

Cost Accounting

Seventeenth Edition, Global Edition



Chapter 18

Process Costing

HORNGREN'S
17^E COST ACCOUNTING
A MANAGERIAL EMPHASIS

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Learning Objectives (1 of 2)

- 18.1** Identify the situations in which process-costing systems are appropriate
- 18.2** Understand the basic concepts of process-costing and compute average unit costs
- 18.3** Describe the five steps in process-costing and calculate equivalent units
- 18.4** Use the weighted-average method and first-in, first-out (FIFO) method of process costing

Learning Objectives (2 of 2)

18.5 Apply process-costing methods to situations with transferred-in costs

18.6 Understand the need for hybrid-costing systems such as operation costing

Job Versus Process-Costing

Job-costing systems

- Distinct, identifiable units of a product or service
- Examples:
 - Custom-made machines, houses

Process-costing systems

- Masses of identical or similar units of a product or service
- Examples:
 - Food, chemical processing

Process Costing

- **Process costing** is a system where the unit cost of a product or service is obtained by assigning total costs to many identical or similar units of output.
- Unit costs are calculated by dividing total costs incurred by the number of units of output from the production process.
- Each unit receives the same or similar amounts of direct materials costs, direct manufacturing labor costs, and indirect manufacturing costs (manufacturing overhead).

More on Job- Versus Process-Costing

- In a **job-costing system**, individual jobs use different quantities of resources, so it would be incorrect to cost each job at the same average production cost.
- In contrast, when identical or similar units of products or services are mass-produced, process costing is used to calculate an average production cost for all units produced.
- The main difference between process costing and job costing is the extent of averaging used to compute the unit costs of products or services.

Process-Costing Cost Categories

Process-costing systems separate costs into cost categories according to when costs are introduced into the process.

1. Direct materials are usually added at the beginning of the production process, or at the start of work in a subsequent department down the assembly line.
2. Conversion costs are generally added equally along the production process.

Process-Costing: Three Cases

Let's look at the process-costing process three ways:

Case 1: No beginning or ending work-in-process inventories

Case 2: No beginning work-in-process inventory and some ending work-in-process inventory

Case 3: Both beginning and ending work-in-process inventories are present

Case 1: No Beginning or Ending Work-in-Process Inventory (1 of 3)

When using process costing without any beginning or ending work-in-process inventory, all costs that were introduced to the process during the period will be assigned to the finished units leaving work-in-process inventory at the end of the period.

Case 1: No Beginning or Ending Work-in-Process Inventory (2 of 3)

Five-Step Process-Costing Allocation

1. Summarize the flow of physical units of output.
2. Compute output in terms of equivalent units.
3. Summarize total costs to account for.
4. Compute cost per equivalent unit.
5. Assign total costs to units completed and to units in ending work-in-process.


Case 1: No Beginning or Ending Work-in-Process Inventory (3 of 3)

Equivalent Units

- A derived amount of output units that
 - takes the quantity of each input in units completed and in unfinished units of work in process and
 - *converts* the quantity of input into the amount of completed output units that *could* be produced with that quantity of input.
- They are calculated separately for each input (direct materials and conversion cost).
- When calculating equivalent units in step 2, focus on quantities and disregard dollar amounts until after the equivalent units are computed.

Case 2: No Beginning, Some Ending WIP Steps 1 and 2 Example

Exhibit 18.1 Summarize the Flow of Physical Units and Compute Output in Equivalent Units for the Assembly Department

 Home Insert Page Layout Formulas Data Review View				
	A	B	C	D
1		(Step 1)	(Step 2)	
2			Equivalent Units	
3	Flow of Production	Physical Units	Direct Materials	Conversion Costs
4	Work in process, beginning	0		
5	Started during current period	<u>400</u>		
6	To account for	<u>400</u>		
7	Completed and transferred out during current period	175	175	175
8	Work in process, ending ^a	225		
9	(225 × 100%; 225 × 60%)		225	135
10	Accounted for	<u>400</u>		
11	Equivalent units of work done in current period		<u>400</u>	<u>310</u>
12				
13	^a Degree of completion in this department: direct materials, 100%; conversion costs, 60%.			

