Berne Company mass produces miniature speakers for portable CD players. The following T-account presents the firm's cost information for February 2001:

#### Work in Process Inventory

2/1 Direct material cost in BI	\$ 1,027
2/1 Conversion cost in BI	588
Feb. DM received	11,682
Feb. DL incurred	2,513
Feb. OH applied to production	1,257

The company had 400 units in process on February 1. These units were 40 percent complete as to material and 30 percent complete as to conversion. During February, the firm started 1,500 units and ended the month with 150 units still in process. The units in ending WIP Inventory were 20 percent complete as to material and 70 percent complete as to conversion.

- Compute the unit costs for February under the FIFO method for direct material and for conversion.
  - Compute the unit costs for February under the weighted average method for direct material and for conversion.
  - Determine the total costs transferred to Finished Goods Inventory during February using the FIFO method.
29. (*EUP; weighted average & FIFO; two departments*) Jones Metals has two processing departments, Fabrication and Assembly. Metal is placed into production in the Fabrication Department, where it is cut, formed, or ground into various components. These components are transferred to Assembly, where they are welded, polished, and hot-dip galvanized with sealant. The production data follow for these two departments for March 2001:

**Fabrication**

Beginning WIP inventory (100% complete as to material; 45% complete as to conversion)	5,000
Units started during month	39,000
Ending WIP inventory (100% complete as to material; 80% complete as to conversion)	6,800

**Assembly**

Beginning WIP inventory (0% complete as to sealant; 15% complete as to conversion)	1,500
Units started during month	?
Ending WIP inventory (100% complete as to sealant; 75% complete as to conversion)	4,600

- a. Determine the equivalent units of production for each cost component for each department under the weighted average method.
  - b. Determine the equivalent units of production for each cost component for each department under the FIFO method.
30. (*Standard process costing; variances*) DiskCity Products manufactures 3.5-inch preformatted computer disks and uses a standard process costing system. All material is added at the start of production, and labor and overhead are incurred equally throughout the process. The standard cost of one disk is as follows:

Direct material	\$0.13
Direct labor	0.02
Overhead	0.11
Total cost	<u>\$0.26</u>

The following production and cost data are applicable to April 2001:

Beginning inventory (45% complete)	17,000 units
Started in April	130,000 units
Ending inventory (65% complete)	14,400 units
Current cost of direct material	\$18,400
Current cost of direct labor	2,598
Current cost of overhead	15,000

- a. What cost is carried as the April beginning balance of Work in Process Inventory?
  - b. What cost is carried as the April ending balance of Work in Process Inventory?
  - c. What cost is transferred to Finished Goods Inventory for April?
  - d. Using the FIFO method, what are the total direct material, direct labor, and overhead variances for April?
31. (*Standard process costing*) Tico Company uses a standard FIFO process costing system to account for its tortilla manufacturing process. The tortillas are packaged and sold by the dozen. The company has set the following standards for production of each one-dozen package:

Direct material—ingredients	\$0.35
Direct material—package	0.05
Direct labor	0.07
Overhead	0.13
Total cost	<u>\$0.60</u>

On June 1, the company had 7,200 individual tortillas in process; these were 100 percent complete as to ingredients, 0 percent complete as to the packaging, and 30 percent complete as to labor and overhead. One hundred forty-four thousand tortillas were started during June and 147,960 were finished. The

ending inventory was 100 percent complete as to ingredients, 0 percent complete as to the packaging, and 60 percent complete as to labor and overhead.

