18 Spoilage, Rework, and Scrap

Learning Objectives

1. Understand the definitions of spoilage, rework, and scrap
2. Identify the differences between normal and abnormal spoilage
3. Account for spoilage in process costing using the weighted-average method and the first-in, first-out (FIFO) method
4. Account for spoilage at various stages of completion in process costing
5. Account for spoilage in job costing
6. Account for rework in job costing
7. Account for scrap

When a product doesn't meet specification but is subsequently repaired and sold, it is called rework.

Firms try to minimize rework, as well as spoilage and scrap, during production. Why? Because higher-than-normal levels of spoilage and scrap can have a significant negative effect on a company's profits. Rework can also cause substantial production delays, as the following article about Boeing shows.

Rework Delays the Boeing Dreamliner by Three Years[1]

In 2007, Boeing was scheduled to introduce its newest airplane, the Dreamliner 787. Engineered to be the most fuel-efficient commercial plane, the Dreamliner received nearly 600 customer orders, making it the fastest selling commercial airplane in history.

By 2010, however, the first Dreamliner still had not rolled off the production line. The design and assembly process was riddled with production snafus, parts shortages, and supply-chain bottlenecks. The Dreamliner was Boeing's first major attempt at giving suppliers and partners far-ranging responsibility for designing and building the wings, fuselage, and other critical components to be shipped to Boeing for final assembly. The approach did not work as planned, with many of the 787's components delivered unfinished, with flaws, and lacking parts.

As a result, the Boeing Dreamliner aircraft required significant rework. The company's engineers had to redesign structural flaws in the airplane's wings, repair cracks in the composite materials used to construct the airplane, and fix faulty software among many other problems. In 2009, one of Boeing's unions calculated that half of its members' time was spent doing rework.

This rework led to costly delays for Boeing. Many of its customers, including Virgin Atlantic and Japan's All Nippon Airways, asked the company to compensate them for keeping less fuel-efficient planes in the air. Other customers cancelled their orders. Australia's Quantas Airways and a Dubai-based aircraft leasing firm each cancelled its

[1] *Sources:* Lunsford, J. Lynn. 2009. Dubai firm cancels 16 of Boeing's Dreamliners. *Wall Street Journal*, February 5; Matlack, Carol. 2009. More Boeing 787 woes as Quantas drops order. *BusinessWeek*, June 26; Sanders, Peter. 2009. At Boeing, Dreamliner fix turns up new glitch. *Wall Street Journal*, November 13; West, Karen. 2009. Boeing has much to prove with 787. *MSNBC.com*, December 16; Wilhelm, Steve. 2009. Boeing engineers seek credit for fixing goofs. *Puget Sound Business Journal*, August 17.

orders for 15 airplanes, which cost Boeing at least $4.5 billion. The company also took a $2.5 billion charge in 2009 related to development costs on the Dreamliner program.

Like Boeing, companies are increasingly focused on improving the quality of, and reducing defects in, their products, services, and activities. A rate of defects regarded as normal in the past is no longer tolerable. In this chapter, we focus on three types of costs that arise as a result of defects—spoilage, rework, and scrap—and ways to account for them. We also describe how to determine (1) cost of products, (2) cost of goods sold, and (3) inventory values when spoilage, rework, and scrap occur.

Defining Spoilage, Rework and Scrap

While the terms used in this chapter may seem familiar, be sure you understand them in the context of management accounting.

Spoilage is units of production—whether fully or partially completed—that do not meet the specifications required by customers for good units and that are discarded or sold at reduced prices. Some examples of spoilage are defective shirts, jeans, shoes, and carpeting sold as "seconds," or defective aluminum cans sold to aluminum manufacturers for remelting to produce other aluminum products.

Rework is units of production that do not meet the specifications required by customers but that are subsequently repaired and sold as good finished units. For example, defective units of products (such as pagers, computers, and telephones) detected during or after the production process but before units are shipped to customers can sometimes be reworked and sold as good products.

Scrap is residual material that results from manufacturing a product. Examples are short lengths from woodworking operations, edges from plastic molding operations, and frayed cloth and end cuts from suit-making operations. Scrap can sometimes be sold for relatively small amounts. In that sense, scrap is similar to byproducts, which we studied in Chapter 16. The difference is that scrap arises as a residual from the manufacturing process, and is not a product targeted for manufacture or sale by the firm.

Some amounts of spoilage, rework, or scrap are inherent in many production processes. For example, semiconductor manufacturing is so complex and delicate that some spoiled units are commonly produced; usually, the spoiled units cannot be reworked. In the manufacture of high-precision machine tools, spoiled units can be reworked to meet standards, but only at a considerable cost. And in the mining industry, companies process ore that contains varying amounts of valuable metals and rock. Some amount of rock, which is scrap, is inevitable.

Learning Objective 1

Understand the definitions of spoilage,

. . . unacceptable units of production

rework,

. . . unacceptable units of production subsequently repaired

and scrap

. . . leftover material

Decision Point

What are spoilage, rework, and scrap?

Two Types of Spoilage

Learning Objective 2

Identify the differences between normal spoilage

. . . spoilage inherent in an efficient production process

and abnormal spoilage

. . . spoilage that would not arise under efficient operation

Accounting for spoilage aims to determine the magnitude of spoilage costs and to distinguish between costs of normal and abnormal spoilage.[2] To manage, control, and reduce spoilage costs, companies need to highlight them, not bury them as an unidentified part of the costs of good units manufactured.

To illustrate normal and abnormal spoilage, consider Mendoza Plastics, which makes casings for the iMac computer using plastic injection molding. In January 2012, Mendoza incurs costs of $615,000 to produce 20,500 units. Of these 20,500 units, 20,000 are good units and 500 are spoiled units. Mendoza has no beginning inventory and no ending inventory that month. Of the 500 spoiled units, 400 units are spoiled because the injection molding machines are unable to manufacture good casings 100% of the time. That is, these units are spoiled even though the machines were run carefully and efficiently. The remaining 100 units are spoiled because of machine breakdowns and operator errors.

Normal Spoilage

Normal spoilage is spoilage inherent in a particular production process. In particular, it arises even when the process is operated in an efficient manner. The costs of normal spoilage are typically included as a component of the costs of good units manufactured, because good units cannot be made without also making some units that are spoiled. There is a tradeoff between the speed of production and the normal spoilage rate. Management makes a conscious decision about how many units to produce per hour with the understanding that, at the rate decided on, a certain level of spoilage is almost unavoidable. For this reason, the cost of normal spoilage is included in the cost of the good units completed. At Mendoza Plastics, the 400 units spoiled because of the limitations of injection molding machines and despite efficient operating conditions are considered normal spoilage. The calculations are as follows:

Manufacturing cost per unit, $615,000 ÷ 20,500 units = $30	
Manufacturing costs of good units alone, $30 per unit × 20,000 units	$600,000
Normal spoilage costs, $30 per unit × 400 units	12,000
Manufacturing costs of good units completed (includes normal spoilage)	$612,000

$$\text{Manufacturing cost per good unit} = \frac{\$612{,}000}{20{,}000 \text{ units}} = \$30.60$$

Because normal spoilage is the spoilage related to the good units produced, normal spoilage rates are computed by dividing units of normal spoilage by total *good units completed*, not total *actual units started* in production. At Mendoza Plastics, the normal spoilage rate is therefore computed as 400 ÷ 20,000 = 2%.

Abnormal Spoilage

Abnormal spoilage is spoilage that is not inherent in a particular production process and would not arise under efficient operating conditions. If a firm has 100% good units as its goal, then any spoilage would be considered abnormal. At Mendoza, the 100 units spoiled due to machine breakdowns and operator errors are abnormal spoilage. Abnormal spoilage is usually regarded as avoidable and controllable. Line operators and other plant personnel generally can decrease or eliminate abnormal spoilage by identifying the reasons for machine breakdowns, operator errors, etc., and by taking steps to prevent their recurrence. To highlight the effect of abnormal spoilage costs, companies calculate the units of abnormal spoilage and record the cost in the Loss from Abnormal Spoilage account, which appears as a separate line item in the income statement. At Mendoza, the loss from abnormal spoilage is $3,000 ($30 per unit × 100 units).

Decision Point

What is the distinction between normal and abnormal spoilage?

Issues about accounting for spoilage arise in both process-costing and job-costing systems. We discuss both instances next, beginning with spoilage in process-costing.

[2] The helpful suggestions of Samuel Laimon, University of Saskatchewan, are gratefully acknowledged.

Spoilage in Process Costing Using Weighted-Average and FIFO

Learning Objective 3

Account for spoilage in process costing using the weighted-average method

. . . spoilage cost based on total costs and equivalent units completed to date

and the first-in, first-out (FIFO) method

. . . spoilage cost based on costs of current period and equivalent units of work done in current period

How do process-costing systems account for spoiled units? We have already said that units of abnormal spoilage should be counted and recorded separately in a Loss from Abnormal Spoilage account. But what about units of normal spoilage? The correct method is to count these units when computing output units—physical or equivalent—in a process-costing system. The following example and discussion illustrate this approach.

Count All Spoilage

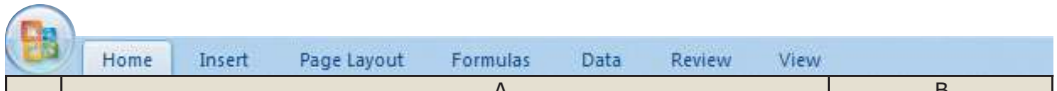
Example 1: Chipmakers, Inc., manufactures computer chips for television sets. All direct materials are added at the beginning of the production process. To highlight issues that arise with normal spoilage, we assume no beginning inventory and focus only on direct material costs. The following data are available for May 2012.

	A	B	C
1		**Physical Units**	**Direct Materials**
2	Work in process, beginning inventory (May 1)	0	
3	Started during May	10,000	
4	Good units completed and transferred out during May	5,000	
5	Units spoiled (all normal spoilage)	1,000	
6	Work in process, ending inventory (May 31)	4,000	
7	Direct material costs added in May		$270,000

Spoilage is detected upon completion of the process and has zero net disposal value.

