

نظام تكاليف المراحل Process costing system

Some companies use job order costing to determine the cost of their custom goods and services. In contrast, Shell Oil, Crayola, and Sony use a series of steps (called processes) to make large quantities of similar products, called process costing systems. There are two methods for handling process costing: weighted average and FIFO. We focus on the weighted average method

تستخدم بعض الشركات نظام الأوامر لتقرير كلفة سلعيهم وخدماتهم حسب الطلب. وبشكل مقابل فإن شركة شل للنفط، وشركة سوني تستخدم سلسلة خطوات تُدعى عمليات لإنتاج كميات كبيرة من المنتجات المتشابهة، بنظام يدعى نظام تكاليف المراحل. هناك طريقتان لمعالجة تكاليف العملية: المتوسط المرجح، والوارد أولاً صادر أولاً.

We use two building blocks for process costing: نستعمل المفهومين التاليين بنظام تكاليف المراحل:

- تكاليف التحويل Conversion costs
- وحدات الإنتاج المُعادل Equivalent units of production

Many companies are highly automated, so direct labor is a small part of total manufacturing costs. Such companies often use only two categories:

العديد من الشركات مؤتمتة بالكامل، لذلك فإن الأجور المباشرة هي جزء صغير من التكاليف الصناعية. مثل هذه الشركات تستخدم في أغلب الأحيان صنفين من التكاليف فقط:

- المواد المباشرة Direct materials
- تكاليف التحويل (direct labor plus manufacturing overhead) Conversion costs

Combining direct labor and manufacturing overhead into a single category simplifies the accounting. We call this category conversion costs because it is the cost (direct labor plus manufacturing overhead) to convert raw materials into finished products.

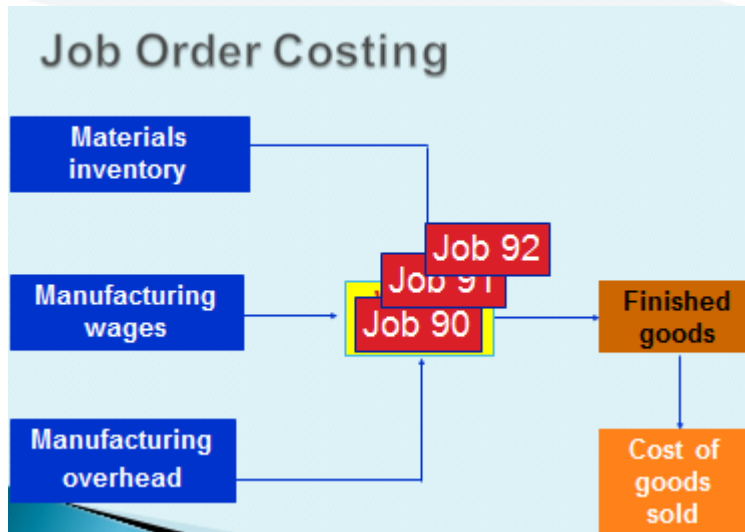
دمج الأجور المباشرة مع التكاليف الإضافية يُبسط المحاسبة. ندعو هذا الدمج تكاليف التحويل لأنها التكاليف التي تحوّل المواد الأولية لمنتجات تامة الصنع.

The concept of equivalent units allows us to measure the amount of work done on a partially finished group of units during a period and to express it in terms of fully complete units of output.

مفهوم الوحدات المكافئة يسمح لنا بقياس كمية العمل المنجز بوحدات مكتملة جزئياً خلال الفترة والتعبير عنها بوحدات تامة.