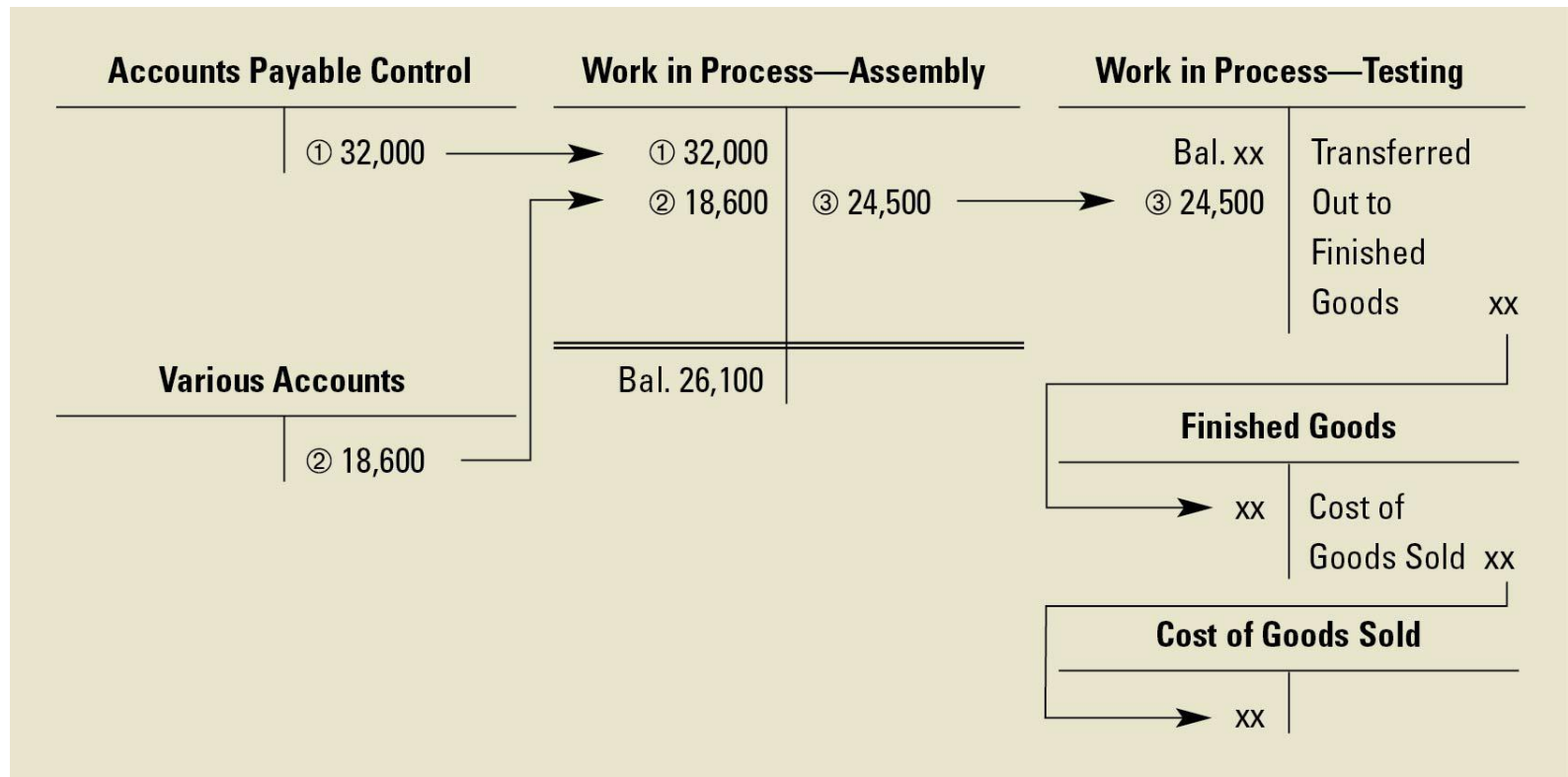
Case 2: No Beginning, Some Ending WIP Steps 3, 4, and 5 Example

Exhibit 18.2 Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed and Units in Ending Work-in-Process Inventory for the Assembly Department

	A	B	C	D	E	F
1			Total Production Costs	Direct Materials		Conversion Costs
2	(Step 3)	Costs added during February	\$50,600	\$32,000	+	\$18,600
3		Total costs to account for	<u>\$50,600</u>	<u>\$32,000</u>	+	<u>\$18,600</u>
4						
5	(Step 4)	Costs added in current period		\$32,000		\$18,600
6		Divide by equivalent units of work done in current period (Exhibit 17-1)		÷ 400		÷ 310
7		Cost per equivalent unit		<u>\$ 80</u>		<u>\$ 60</u>
8						
9	(Step 5)	Assignment of costs:				
10		Completed and transferred out (175 units)	\$24,500	(175 ^a × \$80)	+	(175 ^a × \$60)
11		Work in process, ending (225 units)	<u>26,100</u>	(225 ^b × \$80)	+	(225 ^b × \$60)
12		Total costs accounted for	<u>\$50,600</u>	<u>\$32,000</u>	+	<u>\$18,600</u>
13						
14	^a Equivalent units completed and transferred out from Exhibit 17-1, step 2.					
15	^b Equivalent units in ending work in process from Exhibit 17-1, step 2.					

