CHAPTER 18

**SPOILAGE, REWORK, AND SCRAP**

**18-1** Managers have found that improved quality and intolerance for high spoilage have lowered overall costs and increased sales.

**18-2** Spoilage—units of production that do not meet the standards required by customers for good units and that are discarded or sold at reduced prices.

Rework—units of production that do not meet the specifications required by customers but that are subsequently repaired and sold as good finished units.

Scrap—residual material that results from manufacturing a product. It has low total sales value compared to the total sales value of the product.

**18-3** Yes. Normal spoilage is spoilage inherent in a particular production process that arises even under efficient operating conditions. Management decides the spoilage rate it considers normal depending on the production process.

**18-4** Abnormal spoilage is spoilage that is not inherent in a particular production process and would not arise under efficient operating conditions. Costs of abnormal spoilage are “lost costs,” measures of inefficiency that should be written off directly as losses for the accounting period.

**18-5** Management effort can affect the spoilage rate. Many companies are relentlessly reducing their rates of normal spoilage, spurred on by competitors who, likewise, are continuously reducing costs.

**18-6** Normal spoilage typically is expressed as a percentage of good units passing the inspection point. Given actual spoiled units, we infer abnormal spoilage as follows:

Abnormal spoilage = Actual spoilage – Normal spoilage.

**18-7** Accounting for spoiled goods deals with cost assignment, rather than with cost incurrence, because the existence of spoiled goods does not involve any additional cost beyond the amount already incurred.

**18-8** Yes. Normal spoilage rates should be computed from the good output or from the *normal* input, not the *total* input. Normal spoilage is a given percentage of a certain output base. This base should never include abnormal spoilage, which is included in total input. Abnormal spoilage does not vary in direct proportion to units produced and to include it would cause the normal spoilage count to fluctuate irregularly and not vary in direct proportion to the output base.

**18-9** Yes, the point of inspection is the key to the assignment of spoilage costs. Normal spoilage costs do not attach solely to units transferred out. Thus, if units in ending work in process have passed inspection, they should have normal spoilage costs added to them.

**18-10** No. If abnormal spoilage is detected at a different point in the production cycle than normal spoilage, then unit costs would differ. If, however, normal and abnormal spoilage are detected at the same point in the production cycle, their unit costs would be the same.

**18-11** No. Spoilage may be considered a normal characteristic of a given production cycle. The costs of normal spoilage caused by a random malfunction of a machine would be charged as a part of the manufacturing overhead allocated to all jobs. Normal spoilage attributable to a specific job is charged to that job.

**18-12**  No. Unless there are special reasons for charging normal rework to jobs that contained the bad units, the costs of extra materials, labor, and so on are usually charged to manufacturing overhead and allocated to all jobs.

**18-13** Yes. Abnormal rework is a loss just like abnormal spoilage. By charging it to manufacturing overhead, the abnormal rework costs are spread over other jobs and also included in inventory to the extent a job is not complete. Abnormal rework is rework over and above what is expected during a period and is recognized as a loss for that period.

**18-14** A company is justified in inventorying scrap when its estimated net realizable value is significant and the time between storing it and selling or reusing it is quite long.

**18-15** Companies measure scrap to measure efficiency and to also control a tempting source of theft. Managers of companies that report high levels of scrap focus attention on ways to reduce scrap and to use the scrap the company generates more profitably. Some companies, for example, might redesign products and processes to reduce scrap. Others may also examine if the scrap can be reused to save substantial input costs.

**18-16** (5–10 min.) **Normal and abnormal spoilage in units.**

1. Total spoiled units 12,600

Normal spoilage in units, 4% × 170,000 6,800

Abnormal spoilage in units 5,800

2. Abnormal spoilage, 5,800 × $11 $ 63,800

Normal spoilage, 6,800 × $11 74,800

Potential savings, 12,600 × $11 $138,600

Regardless of the targeted normal spoilage, abnormal spoilage is nonrecurring and avoidable. The targeted normal spoilage rate is subject to change. Many companies have reduced their spoilage to almost zero, which would realize all potential savings. Of course, zero spoilage usually means higher-quality products, more customer satisfaction, more employee satisfaction, and various beneficial effects on nonmanufacturing (for example, purchasing) costs of direct materials.

**18-17** (20 min.) **Weighted-average method, spoilage, equivalent units**.

Solution Exhibit 18-17 calculates equivalent units of work done to date for direct materials and conversion costs.