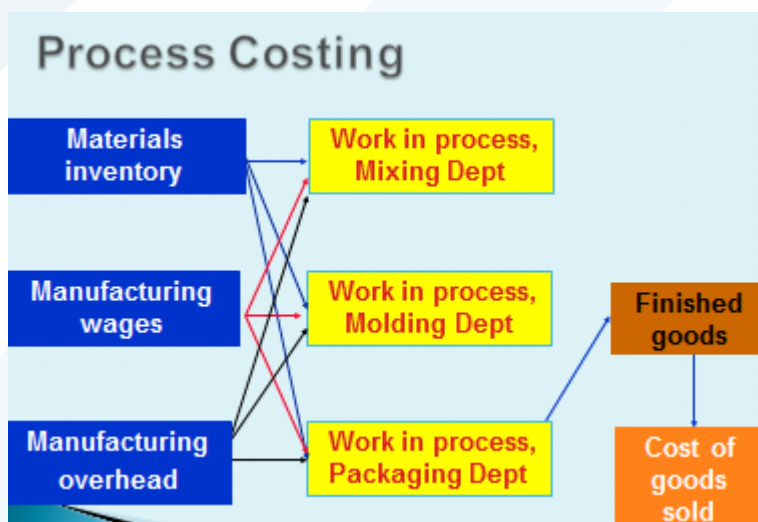
with job order costing, cost information is collected by job. When a job is complete and all costs are added on the job cost record, managers can determine the cost of the job and of producing each unit

بتكاليف الأوامر، فإن موضوع التكلفة هو الأمر التشغيلي. وعندما يكتمل الأمر وكل التكاليف تكون قد أُضيفت لسجل الأمر، يستطيع المدراء أن يحدّدوا تكلفة الأمر والإنتاج لكل وحدة.



In process costing, all units go through the same production process and therefore, have the same unit cost. Each process requires the use of a separate Work in process inventory account. Costs are collected by process (or department). Materials, labor, and overhead can be incurred in any department. The costs accumulate until all costs have been added to the product, and it is sent to finished goods.

بنظام تكاليف المراحل، كل الوحدات تمر بطريقة الإنتاج نفسها ولذا فإن لها تكلفة الإنتاج نفسها. تتطلب كل مرحلة فتح حساب مخزون إنتاج تحت التشغيل مستقل. وبالتالي يتم تجميع التكاليف بحسب المرحلة (أو القسم). المواد، الأجر، والتكاليف الإضافية يمكن أن تصرف بأي قسم. يتم مراكمة التكاليف التي تضاف للمنتج ويتم إرسالها إلى مخزن الإنتاج التام.

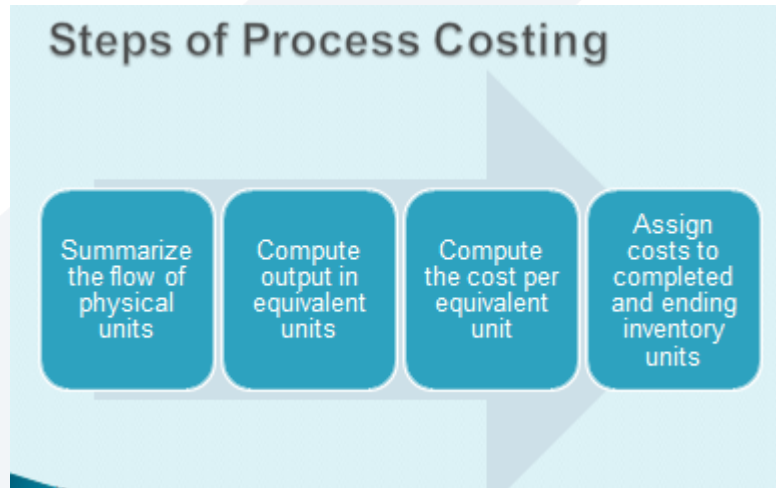


There are four steps in process costing:

1. Summarize the flow of physical units.
2. Compute the output in equivalent units.
3. Compute the cost per equivalent unit.
4. Assign costs to units completed and units in ending inventory.

هناك أربع خطوات في حساب تكاليف المراحل:

1. تلخيص تدفق الوحدات المادية (إعداد تقرير الإنتاج)
2. حساب الناتج بوحدة مكافئة (التعبير عن المخرجات بما يكافئ وحدة مكتملة)
3. حساب تكلفة الوحدة المكافئة
4. تخصيص التكاليف للوحدات المكتملة ولمخزون آخر المدة



To provide an example of process costing, the data shown here will be used. The company had no beginning inventory. Materials are added at the beginning of the process and conversion costs are added evenly throughout the process. During the period, 50,000 units were started and costs were incurred as shown here. Of the 50,000 units started, 40,000 were transferred to the next department. 10,000 remained in process.

لإعطاء مثال عن كيفية حساب تكاليف المراحل، سنستخدم البيانات التالية.