An **inspection point** is the stage of the production process at which products are examined to determine whether they are acceptable or unacceptable units. Spoilage is typically assumed to occur at the stage of completion where inspection takes place. As a result, the spoiled units in our example are assumed to be 100% complete with respect to direct materials.

Exhibit 18-1 calculates and assigns cost per unit of direct materials. Overall, Chipmakers generated 10,000 equivalent units of output: 5,000 equivalent units in good units completed (5,000 physical units × 100%), 4,000 units in ending work in process



	A	B
1		**Approach Counting Spoiled Units When Computing Output in Equivalent Units**
2	Costs to account for	$270,000
3	Divide by equivalent units of output	÷ 10,000
4	Cost per equivalent unit of output	$ 27
5	Assignment of costs:	
6	Good units completed (5,000 units × $27 per unit)	$135,000
7	Add normal spoilage (1,000 units × $27 per unit)	27,000
8	Total costs of good units completed and transferred out	162,000
9	Work in process, ending (4,000 units × $27 per unit)	108,000
10	Costs accounted for	$270,000

Exhibit 18-1

Effect of Recognizing Equivalent Units in Spoilage for Direct Material Costs for Chipmakers, Inc., for May 2012

(4,000 physical units × 100%), and 1,000 equivalent units in normal spoilage (1,000 physical units × 100%). Given total direct material costs of $270,000 in May, this yields an equivalent-unit cost of $27. The total cost of good units completed and transferred out, which includes the cost of normal spoilage, is then $162,000 (6,000 equivalent units × $27), while the ending work in process is assigned a cost of $108,000 (4,000 equivalent units × $27).

There are two noteworthy features of this approach. First, the 4,000 units in ending work in process are not assigned any of the costs of normal spoilage. This is appropriate because the units have not yet been inspected. While the units in ending work in process undoubtedly include some that will be detected as spoiled when inspected, these units will only be identified when the units are completed in the subsequent accounting period. At that time, costs of normal spoilage will be assigned to the good units completed in that period. Second, the approach used in Exhibit 18-1 delineates the cost of normal spoilage as $27,000. By highlighting the magnitude of this cost, the approach helps to focus management's attention on the potential economic benefits of reducing spoilage.

Five-Step Procedure for Process Costing with Spoilage

Example 2: Anzio Company manufactures a recycling container in its forming department. Direct materials are added at the beginning of the production process. Conversion costs are added evenly during the production process. Some units of this product are spoiled as a result of defects, which are detectable only upon inspection of finished units. Normally, spoiled units are 10% of the finished output of good units. That is, for every 10 good units produced, there is 1 unit of normal spoilage. Summary data for July 2012 are as follows:

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	A	B	C	D	E
1		**Physical Units (1)**	**Direct Materials (2)**	**Conversion Costs (3)**	**Total Costs (4) = (2) + (3)**
2	Work in process, beginning inventory (July 1)	1,500	$12,000	$ 9,000	$ 21,000
3	Degree of completion of beginning work in process		100%	60%	
4	Started during July	8,500			
5	Good units completed and transferred out during July	7,000			
6	Work in process, ending inventory (July 31)	2,000			
7	Degree of completion of ending work in process		100%	50%	
8	Total costs added during July		$76,500	$89,100	$165,600
9	Normal spoilage as a percentage of good units	10%			
10	Degree of completion of normal spoilage		100%	100%	
11	Degree of completion of abnormal spoilage		100%	100%	

The five-step procedure for process costing used in Chapter 17 needs only slight modification to accommodate spoilage.

Step 1: Summarize the Flow of Physical Units of Output. Identify the number of units of both normal and abnormal spoilage.

$$\text{Total Spoilage} = \left(\begin{array}{c}\text{Units in beginning}\\ \text{work-in-process inventory}\end{array} + \begin{array}{c}\text{Units}\\ \text{started}\end{array}\right) - \left(\begin{array}{c}\text{Good units}\\ \text{completed and}\\ \text{transferred out}\end{array} + \begin{array}{c}\text{Units in ending}\\ \text{work-in-process inventory}\end{array}\right)$$

$$= (1{,}500 + 8{,}500) - (7{,}000 + 2{,}000)$$

$$= 10{,}000 - 9{,}000$$

$$= 1{,}000 \text{ units}$$

Recall that normal spoilage is 10% of good output at Anzio Company. Therefore, normal spoilage = 10% of the 7,000 units of *good* output = 700 units.

$$\begin{aligned}\text{Abnormal spoilage} &= \text{Total spoilage} - \text{Normal spoilage}\\ &= 1{,}000 \text{ units} - 700 \text{ units}\\ &= 300 \text{ units}\end{aligned}$$

Step 2: Compute Output in Terms of Equivalent Units. Compute equivalent units for spoilage in the same way we compute equivalent units for good units. As illustrated previously, all spoiled units are included in the computation of output units. Because Anzio's inspection point is at the completion of production, the same amount of work will have been done on each spoiled and each completed good unit.

Step 3: Summarize Total Costs to Account For. The total costs to account for are all the costs debited to Work in Process. The details for this step are similar to Step 3 in Chapter 17.

Step 4: Compute Cost per Equivalent Unit. This step is similar to Step 4 in Chapter 17.

Step 5: Assign Total Costs to Units Completed, to Spoiled Units, and to Units in Ending Work in Process. This step now includes computation of the cost of spoiled units and the cost of good units.

We illustrate these five steps of process costing for the weighted-average and FIFO methods next. *The standard-costing method is illustrated in the appendix to this chapter.*

Weighted-Average Method and Spoilage

Exhibit 18-2, Panel A, presents Steps 1 and 2 to calculate equivalent units of work done to date and includes calculations of equivalent units of normal and abnormal spoilage. Exhibit 18-2, Panel B, presents Steps 3, 4, and 5 (together called the production-cost worksheet).

Step 3 summarizes total costs to account for. Step 4 presents cost-per-equivalent-unit calculations using the weighted-average method. Note how, for each cost category, costs of beginning work in process and costs of work done in the current period are totaled and divided by equivalent units of all work done to date to calculate the weighted-average cost per equivalent unit. Step 5 assigns total costs to completed units, normal and abnormal spoiled units, and ending inventory by multiplying the equivalent units calculated in Step 2 by the cost per equivalent unit calculated in Step 4. Also note that the $13,825 costs of normal spoilage are added to the costs of the related good units completed and transferred out.

$$\begin{aligned}\text{Cost per good unit completed and transferred out of the process} &= \frac{\text{Total costs transferred out (including normal spoilage)}}{\text{Number of good units produced}}\\ &= \$152{,}075 \div 7{,}000 \text{ good units} = \$21.725 \text{ per good unit}\end{aligned}$$

This amount is not equal to $19.75 per good unit, the sum of the $8.85 cost per equivalent unit of direct materials plus the $10.90 cost per equivalent unit of conversion costs. That's because the cost per good unit equals the sum of the direct material and conversion costs per equivalent unit, $19.75, plus a share of normal spoilage, $1.975 ($13,825 ÷ 7,000 good units), for a total of $21.725 per good unit. The $5,925 costs of abnormal spoilage are charged to the Loss from Abnormal Spoilage account and do not appear in the costs of good units.[3]

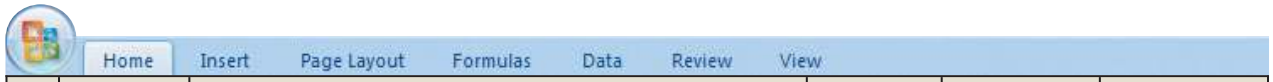
FIFO Method and Spoilage

Exhibit 18-3, Panel A, presents Steps 1 and 2 using the FIFO method, which focuses on equivalent units of work done in the current period. Exhibit 18-3, Panel B, presents Steps 3, 4, and 5. Note how when assigning costs, the FIFO method keeps the costs of

[3] The actual costs of spoilage (and rework) are often greater than the costs recorded in the accounting system because the opportunity costs of disruption of the production line, storage, and lost contribution margins are not recorded in accounting systems. Chapter 19 discusses these opportunity costs from the perspective of cost management.

Exhibit 18-2 Weighted-Average Method of Process Costing with Spoilage for Forming Department of the Anzio Company for July 2012

PANEL A: Steps 1 and 2—Summarize Output in Physical Units and Compute Equivalent Units



	A	B	C	D	E
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. 648)	1,500		
5		Started during current period (given, p. 648)	8,500		
6		To account for	10,000		
7		Good units completed and transferred out during current period	7,000	7,000	7,000
8		Normal spoilage[a]	700		
9		(700 × 100%; 700 × 100%)		700	700
10		Abnormal spoilage[b]	300		
11		(300 × 100%; 300 × 100%)		300	300
12		Work in process, ending[c] (given, p. 648)	2,000		
13		(2,000 × 100%; 2,000 × 50%)		2,000	1,000
14		Accounted for	10,000		
15		Equivalent units of work done to date		10,000	9,000
16					
17	[a]Normal spoilage is 10% of good units transferred out: 10% × 7,000 = 700 units. Degree of completion of normal spoilage				
18	in this department: direct materials, 100%; conversion costs, 100%.				
19	[b]Abnormal spoilage = Total spoilage – Normal spoilage = 1,000 – 700 = 300 units. Degree of completion of abnormal spoilage				
20	in this department: direct materials, 100%; conversion costs, 100%.				
21	[c]Degree of completion in this department: direct materials, 100%; conversion costs, 50%.				

