Job-Order Costing—An Example

To introduce job-order costing, we will follow a specific job as it progresses through the manufacturing process. This job consists of two experimental couplings that Yost Precision Machining has agreed to produce for Loops Unlimited, a manufacturer of roller coasters. Couplings connect the cars on the roller coaster and are a critical component in the performance and safety of the ride. Before we begin our discussion, recall from a previous chapter that companies generally classify manufacturing costs into three broad categories: (1) direct materials, (2) direct labor, and (3) manufacturing overhead. As we study the operation of a job-order costing system, we will see how each of these three types of costs is recorded and accumulated.

MANAGERIAL ACCOUNTING IN ACTION

The Issue

Yost Precision Machining is a small company in Michigan that specializes in fabricating precision metal parts that are used in a variety of applications ranging from deep-sea exploration vehicles to the inertial triggers in automobile air bags. The company's top managers gather every morning at 8:00 A.M. in the company's conference room for the daily planning meeting. Attending the meeting this morning are: Jean Yost, the company's president; David Cheung, the marketing manager; Debbie Turner, the production manager; and Marc White, the company controller. The president opened the meeting:

- ***Jean:*** The production schedule indicates we'll be starting Job 2B47 today. Isn't that the special order for experimental couplings, David?

- ***David:*** That's right. That's the order from Loops Unlimited for two couplings for their new roller coaster ride for Magic Mountain.

- ***Debbie:*** Why only two couplings? Don't they need a coupling for every car?

- ***David:*** Yes. But this is a completely new roller coaster. The cars will go faster and will be subjected to more twists, turns, drops, and loops than on any other existing roller coaster. To hold up under these stresses, Loops Unlimited's engineers completely redesigned the cars and couplings. They want us to make just two of these new couplings for testing purposes. If the design works, then we'll have the inside track on the order to supply couplings for the whole ride.

  Page 120

- ***Jean:*** We agreed to take on this initial order at our cost just to get our foot in the door. Marc, will there be any problem documenting our cost so we can get paid?

- ***Marc:*** No problem. The contract with Loops stipulates that they will pay us an amount equal to our cost of goods sold. With our job-order costing system, I can tell you the cost on the day the job is completed.

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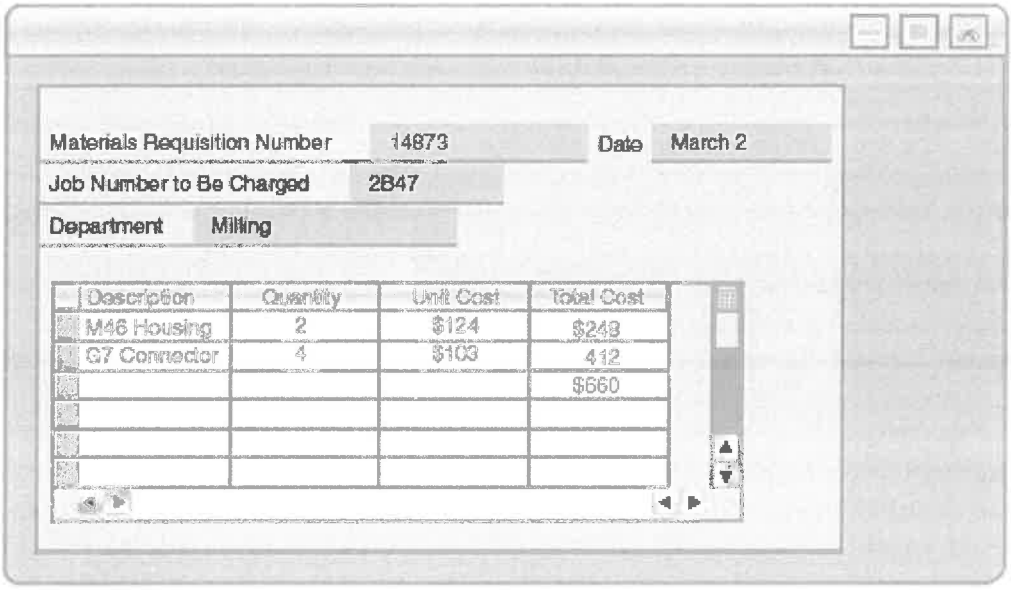

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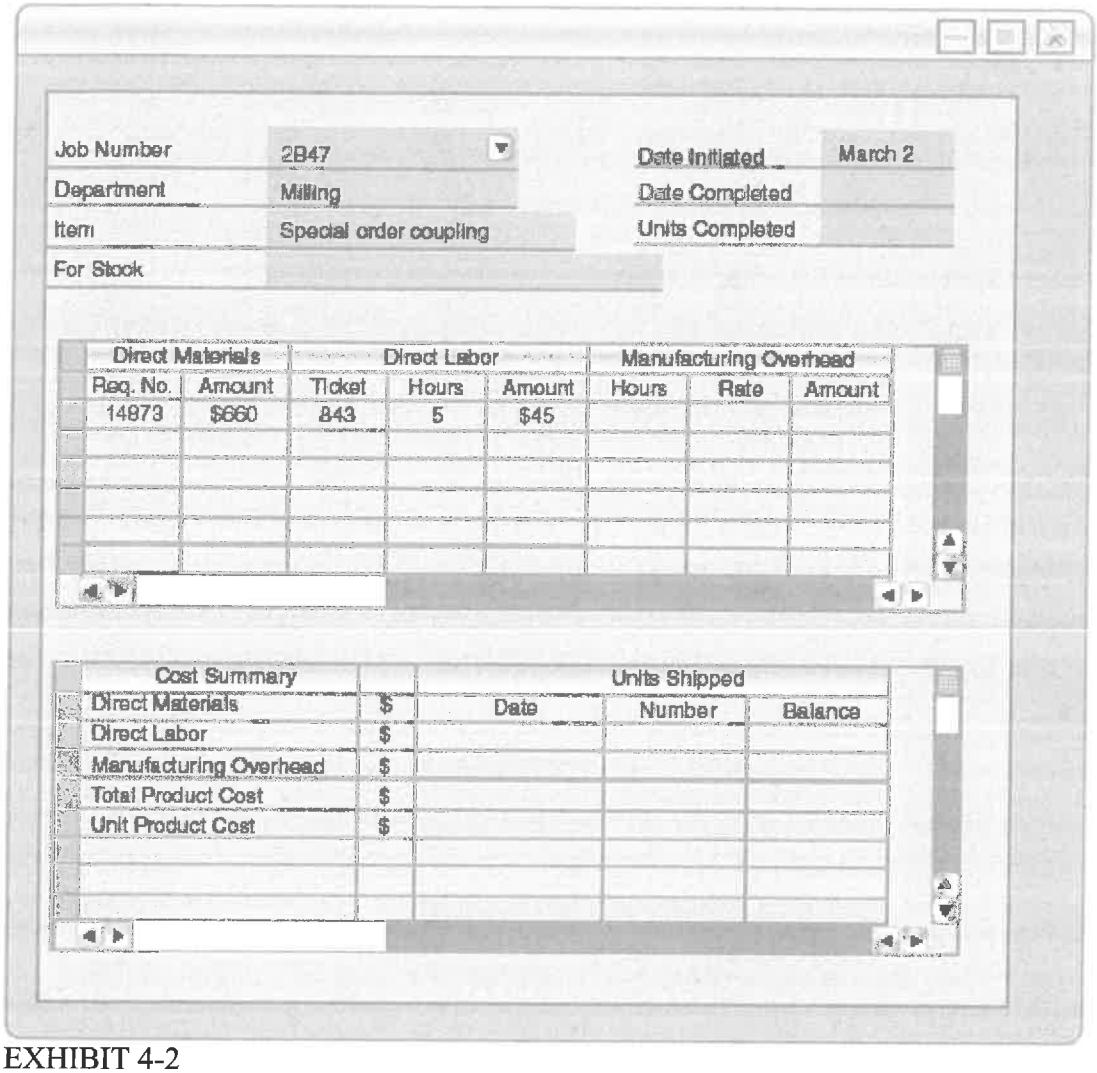

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IN BUSINESS
SUPPLY AND DEMAND INFLUENCE LUMBER PRICES

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Home builders use job-order costing systems to accumulate the costs incurred to build each new home. When materials and labor costs fluctuate, job-order costing systems can measure these impacts on each customer's new home construction costs.