لا يوجد إنتاج تحت التشغيل أول المدة. تضاف المواد في بداية المرحلة. في حين تضاف عناصر التحويل بصفة منتظمة ومستمرة. خلال الفترة تم البدء بـ 50000 وحدة اكتمل منها 40000 وحدة وتم تحويلها إلى القسم التالي.

Department 1				
	Physical units	Dollars		Physical units
Beginning inventory	0	\$ 0	Transferred out	40,000
Production started	50,000			
Direct materials		\$140,000		
<u>Conversion costs</u>				
Direct labor		20,000		
Manufacturing overhead		48,000		
Total to account for	50,000	\$208,000		
Ending inventory-25% complete				10,000

The first two steps involve determining the number of units worked on during the period and where they are in the production cycles.

1. "Units to account for" include the number of units still in process at the beginning of the period plus the number of units started. In this example, there were no units in beginning work in process and 50,000 units started.
2. "Units accounted for" shows what happened to the units in process during the period.

Of the 50,000 units started, 40,000 were completed and transferred out to the next department. The remaining 10,000 are only partially completed. In this example, materials are added at the beginning of the process, so the ending work in process is 100% complete as to materials (there are no more materials to add to these units). However, for conversion costs, the goods are 25% complete. Therefore, for ending inventory we multiply the 10,000 units by 25%.

The equivalent units for Department 1 are 50,000 for materials and 42,500 for conversion costs.

Department 1			
	Step 1	Step 2: Equivalent units	
Flow of production	Flow of physical units	Direct materials	Conversion costs
Units to be accounted for:			
Beginning work in process	0		
Started in production	50,000		
Total physical units to account for	50,000		
Units accounted for:			
Completed and transferred out	40,000	40,000	40,000
Ending work in process	10,000	10,000	2,500
Total physical units accounted for	50,000		
Equivalent units		50,000	42,500

Step three is to compute the equivalent cost per unit. The cost of direct materials is divided by the equivalent units. The result is \$2.80 of materials cost per equivalent unit. For conversion costs, the direct labor and overhead costs are added together and divided by the 42,500 equivalent units for conversion costs.

Department 1		
	Direct materials	Conversion costs
Beginning work in process	0	0
Costs added	\$140,000	\$68,000
Divide by equivalent units	÷ 50,000	÷ 42,500
Cost per equivalent unit	\$2.80	\$1.60

The last step is to assign the period's cost to the units. For the 40,000 units transferred out, we multiply them by both the materials and labor cost per unit. \$176,000 will be transferred to the next department. The ending inventory needs to be split between materials and conversion. The materials cost uses the 10,000 equivalent units multiplied by the material unit costs. For conversion, we use 2,500 equivalent units multiplied by \$1.60. Ending inventory totals \$32,000.

Department 1			
	Direct materials	Conversion costs	Total
Completed and transferred out	[40,000 units x (2.80 + 1.60)]		\$176,000
Ending work in process			
Direct materials	(10,000 x 2.80)		\$28,000
Conversion costs		(2,500 x 1.60)	4,000
Total cost of ending inventory			32,000
Total costs accounted for			\$208,000

in process of one department to the next. The amount is taken from the previous schedule.

GENERAL JOURNAL			
DATE	DESCRIPTION	DEBIT	CREDIT
	Work in process – Dept. 2	176,000	
	Work in process – Dept. 1		176,000

Notice how the ending balance in the Work in process-Dept 1 T-account is the same \$32,000 that is shown on the process costing schedule as “Total cost of ending inventory.”

Work in process - Dept. 1	
Work in process – Dept. 1	
Direct materials	140,000
Direct labor	20,000
Manufacturing overhead	48,000
Ending WIP	32,000
	176,000
	Completed and transferred out

The Blue Tide Company manufactures its product in a single process. The following information is available:

Work in process inventory, Jan. 1	—0— units
Units started in production	18,000 units
Work in process inventory, Dec. 31	6,000 units
Production costs:	
Direct materials	\$367,500
Direct labor	\$200,000
Manufacturing overhead	\$223,000

The units still in process are 45% complete with respect to direct materials and 35% complete with respect to conversion costs.