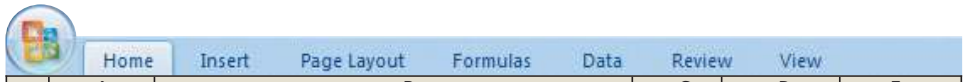
PANEL B: Steps 3, 4, and 5—Summarize Total Costs to Account For, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed, to Spoiled Units, and to Units in Ending Work Process

			Total Production Costs	Direct Materials	Conversion Costs
23					
24	**(Step 3)**	Work in process, beginning (given, p. 648)	$ 21,000	$12,000	$ 9,000
25		Costs added in current period (given, p. 648)	165,600	76,500	89,100
26		Total costs to account for	$186,600	$88,500	$98,100
27	**(Step 4)**	Costs incurred to date		$88,500	$98,100
28		Divide by equivalent units of work done to date (Panel A)		÷10,000	÷ 9,000
29		Cost per equivalent unit		$ 8.85	$ 10.90
30	**(Step 5)**	Assignment of costs:			
31		Good units completed and transferred out (7,000 units)			
32		Costs before adding normal spoilage	$138,250	(7,000[d] × $8.85) +	(7,000[d] × $10.90)
33		Normal spoilage (700 units)	13,825	(700[d] × $8.85) +	(700[d] × $10.90)
34	(A)	Total costs of good units completed and transferred out	152,075		
35	(B)	Abnormal spoilage (300 units)	5,925	(300[d] × $8.85) +	(300[d] × $10.90)
36	(C)	Work in process, ending (2,000 units)	28,600	(2,000[d] × $8.85) +	(1,000[d] × $10.90)
37	(A)+(B)+(C)	Total costs accounted for	$186,600	$88,500 +	$98,100
38					
39	[d]Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A.				

Exhibit 18-3

First-In, First-Out (FIFO) Method of Process Costing with Spoilage for Forming Department of the Anzio Company for July 2012

PANEL A: Steps 1 and 2—Summarize Output in Physical Units and Compute Equivalent Units



	A	B	C	D	E
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. 648)	1,500		
5		Started during current period (given, p. 648)	8,500		
6		To account for	10,000		
7		Good units completed and transferred out during current period:			
8		From beginning work in process[a]	1,500		
9		[1,500 × (100% – 100%); 1,500 × (100% – 60%)]		0	600
10		Started and completed	5,500[b]		
11		(5,500 × 100%; 5,500 × 100%)		5,500	5,500
12		Normal spoilage[c]	700		
13		(700 × 100%; 700 × 100%)		700	700
14		Abnormal spoilage[d]	300		
15		(300 × 100%; 300 × 100%)		300	300
16		Work in process, ending[e] (given, p. 648)	2,000		
17		(2,000 × 100%; 2,000 × 50%)		2,000	1,000
18		Accounted for	10,000		
19		Equivalent units of work done in current period		8,500	8,100
20					
21	[a]Degree of completion in this department: direct materials, 100%; conversion costs, 60%.				
22	[b]7,000 physical units completed and transferred out minus 1,500 physical units completed and transferred out from beginning				
23	work-in-process inventory.				
24	[c]Normal spoilage is 10% of good units transferred out: 10% × 7,000 = 700 units. Degree of completion of normal spoilage				
25	in this department: direct materials, 100%; conversion costs, 100%.				
26	[d]Abnormal spoilage = Actual spoilage – Normal spoilage = 1,000 – 700 = 300 units. Degree of completion of abnormal spoilage				
27	in this department: direct materials, 100%; conversion costs, 100%.				
28	[e]Degree of completion in this department: direct materials, 100%; conversion costs, 50%.				

PANEL B: Steps 3, 4, and 5—Summarize Total Costs to Account for, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed, to Spoiled Units, and to Units in Ending Work in Process

30			Total Production Costs	Direct Materials	Conversion Costs
31	**(Step 3)**	Work in process, beginning (given, p. 648)	$ 21,000	$12,000	$ 9,000
32		Costs added in current period (given, p. 648)	165,600	76,500	89,100
33		Total costs to account for	$186,600	$88,500	$98,100
34	**(Step 4)**	Costs added in current period		$76,500	$89,100
35		Divide by equivalent units of work done in current period (Panel A)		÷ 8,500	÷ 8,100
36		Cost per equivalent unit		$ 9.00	$ 11.00
37	**(Step 5)**	Assignment of costs:			
38		Good units completed and transferred out (7,000 units)			
39		Work in process, beginning (1,500 units)	$ 21,000	$12,000 +	$9,000
40		Costs added to beginning work in process in current period	6,600	(0[f] × $9) +	(600[f] × $11)
41		Total from beginning inventory before normal spoilage	27,600		
42		Started and completed before normal spoilage (5,500 units)	110,000	(5,500[f] × $9) +	(5,500[f] × $11)
43		Normal spoilage (700 units)	14,000	(700[f] × $9) +	(700[f] × $11)
44	(A)	Total costs of good units completed and transferred out	151,600		
45	(B)	Abnormal spoilage (300 units)	6,000	(300[f] × $9) +	(300[f] × $11)
46	(C)	Work in process, ending (2,000 units)	29,000	(2,000[f] × $9) +	(1,000[f] × $11)
47	(A)+(B)+(C)	Total costs accounted for	$186,600	$88,500 +	$98,100
48					
49					
50					
51	[f]Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A.				

the beginning work in process separate and distinct from the costs of work done in the current period. All spoilage costs are assumed to be related to units completed during this period, using the unit costs of the current period.[4]

Journal Entries

Decision Point

How do the weighted-average and FIFO methods of process costing calculate the costs of good units and spoilage?

The information from Panel B in Exhibits 18-2 and 18-3 supports the following journal entries to transfer good units completed to finished goods and to recognize the loss from abnormal spoilage.

	Weighted Average		FIFO	
Finished Goods	152,075		151,600	
Work in Process—Forming		152,075		151,600
To record transfer of good units completed in July.				
Loss from Abnormal Spoilage	5,925		6,000	
Work in Process—Forming		5,925		6,000
To record abnormal spoilage detected in July.				

Inspection Points and Allocating Costs of Normal Spoilage

Learning Objective 4

Account for spoilage at various stages of completion in process costing

. . . spoilage costs vary based on the point at which inspection is carried out

Our Anzio Company example assumes inspection occurs upon completion of the units. Although spoilage is typically detected only at one or more inspection points, it might actually occur at various stages of a production process. The cost of spoiled units is assumed to equal all costs incurred in producing spoiled units up to the point of inspection. When spoiled goods have a disposal value (for example, carpeting sold as "seconds"), the net cost of spoilage is computed by deducting the disposal value from the costs of the spoiled goods that have been accumulated up to the inspection point.

The unit costs of normal and abnormal spoilage are the same when the two are detected at the same inspection point. However, situations may arise when abnormal spoilage is detected at a different point from normal spoilage. Consider shirt manufacturing. Normal spoilage in the form of defective shirts is identified upon inspection at the end of the production process. Now suppose a faulty machine causes many defective shirts to be produced at the halfway point of the production process. These defective shirts are abnormal spoilage and occur at a different point in the production process from normal spoilage. In such cases, the unit cost of abnormal spoilage, which is based on costs incurred up to the halfway point of the production process, differs from the unit cost of normal spoilage, which is based on costs incurred through the end of the production process.

Costs of abnormal spoilage are separately accounted for as losses of the accounting period in which they are detected. However, recall that normal spoilage costs are added to the costs of good units, which raises an additional issue: Should normal spoilage costs be allocated between completed units and ending work-in-process inventory? *The common approach is to presume that normal spoilage occurs at the inspection point in the production cycle and to allocate its cost over all units that have passed that point during the accounting period.*

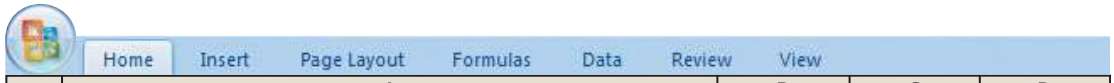
In the Anzio Company example, spoilage is assumed to occur when units are inspected at the end of the production process, so no costs of normal spoilage are allocated to ending work in process. If the units in ending work in process have passed the inspection point, however, the costs of normal spoilage are allocated to units in ending work in process as well as to completed units. For example, if the inspection point is at the halfway point of production, then any ending work in process that is at least 50% complete would be allocated a full measure of normal spoilage costs, and those spoilage costs would be calculated on the basis of all costs incurred up to the inspection point. If ending work in process is less than 50% complete, however, no normal spoilage costs would be allocated to it.

To better understand these issues, let us now assume that inspection at Anzio Company occurs at various stages in the production process. How does this affect the

[4] To simplify calculations under FIFO, spoiled units are accounted for as if they were started in the current period. Although some of the beginning work in process probably did spoil, all spoilage is treated as if it came from current production.

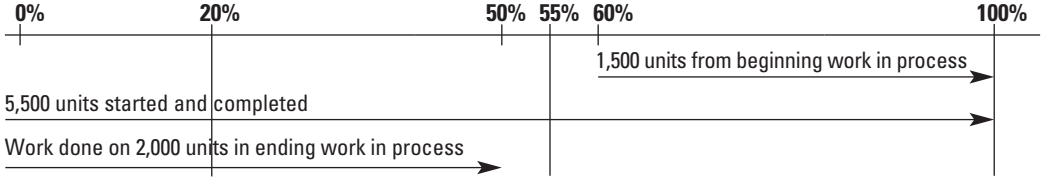
amount of normal and abnormal spoilage? As before, consider the forming department, and recall that direct materials are added at the start of production, while conversion costs are added evenly during the process.

Consider three different cases: Inspection occurs at (1) the 20%, (2) the 55%, or (3) the 100% completion stage. The last option is the one we have analyzed so far (see Exhibit 18-2). Assume that normal spoilage is 10% of the good units passing inspection. A total of 1,000 units are spoiled in all three cases. Normal spoilage is computed on the basis of the number of *good units* that pass the inspection point *during the current period*. The following data are for July 2012. Note how the number of units of normal and abnormal spoilage changes, depending on when inspection occurs.



	A	B	C	D
1		Physical Units: Stage of Completion at Which Inspection Occurs		
2	**Flow of Production**	**20%**	**55%**	**100%**
3	Work in process, beginning[a]	1,500	1,500	1,500
4	Started during July	8,500	8,500	8,500
5	To account for	10,000	10,000	10,000
6	Good units completed and transferred out			
7	(10,000 – 1,000 spoiled – 2,000 ending)	7,000	7,000	7,000
8	Normal spoilage	750[c]	550[d]	700[e]
9	Abnormal spoilage (1,000 – normal spoilage)	250	450	300
10	Work in process, ending[b]	2,000	2,000	2,000
11	Accounted for	10,000	10,000	10,000
12				
13	[a]Degree of completion in this department: direct materials, 100%; conversion costs, 60%.			
14	[b]Degree of completion in this department: direct materials, 100%; conversion costs, 50%.			
15	[c]10% × (8,500 units started – 1,000 units spoiled), because only the units started passed the 20% completion			
16	inspection point in the current period. Beginning work in process is excluded from this calculation because,			
17	being 60% complete at the start of the period, it passed the inspection point in the previous period.			
18	[d]10% × (8,500 units started – 1,000 units spoiled – 2,000 units in ending work in process). Both beginning and			
19	ending work in process are excluded since neither was inspected this period.			
20	[e]10% × 7,000, because 7,000 units are fully completed and inspected in the current period.			