Source: Liam Pleven and Lester Aldrich, "Builders Nailed by Lumber Prices," *The Wall Street Journal*, February 16, 2010, pp. C1 and C4.

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EXHIBIT 4-3 Employee Time Ticket

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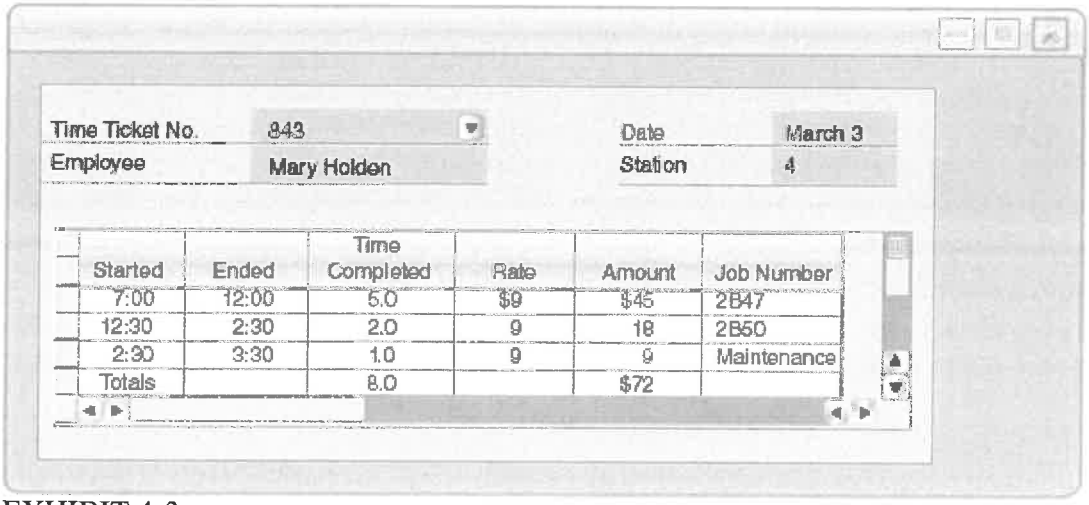

EXHIBIT 4-3
Employee Time Ticket

Computing Predetermined Overhead Rates

LEARNING OBJECTIVE 4-1

Compute a predetermined overhead rate.

Recall that product costs include manufacturing overhead as well as direct materials and direct labor. Therefore, manufacturing overhead also needs to be recorded on the job cost sheet. However, assigning manufacturing overhead to a specific job involves some difficulties. There are three reasons for this:

1. Manufacturing overhead is an *indirect cost.* This means that it is either impossible or difficult to trace these costs to a particular product or job.

2. Manufacturing overhead consists of many different types of cost ranging from the grease used in machines to the annual salary of the production manager. Some of these costs are variable overhead costs because they vary in direct proportion to changes in the level of production (e.g., indirect materials, supplies, and power) and some are fixed overhead costs because they remain constant as the level of production fluctuates (e.g., heat and light, property taxes, and insurance).

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3. Because of the fixed costs in manufacturing overhead, total manufacturing overhead costs tend to remain relatively constant from one period to the next even though the number of units produced can fluctuate widely. Consequently, the average cost per unit will vary from one period to the next.

Given these problems, allocation is used to assign overhead costs to products. Allocation is accomplished by selecting an *allocation base* that is common to all of the company's products and services. An **allocation base** is a measure such as direct labor-hours (DLH) or machine-hours (MH) that is used to assign overhead costs to products and services. The most widely used allocation bases in manufacturing are direct labor-hours, direct labor cost, machine-hours and (where a company has only a single product) units of product.

Manufacturing overhead is commonly assigned to products using *a predetermined overhead rate.* The **predetermined overhead rate** is computed by dividing the total estimated manufacturing overhead cost for the period by the estimated total amount of the allocation base for the period as follows:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

The predetermined overhead rate is computed *before* the period begins using a four-step process. The first step is to estimate the total amount of the allocation base (the denominator) that will be required for next period's estimated level of production. The second step is to estimate the total fixed manufacturing overhead cost for the coming period and the variable manufacturing overhead cost per unit of the allocation base. The third step is to use the cost formula shown below to estimate the total manufacturing overhead cost (the numerator) for the coming period:

$Y = a + bX$

where,

Y = The estimated total manufacturing overhead cost

a = The estimated total fixed manufacturing overhead cost

b = The estimated variable manufacturing overhead cost per unit of the allocation base

X = The estimated total amount of the allocation base

The fourth step is to compute the predetermined overhead rate. Notice, the estimated amount of the allocation base is determined before estimating the total manufacturing overhead cost. This needs to be done because total manufacturing overhead cost includes variable overhead costs that depend on the amount of the allocation base.

Applying Manufacturing Overhead

LEARNING OBJECTIVE 4-2

Apply overhead cost to jobs using a predetermined overhead rate.

To repeat, the predetermined overhead rate is computed *before* the period begins. The predetermined overhead rate is then used to apply overhead cost to jobs throughout the period. The process of assigning overhead cost to jobs is called **overhead application**. The formula for determining the amount of overhead cost to apply to a particular job is:

$$\text{Overhead applied to a particular job} = \text{Predetermined overhead rate} \times \text{Amount of the allocation base incurred by the job}$$

For example, if the predetermined overhead rate is $8 per direct labor-hour, then $8 of overhead cost is *applied* to a job for each direct labor-hour incurred on the job. When the allocation base is direct labor-hours, the formula becomes:

$$\text{Overhead applied to a particular job} = \text{Predetermined overhead rate} \times \text{Actual direct labor-hours charged to the job}$$

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Manufacturing Overhead—A Closer Look

To illustrate the steps involved in computing and using a predetermined overhead rate, let's return to Yost Precision Machining and make the following assumptions. In step one, the company estimated that 40,000 direct labor-hours would be required to support the production planned for the year. In step two, it estimated $220,000 of total fixed manufacturing overhead cost for the coming year and $2.50 of variable manufacturing overhead cost per direct labor-hour. Given these assumptions, in step three the company used the cost formula shown below to estimate its total manufacturing overhead cost for the year:

$Y = a + bX$

$Y = \$220{,}000 + (\$2.50 \text{ per direct labor-hour} \times 40{,}000 \text{ direct labor-hours})$