1. Summarize the flow of physical units.
2. Compute the output in equivalent units.
3. Compute the cost per equivalent unit.
4. Assign costs to units completed and units in ending inventory

1. Flow of production				
Beginning work in process	0			
Started in production	18000	2. Equivalent units		
Total inputs	<u>18000</u>	Materials	Conversion	Total
Completed and transferred out	12000	12000	12000	
Ending work in process	6000	$6000 \times 45\% = 2700$	$6000 \times 35\% = 2100$	
Total outputs	<u>18000</u>			
Equivalent units		<u>14700</u>	<u>14100</u>	
Cost		367500	$200000 + 223000 = 423000$	<u>790500</u>
3. Cost per equivalent unit		$367500 \div 14700 = 25$	$423000 \div 14100 = 30$	
4. Assign costs	Completed and transferred	$12000 \times (25 + 30) = 660000$		<u>790500</u>
	Ending inventory	$(6000 \times 45\%) \times 25 = 67500$	$(6000 \times 35\%) \times 30 = 63000$	

The Made Rite Shoe Corporation uses a process costing system. In the Cutting Department, 4,000 units were started and by the end of the period, all but 400 units had been completed. The 400 units were 80% complete regarding materials and 40% complete regarding conversion costs. Costs added during the current period include \$66,640 for materials and \$70,312 for conversion.

1. Summarize the flow of physical units.
2. Compute the output in equivalent units.
3. Compute the cost per equivalent unit.
4. Assign costs to units completed and units in ending inventory

1. Flow of production		2. Equivalent units		
Beginning work in process	0			
Started in production	4000			
Total inputs	<u>4000</u>	Materials	Conversion	Total
Completed and transferred out	3600	3600	3600	
Ending work in process	400	400×80%= 320	400×40%= 160	
Total outputs	<u>4000</u>			
	Equivalent units	<u>3920</u>	<u>3760</u>	
	Cost	66640	70312	<u>136952</u>
	3. Cost per equivalent unit	66640÷3920=17	70312÷3760=18.7	
4. Assign costs	Completed and transferred	3600 × (17+ 18.7)= 128520		<u>136952</u>
	Ending inventory	(400×80%) × 17= 5440	(400×40%) × 18.7= 2992	

CJ Company reported that during the last month 50,000 units were completed and 3,600 units were in work in process the end of the month. If the ending work in process inventory was 75% complete as to direct materials and 25% complete as to conversion costs, how much would the equivalent units of production for direct materials, conversion be for the last month?

1. Flow of production		2. Equivalent units		
Beginning work in process	?			
Started in production	?			
Total inputs	<u>53600</u>	Materials	Conversion	Total
Completed and transferred out	50000	50000	50000	
Ending work in process	3600	3600×75%= 2700	3600×25%= 900	
Total outputs	<u>53600</u>			
	Equivalent units	<u>52700</u>	<u>50900</u>	

The Rugger Company uses a process costing system. During the period, 1,400 were started and 1,000 units were completed and transferred out. The units at the end of the period were 60% complete regarding materials and 40% complete regarding conversion. The cost of materials added during the current period amounted to \$31,930; the conversion costs added during the current period amounted to \$34,800.

1. Summarize the flow of physical units.
2. Compute the output in equivalent units.
3. Compute the cost per equivalent unit.
4. Assign costs to units completed and units in ending inventory

1. Flow of production				
Beginning work in process	0			
Started in production	1400	2. Equivalent units		
Total inputs	<u>1400</u>	Materials	Conversion	Total
Completed and transferred out	1000	1000	1000	
Ending work in process	400	$400 \times 60\% = 240$	$400 \times 40\% = 160$	
Total outputs	<u>4000</u>			
Equivalent units		<u>1240</u>	<u>1160</u>	
Cost		31,930	34,800	<u>66730</u>
3. Cost per equivalent unit		$31930 \div 1240 = 25.75$	$34800 \div 1160 = 30$	
4. Assign costs	Completed and transferred	$1000 \times (25.75 + 30) = 55750$		<u>66730</u>
	Ending inventory	$(400 \times 60\%) \times 25.75 = 6180$	$(400 \times 40\%) \times 30 = 4800$	

The Blue Tide Company manufactures light bulbs in a single process. The following information is available:

Work in process inventory, Jan. 1	0 units
Units started in production	14,000 units
Units completed and transferred out	9,000 units
Work in process inventory, Dec. 31	5,000 units
Production costs:	
Direct materials	\$27,000
Direct labor	\$22,000
Manufacturing overhead	\$33,000

The ending work in process was 90% complete with respect to direct materials and 40% complete with respect to conversion costs.