The following diagram shows the flow of physical units for July and illustrates the normal spoilage numbers in the table. Note that 7,000 good units are completed and transferred out—1,500 from beginning work in process and 5,500 started and completed during the period—while 2,000 units are in ending work in process.



To see the number of units passing each inspection point, consider in the diagram the vertical lines at the 20%, 55%, and 100% inspection points. Note that the vertical line at 20% crosses two horizontal lines—5,500 good units started and completed and 2,000 units in ending work in process—for a total of 7,500 good units. (The 20% vertical line does not cross the line representing work done on the 1,500 good units completed

from beginning work in process, because these units are already 60% complete at the start of the period and, hence, are not inspected this period.) Normal spoilage equals 10% of 7,500 = 750 units. On the other hand, the vertical line at the 55% point crosses just the second horizontal line, indicating that only 5,500 good units pass this point. Normal spoilage in this case is 10% of 5,500 = 550 units. At the 100% point, normal spoilage = 10% of 7,000 (1,500 + 5,500) good units = 700 units.

Exhibit 18-4 shows the computation of equivalent units under the weighted-average method, assuming inspection at the 20% completion stage. The calculations depend on the direct materials and conversion costs incurred to get the units to this inspection point. The spoiled units have a full measure of direct materials and a 20% measure of conversion costs. Calculations of costs per equivalent unit and the assignment of total costs to units completed and to ending work in process are similar to calculations in previous illustrations in this chapter. Because ending work in process has passed the inspection point, these units bear normal spoilage costs, just like the units that have been completed and transferred out. For example, conversion costs for units completed and transferred out include conversion costs for 7,000 good units produced plus 20% × (10% × 5,500) = 110 equivalent units of normal spoilage. *We multiply by 20% to obtain equivalent units of normal spoilage because conversion costs are only 20% complete at the inspection point.* Conversion costs of ending work in process include conversion costs of 50% of 2,000 = 1,000 equivalent good units plus 20% × (10% × 2,000) = 40 equivalent units of normal spoilage. Thus, the equivalent units of normal spoilage accounted for are 110 equivalent units related to units completed and transferred out plus 40 equivalent units related to units in ending work in process, for a total of 150 equivalent units, as shown in Exhibit 18-4.

Decision Point

How does inspection at various stages of completion affect the amount of normal and abnormal spoilage?

Early inspections can help prevent any further direct materials and conversion costs being wasted on units that are already spoiled. For example, if inspection can occur when units are 70% (rather than 100%) complete as to conversion costs and spoilage occurs prior to the 70% point, a company can avoid incurring the final 30% of conversion costs on the spoiled units. The downside to conducting inspections at too early a stage is that spoilage that happens at later stages of the process may go undetected. It is for these reasons that firms often conduct multiple inspections and also empower workers to identify and resolve defects on a timely basis.

Exhibit 18-4

Computing Equivalent Units with Spoilage Using Weighted-Average Method of Process Costing with Inspection at 20% of Completion for Forming Department of Anzio Company for July 2012

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[a]	1,500		
5	Started during current period	8,500		
6	To account for	10,000		
7	Good units completed and transferred out:	7,000	7,000	7,000
8	Normal spoilage	750		
9	(750 × 100%; 750 × 20%)		750	150
10	Abnormal spoilage	250		
11	(250 × 100%; 250 × 20%)		250	50
12	Work in process, ending[b]	2,000		
13	(2,000 × 100%; 2,000 × 50%)		2,000	1,000
14	Accounted for	10,000		
15	Equivalent units of work done to date		10,000	8,200
16				
17	[a]Degree of completion: direct materials, 100%; conversion costs, 60%.			
18	[b]Degree of completion: direct materials, 100%; conversion costs, 50%.			

Job Costing and Spoilage

Learning Objective 5

Account for spoilage in job costing

. . . normal spoilage assigned directly or indirectly to job; abnormal spoilage written off as a loss of the period

The concepts of normal and abnormal spoilage also apply to job-costing systems. Abnormal spoilage is separately identified so companies can work to eliminate it altogether. Costs of abnormal spoilage are not considered to be inventoriable costs and are written off as costs of the accounting period in which the abnormal spoilage is detected. Normal spoilage costs in job-costing systems—as in process-costing systems—are inventoriable costs, although increasingly companies are tolerating only small amounts of spoilage as normal. When assigning costs, job-costing systems generally distinguish *normal spoilage attributable to a specific job from normal spoilage common to all jobs*.

We describe accounting for spoilage in job costing using the following example.

> Example 3: In the Hull Machine Shop, 5 aircraft parts out of a job lot of 50 aircraft parts are spoiled. Costs assigned prior to the inspection point are $2,000 per part. When the spoilage is detected, the spoiled goods are inventoried at $600 per part, the net disposal value.

Our presentation here and in subsequent sections focuses on how the $2,000 cost per part is accounted for.

Normal Spoilage Attributable to a Specific Job

When normal spoilage occurs because of the specifications of a particular job, that job bears the cost of the spoilage minus the disposal value of the spoilage. The journal entry to recognize disposal value (items in parentheses indicate subsidiary ledger postings) is as follows:

Materials Control (spoiled goods at current net disposal value): 5 units × $600 per unit	3,000	
Work-in-Process Control (specific job): 5 units × $600 per unit		3,000

Note, the Work-in-Process Control (specific job) has already been debited (charged) $10,000 for the spoiled parts (5 spoiled parts × $2,000 per part). The net cost of normal spoilage = $7,000 ($10,000 − $3,000), which is an additional cost of the 45 (50 − 5) good units produced. Therefore, total cost of the 45 good units is $97,000: $90,000 (45 units × $2,000 per unit) incurred to produce the good units plus the $7,000 net cost of normal spoilage. Cost per good unit is $2,155.56 ($97,000 ÷ 45 good units).

Normal Spoilage Common to All Jobs

In some cases, spoilage may be considered a normal characteristic of the production process. The spoilage inherent in production will, of course, occur when a specific job is being worked on. But the spoilage is not attributable to, and hence is not charged directly to, the specific job. Instead, the spoilage is allocated indirectly to the job as manufacturing overhead because the spoilage is common to all jobs. The journal entry is as follows:

Materials Control (spoiled goods at current disposal value): 5 units × $600 per unit	3,000	
Manufacturing Overhead Control (normal spoilage): ($10,000 − $3,000)	7,000	
Work-in-Process Control (specific job): 5 units × $2,000 per unit		10,000

When normal spoilage is common to all jobs, the budgeted manufacturing overhead rate includes a provision for normal spoilage cost. Normal spoilage cost is spread, through overhead allocation, over all jobs rather than allocated to a specific job.[5] For example, if Hull produced 140 good units from all jobs in a given month, the $7,000 of normal spoilage overhead costs would be allocated at the rate of $50 per good unit ($7,000 ÷ 140 good units). Normal spoilage overhead costs allocated to the 45 good units in the job would be $2,250 ($50 × 45 good units). Total cost of the 45 good units is $92,250: $90,000 (45 units × $2,000 per unit) incurred to produce the good units plus $2,250 of normal spoilage overhead costs. Cost per good unit is $2,050 ($92,250 ÷ 45 good units).

[5] Note that costs already assigned to products are charged back to Manufacturing Overhead Control, which generally accumulates only costs incurred, not both costs incurred and costs already assigned.

Abnormal Spoilage

If the spoilage is abnormal, the net loss is charged to the Loss from Abnormal Spoilage account. Unlike normal spoilage costs, abnormal spoilage costs are not included as a part of the cost of good units produced. Total cost of the 45 good units is $90,000 (45 units × $2,000 per unit). Cost per good unit is $2,000 ($90,000 ÷ 45 good units).

Materials Control (spoiled goods at current disposal value): 5 units × $600 per unit	3,000	
Loss from Abnormal Spoilage ($10,000 − $3,000)	7,000	
Work-in-Process Control (specific job): 5 units × $2,000 per unit		10,000

Decision Point

How do job-costing systems account for spoilage?

Even though, for external reporting purposes, abnormal spoilage costs are written off in the accounting period and are not linked to specific jobs or units, companies often identify the particular reasons for abnormal spoilage, and, when appropriate, link abnormal spoilage with specific jobs or units for cost management purposes.

Job Costing and Rework

Learning Objective 6

Account for rework in job costing

. . . normal rework assigned directly or indirectly to job; abnormal rework written off as a loss of the period

Rework is units of production that are inspected, determined to be unacceptable, repaired, and sold as acceptable finished goods. We again distinguish (1) normal rework attributable to a specific job, (2) normal rework common to all jobs, and (3) abnormal rework.

Consider the Hull Machine Shop data in Example 3 on page 655. Assume the five spoiled parts are reworked. The journal entry for the $10,000 of total costs (the details of these costs are assumed) assigned to the five spoiled units before considering rework costs is as follows:

Work-in-Process Control (specific job)	10,000	
Materials Control		4,000
Wages Payable Control		4,000
Manufacturing Overhead Allocated		2,000

Assume the rework costs equal $3,800 (comprising $800 direct materials, $2,000 direct manufacturing labor, and $1,000 manufacturing overhead).

Normal Rework Attributable to a Specific Job

If the rework is normal but occurs because of the requirements of a specific job, the rework costs are charged to that job. The journal entry is as follows:

Work-in-Process Control (specific job)	3,800	
Materials Control		800
Wages Payable Control		2,000
Manufacturing Overhead Allocated		1,000

Normal Rework Common to All Jobs

When rework is normal and not attributable to a specific job, the costs of rework are charged to manufacturing overhead and are spread, through overhead allocation, over all jobs.

Manufacturing Overhead Control (rework costs)	3,800	
Materials Control		800
Wages Payable Control		2,000
Manufacturing Overhead Allocated		1,000

Abnormal Rework

If the rework is abnormal, it is recorded by charging abnormal rework to a loss account.