$Y = \$220{,}000 + \$100{,}000$

$Y = \$320{,}000$

In step four, Yost Precision Machining computed its predetermined overhead rate for the year of $8 per direct labor-hour as shown below:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$320{,}000}{40{,}000 \text{ direct labor-hours}}$$

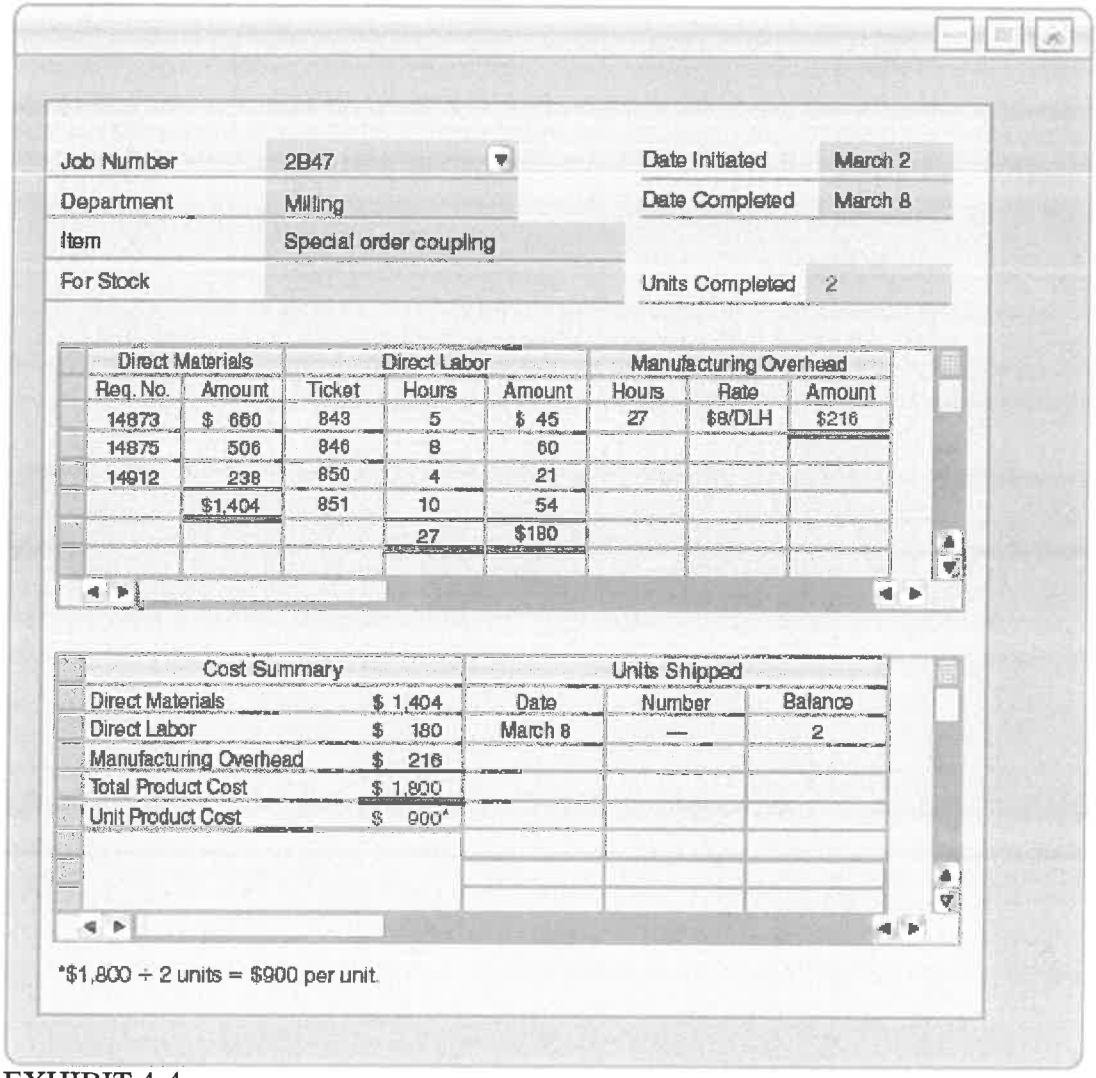
$$= \$8 \text{ per direct labor-hour}$$

The job cost sheet in Exhibit 4-4 indicates that 27 direct labor-hours (i.e., DLHs) were charged to Job 2B47. Therefore, a total of $216 of manufacturing overhead cost would be applied to the job:

$$\begin{aligned}\text{Overhead applied to Job 2B47} &= \text{Predetermined overhead rate} \times \text{Actual direct labor-hours charged to Job 2B47} \\ &= \$8 \text{ per DLH} \times 27 \text{ DLHs} \\ &= \$216 \text{ of overhead applied to Job 2B47}\end{aligned}$$

EXHIBIT 4-4 A Completed Job Cost Sheet

A Completed Job Cost Sheet



Job Number	2B47	Date Initiated	March 2
Department	Milling	Date Completed	March 8
Item	Special order coupling		
For Stock		Units Completed	2

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
14873	$ 660	843	5	$ 45	27	$8/DLH	$216
14875	506	846	8	60			
14912	238	850	4	21			
	$1,404	851	10	54			
			27	$180			

Cost Summary		Units Shipped		
		Date	Number	Balance
Direct Materials	$ 1,404	March 8	—	2
Direct Labor	$ 180			
Manufacturing Overhead	$ 216			
Total Product Cost	$ 1,800			
Unit Product Cost	$ 900*			

*$1,800 ÷ 2 units = $900 per unit.

EXHIBIT 4-4
A Completed Job Cost Sheet

This amount of overhead has been entered on the job cost sheet in Exhibit 4-4. Note that this is *not* the actual amount of overhead caused by the job. Actual overhead costs are *not* assigned to jobs—if that could be done, the costs would be direct costs, not overhead. The overhead assigned to the job is simply a share of the total overhead that was estimated at the beginning of the year. A **normal cost system**, which we have been describing, applies overhead to jobs by multiplying a predetermined overhead rate by the actual amount of the allocation base incurred by the jobs.

The Need for a Predetermined Rate

Instead of using a predetermined rate based on estimates, why not base the overhead rate on the *actual* total manufacturing overhead cost and the *actual* total amount of the allocation base incurred on a monthly, quarterly, or annual basis? If an actual rate is computed monthly or quarterly, seasonal factors in overhead costs or in the allocation base can produce fluctuations in the overhead rate. For example, the costs of heating and cooling a factory in Illinois will be highest in the winter and summer months and lowest in the spring and fall. If the overhead rate is recomputed at the end of each month or each quarter based on actual costs and activity, the overhead rate would go up in the winter and summer and down in the spring and fall. As a result, two identical jobs, one completed in the winter and one completed in the spring, would be assigned different manufacturing overhead costs. Many managers believe that such fluctuations in product costs serve no useful purpose. To avoid such fluctuations, actual overhead rates could be computed on an annual or less-frequent basis. However, if the overhead rate is computed annually based on the actual costs and activity for the year, the manufacturing overhead assigned to any particular job would not be known until the end of the year. For example, the cost of Job 2B47 at Yost Precision Machining would not be known until the end of the year, even though the job will be completed and shipped to the customer in March. For these reasons, most companies use predetermined overhead rates rather than actual overhead rates in their cost accounting systems.