- a. What were the equivalent units of production for June?
  - b. What was the cost of the packages transferred to Finished Goods Inventory during June?
  - c. What was the cost of the ending Work in Process Inventory for June?
32. (*Hybrid costing*) Carolina Coats makes casual coats (one size fits most). Each coat goes through the same conversion process, but three types of fabric (Dacron, denim, or cotton) are available. The company uses a standard costing system, and standard costs for each type of coat follow:

	Dacron	Denim	Cotton
Material (5 yards)	\$10	\$ 5	\$12
Direct labor (2 hours)	12	12	12
Overhead (based on 1.5 machine hours)	9	9	9
Total	<u>\$31</u>	<u>\$26</u>	<u>\$33</u>

Material is added at the start of production. In March 2001, there was no beginning Work in Process Inventory and 1,500 coats were started into production. Of these, 200 were Dacron, 600 were denim, and 700 were cotton. At the end of March, 300 jackets (50 Dacron, 100 denim, and 150 cotton) were not yet completed. The stage of completion for each cost component for the 300 unfinished jackets is as follows:

Material	100% complete
Direct labor	25% complete
Overhead	35% complete

- a. Determine the total cost of the coats completed and transferred to Finished Goods Inventory.
- b. Determine the total cost of the coats in ending Work in Process Inventory.

## PROBLEMS

33. (*EUP; weighted average & FIFO*) Patio Company produces outdoor brooms. On April 30, 2001, the firm had 3,600 units in process that were 70 percent complete as to material, 40 percent complete as to direct labor, and 30 percent complete as to overhead. During May, 186,000 brooms were started. Records indicate that 184,200 units were transferred to Finished Goods Inventory in May. Ending units in process were 40 percent complete as to material, 25 percent complete as to direct labor, and 10 percent complete as to overhead.
- a. Calculate the physical units to account for in May.
  - b. How many units were started and completed during May?
  - c. Determine May's EUP for each category using the weighted average method.
  - d. Determine May's EUP for each category using the FIFO method.
  - e. Reconcile your answers to parts (c) and (d).
34. (*EUP; weighted average & FIFO*) The Midwest Coal Company mines and processes coal that is sold to four power plants in central Pennsylvania. The company employs a process costing system to assign production costs to the coal it processes. For the third week in March 2001, the firm had a beginning Work in Process Inventory of 50,000 tons of ore that were 100 percent complete as to material and 30 percent complete as to conversion. During the week, an additional 200,000 tons of ore were started in process. At the end of

the week, 35,000 tons remained in Work in Process Inventory and were 70 percent complete as to material and 60 percent complete as to conversion.

For the third week in March:

- a. Compute the total units to account for.
- b. Determine how many units were started and completed.
- c. Determine the equivalent units of production using the weighted average method.
- d. Determine the equivalent units of production using the FIFO method.



35. (*Weighted average*) Frankfurt Products manufactures an electronic language translator. The device can translate seven languages in either direction. Analysis of beginning Work in Process Inventory for February 2001 revealed the following:

800 Units	Percent Complete	Cost Incurred
Material	45	\$ 8,700
Direct labor	65	3,800
Overhead	40	6,600
Total beginning WIP		<u>\$19,100</u>

During February, Frankfurt Products started production of another 3,800 translators and incurred \$85,380 for material, \$23,560 for direct labor, and \$65,720 for overhead. On February 28, the company had 400 units in process (70 percent complete as to material, 90 percent complete as to direct labor, and 80 percent complete as to overhead).

- a. Prepare a cost of production report for February using the weighted average method.
  - b. Journalize the February transactions.
  - c. Prepare T-accounts to represent the flow of costs for Frankfurt Products for February. Use "XXX" where amounts are unknown and identify what each unknown amount represents.
36. (*Weighted average*) Alt Enterprises manufactures belt buckles in a single-step production process. To determine the proper valuations for inventory balances and Cost of Goods Sold, you have obtained the following information for August 2001:

	Whole Units	Cost of Material	Cost of Labor
Beginning work in process	400,000	\$ 400,000	\$ 630,000
Units started during period	2,000,000	2,600,000	3,990,000
Units transferred to finished goods	1,800,000		

Beginning inventory units were 100 percent complete as to material, but only 80 percent complete as to labor and overhead. The ending inventory units were 100 percent complete as to material and 50 percent complete as to conversion. Overhead is applied to production at the rate of 60 percent of direct labor cost.