Loss from Abnormal Rework	3,800	
Materials Control		800
Wages Payable Control		2,000
Manufacturing Overhead Allocated		1,000

Accounting for rework in a process-costing system also requires abnormal rework to be distinguished from normal rework. Process costing accounts for abnormal rework in the same way as job costing. Accounting for normal rework follows the accounting described for normal rework common to all jobs (units) because masses of identical or similar units are being manufactured.

Costing rework focuses managers' attention on the resources wasted on activities that would not have to be undertaken if the product had been made correctly. The cost of rework prompts managers to seek ways to reduce rework, for example, by designing new products or processes, training workers, or investing in new machines. To eliminate rework and to simplify the accounting, some companies set a standard of zero rework. All rework is then treated as abnormal and is written off as a cost of the current period.

Decision Point

How do job-costing systems account for rework?

Accounting for Scrap

Scrap is residual material that results from manufacturing a product; it has low total sales value compared with the total sales value of the product. No distinction is made between normal and abnormal scrap because no cost is assigned to scrap. The only distinction made is between scrap attributable to a specific job and scrap common to all jobs.

Learning Objective 7

Account for scrap

. . . reduces cost of job either at time of sale or at time of production

There are two aspects of accounting for scrap:

1. Planning and control, including physical tracking
2. Inventory costing, including when and how scrap affects operating income

Initial entries to scrap records are commonly expressed in physical terms. In various industries, companies quantify items such as stamped-out metal sheets or edges of molded plastic parts by weighing, counting, or some other measure. Scrap records not only help measure efficiency, but also help keep track of scrap, and so reduce the chances of theft. Companies use scrap records to prepare periodic summaries of the amounts of actual scrap compared with budgeted or standard amounts. Scrap is either sold or disposed of quickly or it is stored for later sale, disposal, or reuse.

Careful tracking of scrap often extends into the accounting records. Many companies maintain a distinct account for scrap costs somewhere in their accounting system. The issues here are similar to the issues in Chapter 16 regarding the accounting for byproducts:

- When should the value of scrap be recognized in the accounting records—at the time scrap is produced or at the time scrap is sold?
- How should revenues from scrap be accounted for?

To illustrate, we extend our Hull example. Assume the manufacture of aircraft parts generates scrap and that the scrap from a job has a net sales value of $900.

Recognizing Scrap at the Time of Its Sale

When the dollar amount of scrap is immaterial, the simplest accounting is to record the physical quantity of scrap returned to the storeroom and to regard scrap sales as a separate line item in the income statement. In this case, the only journal entry is as follows:

Sale of scrap:	Cash or Accounts Receivable	900	
	Scrap Revenues		900

When the dollar amount of scrap is material and the scrap is sold quickly after it is produced, the accounting depends on whether the scrap is attributable to a specific job or is common to all jobs.

Scrap Attributable to a Specific Job

Job-costing systems sometimes trace scrap revenues to the jobs that yielded the scrap. This method is used only when the tracing can be done in an economically feasible way. For example, the Hull Machine Shop and its customers, such as the U.S. Department of Defense, may reach an agreement that provides for charging specific jobs with all rework

or spoilage costs and then crediting these jobs with all scrap revenues that arise from the jobs. The journal entry is as follows:

Scrap returned to storeroom:	No journal entry.		
	[Notation of quantity received and related job entered in the inventory record]		
Sale of scrap:	Cash or Accounts Receivable	900	
	Work-in-Process Control		900
	Posting made to specific job cost record.		

Unlike spoilage and rework, there is no cost assigned to the scrap, so no distinction is made between normal and abnormal scrap. All scrap revenues, whatever the amount, are credited to the specific job. Scrap revenues reduce the costs of the job.

Scrap common to all jobs

The journal entry in this case is as follows:

Scrap returned to storeroom:	No journal entry.		
	[Notation of quantity received and related job entered in the inventory record]		
Sale of scrap:	Cash or Accounts Receivable	900	
	Manufacturing Overhead Control		900
	Posting made to subsidiary ledger—"Sales of Scrap" column on department cost record.		

Scrap is not linked with any particular job or product. Instead, all products bear production costs without any credit for scrap revenues except in an indirect manner: Expected scrap revenues are considered when setting the budgeted manufacturing overhead rate. Thus, the budgeted overhead rate is lower than it would be if the overhead budget had not been reduced by expected scrap revenues. This method of accounting for scrap is also used in process costing when the dollar amount of scrap is immaterial, because the scrap in process costing is common to the manufacture of all the identical or similar units produced (and cannot be identified with specific units).

Recognizing Scrap at the Time of Its Production

Our preceding illustrations assume that scrap returned to the storeroom is sold quickly, so it is not assigned an inventory cost figure. Sometimes, as in the case with edges of molded plastic parts, the value of scrap is not immaterial, and the time between storing it and selling or reusing it can be long and unpredictable. In these situations, the company assigns an inventory cost to scrap at a conservative estimate of its net realizable value so that production costs and related scrap revenues are recognized in the same accounting period. Some companies tend to delay sales of scrap until its market price is considered attractive. Volatile price fluctuations are typical for scrap metal. In these cases, it's not easy to determine some "reasonable inventory value."

Scrap Attributable to a Specific Job

The journal entry in the Hull example is as follows:

Scrap returned to storeroom:	Materials Control	900	
	Work-in-Process Control		900

Scrap Common to All Jobs

The journal entry in this case is as follows:

Scrap returned to storeroom:	Materials Control	900	
	Manufacturing Overhead Control		900

Observe that the Materials Control account is debited in place of Cash or Accounts Receivable. When the scrap is sold, the journal entry is as follows:

Sale of scrap:	Cash or Accounts Receivable	900	
	Materials Control		900

Concepts in Action

Managing Waste and Environmental Costs at KB Home

KB Home is one of the largest home builders in the United States. In recent years, public awareness of environmental issues and interest in environmentally-friendly products and services has led to increased demand for sustainable home construction. KB Home has responded by increasing the sustainability of its homebuilding operations, which includes reducing its waste and environmental costs.

Through its "My Home. My Earth." program, launched in 2007, KB Home has established environmental sustainability as top-priority management issue. It developed core principles to guide its efforts including using "innovation and our process-driven approach to reduce waste and natural resource usage throughout our organization." Much of that focus involves reducing scrap, the residual materials that result from its homebuilding processes. These materials pose additional problems for companies like KB Home, because many federal and state environmental laws dictate that scrap materials be deposed of in an environmentally friendly way; therefore, they add to the cost of generating waste.

To reduce these costs during the homebuilding process, all new homes are built with pre-engineered roof trusses, while 90% also use preconstructed panels. These preconstructed materials are cut offsite for greater precision, which reduces wood waste. Further, these precut materials are made of engineered wood products, which reduce the use of long solid boards that require larger trees to be cut. Beyond scrap reduction, these trusses and panels also eliminate the need for costly job-site rework, or the repair of defective materials during construction.

Similarly, all new homes use oriented strand board, which is made from wood chip rather than plywood. Wood chip is both cheaper and more environmentally sustainable than traditional construction materials. These sustainable practices helped KB Home reduce the cost, exclusive of land, of each home manufactured in 2009 by nearly 39% over the previous year, while increasing profit margins by 13% despite the broader U.S. housing market collapse.

Beyond the construction process, KB Home also includes earth-friendly standard features in all of its homes, at no cost to homebuyers, including energy-efficient windows, recyclable carpets, programmable thermostats, and faucets that reduce water usage. Beyond cutting costs, KB Home's efforts to effectively manage waste and environmental costs have helped the company partially stabilize revenues in a difficult real-estate market. Chief executive Jeffrey Mazger said, "Less than 2% of customers a few years ago were asking about energy-efficient options. Since we introduced 'My Home. My Earth.' in April 2007, it's gone up to 75%." This has helped KB Home differentiate itself within a very competitive market for homebuilders.

Sources: KB Home. 2010. 2009 annual report. Los Angeles: KB Home; KB Home. 2010. 2009 sustainability report. Los Angeles: KB Home; Tischler, Linda. 2008. The green housing boom. *Fast Company*, June 23.

Scrap is sometimes reused as direct material rather than sold as scrap. In this case, Materials Control is debited at its estimated net realizable value and then credited when the scrap is reused. For example, the entries when the scrap is common to all jobs are as follows:

Scrap returned to storeroom:	Materials Control	900	
	Manufacturing Overhead Control		900
Reuse of scrap:	Work-in-Process Control	900	
	Materials Control		900

Accounting for scrap under process costing is similar to accounting under job costing when scrap is common to all jobs. That's because the scrap in process costing is common to the manufacture of masses of identical or similar units.

Managers focus their attention on ways to reduce scrap and to use it more profitably, especially when the cost of scrap is high (see Concepts in Action on p. 659). For example, General Motors has redesigned its plastic injection molding processes to reduce the scrap plastic that must be broken away from its molded products. General Motors also regrinds and reuses the plastic scrap as direct material, saving substantial input costs.

Decision Point

How is scrap accounted for?

Problem for Self-Study

Burlington Textiles has some spoiled goods that had an assigned cost of $40,000 and zero net disposal value.

Required

Prepare a journal entry for each of the following conditions under (a) process costing (department A) and (b) job costing:

1. Abnormal spoilage of $40,000
2. Normal spoilage of $40,000 regarded as common to all operations
3. Normal spoilage of $40,000 regarded as attributable to specifications of a particular job

Solution

	(a) Process Costing			(b) Job Costing		
1.	Loss from Abnormal Spoilage	40,000		Loss from Abnormal Spoilage	40,000	
	Work in Process—Dept. A		40,000	Work-in-Process Control (specific job)		40,000
2.	No entry until units are completed and transferred out. Then the normal spoilage costs are transferred as part of the cost of good units.			Manufacturing Overhead Control	40,000	
				Work-in-Process Control (specific job)		40,000
	Work in Process—Dept. B	40,000				
	Work in Process—Dept. A		40,000			
3.	Not applicable			No entry. Normal spoilage cost remains in Work-in-Process Control (specific job)		

Decision Points

The following question-and-answer format summarizes the chapter's learning objectives. Each decision presents a key question related to a learning objective. The guidelines are the answer to that question.