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Choice of an Allocation Base for Overhead Cost

Ideally, the allocation base in the predetermined overhead rate should *drive* overhead cost. A **cost driver** is a factor, such as machine-hours, beds occupied, computer time, or flight-hours, that causes overhead costs. If the base in the predetermined overhead rate does not "drive" overhead costs, product costs will be distorted. For example, if direct labor-hours is used to allocate overhead, but in reality overhead has little to do with direct labor-hours, then products with high direct labor-hour requirements will be overcosted.

Most companies use direct labor-hours or direct labor cost as the allocation base for manufacturing overhead. In the past, direct labor accounted for up to 60% of the cost of many products, with overhead cost making up only a portion of the remainder. This situation has changed for two reasons. First, sophisticated automated equipment has taken over functions that used to be performed by direct labor workers. Because the costs of acquiring and maintaining such equipment are classified as overhead, this increases overhead while decreasing direct labor. Second, products are becoming more sophisticated and complex and are modified more frequently. This increases the need for highly skilled indirect workers such as engineers. As a result of these two trends, direct labor has decreased relative to overhead as a component of product costs.

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In companies where direct labor and overhead costs have been moving in opposite directions, it would be difficult to argue that direct labor "drives" overhead costs. Accordingly, managers in some companies use *activity-based costing* principles to redesign their cost accounting systems. Activity-based costing is designed to more accurately reflect the demands that products, customers, and other cost objects make on overhead resources. The activity-based approach is discussed in more detail in Appendix 4A and in Chapter 6.

Although direct labor may not be an appropriate allocation base in some industries, in others it continues to be a significant driver of manufacturing overhead. Indeed, most manufacturing companies in the United States continue to use direct labor as the primary or secondary allocation base for manufacturing overhead. The key point is that the allocation base used by the company should really drive, or cause, overhead costs, and direct labor is not always the most appropriate allocation base.

IN BUSINESS
REDUCING HEALTH-DAMAGING BEHAVIORS

© Keith Brofsky/Photodisc/Getty Images, RF

Cianbro is an industrial construction company headquartered in Pittsfield, Maine, whose goal is "to be the healthiest company in America." It introduced a corporate wellness program to attack employee behaviors that drive up health-care costs. The table below summarizes the number of employees in five health risk categories as of 2003 and 2005. The decreases in the number of employees in these high-risk categories are evidence that the wellness program was effective in helping employees make positive lifestyle changes. This should result in reduced health-care costs for the company.

	Number of Employees		
Health Risk Category	January 2003	March 2005	Decrease
Obesity	432	353	79
High cholesterol	637	515	122
Tobacco use	384	274	110
Inactivity	354	254	100
High blood pressure	139	91	48

Source: Cianbro, WELCOA's *Absolute Advantage* Magazine, 2006.

Computation of Unit Costs

LEARNING OBJECTIVE 4-3

Compute the total cost and average cost per unit of a job.

With the application of Yost Precision Machining's $216 of manufacturing overhead to the job cost sheet in Exhibit 4-4, the job cost sheet is complete except for two final steps. First, the totals for direct materials, direct labor, and manufacturing overhead are transferred to the Cost Summary section of the job cost sheet and added together to obtain the total cost for the job.[1] Then the total product cost ($1,800) is divided by the number of units (2) to obtain the unit product cost ($900). This unit product cost information is used for valuing unsold units in ending inventory and for determining cost of goods sold. As indicated earlier, *this unit product cost is an average cost and should not be interpreted as the cost that would actually be incurred if another unit were produced.* The incremental cost of an additional unit is something less than the average unit cost of $900 because much of the actual overhead costs would not change if another unit were produced.

MANAGERIAL ACCOUNTING IN ACTION

The Wrap-Up

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In the 8:00 A.M. daily planning meeting on March 9, Jean Yost, the president of Yost Precision Machining, once again drew attention to Job 2B47, the experimental couplings:

- ***Jean:*** I see Job 2B47 is completed. Let's get those couplings shipped immediately to Loops Unlimited so they can get their testing program under way. Marc, how much are we going to bill Loops for those two units?

- ***Marc:*** Because we agreed to sell the experimental couplings at cost, we will be charging Loops Unlimited just $900 a unit.

- ***Jean:*** Fine. Let's hope the couplings work out and we make some money on the big order later.

IN BUSINESS
ONE-OF-A-KIND MASTERPIECE

In a true job-order costing environment, every job is unique. For example, Purdey manufactures 80–90 shotguns per year with each gun being a specially commissioned one-of-a-kind masterpiece. The prices start at $110,000 because every detail is custom built, engraved, assembled, and polished by a skilled craftsman. The hand engraving can take months to complete and may add as much as $100,000 to the price. The guns are designed to shoot perfectly straight and their value increases over time even with heavy use. One Purdey gun collector said "when I shoot my Purdeys I feel like an orchestra conductor waving my baton."

Source: Eric Arnold, "Aim High," *Forbes*, December 28, 2009, p. 86.

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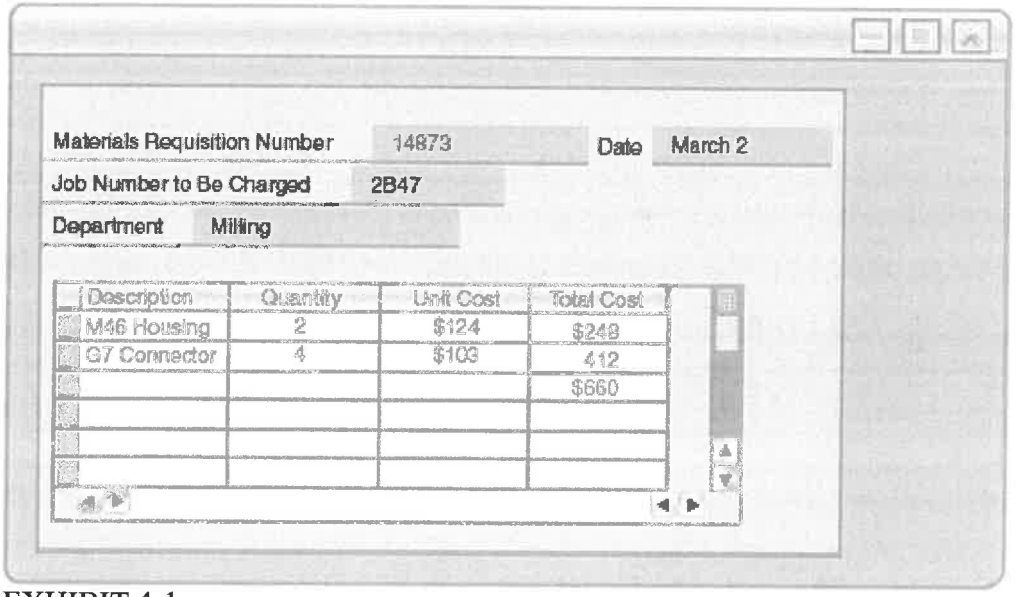