- a. Prepare a schedule to compute equivalent units of production by cost component assuming the weighted average method.
  - b. Determine the unit production costs for material and conversion.
  - c. Calculate the costs assigned to completed units and ending inventory for August 2000.
37. (*Weighted average*) You have just been hired as the cost accountant for Sun Valley Micro, a producer of personal computer cases. This position has been vacant for one month. John Amos, manager of the firm's tax department, has performed some computations for last month's information; however, he confesses to you that he doesn't remember a great deal about cost accounting.

In the production process, materials are added at the beginning of production and overhead is applied to each product at the rate of 70 percent of

direct labor cost. There was no Finished Goods Inventory at the beginning of July. A review of the firm's inventory cost records provides you with the following information:

	Units	DM Cost	DL Cost
Work in Process 7/1/00 (70% complete as to labor and overhead)	100,000	\$ 750,000	\$ 215,000
Units started in production	1,300,000		
Costs for July		4,850,000	3,265,000
Work in Process 7/31/00 (40% complete as to labor and overhead)	400,000		

At the end of July, the cost of Finished Goods Inventory was determined to be \$124,033.

- a. Prepare schedules for July 2000, to compute the following:
  1. Equivalent units of production using the weighted average method.
  2. Unit production costs for material, labor, and overhead.
  3. Cost of Goods Sold.
- b. Prepare the journal entries to record the July transfer of completed goods and the July cost of goods sold. *(CPA adapted)*

38. *(FIFO cost per EUP)* The following information has been gathered from the records of Jack's Snacks for August 2001. The firm makes a variety of snacks; the information presented here is for a cashew and dried mango mix. Materials are added at the beginning of processing; overhead is applied on a direct labor basis. The mix is transferred to a second department for packaging. Jack's uses a FIFO process costing system.



Beginning WIP inventory (40% complete as to conversion)	5,000 pounds
Mix started in August	90,400 pounds
Ending WIP inventory (70% complete as to conversion)	4,000 pounds
Materials cost incurred in August	\$415,840
Conversion costs incurred in August	\$106,030

Beginning inventory cost totaled \$13,875. For August 2001, compute the following:

- a. Equivalent units of production by cost component.
  - b. Cost per equivalent unit by cost component.
  - c. Cost of mix transferred to the packaging department in August.
  - d. Cost of August's ending inventory.
39. *(Cost assignment; FIFO)* Green Seasons Processors is a contract manufacturer for the Delectable Dressing Company. Green Seasons uses a FIFO process costing system to account for the production of its salad dressing. All ingredients are added at the start of the process. Delectable provides reusable vats to Green Seasons for the completed product to be shipped to Delectable for bottling so Green Seasons incurs no packaging costs. April 2001 production and cost information for Green Seasons Processors is as follows:

Gallons of dressing in beginning inventory	37,000
Gallons transferred out during April	243,000
Gallons of dressing in ending inventory	23,500
Costs of beginning inventory:	
Direct material	\$ 181,300
Direct labor	45,695
Overhead	50,320
Costs incurred in April:	
Direct material	\$1,131,435
Direct labor	452,976
Overhead	770,133

The beginning and ending inventories had the following degrees of completion each for labor and overhead:

	Beginning Inventory	Ending Inventory
Direct labor	35%	25%
Overhead	60%	30%

- How many gallons of dressing ingredients were started in April?
- What is the total cost of the completed beginning inventory?
- What is the total cost of goods completed during April?
- What is the average cost per gallon of all goods completed during April?
- What is the cost of April's ending WIP inventory?



40. (*Weighted average & FIFO*) In a single-process production system, the Cleopatra Corporation produces press-on fingernails. For October 2000, the company's accounting records reflected the following:

Beginning Work in Process Inventory (100% complete as to material; 30% complete as to direct labor; 60% complete as to overhead)	6,000 units
Units started during the month	45,000 units
Ending Work in Process Inventory (100% complete as to material; 40% complete as to direct labor; 70% complete as to overhead)	10,000 units

Cost Component	Beginning Inventory	October
Material	\$4,980	\$45,000
Direct labor	450	21,600
Overhead	3,180	33,300