Decision	Guidelines
1. What are spoilage, rework, and scrap?	Spoilage is units of production that do not meet the specifications required by customers for good units and that are discarded or sold at reduced prices. Spoilage is generally divided into normal spoilage, which is inherent to a particular production process, and abnormal spoilage, which arises because of inefficiency in operations. Rework is unacceptable units that are subsequently repaired and sold as acceptable finished goods. Scrap is residual material that results from manufacturing a product; it has low total sales value compared with the total sales value of the product.
2. What is the distinction between normal and abnormal spoilage?	Normal spoilage is inherent in a particular production process and arises when the process is operated in an efficient manner. Abnormal spoilage on the other hand is not inherent in a particular production process and would not arise under efficient operating conditions. Abnormal spoilage is usually regarded as avoidable and controllable.
3. How do the weighted-average and FIFO methods of process costing calculate the costs of good units and spoilage?	The weighted-average method combines costs in beginning inventory with costs of the current period when determining the costs of good units, which include normal spoilage, and the costs of abnormal spoilage, which are written off as a loss of the accounting period.

	The FIFO method keeps separate the costs in beginning inventory from the costs of the current period when determining the costs of good units (which include normal spoilage) and the costs of abnormal spoilage, which are written off as a loss of the accounting period.
4. How does inspection at various stages of completion affect the amount of normal and abnormal spoilage?	The cost of spoiled units is assumed to equal all costs incurred in producing spoiled units up to the point of inspection. Spoilage costs therefore vary based on different inspection points.
5. How do job-costing systems account for spoilage?	Normal spoilage specific to a job is assigned to that job, or when common to all jobs, is allocated as part of manufacturing overhead. Cost of abnormal spoilage is written off as a loss of the accounting period.
6. How do job-costing systems account for rework?	Completed reworked units should be indistinguishable from non-reworked good units. Normal rework specific to a job is assigned to that job, or when common to all jobs, is allocated as part of manufacturing overhead. Cost of abnormal rework is written off as a loss of the accounting period.
7. How is scrap accounted for?	Scrap is recognized in the accounting records either at the time of its sale or at the time of its production. Sale of scrap, if immaterial, is often recognized as other revenue. If not immaterial, sale of scrap or its net realizable value reduces the cost of a specific job or, when common to all jobs, reduces Manufacturing Overhead Control.

Appendix

Standard-Costing Method and Spoilage

The standard-costing method simplifies the computations for normal and abnormal spoilage. To illustrate, we return to the Anzio Company example in the chapter. Suppose Anzio develops the following standard costs per unit for work done in the forming department in July 2012:

Direct materials	$ 8.50
Conversion costs	10.50
Total manufacturing cost	$19.00

Assume the same standard costs per unit also apply to the beginning inventory: 1,500 (1,500 × 100%) equivalent units of direct materials and 900 (1,500 × 60%) equivalent units of conversion costs. Hence, the beginning inventory at standard costs is as follows:

Direct materials, 1,500 units × $8.50 per unit	$12,750
Conversion costs, 900 units × $10.50 per unit	9,450
Total manufacturing costs	$22,200

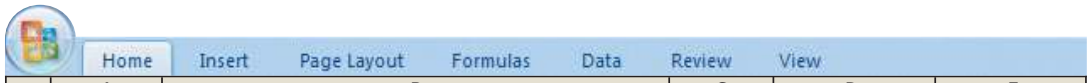
Exhibit 18-5, Panel A, presents Steps 1 and 2 for calculating physical and equivalent units. These steps are the same as for the FIFO method described in Exhibit 18-3. Exhibit 18-5, Panel B, presents Steps 3, 4, and 5.

The costs to account for in Step 3 are at standard costs and, hence, they differ from the costs to account for under the weighted-average and FIFO methods, which are at actual costs. In Step 4, cost per equivalent unit is simply the standard cost: $8.50 per unit for direct materials and $10.50 per unit for conversion costs. The standard-costing method makes calculating equivalent-unit costs unnecessary, so it simplifies process costing. Step 5 assigns standard costs to units completed (including normal spoilage), to abnormal spoilage, and to ending work-in-process inventory by multiplying the equivalent units calculated in Step 2 by the standard costs per equivalent unit presented in Step 4. Variances can then be measured and analyzed in the manner described in the appendix to Chapter 17 (pp. 634–635).[6]

[6] For example, from Exhibit 18-5, Panel B, the standard costs for July are direct materials used, 8,500 × $8.50 = $72,250, and conversion costs, 8,100 × $10.50 = $85,050. From page 648, the actual costs added during July are direct materials, $76,500, and conversion costs, $89,100, resulting in a direct materials variance of $72,250 – $76,500 = $4,250 U and a conversion costs variance of $85,050 – $89,100 = $4,050 U. These variances could then be subdivided further as in Chapters 7 and 8; the abnormal spoilage would be part of the efficiency variance.

Exhibit 18-5 Standard-Costing Method of Process Costing with Spoilage for Forming Department of the Anzio Company for July 2012

PANEL A: Steps 1 and 2—Summarize Output in Physical Units and Compute Equivalent Units



	A	B	C	D	E
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. 648)	1,500		
5		Started during current period (given, p. 648)	8,500		
6		To account for	10,000		
7		Good units completed and transferred out during current period:			
8		From beginning work in process[a]	1,500		
9		[1,500 × (100% – 100%); 1,500 × (100% – 60%)]		0	600
10		Started and completed	5,500[b]		
11		(5,500 × 100%; 5,500 × 100%)		5,500	5,500
12		Normal spoilage[c]	700		
13		(700 × 100%; 700 × 100%)		700	700
14		Abnormal spoilage[d]	300		
15		(300 × 100%; 300 × 100%)		300	300
16		Work in process, ending[e] (given, p. 648)	2,000		
17		(2,000 × 100%; 2,000 × 50%)		2,000	1,000
18		Accounted for	10,000		
19		Equivalent units of work done in current period		8,500	8,100
20					
21	[a]Degree of completion in this department: direct materials, 100%; conversion costs, 60%.				
22	[b]7,000 physical units completed and transferred out minus 1,500 physical units completed and transferred out from beginning				
23	work-in-process inventory.				
24	[c]Normal spoilage is 10% of good units transferred out: 10% × 7,000 = 700 units. Degree of completion of normal spoilage in this				
25	department: direct materials, 100%; conversion costs, 100%.				
26	[d]Abnormal spoilage = Actual spoilage – Normal spoilage = 1,000 – 700 = 300 units. Degree of completion of abnormal spoilage in this				
27	department: direct materials, 100%; conversion costs, 100%.				
28	[e]Degree of completion in this department: direct materials, 100%; conversion costs, 50%.				

PANEL B: Steps 3, 4, and 5—Summarize Total Costs to Account for, Compute Cost per Equivalent Unit, and Assign Total Costs to Units Completed, to Spoiled Units, and to Units in Ending Work in Process

	A	B	C	D	E
30			Total Production Costs	Direct Materials	Conversion Costs
31	(Step 3)	Work in process, beginning (given, p. 661)	$ 22,200	(1,500 × $8.50)	(900 × $10.50)
32		Costs added in current period at standard prices	157,300	(8,500 × $8.50)	(8,100 × $10.50)
33		Total costs to account for	$179,500	$85,000	$94,500
34	(Step 4)	Standard costs per equivalent unit (given, p. 661)	$ 19.00	$ 8.50	$ 10.50
35	(Step 5)	Assignment of costs at standard costs:			
36		Good units completed and transferred out (7,000 units)			
37		Work in process, beginning (1,500 units)	$ 22,200	(1,500 × $8.50) +	(900 × $10.50)
38		Costs added to beginning work in process in current period	6,300	(0[f] × $8.50) +	(600[f] × $10.50)
39		Total from beginning inventory before normal spoilage	28,500		
40		Started and completed before normal spoilage (5,500 units)	104,500	(5,500[f] × $8.50) +	(5,500[f] × $10.50)
41		Normal spoilage (700 units)	13,300	(700[f] × $8.50) +	(700[f] × $10.50)
42	(A)	Total costs of good units completed and transferred out	146,300		
43	(B)	Abnormal spoilage (300 units)	5,700	(300[f] × $8.50) +	(300[f] × $10.50)
44	(C)	Work in process, ending (2,000 units)	27,500	(2,000[f] × $8.50) +	(1,000[f] × $10.50)
45	(A)+(B)+(C)	Total costs accounted for	$179,500	$85,000 +	$94,500
46					
47	[f]Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A.				

Finally, note that the journal entries corresponding to the amounts calculated in Step 5 are as follows:

Finished Goods	146,300	
Work in Process—Forming		146,300
To record transfer of good units completed in July.		
Loss from Abnormal Spoilage	5,700	
Work in Process—Forming		5,700
To record abnormal spoilage detected in July.		

Terms to Learn

This chapter and the Glossary at the end of the book contain definitions of the following important terms:

abnormal spoilage (**p. 646**)
inspection point (**p. 647**)
normal spoilage (**p. 646**)
rework (**p. 645**)
scrap (**p. 645**)
spoilage (**p. 645**)

Assignment Material

Questions

MyAccountingLab

18-1 Why is there an unmistakable trend in manufacturing to improve quality?
18-2 Distinguish among spoilage, rework, and scrap.
18-3 "Normal spoilage is planned spoilage." Discuss.
18-4 "Costs of abnormal spoilage are losses." Explain.
18-5 "What has been regarded as normal spoilage in the past is not necessarily acceptable as normal spoilage in the present or future." Explain.
18-6 "Units of abnormal spoilage are inferred rather than identified." Explain.
18-7 "In accounting for spoiled units, we are dealing with cost assignment rather than cost incurrence." Explain.
18-8 "Total input includes abnormal as well as normal spoilage and is, therefore, inappropriate as a basis for computing normal spoilage." Do you agree? Explain.
18-9 "The inspection point is the key to the allocation of spoilage costs." Do you agree? Explain.
18-10 "The unit cost of normal spoilage is the same as the unit cost of abnormal spoilage." Do you agree? Explain.
18-11 "In job costing, the costs of normal spoilage that occur while a specific job is being done are charged to the specific job." Do you agree? Explain.
18-12 "The costs of rework are always charged to the specific jobs in which the defects were originally discovered." Do you agree? Explain.
18-13 "Abnormal rework costs should be charged to a loss account, not to manufacturing overhead." Do you agree? Explain.
18-14 When is a company justified in inventorying scrap?
18-15 How do managers use information about scrap?