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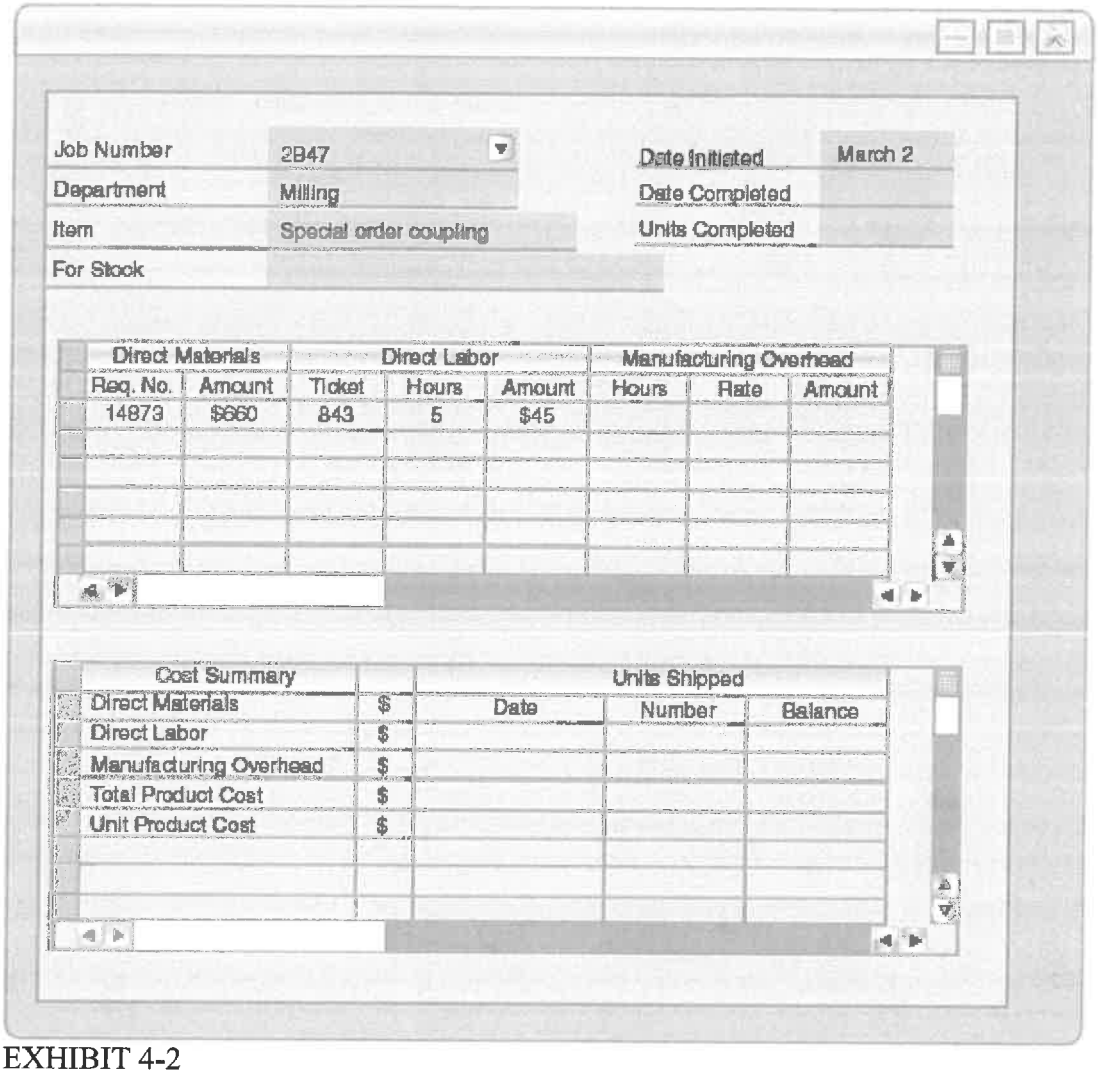

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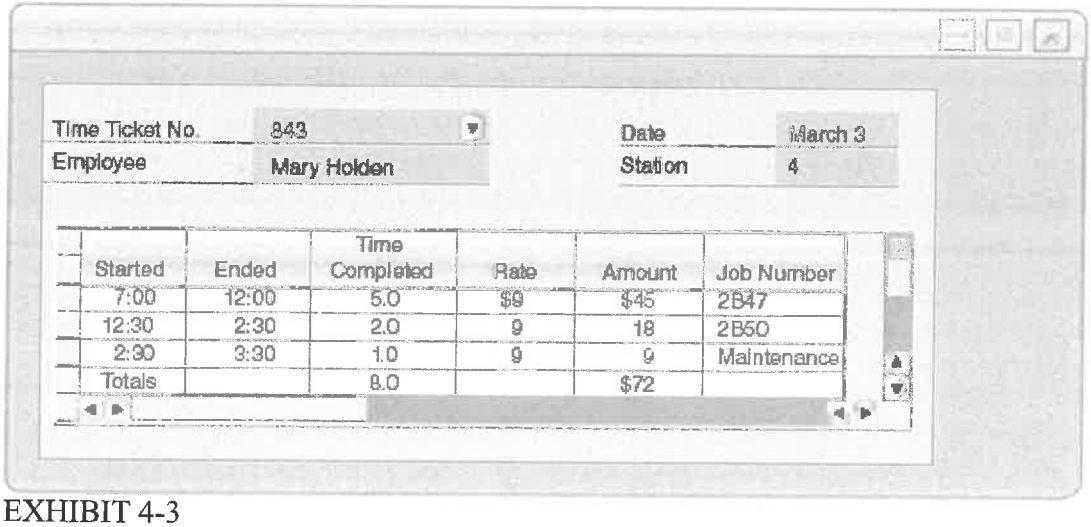
Employee Time Ticket



Time Ticket No.	843			Date	March 3	
Employee	Mary Holden			Station	4	
Started	Ended	Time Completed	Rate	Amount	Job Number	
7:00	12:00	5.0	$9	$45	2B47	
12:30	2:30	2.0	9	18	2B50	
2:30	3:30	1.0	9	9	Maintenance	
Totals		8.0		$72		

EXHIBIT 4-3
Employee Time Ticket

Computing Predetermined Overhead Rates

LEARNING OBJECTIVE 4-1

Compute a predetermined overhead rate.

Recall that product costs include manufacturing overhead as well as direct materials and direct labor. Therefore, manufacturing overhead also needs to be recorded on the job cost sheet. However, assigning manufacturing overhead to a specific job involves some difficulties. There are three reasons for this:

1. Manufacturing overhead is an *indirect cost.* This means that it is either impossible or difficult to trace these costs to a particular product or job.

2. Manufacturing overhead consists of many different types of cost ranging from the grease used in machines to the annual salary of the production manager. Some of these costs are variable overhead costs because they vary in direct proportion to changes in the level of production (e.g., indirect materials, supplies, and power) and some are fixed overhead costs because they remain constant as the level of production fluctuates (e.g., heat and light, property taxes, and insurance).

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3. Because of the fixed costs in manufacturing overhead, total manufacturing overhead costs tend to remain relatively constant from one period to the next even though the number of units produced can fluctuate widely. Consequently, the average cost per unit will vary from one period to the next.

Given these problems, allocation is used to assign overhead costs to products. Allocation is accomplished by selecting an *allocation base* that is common to all of the company's products and services. An **allocation base** is a measure such as direct labor-hours (DLH) or machine-hours (MH) that is used to assign overhead costs to products and services. The most widely used allocation bases in manufacturing are direct labor-hours, direct labor cost, machine-hours and (where a company has only a single product) units of product.