General Ledger Cost Flows Illustrated

Exhibit 18.3 Flow of Costs in a Process-Costing System for the Assembly Department



Weighted-Average Process-Costing Method (1 of 2)

Process costing can be accomplished using the weighted-average method or the FIFO method. We'll look first at weighted-average.

Weighted-Average Method

- Calculates cost per equivalent unit of all work done to date (regardless of the accounting period in which it was done)
- Assigns this cost to equivalent units completed and transferred out of the process and to equivalent units in ending work-in-process inventory

Weighted-Average Process-Costing Method (2 of 2)

- The weighted-average cost is the total of all costs entering the work-in-process account divided by the total equivalent units of work done to date.
- The beginning balance of the work-in-process account (work done in a prior period) is *blended* in with current period costs.
- Let's look at Case 3 (with both beginning and ending work-in-process inventory using the weighted average method).

Case 3: Beginning and Ending WIP

Steps 1 and 2 Example (1 of 2)

Exhibit 18.4 Summarize the Flow of Physical Units and Compute Output in Equivalent Units Using the Weighted-Average Method for the Assembly Department

	A	B	C	D
1		(Step 1)	(Step 2)	
2			Equivalent Units	
3	Flow of Production	Physical Units	Direct Materials	Conversion Costs
4	Work in process, beginning (given, p. 684)	225		
5	Started during current period (given, p. 684)	275		
6	To account for	500		
7	Completed and transferred out during current period	400	400	400
8	Work in process, ending ^a (given, p. 684)	100		
9	(100 × 100%; 100 × 50%)		100	50
10	Accounted for	500		
11	Equivalent units of work done to date		500	450
12				
13	^a Degree of completion in this department: direct materials, 100%; conversion costs, 50%.			

Case 3: Beginning and Ending WIP

Steps 3, 4, and 5 Example (1 of 2)

Exhibit 18.5 Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed and Units in Ending Work-in-Process Inventory Using the Weighted-Average Method for the Assembly Department

	A	B	C	D	E	F
			Total Production Costs	Direct Materials		Conversion Costs
1						
2	(Step 3)	Work in process, beginning (given, p. 684)	\$26,100	\$18,000	+	\$ 8,100
3		Costs added in current period (given, p. 684)	36,180	19,800	+	16,380
4		Total costs to account for	<u>\$62,280</u>	<u>\$37,800</u>	+	<u>\$24,480</u>
5						
6	(Step 4)	Costs incurred to date		\$37,800		\$24,480
7		Divide by equivalent units of work done to date (Exhibit 17-4)		÷ 500		÷ 450
8		Cost per equivalent unit of work done to date		<u>\$ 75.60</u>		<u>\$ 54.40</u>
9						
10	(Step 5)	Assignment of costs:				
11		Completed and transferred out (400 units)	\$52,000	(400 ^a × \$75.60)	+	(400 ^a × \$54.40)
12		Work in process, ending (100 units)	10,280	(100 ^b × \$75.60)	+	(50 ^b × \$54.40)
13		Total costs accounted for	<u>\$62,280</u>	<u>\$37,800</u>	+	<u>\$24,480</u>
14						
15	^a Equivalent units completed and transferred out from Exhibit 17-4, Step 2.					
16	^b Equivalent units in ending work in process from Exhibit 17-4, Step 2.					

Results of the Process

Two critical figures arise out of step 5 of the cost allocation process:

1. The amount of the journal entry transferring the allocated cost of units completed and sent from work-in-process inventory to finished goods inventory
2. The ending balance of the work-in-process inventory account that will appear on the balance sheet

First-In, First-Out (FIFO) Process-Costing Method (1 of 2)

- Assigns the cost of the previous accounting period's equivalent units in beginning work-in-process inventory to the first units completed and transferred out of the process
- Assigns the cost of equivalent units worked on during the current period first to complete beginning inventory, next to started and completed new units, and finally to units in ending work-in-process inventory


First-In, First-Out (FIFO) Process-Costing Method (2 of 2)

- A distinctive feature of FIFO process-costing method is that work done on the beginning inventory before the current period is kept separate from work done in the current period.
- The costs incurred and units produced in the current period are used to calculate the cost per equivalent unit of work done in the current period.
- In contrast, the equivalent-unit and cost per equivalent unit calculations under the weighted-average method MERGE the units and costs in beginning inventory with the units and costs of work done in the current period.