1. Summarize the flow of physical units.
2. Compute the output in equivalent units.
3. Compute the cost per equivalent unit.
4. Assign costs to units completed and units in ending inventory

1. Flow of production				
Beginning work in process	0			
Started in production	14000	2. Equivalent units		
Total inputs	<u>14000</u>	Materials	Conversion	Total
Completed and transferred out	9000	9000	9000	
Ending work in process	5000	$5000 \times 90\% = 4500$	$5000 \times 40\% = 2000$	
Total outputs	<u>14000</u>			
Equivalent units		<u>13500</u>	<u>11000</u>	
Cost		27,000	$22000 + 33,000 = 55000$	<u>82000</u>
3. Cost per equivalent unit		$27000 \div 13500 = 2$	$55000 \div 11000 = 5$	
4. Assign costs	Completed and transferred	$9000 \times (2 + 5) = 63000$		<u>82000</u>
	Ending inventory	$(5000 \times 90\%) \times 2 = 9000$	$(5000 \times 40\%) \times 5 = 10000$	

The Nesting Company manufactures birdhouses in a single manufacturing process. **Materials** are added **at the beginning of the process** while conversion costs are incurred uniformly throughout the process.

The following information has been provided by Nesting Company:

Work in process inventory, Jan. 1	—0— units
Units started in production	14,000 units
Work in process inventory, Dec. 31 (35%)	5,000 units
Production costs:	
Direct materials	\$28,000
Direct labor	\$12,250
Manufacturing overhead	\$20,000

1. Summarize the flow of physical units.
2. Compute the output in equivalent units.
3. Compute the cost per equivalent unit.
4. Assign costs to units completed and units in ending inventory

1. Flow of production				
Beginning work in process	0			
Started in production	14000	2. Equivalent units		
Total inputs	<u>14000</u>	Materials	Conversion	Total
Completed and transferred out	9000	9000	9000	
Ending work in process	5000	5000	5000×35%= 1750	
Total outputs	<u>14000</u>			
Equivalent units		<u>14000</u>	<u>10750</u>	
Cost		28,000	12,250+ 20,000= 32250	<u>60250</u>
3. Cost per equivalent unit		28000÷14000=2	32250÷10750=3	
4. Assign costs	Completed and transferred	9000 × (2+ 3)= 45000		<u>60250</u>
	Ending inventory	5000× 2= 10000	(5000×35%) × 3= 5250	

Winter Corporation uses a process costing system. Materials are **added at the beginning of the process** while conversion costs are incurred uniformly throughout the process.

Beginning work in process inventory (70%)	33,500 units
Units started in production	325,000 units
Ending work in process inventory (40%)	58,500 units
Costs contained in beginning work in process inventory	
direct materials	\$117,000
conversion	\$70,200
Costs added during current period	
direct materials	\$600,000
conversion	\$900,000

1. Summarize the flow of physical units.
2. Compute the output in equivalent units.
3. Compute the cost per equivalent unit.
4. Assign costs to units completed and units in ending inventory

1. Flow of production				
Beginning work in process	33500			
Started in production	325000	2. Equivalent units		
Total inputs	<u>358500</u>	Materials	Conversion	Total
Completed and transferred out	300000	300000	300000	
Ending work in process (40%)	58500	58500	$58500 \times 40\% = 23400$	
Total outputs	<u>358500</u>			
Equivalent units		<u>358500</u>	<u>323400</u>	
Cost	in beginning work in process	117,000	70,200	187200
	added during current period	600,000	900,000	1500000
Total cost		717,000	970,200	<u>1687200</u>
3. Cost per equivalent unit		$717000 \div 358500 = 2$	$970200 \div 323400 = 3$	
4. Assign costs	Completed and transferred	$300000 \times (2+3) = 1500000$		<u>1687200</u>
	Ending inventory	$58500 \times 2 = 117000$	$(58500 \times 40\%) \times 3 = 70200$	