Exercises

MyAccountingLab

18-16 **Normal and abnormal spoilage in units.** The following data, in physical units, describe a grinding process for January:

Work in process, beginning	19,000
Started during current period	150,000
To account for	169,000
Spoiled units	12,000
Good units completed and transferred out	132,000
Work in process, ending	25,000
Accounted for	169,000

Inspection occurs at the 100% completion stage. Normal spoilage is 5% of the good units passing inspection.

Required

1. Compute the normal and abnormal spoilage in units.
2. Assume that the equivalent-unit cost of a spoiled unit is $10. Compute the amount of potential savings if all spoilage were eliminated, assuming that all other costs would be unaffected. Comment on your answer.

18-17 Weighted-average method, spoilage, equivalent units. (CMA, adapted) Consider the following data for November 2012 from Gray Manufacturing Company, which makes silk pennants and uses a process-costing system. All direct materials are added at the beginning of the process, and conversion costs are added evenly during the process. Spoilage is detected upon inspection at the completion of the process. Spoiled units are disposed of at zero net disposal value. Gray Manufacturing Company uses the weighted-average method of process costing.

	Physical Units (Pennants)	Direct Materials	Conversion Costs
Work in process, November 1[a]	1,000	$ 1,423	$ 1,110
Started in November 2012	?		
Good units completed and transferred out during November 2012	9,000		
Normal spoilage	100		
Abnormal spoilage	50		
Work in process, November 30[b]	2,000		
Total costs added during November 2012		$12,180	$27,750

[a]Degree of completion: direct materials, 100%; conversion costs, 50%.
[b]Degree of completion: direct materials, 100%; conversion costs, 30%.

Required Compute equivalent units for direct materials and conversion costs. Show physical units in the first column of your schedule.

18-18 Weighted-average method, assigning costs (continuation of 18-17).

Required For the data in Exercise 18-17, summarize total costs to account for; calculate the cost per equivalent unit for direct materials and conversion costs; and assign total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process.

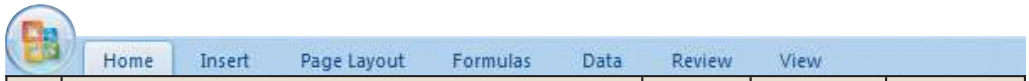
18-19 FIFO method, spoilage, equivalent units. Refer to the information in Exercise 18-17. Suppose Gray Manufacturing Company uses the FIFO method of process costing instead of the weighted-average method.

Required Compute equivalent units for direct materials and conversion costs. Show physical units in the first column of your schedule.

18-20 FIFO method, assigning costs (continuation of 18-19).

Required For the data in Exercise 18-17, use the FIFO method to summarize total costs to account for; calculate the cost per equivalent unit for direct materials and conversion costs; and assign total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process.

18-21 Weighted-average method, spoilage. Appleton Company makes wooden toys in its forming department, and it uses the weighted-average method of process costing. All direct materials are added at the beginning of the process, and conversion costs are added evenly during the process. Spoiled units are detected upon inspection at the end of the process and are disposed of at zero net disposal value. Summary data for August 2012 are as follows:



	A	B	C	D
1		Physical Units	Direct Materials	Conversion Costs
2	Work in process, beginning inventory (August 1)	2,000	$17,700	$10,900
3	Degree of completion of beginning work in process		100%	50%
4	Started during August	10,000		
5	Good units completed and transferred out during August	9,000		
6	Work in process, ending inventory (August 31)	1,800		
7	Degree of completion of ending work in process		100%	75%
8	Total costs added during August		$81,300	$93,000
9	Normal spoilage as a percentage of good units	10%		
10	Degree of completion of normal spoilage		100%	100%
11	Degree of completion of abnormal spoilage		100%	100%

Required

1. For each cost category, calculate equivalent units. Show physical units in the first column of your schedule.
2. Summarize total costs to account for; calculate cost per equivalent unit for each cost category; and assign total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process.

18-22 Standard costing method, spoilage, journal entries. Jordan, Inc., is a manufacturer of vents for water heaters. The company uses a process-costing system to account for its work-in-process inventories. When Job 512 was being processed in the machining department, a piece of sheet metal was off center in the bending machine and two vents were spoiled. Because this problem occurs periodically, it is considered normal spoilage and is consequently recorded as an overhead cost. Because this step comes first in the procedure for making the vents, the only costs incurred were $475 for direct materials. Assume the sheet metal cannot be sold, and its cost has been recorded in work-in-process inventory.

Required

Prepare the journal entries to record the spoilage incurred.

18-23 Recognition of loss from spoilage. Arokia Electronics manufactures cell phone models in its Walnut Creek plant. Suppose the company provides you with the following information regarding operations for September 2011:

Total cell phones manufactured	8,000
Phones rejected as spoiled units	300
Total manufacturing cost	$320,000

Assume the spoiled units have no disposal value.

Required

1. What is the unit cost of making the 8,000 cell phones?
2. What is the total cost of the 300 spoiled units?
3. If the spoilage is considered normal, what is the increase in the unit cost of good phones manufactured as a result of the spoilage?
4. If the spoilage is considered abnormal, prepare the journal entries for the spoilage incurred.

18-24 Weighted-average method, spoilage. Chipcity is a fast-growing manufacturer of computer chips. Direct materials are added at the start of the production process. Conversion costs are added evenly during the process. Some units of this product are spoiled as a result of defects not detectable before inspection of finished goods. Spoiled units are disposed of at zero net disposal value. Chipcity uses the weighted-average method of process costing.

Summary data for September 2011 are as follows:

	A	B	C	D
1		**Physical Units (Computer Chips)**	**Direct Materials**	**Conversion Costs**
2	Work in process, beginning inventory (September 1)	600	$ 96,000	$ 15,300
3	Degree of completion of beginning work in process		100%	30%
4	Started during September	2,550		
5	Good units completed and transferred out during September	2,100		
6	Work in process, ending inventory (September 30)	450		
7	Degree of completion of ending work in process		100%	40%
8	Total costs added during September		$567,000	$230,400
9	Normal spoilage as a percentage of good units	15%		
10	Degree of completion of normal spoilage		100%	100%
11	Degree of completion of abnormal spoilage		100%	100%

Required

1. For each cost category, compute equivalent units. Show physical units in the first column of your schedule.
2. Summarize total costs to account for; calculate cost per equivalent unit for each cost category; and assign total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process.

18-25 FIFO method, spoilage. Refer to the information in Exercise 18-24.

Required Do Exercise 18-24 using the FIFO method of process costing.

18-26 Standard-costing method, spoilage. Refer to the information in Exercise 18-24. Suppose Chipcity determines standard costs of $200 per equivalent unit for direct materials and $75 per equivalent unit for conversion costs for both beginning work in process and work done in the current period.

Required Do Exercise 18-24 using the standard-costing method.

18-27 Spoilage and job costing. (L. Bamber) Barrett Kitchens produces a variety of items in accordance with special job orders from hospitals, plant cafeterias, and university dormitories. An order for 2,100 cases of mixed vegetables costs $9 per case: direct materials, $4; direct manufacturing labor, $3; and manufacturing overhead allocated, $2. The manufacturing overhead rate includes a provision for normal spoilage. Consider each requirement independently.

Required

1. Assume that a laborer dropped 420 cases. Suppose part of the 420 cases could be sold to a nearby prison for $420 cash. Prepare a journal entry to record this event. Calculate and explain briefly the unit cost of the remaining 1,680 cases.
2. Refer to the original data. Tasters at the company reject 420 of the 2,100 cases. The 420 cases are disposed of for $840. Assume that this rejection rate is considered normal. Prepare a journal entry to record this event, and do the following:
   a. Calculate the unit cost if the rejection is attributable to exacting specifications of this particular job.
   b. Calculate the unit cost if the rejection is characteristic of the production process and is not attributable to this specific job.
   c. Are unit costs the same in requirements 2a and 2b? Explain your reasoning briefly.
3. Refer to the original data. Tasters rejected 420 cases that had insufficient salt. The product can be placed in a vat, salt can be added, and the product can be reprocessed into jars. This operation, which is considered normal, will cost $420. Prepare a journal entry to record this event and do the following:
   a. Calculate the unit cost of all the cases if this additional cost was incurred because of the exacting specifications of this particular job.
   b. Calculate the unit cost of all the cases if this additional cost occurs regularly because of difficulty in seasoning.
   c. Are unit costs the same in requirements 3a and 3b? Explain your reasoning briefly.

18-28 Reworked units, costs of rework. White Goods assembles washing machines at its Auburn plant. In February 2012, 60 tumbler units that cost $44 each (from a new supplier who subsequently went bankrupt) were defective and had to be disposed of at zero net disposal value. White Goods was able to rework all 60 washing machines by substituting new tumbler units purchased from one of its existing suppliers. Each replacement tumbler cost $50.

Required

1. What alternative approaches are there to account for the material cost of reworked units?
2. Should White Goods use the $44 tumbler or the $50 tumbler to calculate the cost of materials reworked? Explain.
3. What other costs might White Goods include in its analysis of the total costs of rework due to the tumbler units purchased from the (now) bankrupt supplier?

18-29 Scrap, job costing. The Morgan Company has an extensive job-costing facility that uses a variety of metals. Consider each requirement independently.

Required

1. Job 372 uses a particular metal alloy that is not used for any other job. Assume that scrap is material in amount and sold for $520 quickly after it is produced. Prepare the journal entry.
2. The scrap from Job 372 consists of a metal used by many other jobs. No record is maintained of the scrap generated by individual jobs. Assume that scrap is accounted for at the time of its sale. Scrap totaling $4,400 is sold. Prepare two alternative journal entries that could be used to account for the sale of scrap.
3. Suppose the scrap generated in requirement 2 is returned to the storeroom for future use, and a journal entry is made to record the scrap. A month later, the scrap is reused as direct material on a subsequent job. Prepare the journal entries to record these transactions.