Manufacturing overhead is commonly assigned to products using *a predetermined overhead rate.* The **predetermined overhead rate** is computed by dividing the total estimated manufacturing overhead cost for the period by the estimated total amount of the allocation base for the period as follows:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

The predetermined overhead rate is computed *before* the period begins using a four-step process. The first step is to estimate the total amount of the allocation base (the denominator) that will be required for next period's estimated level of production. The second step is to estimate the total fixed manufacturing overhead cost for the coming period and the variable manufacturing overhead cost per unit of the allocation base. The third step is to use the cost formula shown below to estimate the total manufacturing overhead cost (the numerator) for the coming period:

$Y = a + bX$

where,

Y = The estimated total manufacturing overhead cost

a = The estimated total fixed manufacturing overhead cost

b = The estimated variable manufacturing overhead cost per unit of the allocation base

X = The estimated total amount of the allocation base

The fourth step is to compute the predetermined overhead rate. Notice, the estimated amount of the allocation base is determined before estimating the total manufacturing overhead cost. This needs to be done because total manufacturing overhead cost includes variable overhead costs that depend on the amount of the allocation base.

Applying Manufacturing Overhead

LEARNING OBJECTIVE 4-2

Apply overhead cost to jobs using a predetermined overhead rate.

To repeat, the predetermined overhead rate is computed *before* the period begins. The predetermined overhead rate is then used to apply overhead cost to jobs throughout the period. The process of assigning overhead cost to jobs is called **overhead application**. The formula for determining the amount of overhead cost to apply to a particular job is:

$$\text{Overhead applied to a particular job} = \text{Predetermined overhead rate} \times \text{Amount of the allocation base incurred by the job}$$

For example, if the predetermined overhead rate is $8 per direct labor-hour, then $8 of overhead cost is *applied* to a job for each direct labor-hour incurred on the job. When the allocation base is direct labor-hours, the formula becomes:

$$\text{Overhead applied to a particular job} = \text{Predetermined overhead rate} \times \text{Actual direct labor-hours charged to the job}$$

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Manufacturing Overhead—A Closer Look

To illustrate the steps involved in computing and using a predetermined overhead rate, let's return to Yost Precision Machining and make the following assumptions. In step one, the company estimated that 40,000 direct labor-hours would be required to support the production planned for the year. In step two, it estimated $220,000 of total fixed manufacturing overhead cost for the coming year and $2.50 of variable manufacturing overhead cost per direct labor-hour. Given these assumptions, in step three the company used the cost formula shown below to estimate its total manufacturing overhead cost for the year:

$Y = a + bX$

$Y = \$220{,}000 + (\$2.50 \text{ per direct labor-hour} \times 40{,}000 \text{ direct labor-hours})$

$Y = \$220{,}000 + \$100{,}000$

$Y = \$320{,}000$

In step four, Yost Precision Machining computed its predetermined overhead rate for the year of $8 per direct labor-hour as shown below:

$$\text{Predetermined overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total amount of the allocation base}}$$

$$= \frac{\$320{,}000}{40{,}000 \text{ direct labor-hours}}$$

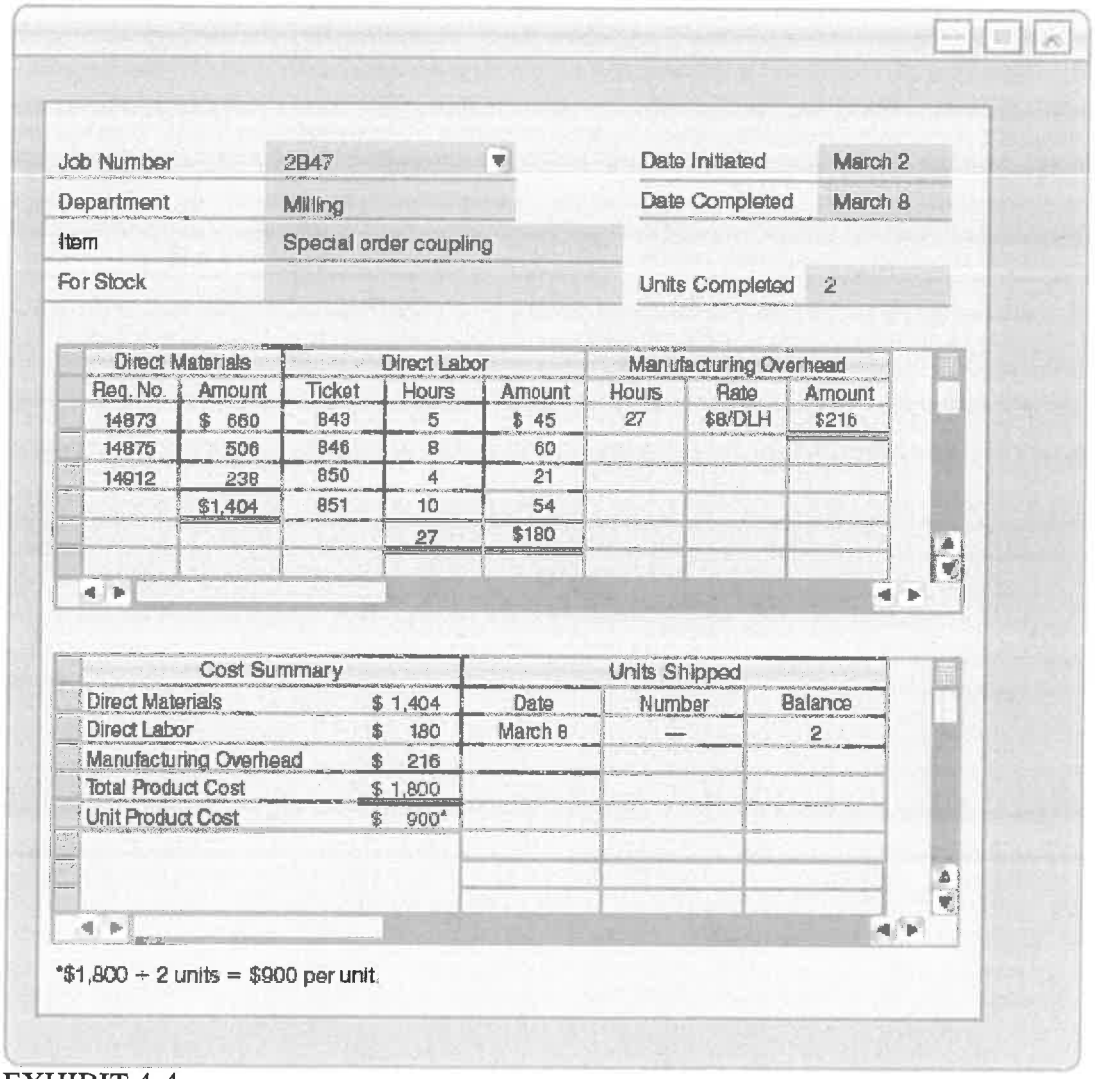
$$= \$8 \text{ per direct labor-hour}$$

The job cost sheet in Exhibit 4-4 indicates that 27 direct labor-hours (i.e., DLHs) were charged to Job 2B47. Therefore, a total of $216 of manufacturing overhead cost would be applied to the job:

$$\begin{aligned}\text{Overhead applied to Job 2B47} &= \text{Predetermined overhead rate} \times \text{Actual direct labor-hours charged to Job 2B47} \\ &= \$8 \text{ per DLH} \times 27 \text{ DLHs} \\ &= \$216 \text{ of overhead applied to Job 2B47}\end{aligned}$$

EXHIBIT 4-4 A Completed Job Cost Sheet

A Completed Job Cost Sheet



Job Number	2B47		Date Initiated	March 2
Department	Milling		Date Completed	March 8
Item	Special order coupling			
For Stock			Units Completed	2

Direct Materials		Direct Labor			Manufacturing Overhead		
Req. No.	Amount	Ticket	Hours	Amount	Hours	Rate	Amount
14873	$ 660	843	5	$ 45	27	$8/DLH	$216
14875	506	846	8	60			
14912	238	850	4	21			
	$1,404	851	10	54			
			27	$180			

Cost Summary		Units Shipped		
Direct Materials	$ 1,404	Date	Number	Balance
Direct Labor	$ 180	March 8	—	2
Manufacturing Overhead	$ 216			
Total Product Cost	$ 1,800			
Unit Product Cost	$ 900*			

*$1,800 ÷ 2 units = $900 per unit.