- For October, prepare a cost of production report assuming the company uses the weighted average method.
  - For October, prepare a cost of production report assuming the company uses the FIFO method.
41. (*FIFO; second department*) Bixby Company makes porcelain kitchen sinks in a process requiring operations in three separate departments: Molding, Curing, and Finishing. Materials are first introduced in the molding operation and additional material is added during the curing process. The following information is available for the Curing Department for May 2001:

Beginning WIP Inventory (degree of completion: transferred-in, 100%; direct material, 80%; direct labor, 40%; overhead, 30%)	8,000 units
Transferred-in from Molding	40,000 units
Ending WIP Inventory (degree of completion: transferred-in, 100%; direct material, 70%; direct labor, 50%; overhead, 40%)	4,000 units
Transferred to Finishing	? units

Cost Component	Beginning Inventory	Current Period
Transferred-in	\$66,000	\$320,000
Direct material	24,960	161,600
Direct labor	6,720	85,600
Overhead	3,580	43,200

Prepare, in good form, a cost of production report for the Curing Department for May 2001. *(CPA adapted)*

42. (*Two departments; weighted average*) The Best of the Season Corporation makes plastic Christmas trees in two departments: Cutting and Boxing. In the Cutting Department, wire wrapped with green "needles" is placed into production at

the beginning of the process and is cut to various lengths depending on the size of the trees being made at that time. The “branches” are then transferred to the Boxing Department where the lengths are separated into the necessary groups to make a tree. These are then placed in boxes and immediately sent to Finished Goods.

The following data are available related to the October 2000 production in each of the two departments:

	Units	PERCENT OF COMPLETION		
		Transferred-in	Material	Conversion
<b>Cutting Department</b>				
Beginning inventory	9,000	N/A	100	30
Started in process	35,000			
Ending inventory	3,600	N/A	100	70
<b>Boxing Department</b>				
Beginning inventory	2,500	100	0	55
Transferred-in	?			
Ending inventory	1,200	100	0	60
<b>COSTS</b>		Transferred-in	Material	Conversion
<b>Cutting Department</b>				
Beginning inventory		N/A	\$13,250	\$ 5,550
Current period		\$52,750	80,290	
<b>Boxing Department</b>				
Beginning inventory		\$ 9,608	\$ 0	\$ 550
Current period		?	12,510	20,660

- Prepare a cost of production report for the Cutting Department assuming a weighted average method.
  - Using the data developed from part (a), prepare a cost of production report for the Boxing Department, also using the weighted average method.
43. (*Cost flows: multiple departments*) Sharp Corporation produces accent stripes for automobiles in 50-inch rolls. Each roll passes through three departments (Striping, Adhesion, and Packaging) before it is ready for shipment to automobile dealers and detailing shops. Product costs are tracked by department and assigned using a process costing system. Overhead is applied to production in each department at a rate of 60 percent of the department’s direct labor cost. The following information pertains to departmental operations for June 2001:

Work in Process—Striping			Work in Process—Adhesion		
Beginning	\$20,000		Beginning	\$70,000	
DM	90,000		Transferred-in	?	
DL	80,000		DM	60,000	\$480,000
Overhead	?		DL	?	
			Overhead	?	
Ending	\$17,000		Ending	\$20,000	
Work in Process—Packaging			Finished Goods		
Beginning	\$150,000		Beginning	\$185,000	
Transferred-in	?		CGM	830,000	\$720,000
DM	?				
DL	?				
Overhead	90,000		Ending	?	
Ending	\$ 90,000				

- a. What was the cost of goods transferred from the Striping Department to the Adhesion Department for the month?
  - b. How much direct labor cost was incurred in the Adhesion Department? How much overhead was assigned to production in the Adhesion Department for the month?
  - c. How much direct material cost was charged to products passing through the Packaging Department?
  - d. Prepare the journal entries for all interdepartmental transfers of products and the cost of the units sold during June 2001.
44. (*Comprehensive; two departments*) Safe-N-Sound makes a backyard fencing system for pet owners in a two-stage production system. In Process 1, wood is cut and assembled into six-foot fence sections. In Process 2, the sections are pressure treated to resist the effects of weather and then coated with a wood preservative. The following production and cost data are available for March 2001 (units are six-foot fence sections):