Case 3: Beginning and Ending WIP

Steps 1 and 2 Example (2 of 2)

Exhibit 18.6 Summarize the Flow of Physical Units and Compute Output in Equivalent Units Using the FIFO Method for the Assembly Department

 Home Insert Page Layout Formulas Data Review View				
	A	B	C	D
1		(Step 1)	(Step 2)	
2			Equivalent Units	
3	Flow of Production	Physical Units	Direct Materials	Conversion Costs
4	Work in process, beginning (given, p. 684)	225	(work done before current period)	
5	Started during current period (given, p. 684)	275		
6	To account for	500		
7	Completed and transferred out during current period:			
8	From beginning work in process ^a	225		
9	[$225 \times (100\% - 100\%)$; $225 \times (100\% - 60\%)$]		0	90
10	Started and completed	175 ^b		
11	($175 \times 100\%$; $175 \times 100\%$)		175	175
12	Work in process, ending ^c (given, p. 684)	100		
13	($100 \times 100\%$; $100 \times 50\%$)		100	50
14	Accounted for	500		
15	Equivalent units of work done in current period		275	315
16				
17	^a Degree of completion in this department: direct materials, 100%; conversion costs, 60%.			
18	^b 400 physical units completed and transferred out minus 225 physical units completed and			
19	transferred out from beginning work-in-process inventory.			
20	^c Degree of completion in this department: direct materials, 100%; conversion costs, 50%.			

Case 3: Beginning and Ending WIP

Steps 3, 4, and 5 Example (2 of 2)

Exhibit 18.7 Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed and Units in Ending Work-in-Process Inventory Using the FIFO Method for the Assembly Department

	A	B	C	D	E	F
			Total Production Costs	Direct Materials		Conversion Costs
1						
2	(Step 3)	Work in process, beginning (given, p. 684)	\$26,100	\$18,000	+	\$ 8,100
3		Costs added in current period (given, p. 684)	<u>36,180</u>	<u>19,800</u>	+	<u>16,380</u>
4		Total costs to account for	<u>\$62,280</u>	<u>\$37,800</u>	+	<u>\$24,480</u>
5						
6	(Step 4)	Costs added in current period		\$19,800		\$16,380
7		Divide by equivalent units of work done in current period (Exhibit 17-6)		÷ 275		÷ 315
8		Cost per equivalent unit of work done in current period		<u>\$ 72</u>		<u>\$ 52</u>
9						
10	(Step 5)	Assignment of costs:				
11		Completed and transferred out (400 units):				
12		Work in process, beginning (225 units)	\$26,100	\$18,000	+	\$8,100
13		Costs added to beginning work in process in current period	<u>4,680</u>	(0 ^a × \$72)	+	(90 ^a × \$52)
14		Total from beginning inventory	30,780			
15		Started and completed (175 units)	<u>21,700</u>	(175 ^b × \$72)	+	(175 ^b × \$52)
16		Total costs of units completed and transferred out	52,480			
17		Work in process, ending (100 units)	<u>9,800</u>	(100 ^c × \$72)	+	(50 ^c × \$52)
18		Total costs accounted for	<u>\$62,280</u>	<u>\$37,800</u>	+	<u>\$24,480</u>
19						
20		^a Equivalent units used to complete beginning work in process from Exhibit 17-6, Step 2.				
21		^b Equivalent units started and completed from Exhibit 17-6, Step 2.				
22		^c Equivalent units in ending work in process from Exhibit 17-6, Step 2.				

Comparing Weighted-Average and FIFO Methods (1 of 2)

- **FIFO** assumes that all the units from the previous period (higher cost units in our example) in beginning WIP are the first to be completed and transferred out and that ending WIP consists of only the lower cost current-period units.
- The **weighted-average** method smooths out the cost per equivalent unit by assuming that more lower cost units are transferred out and some higher cost remain in ending WIP.