EXHIBIT 4-4
A Completed Job Cost Sheet

This amount of overhead has been entered on the job cost sheet in Exhibit 4-4. Note that this is *not* the actual amount of overhead caused by the job. Actual overhead costs are *not* assigned to jobs—if that could be done, the costs would be direct costs, not overhead. The overhead assigned to the job is simply a share of the total overhead that was estimated at the beginning of the year. A **normal cost system**, which we have been describing, applies overhead to jobs by multiplying a predetermined overhead rate by the actual amount of the allocation base incurred by the jobs.

The Need for a Predetermined Rate

Instead of using a predetermined rate based on estimates, why not base the overhead rate on the *actual* total manufacturing overhead cost and the *actual* total amount of the allocation base incurred on a monthly, quarterly, or annual basis? If an actual rate is computed monthly or quarterly, seasonal factors in overhead costs or in the allocation base can produce fluctuations in the overhead rate. For example, the costs of heating and cooling a factory in Illinois will be highest in the winter and summer months and lowest in the spring and fall. If the overhead rate is recomputed at the end of each month or each quarter based on actual costs and activity, the overhead rate would go up in the winter and summer and down in the spring and fall. As a result, two identical jobs, one completed in the winter and one completed in the spring, would be assigned different manufacturing overhead costs. Many managers believe that such fluctuations in product costs serve no useful purpose. To avoid such fluctuations, actual overhead rates could be computed on an annual or less-frequent basis. However, if the overhead rate is computed annually based on the actual costs and activity for the year, the manufacturing overhead assigned to any particular job would not be known until the end of the year. For example, the cost of Job 2B47 at Yost Precision Machining would not be known until the end of the year, even though the job will be completed and shipped to the customer in March. For these reasons, most companies use predetermined overhead rates rather than actual overhead rates in their cost accounting systems.

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Choice of an Allocation Base for Overhead Cost

Ideally, the allocation base in the predetermined overhead rate should *drive* overhead cost. A **cost driver** is a factor, such as machine-hours, beds occupied, computer time, or flight-hours, that causes overhead costs. If the base in the predetermined overhead rate does not "drive" overhead costs, product costs will be distorted. For example, if direct labor-hours is used to allocate overhead, but in reality overhead has little to do with direct labor-hours, then products with high direct labor-hour requirements will be overcosted.

Most companies use direct labor-hours or direct labor cost as the allocation base for manufacturing overhead. In the past, direct labor accounted for up to 60% of the cost of many products, with overhead cost making up only a portion of the remainder. This situation has changed for two reasons. First, sophisticated automated equipment has taken over functions that used to be performed by direct labor workers. Because the costs of acquiring and maintaining such equipment are classified as overhead, this increases overhead while decreasing direct labor. Second, products are becoming more sophisticated and complex and are modified more frequently. This increases the need for highly skilled indirect workers such as engineers. As a result of these two trends, direct labor has decreased relative to overhead as a component of product costs.

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In companies where direct labor and overhead costs have been moving in opposite directions, it would be difficult to argue that direct labor "drives" overhead costs. Accordingly, managers in some companies use *activity-based costing* principles to redesign their cost accounting systems. Activity-based costing is designed to more accurately reflect the demands that products, customers, and other cost objects make on overhead resources. The activity-based approach is discussed in more detail in Appendix 4A and in Chapter 6.

Although direct labor may not be an appropriate allocation base in some industries, in others it continues to be a significant driver of manufacturing overhead. Indeed, most manufacturing companies in the United States continue to use direct labor as the primary or secondary allocation base for manufacturing overhead. The key point is that the allocation base used by the company should really drive, or cause, overhead costs, and direct labor is not always the most appropriate allocation base.

IN BUSINESS
REDUCING HEALTH-DAMAGING BEHAVIORS

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Cianbro is an industrial construction company headquartered in Pittsfield, Maine, whose goal is "to be the healthiest company in America." It introduced a corporate wellness program to attack employee behaviors that drive up health-care costs. The table below summarizes the number of employees in five health risk categories as of 2003 and 2005. The decreases in the number of employees in these high-risk categories are evidence that the wellness program was effective in helping employees make positive lifestyle changes. This should result in reduced health-care costs for the company.

	Number of Employees		
Health Risk Category	January 2003	March 2005	Decrease
Obesity	432	353	79
High cholesterol	637	515	122
Tobacco use	384	274	110
Inactivity	354	254	100
High blood pressure	139	91	48

Source: Cianbro, WELCOA's *Absolute Advantage* Magazine, 2006.

Computation of Unit Costs

LEARNING OBJECTIVE 4-3

Compute the total cost and average cost per unit of a job.

With the application of Yost Precision Machining's $216 of manufacturing overhead to the job cost sheet in Exhibit 4-4, the job cost sheet is complete except for two final steps. First, the totals for direct materials, direct labor, and manufacturing overhead are transferred to the Cost Summary section of the job cost sheet and added together to obtain the total cost for the job.[1] Then the total product cost ($1,800) is divided by the number of units (2) to obtain the unit product cost ($900). This unit product cost information is used for valuing unsold units in ending inventory and for determining cost of goods sold. As indicated earlier, *this unit product cost is an average cost and should not be interpreted as the cost that would actually be incurred if another unit were produced.* The incremental cost of an additional unit is something less than the average unit cost of $900 because much of the actual overhead costs would not change if another unit were produced.

MANAGERIAL ACCOUNTING IN ACTION

The Wrap-Up

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In the 8:00 A.M. daily planning meeting on March 9, Jean Yost, the president of Yost Precision Machining, once again drew attention to Job 2B47, the experimental couplings:

- ***Jean:*** I see Job 2B47 is completed. Let's get those couplings shipped immediately to Loops Unlimited so they can get their testing program under way. Marc, how much are we going to bill Loops for those two units?

- ***Marc:*** Because we agreed to sell the experimental couplings at cost, we will be charging Loops Unlimited just $900 a unit.

- ***Jean:*** Fine. Let's hope the couplings work out and we make some money on the big order later.

IN BUSINESS
ONE-OF-A-KIND MASTERPIECE

In a true job-order costing environment, every job is unique. For example, Purdey manufactures 80–90 shotguns per year with each gun being a specially commissioned one-of-a-kind masterpiece. The prices start at $110,000 because every detail is custom built, engraved, assembled, and polished by a skilled craftsman. The hand engraving can take months to complete and may add as much as $100,000 to the price. The guns are designed to shoot perfectly straight and their value increases over time even with heavy use. One Purdey gun collector said "when I shoot my Purdeys I feel like an orchestra conductor waving my baton."