Units	Cutting Process	Pressure Process
Beginning WIP Inventory (March 1)	1,300	900
Complete as to material	80%	0%
Complete as to conversion	75%	60%
Units started in March	4,800	?
Units completed in March	?	4,500
Ending WIP Inventory (March 31)	1,100	?
Complete as to material	40%	0%
Complete as to conversion	20%	40%

#### Costs

Beginning WIP Inventory		
Transferred-in		\$ 4,725
Material	\$ 2,130	0
Conversion	3,175	1,674
Current		
Transferred-in		\$ ?
Material	\$ 8,800	4,995
Conversion	12,735	13,560

- a. Prepare EUP schedules for both the cutting and pressure processes. Use the FIFO method.
  - b. Determine the cost per equivalent unit for the cutting process assuming a FIFO method.
  - c. Assign costs to goods transferred and to inventory in the cutting process on a FIFO basis.
  - d. Transfer the FIFO costs to the pressure process. Determine cost per EUP on a modified FIFO basis. (See footnote 8, page 233.)
  - e. Assign costs to goods transferred and to inventory in the pressure process on a modified FIFO basis.
  - f. Assuming there was no beginning or ending inventory of Finished Goods Inventory for March, what was Cost of Goods Sold for March?
45. (*Standard process costing*) HealthySight is a manufacturer of high-quality lenses for sunglasses and ski goggles. HealthySight uses a standard process costing system and carries inventories at standard. In May 2001, the following data were available:

	Standard Cost of 1 Unit
Direct material	\$ 4.50
Conversion	12.50
Total manufacturing cost	<u>\$17.00</u>

Beginning WIP Inventory	10,000 units (100% DM; 70% conversion)
Started in May	180,000 units
Completed in May	160,000 units
Ending WIP Inventory	? units (100% DM; 60% conversion)

Actual costs for May	
Direct material	\$ 781,000
Conversion	<u>2,045,000</u>
Total actual cost	<u>\$2,826,000</u>

- Prepare an equivalent units of production schedule.
- Prepare a cost of production report and assign costs to goods transferred and to inventory.
- Calculate and label the variances and charge them to Cost of Goods Sold.

46. (*Multiproduct; hybrid costing*) Be-At-Ease Industries manufactures a series of three models of molded plastic chairs: standard (can be stacked), deluxe (with arms), and executive (with arms and padding); all are variations of the same design. The company uses batch manufacturing and has a hybrid costing system.



Be-At-Ease has an extrusion operation and subsequent operations to form, trim, and finish the chairs. Plastic sheets are produced by the extrusion operation, some of which are sold directly to other manufacturers. During the forming operation, the remaining plastic sheets are molded into chair seats and the legs are added; the standard model is sold after this operation. During the trim operation, the arms are added to the deluxe and executive models and the chair edges are smoothed. Only the executive model enters the finish operation where the padding is added. All of the units produced receive the same steps within each operation.

The July production run had a total manufacturing cost of \$898,000. The units of production and direct material costs incurred were as follows:

	Units Produced	Extrusion Materials	Form Materials	Trim Materials	Finish Materials
Plastic sheets	5,000	\$ 60,000			
Standard model	6,000	72,000	\$24,000		
Deluxe model	3,000	36,000	12,000	\$ 9,000	
Executive model	<u>2,000</u>	<u>24,000</u>	<u>8,000</u>	<u>6,000</u>	<u>\$12,000</u>
	<u>16,000</u>	<u>\$192,000</u>	<u>\$44,000</u>	<u>\$15,000</u>	<u>\$12,000</u>

Manufacturing costs applied during July were as follows:

	Extrusion Operation	Form Operation	Trim Operation	Finish Operation
Direct labor	\$152,000	\$60,000	\$30,000	\$18,000
Factory overhead	240,000	72,000	39,000	24,000