Comparing Weighted-Average and FIFO Methods (2 of 2)

- Managers use information from process-costing systems to make pricing and product-mix decisions and understand how well a firm's processes are performing.
- FIFO provides managers with information about changes in the costs per unit from one period to the next.
- In a period of rising prices, the weighted-average method will decrease taxes because cost of goods sold will be higher and operating income lower.

Transferred-In Costs

- **Transferred-in costs** are costs incurred in previous departments that are carried forward as the product's cost when it moves to a subsequent process in the production cycle.
- They are also called *previous department costs*.
- Journal entries are made to mirror the progress in production from department to department.
- Transferred-in costs are treated as if they are a separate type of direct material added at the beginning of the process.

Steps 1 and 2 Example for Beginning and Ending WIP and Transferred-in Costs: Weighted Average Method

Exhibit 18.8 Summarize the Flow of Physical Units and Compute Output in Equivalent Units Using the Weighted-Average Method for the Testing Department

	A	B	C	D	E
1		(Step 1)	(Step 2)		
2			Equivalent Units		
3	Flow of Production	Physical Units	Transferred-In Costs	Direct Materials	Conversion Costs
4	Work in process, beginning (given, p. 693)	240			
5	Transferred-in during current period (given, p. 693)	400			
6	To account for	640			
7	Completed and transferred out during current period	440	440	440	440
8	Work in process, ending ^a (given, p. 693)	200			
9	(200 × 100%; 200 × 0%; 200 × 80%)		200	0	160
10	Accounted for	640			
11	Equivalent units of work done to date		640	440	600
12					
13	^a Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.				

Steps 3, 4, and 5 Example for Beginning and Ending WIP and Transferred-In Costs: Weighted Average Method

Exhibit 18.9 Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed and Units in Ending WIP Inventory Using the Weighted-Average Method for the Testing Department

	A	B	C	D	E	F	G	H
1			Total Production Costs	Transferred-In Costs		Direct Materials		Conversion Costs
2	(Step 3)	Work in process, beginning (given, p. 693)	\$ 51,600	\$33,600	+	\$ 0	+	\$18,000
3		Costs added in current period (given, p. 693)	113,800	52,000	+	13,200	+	48,600
4		Total costs to account for	<u>\$165,400</u>	<u>\$85,600</u>	+	<u>\$13,200</u>	+	<u>\$66,600</u>
5								
6	(Step 4)	Costs incurred to date		\$85,600		\$13,200		\$66,600
7		Divide by equivalent units of work done to date (Exhibit 17-8)		÷ 640		÷ 440		÷ 600
8		Cost per equivalent unit of work done to date		<u>\$133.75</u>		<u>\$ 30.00</u>		<u>\$111.00</u>
9								
10	(Step 5)	Assignment of costs:						
11		Completed and transferred out (440 units)	\$120,890	(440 ^a × \$133.75)	+	(440 ^a × \$30)	+	(440 ^a × \$111)
12		Work in process, ending (200 units)	44,510	(200 ^b × \$133.75)	+	(0 ^b × \$30)	+	(160 ^b × \$111)
13		Total costs accounted for	<u>\$165,400</u>	<u>\$85,600</u>	+	<u>\$13,200</u>	+	<u>\$66,600</u>
14								
15		^a Equivalent units completed and transferred out from Exhibit 17-8, Step 2.						
16		^b Equivalent units in ending work in process from Exhibit 17-8, Step 2.						

Steps 1 and 2 Example for Beginning and Ending WIP and Transferred-In Costs: FIFO Method

Exhibit 18.10 Summarize the Flow of Physical Units and Compute Output in Equivalent Units Using the FIFO Method for the Testing Department

	A	B	C	D	E
1		(Step 1)	(Step 2)		
2			Equivalent Units		
3	Flow of Production	Physical Units	Transferred-In Costs	Direct Materials	Conversion Costs
4	Work in process, beginning (given, p. 693)	240	(work done before current period)		
5	Transferred in during current period (given, p. 693)	400			
6	To account for	640			
7	Completed and transferred out during current period:				
8	From beginning work in process ^a	240			
9	$[240 \times (100\% - 100\%); 240 \times (100\% - 0\%); 240 \times (100\% - 62.5\%)]$		0	240	90
10	Started and completed	200 ^b			
11	$(200 \times 100\%; 200 \times 100\%; 200 \times 100\%)$		200	200	200
12	Work in process, ending ^c (given, p. 693)	200			
13	$(200 \times 100\%; 200 \times 0\%; 200 \times 80\%)$		200	0	160
14	Accounted for	640			
15	Equivalent units of work done in current period		400	440	450
16					
17	^a Degree of completion in this department: Transferred-in costs, 100%; direct materials, 0%; conversion costs, 62.5%.				
18	^b 440 physical units completed and transferred out minus 240 physical units completed and transferred out from beginning				
19	work-in-process inventory.				
20	^c Degree of completion in this department: Transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.				