Source: Eric Arnold, "Aim High," *Forbes*, December 28, 2009, p. 86.

Underapplied or Overapplied Overhead

LEARNING OBJECTIVE 4-4

Compute underapplied or overapplied overhead cost.

You may have noticed a discrepancy in Exhibit 4-9. The actual manufacturing overhead incurred during April was $95,000, but only $90,000 in manufacturing overhead cost was applied to the two jobs in process during the month. This discrepancy occurs because the manufacturing overhead applied to jobs is based on the predetermined overhead rate, which is itself based on estimates of the total manufacturing overhead cost and the total machine-hours that were made before the month began. Except under very special circumstances, if either of these estimates is off, the actual manufacturing overhead costs that are incurred will not equal the manufacturing overhead cost that is applied to jobs using the predetermined overhead rate.

The difference between the manufacturing overhead cost applied to jobs and the actual manufacturing overhead costs of a period is called either **underapplied** or **overapplied overhead**. For Rand Company, overhead was underapplied by $5,000 because the applied cost ($90,000) was $5,000 less than the actual cost ($95,000). If the situation had been reversed and the company had applied $95,000 in manufacturing overhead cost to jobs while incurring actual manufacturing overhead costs of only $90,000, then the overhead would have been overapplied.

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What is the cause of the underapplied or overapplied overhead? The causes can be complex. To illustrate what can happen, suppose that two companies—Turbo Crafters and Black & Huang—have prepared the following estimates for the coming year:

	Turbo Crafters	Black & Huang
Allocation base	Machine-hours	Direct materials cost
Estimated manufacturing overhead cost (a)	$300,000	$120,000
Estimated total amount of the allocation base (b)	75,000 machine-hours	$80,000 direct materials cost
Predetermined overhead rate (a) ÷ (b)	$4 per machine-hour	150% of direct materials cost

Note that when the allocation base is dollars (such as direct materials cost in the case of Black & Huang) the predetermined overhead rate is expressed as a percentage of the allocation base. When dollars are divided by dollars, the result is a percentage.

Now assume that because of unexpected changes in overhead spending and in demand for the companies' products, the *actual* overhead cost and the actual activity recorded during the year in each company are as follows:

	Turbo Crafters	Black & Huang
Actual manufacturing overhead cost	$290,000	$130,000
Actual total amount of the allocation base	68,000 machine-hours	$90,000 direct materials cost

For each company, note that the actual data for both the cost and the allocation base differ from the estimates used in computing the predetermined overhead rate. This results in underapplied and overapplied overhead as follows:

	Turbo Crafters	Black & Huang
Actual manufacturing overhead cost	$290,000	$130,000
Manufacturing overhead cost applied to jobs during the year:		
Predetermined overhead rate (a)	$4 per machine-hour	150% of direct materials cost
Actual total amount of the allocation base (b)	68,000 machine-hours	$ 90,000 direct materials cost
Manufacturing overhead applied (a) × (b)	$272,000	$135,000
Underapplied (overapplied) manufacturing overhead	$ 18,000	$ (5,000)

For Turbo Crafters, the $272,000 of manufacturing overhead cost applied to jobs is less than the $290,000 actual manufacturing overhead cost for the year. Therefore, overhead is underapplied. Notice that the original $300,000 estimate of manufacturing overhead for Turbo Crafters is not directly involved in this computation. Its impact is felt only through the $4 predetermined overhead rate.

For Black & Huang, the $135,000 of manufacturing overhead cost applied to jobs is greater than the $130,000 actual manufacturing overhead cost for the year, so overhead is overapplied. A summary of the concepts discussed above is presented in Exhibit 4-10.

EXHIBIT 4-10 At the beginning of the period:

At the beginning of the period:

At the beginning of the period:

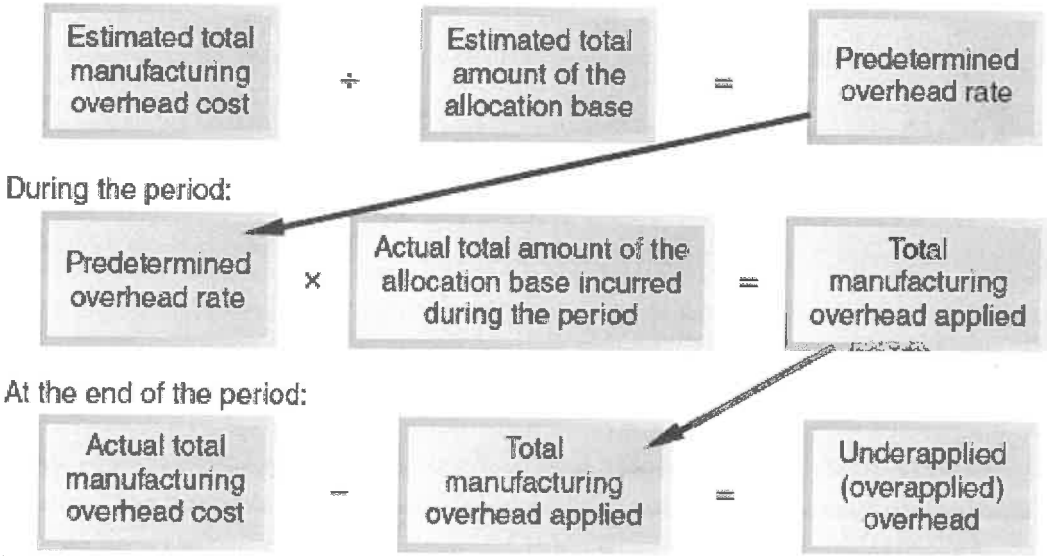

EXHIBIT 4-10
At the beginning of the period:

Disposition of Underapplied or Overapplied Overhead

Note that the manufacturing overhead cost that is applied to jobs is an estimate—it does not represent actual costs incurred. The company's accounts must be adjusted at the end of the period so that they reflect actual costs rather than this estimate. This is accomplished in one of two ways: either (1) the underapplied or overapplied overhead at the end of a period is closed out to Cost of Goods Sold; or (2) it is allocated among Work in Process, Finished Goods, and Cost of Goods Sold in proportion to the overhead applied during the current period that is in the ending balances of these accounts. The latter method takes us further into the details of bookkeeping than we would like to go in this book, so we will always assume that the underapplied or overapplied overhead is closed out to Cost of Goods Sold. In other words, Cost of Goods Sold is adjusted for the amount of underapplied or overapplied overhead.

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The procedure for closing out underapplied or overapplied overhead to Cost of Goods Sold is quite simple. Underapplied overhead is added to Cost of Goods Sold. Overapplied overhead is deducted from Cost of Goods Sold. The reasoning is that if overhead is underapplied, not enough manufacturing overhead was applied to jobs and hence their costs are understated. Therefore, Cost of Goods Sold must be increased to compensate for this understatement. Likewise, if overhead is overapplied, too much manufacturing overhead was applied to jobs and hence their costs are overstated. Therefore, Cost of Goods Sold must be decreased to compensate for this overstatement. In short, adding to or deducting from Cost of Goods Sold corrects the misstatement of cost that occurs as a result of using a predetermined overhead rate.