- For each product produced by Be-At-Ease during July, determine the
  - Unit cost.
  - Total cost.
 Be sure to account for all costs incurred during the month, and support your answer with appropriate calculations.
- Without prejudice to your answer in part (a), assume that 1,000 units of the deluxe model remained in Work in Process Inventory at the end of the month. These units were 100 percent complete in the trim operation. Determine the value of the 1,000 units of the deluxe model in Be-At-Ease's Work in Process Inventory at the end of July. (*CMA adapted*)

## CASE

47. (*WA and FIFO*) Rainbow Paints makes quality paint sold at premium prices in one production department. Production begins with the blending of various chemicals, which are added at the beginning of the process, and ends with the canning of the paint. Canning occurs when the mixture reaches the 90 percent stage of completion. The gallon cans are then transferred to the Shipping Department for crating and shipment. Labor and overhead are added continuously throughout the process. Factory overhead is applied at the rate of \$3 per direct labor hour.

Prior to May, when a change in the process was implemented, work in process inventories were insignificant. The change in process enables greater production but results in large amounts of work in process. The company has always used the weighted average method to determine equivalent production and unit costs. Now, production management is considering changing from the weighted average method to the first-in, first-out method.

The following data relate to actual production during May:

### Costs for May

Work in process inventory, May 1	
Direct material—chemicals	\$ 45,600
Direct labor (\$10 per hour)	6,250
Factory overhead	1,875
Current month	
Direct material—chemicals	\$228,400
Direct material—cans	7,000
Direct labor (\$10 per hour)	35,000
Factory overhead	10,500

### Units for May (Gallons)

Work in process inventory, May 1 (25% complete)	4,000
Sent to Shipping Department	20,000
Started in May	21,000
Work in process inventory, May 31 (80% complete)	5,000

- a. Prepare a cost of production report for each cost element for May using the weighted average method.
- b. Prepare a cost of production report for each cost element for May using the FIFO method.
- c. Discuss the advantages and disadvantages of using the weighted average method versus the FIFO method, and explain under what circumstances each method should be used. *(CMA adapted)*

## REALITY CHECK

48. The term *total cost to account for* has been used in this chapter and in another setting earlier in the text. Find that earlier reference to this term and write a brief report explaining whether or not the term is being used consistently in both places.
49. The weighted average and FIFO methods generally result in approximately the same unit costs because costs do not usually vary dramatically from period to period. Discuss some reasons for exceptions to this observation.

- 50.** Cost accountants use the concept of equivalent units of production (EUP) to measure actual production for a period in a process costing environment. Write a memo describing what EUP measures and why it is necessary to use EUP to determine actual production for a period.
- 51.** Search the Internet to identify a vendor of process costing software. Read the on-line literature provided by the vendor regarding the software. Then, briefly describe the major features of the software in the areas of product costing, cost budgeting, and cost control.
- 52.** In a team of three or four people, choose a company whose mass production process you would like to learn. Use the library, the Internet, and (if possible) personal resources to gather information. Prepare a visual representation (similar to Exhibit 6–2) of that production process. In this illustration, indicate the approximate percentage of completion points at which various materials are added and where/how labor and overhead flow into and through the process. Assume that 1,000 units of product are flowing through your production process and are now at the 60 percent completion point as to labor. Prepare a written explanation about the quantity of direct material equivalent units that are included in the 1,000 units. Also explain how much overhead activity and cost have occurred and why the overhead percentage is the same as or different from the percentage of completion for labor.
- 53.** Find a Web site or current professional article discussing developments in the pharmaceutical/medical devices industry. Read the materials on that site about evolving practices in the industry to improve cost effectiveness of operations. Discuss how the industry's new practices will affect process costing in the pharmaceutical industry. Which cost pools (direct material, direct labor, manufacturing overhead) will be affected by the emerging practices? Also, address whether any of the evolving practices would be better served by life cycle costing.
- 54.** Find the Web page for Agile Software. Provide its Web address and discuss the nature of this Internet-based software and how it can affect cost accounting practices in industries that manufacture complex products.