Steps 3, 4, and 5 Example for Beginning and Ending WIP and Transferred-In Costs: FIFO Method

Exhibit 18.11 Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed and Units in Ending WIP Inventory Using the FIFO Method for the Testing Department

	A	B	C	D	E	F	G	H
			Total Production Costs	Transferred-In Cost		Direct Materials		Conversion Costs
1								
2	(Step 3)	Work in process, beginning (given, p. 693)	\$ 51,600	\$33,600	+	\$ 0	+	\$18,000
3		Costs added in current period (given, p. 693)	114,280	52,480	+	13,200	+	48,600
4		Total costs to account for	<u>\$165,880</u>	<u>\$86,080</u>	+	<u>\$13,200</u>	+	<u>\$66,600</u>
5								
6	(Step 4)	Costs added in current period		\$52,480		\$13,200		\$48,600
7		Divide by equivalent units of work done in current period (Exhibit 17-10)		+ 400		+ 440		+ 450
8		Cost per equivalent unit of work done in current period		<u>\$131.20</u>		<u>\$ 30</u>		<u>\$ 108</u>
9								
10	(Step 5)	Assignment of costs:						
11		Completed and transferred out (440 units):						
12		Work in process, beginning (240 units)	\$ 51,600	\$33,600	+	\$0	+	\$18,000
13		Costs added to beginning work in process in current period	16,920	(0 ^a × \$131.20)	+	(240 ^a × \$30)	+	(90 ^a × \$108)
14		Total from beginning inventory	68,520					
15		Started and completed (200 units)	53,840	(200 ^b × \$131.20)	+	(200 ^b × \$30)	+	(200 ^b × \$108)
16		Total costs of units completed and transferred out	122,360					
17		Work in process, ending (200 units)	43,520	(200 ^c × \$131.20)	+	(0 ^c × \$30)	+	(160 ^c × \$108)
18		Total costs accounted for	<u>\$165,880</u>	<u>\$86,080</u>	+	<u>\$13,200</u>	+	<u>\$66,600</u>
19								
20		^a Equivalent units used to complete beginning work in process from Exhibit 17-10, Step 2.						
21		^b Equivalent units started and completed from Exhibit 17-10, Step 2.						
22		^c Equivalent units in ending work in process from Exhibit 17-10, Step 2.						

Points to Remember About Transferred-In Costs (1 of 2)

1. Be sure to include the transferred-in costs from previous departments in your calculations.
2. When calculating the costs to be transferred using the FIFO method, do not overlook costs assigned in the previous period to units that were in process at the beginning of the current period but are now included in the units transferred.

These unit costs will be transferred to the next department at ONE AVERAGE UNIT cost.

Points to Remember About Transferred-In Costs (2 of 2)

3. Unit costs may fluctuate between periods so transferred units may contain batches accumulated at different costs (using FIFO).
4. Units may be measured in different denominations in different departments (feet in one department and yards in another or kilos versus liters). In this case, measurements must be converted to the correct measure.

Hybrid Costing Systems (1 of 2)

- Product-costing systems do not always fall neatly into either job-costing or process-costing categories.
- A **hybrid-costing system** blends characteristics from both job-costing and process-costing systems.
- Many actual production systems are in fact hybrids.
- Manufacturers who tend to use hybrid-costing systems include producers of televisions, dishwashers, washing machines, and shoes.

Hybrid Costing Systems (2 of 2)

- The hybrid-costing systems use process costing to account for the conversion costs and job costing for the material and customizable components.
- One specific type of hybrid-costing system is known as the **operation costing system**.

Operation Costing System

- An operation is a standardized method or technique often performed repetitively on different material resulting in different finished goods.
- An operation-costing system is a hybrid-costing system applied to batches of similar, but not identical, products.
- Within each operation, all product units are treated exactly alike, using identical amounts of the operation's resources.
- Managers find operation costing useful in cost management because operation costing focuses on control of physical processes or operations of a given production system.

Terms to Learn

Equivalent units
First-in, first-out (FIFO) process-costing method
Hybrid-costing system
Operation
Operation costing system
Previous department cost
Transferred-in cost
Weighted-average process-costing method