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Problems

18-30 Weighted-average method, spoilage. The Boston Company is a food-processing company based in San Francisco. It operates under the weighted-average method of process costing and has two departments: cleaning and packaging. For the cleaning department, conversion costs are added evenly during the process, and direct materials are added at the beginning of the process. Spoiled units are detected upon inspection at the end of the process and are disposed of at zero net disposal value. All completed work is transferred to the packaging department. Summary data for May follow:

	A	B	C	D
1	**The Boston Company: Cleaning Department**	**Physical Units**	**Direct Materials**	**Conversion Costs**
2	Work in process, beginning inventory (May 1)	3,000	$ 4,500	$ 2,700
3	Degree of completion of beginning work in process		100%	60%
4	Started during May	25,000		
5	Good units completed and transferred out during May	20,500		
6	Work in process, ending inventory (May 31)	4,200		
7	Degree of completion of ending work in process		100%	30%
8	Total costs added during May		$46,250	$37,216
9	Normal spoilage as a percentage of good units	10%		
10	Degree of completion of normal spoilage		100%	100%
11	Degree of completion of abnormal spoilage		100%	100%

For the cleaning department, summarize total costs to account for and assign total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process. Carry unit-cost calculations to four decimal places when necessary. Calculate final totals to the nearest dollar. (Problem 18-32 explores additional facets of this problem.) **Required**

18-31 FIFO method, spoilage. Refer to the information in Problem 18-30.

Do Problem 18-30 using the FIFO method of process costing. (Problem 18-33 explores additional facets of this problem.) **Required**

18-32 Weighted-average method, packaging department (continuation of 18-30). In Boston Company's packaging department, conversion costs are added evenly during the process, and direct materials are added at the end of the process. Spoiled units are detected upon inspection at the end of the process and are disposed of at zero net disposal value. All completed work is transferred to the next department. The transferred-in costs for May equal the total cost of good units completed and transferred out in May from the cleaning department, which were calculated in Problem 18-30 using the weighted-average method of process costing. Summary data for May follow.

	A	B	C	D	E
1	**The Boston Company: Packaging Department**	**Physical Units**	**Transferred-In Costs**	**Direct Materials**	**Conversion Costs**
2	Work in process, beginning inventory (May 1)	10,500	$39,460	$ 0	$14,700
3	Degree of completion of beginning work in process		100%	0%	70%
4	Started during May	20,500			
5	Good units completed and transferred out during May	22,000			
6	Work in process, ending inventory (May 31)	7,000			
7	Degree of completion of ending work in process		100%	0%	40%
8	Total costs added during May		?	$4,800	$38,900
9	Normal spoilage as a percentage of good units	8%			
10	Degree of completion of normal spoilage			100%	100%
11	Degree of completion of abnormal spoilage			100%	100%

For the packaging department, use the weighted-average method to summarize total costs to account for and assign total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process. **Required**

18-33 FIFO method, packaging department (continuation of 18-31). Refer to the information in Problem 18-32 except for the transferred-in costs for May, which equal the total cost of good units completed and transferred out in May from the cleaning department, which were calculated in Problem 18-31 using the FIFO method of process costing.

Required For the packaging department, use the FIFO method to summarize total costs to account for and assign total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process.

18-34 Job-costing spoilage and scrap. MetalWorks, Inc., manufactures various metal parts in batches as ordered by customers, and accounts for them using job costing. Job 2346-8, a large job for customer X, incurred $240,000 of direct materials costs and $620,000 of direct labor costs. MetalWorks applies overhead at a rate of 150% of direct labor cost. MetalWorks quoted customer X a fixed price for the job of $2,000,000. The job consisted of 90,000 good units and 10,000 spoiled units with no rework or disposal value. The job also created 200 pounds of scrap which can be sold for $3 per pound.

1. Calculate the gross margin MetalWorks will earn for this job, assuming the scrap sale is treated as material, and
   - **a.** all spoilage is considered abnormal.
   - **b.** normal spoilage is 8% of good units.
   - **c.** normal spoilage is 12% of good units.
2. How would your answer to number 1 differ if the scrap sale is treated as immaterial?

18-35 Spoilage in job costing. Crystal Clear Machine Shop is a manufacturer of motorized carts for vacation resorts.

Peter Cruz, the plant manager of Crystal Clear, obtains the following information for Job #10 in August 2010. A total of 32 units were started, and 7 spoiled units were detected and rejected at final inspection, yielding 25 good units. The spoiled units were considered to be normal spoilage. Costs assigned prior to the inspection point are $1,450 per unit. The current disposal price of the spoiled units is $230 per unit. When the spoilage is detected, the spoiled goods are inventoried at $230 per unit.

Required

1. What is the normal spoilage rate?
2. Prepare the journal entries to record the normal spoilage, assuming the following:
   - **a.** The spoilage is related to a specific job.
   - **b.** The spoilage is common to all jobs.
   - **c.** The spoilage is considered to be abnormal spoilage.

18-36 Rework in job costing, journal entry (continuation of 18-35). Assume that the 7 spoiled units of Whitefish Machine Shop's Job #10 can be reworked for a total cost of $1,700. A total cost of $10,150 associated with these units has already been assigned to Job #10 before the rework.

Required Prepare the journal entries for the rework, assuming the following:

- **a.** The rework is related to a specific job.
- **b.** The rework is common to all jobs.
- **c.** The rework is considered to be abnormal.

18-37 Scrap at time of sale or at time of production, journal entries (continuation of 18-35). Assume that Job #10 of Crystal Clear Machine Shop generates normal scrap with a total sales value of $650 (it is assumed that the scrap returned to the storeroom is sold quickly).

Required Prepare the journal entries for the recognition of scrap, assuming the following:

- **a.** The value of scrap is immaterial and scrap is recognized at the time of sale.
- **b.** The value of scrap is material, is related to a specific job, and is recognized at the time of sale.
- **c.** The value of scrap is material, is common to all jobs, and is recognized at the time of sale.
- **d.** The value of scrap is material, and scrap is recognized as inventory at the time of production and is recorded at its net realizable value.

18-38 Physical units, inspection at various stages of completion. Fantastic Furniture manufactures plastic lawn furniture in a continuous process. The company pours molten plastic into molds and then cools the plastic. Materials are added at the beginning of the process, and conversion is considered uniform through the period. Occasionally, the plastic does not completely fill a mold because of air pockets, and the chair is then considered spoiled. Normal spoilage is 6% of the good units that pass inspection. The following information pertains to March, 2011:

Beginning inventory	1,400 units (100% complete for materials; 20% complete for conversion costs)
Units started	12,000
Units in ending work in process	1,100 (100% complete for materials; 70% complete for conversion costs)

Fantastic Furniture had 1,000 spoiled units in March, 2011.

Required Using the format on page 653, compute the normal and abnormal spoilage in units, assuming the inspection point is at (a) the 15% stage of completion, (b) the 40% stage of completion, and (c) the 100% stage of completion.

18-39 Weighted-average method, inspection at 80% completion. (A. Atkinson) The Kim Company is a furniture manufacturer with two departments: molding and finishing. The company uses the weighted-average method of process costing. In August, the following data were recorded for the finishing department:

Units of beginning work in process inventory	12,500
Percentage completion of beginning work in process units	25%
Cost of direct materials in beginning work in process	$0
Units started	87,500
Units completed	62,500
Units in ending inventory	25,000
Percentage completion of ending work in process units	95%
Spoiled units	12,500
Total costs added during current period:	
Direct materials	$819,000
Direct manufacturing labor	$794,500
Manufacturing overhead	$770,000
Work in process, beginning:	
Transferred-in costs	$103,625
Conversion costs	$52,500
Cost of units transferred in during current period	$809,375

Conversion costs are added evenly during the process. Direct material costs are added when production is 90% complete. The inspection point is at the 80% stage of production. Normal spoilage is 10% of all good units that pass inspection. Spoiled units are disposed of at zero net disposal value.

Required

For August, summarize total costs to account for and assign these costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process.

18-40 Job costing, rework. Riposte Corporation manufactures a computer chip called XD1. Manufacturing costs of one XD1 chip, excluding rework costs, are direct materials, $60; direct manufacturing labor, $12; and manufacturing overhead, $38. At the inspection point, defective units are sent back for rework. Rework costs per XD1 chip are direct materials, $12; direct manufacturing labor, $9; and manufacturing overhead, $15.

In August 2011, Riposte manufactured 1,000 XD1 chips, 80 of which required rework. Of these 80 chips, 50 were considered normal rework common to all jobs and the other 30 were considered abnormal rework.

Required

1. Prepare journal entries to record the accounting for both the normal and abnormal rework.
2. What were the total rework costs of XD1 chips in August 2011?
3. Now assume instead that the normal rework is attributable entirely to job #3879, for 200 units of XD1. In this case, what would be the total and unit cost of the good units produced for that job in August 2011? Prepare journal entries for the manufacture of the 200 units, as well as the normal rework costs.

Collaborative Learning Problem

18-41 Physical units, inspection at various levels of completion, weighted-average process costing report. Lester Company makes metal products and has a forging department. In this department, materials are added at the beginning of the process and conversion takes place uniformly. At the start of November 2011, the forging department had 20,000 units in beginning work in process, which are 100% complete for materials and 40% complete for conversion costs. An additional 100,000 units are started in the department in November, and 30,000 units remain in work in process at the end of the month. These unfinished units are 100% complete for materials and 70% complete for conversion costs.

The forging department had 15,000 spoiled units in November. Normal spoilage is 12% of good units. The department's costs for the month of November are as follows:

	Beginning WIP	Costs Incurred During Period
Direct materials costs	$ 64,000	$ 200,000
Conversion costs	102,500	1,000,000

Required

1. Using the format on page 653, compute the normal and abnormal spoilage in units for November, assuming the inspection point is at (a) the 30% stage of completion, (b) the 60% stage of completion, and (c) the 100% stage of completion.
2. Refer to your answer in requirement 1. Why are there different amounts of normal and abnormal spoilage at different inspection points?
3. Now assume that the forging department inspects at the 60% stage of completion. Using the weighted-average method, calculate the cost of units transferred out, the cost of abnormal spoilage, and the cost of ending inventory for the forging department in November.