## SOLUTION EXHIBIT 18-17

Summarize the Flow of Physical Units and Compute Output in Equivalent Units;

Weighted-Average Method of Process Costing with Spoilage,

### Gray Manufacturing Company for November 2014.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | |
| **Flow of Production** | **Physical**  **Units** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period  To account for  Good units completed and transferred out  during current period:  Normal spoilage\*  100 × 100%; 100 × 100%  Abnormal spoilage†  50 × 100%; 50 ×100%  Work in process, ending‡ (given)  2,000 × 100%; 2,000 × 30%  Accounted for  Equivalent units of work done to date | 1,000  10,150a  11,150  9,000  100  50  2,000    11,150 | 9,000  100  50  2,000    11,150 | 9,000  100  50  600    9,750 |

a From below, 11,150 total units are accounted for. Therefore, units started during current period must be = 11,150 – 1,000 = 10,150.

\*Degree of completion of normal spoilage in this department: direct materials, 100%; conversion costs, 100%.

†Degree of completion of abnormal spoilage in this department: direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: direct materials, 100%; conversion costs, 30%.

**18-18** (20−25 min.) **Weighted-average method, assigning costs (continuation of 18-17).**

Solution Exhibit 18-18 summarizes total costs to account for, calculates the costs per equivalent unit for direct materials and conversion costs, and assigns total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to ending work in process.

**SOLUTION EXHIBIT 18-18**

Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory;

Weighted-Average Method of Process Costing,

Gray Manufacturing Company, November 2014.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs incurred to date  Divided by equivalent units of work done to date  Cost per equivalent unit  **(Step 5)** Assignment of costs  Good units completed and transferred out (9,000 units) | $ 2,533  39,930  $42,463 | $ 1,423  12,180  $13,603  $13,603  ÷11,150  $ 1.22 | $ 1,110  27,750  $28,860  $28,860  ÷ 9,750  $ 2.96 |
| Costs before adding normal spoilage  Normal spoilage (100 units)  (A) Total cost of good units completed & transf. out  (B) Abnormal spoilage (50 units)  (C) Work in process, ending (2,000 units)  (A)+(B)+(C) Total costs accounted for | $37,620  418  38,038  209  4,216  $42,463 | (9,000# × $1.22) + (9,000# × $2.96)  (100# × $1.22) + (100# × $2.96)    (50# × $1.22) + (50# × $2.96)  (2,000# × $1.22) + (600# × $2.96)  $13,603 + $28,860 | |

#Equivalent units of direct materials and conversion costs calculated in Step 2 in Solution Exhibit 18-17.

# 18-19 (15 min.) FIFO method, spoilage, equivalent units.

# Solution Exhibit 18-19 calculates equivalent units of work done in the current period for direct materials and conversion costs.

# SOLUTION EXHIBIT 18-19

Summarize the Flow of Physical Units and Compute Output in Equivalent Units;

First-in, First-out (FIFO) Method of Process Costing with Spoilage,

### Gray Manufacturing Company for November 2014.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | |
| **Flow of Production** | **Physical**  **Units** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period  To account for  Good units completed and transferred out during current period:  From beginning work in process||  1,000 × (100% −100%); 1,000 × (100% − 50%)  Started and completed  8,000 × 100%; 8,000 × 100%  Normal spoilage\*  100 × 100%; 100 × 100%  Abnormal spoilage†  50 × 100%; 50 × 100%  Work in process, ending‡  2,000 × 100%; 2,000 × 30%  Accounted for  Equivalent units of work done in current period | 1,000  10,150a  11,150  1,000  8,000#  100  50  2,000  \_\_\_\_  11,150 | 0  8,000  100  50  2,000    10,150 | 500  8,000  100  50  600    9,250 |

a From below, 11,150 total units are accounted for. Therefore, units started during current period must be 11,150 – 1,000 = 10,150.

||Degree of completion in this department: direct materials, 100%; conversion costs, 50%.

#9,000 physical units completed and transferred out minus 1,000 physical units completed and transferred out from beginning work-in-process inventory.

\*Degree of completion of normal spoilage in this department: direct materials, 100%; conversion costs, 100%.

†Degree of completion of abnormal spoilage in this department: direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: direct materials, 100%; conversion costs, 30%.

**18-20** (20−25 min.) **FIFO method, assigning costs (continuation of 18-19).**

Solution Exhibit 18-20 summarizes total costs to account for, calculates the costs per equivalent unit for direct materials and conversion costs, and assigns total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to ending work in process.

**SOLUTION EXHIBIT 18-20**

Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory;

FIFO Method of Process Costing,

Gray Manufacturing Company, November 2014.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs added in current period  Divided by equivalent units of work done in current period  Cost per equivalent unit  **(Step 5)** Assignment of costs:  Good units completed and transferred out (9,000 units) | $ 2,533  39,930  $42,463 | $ 1,423  12,180  $13,603  $12,180  ÷10,150  $ 1.20 | $ 1,110  27,750  $28,860  $27,750  ÷ 9,250  $ 3 |
| Work in process, beginning (1,000 units)  Costs added to beg. work in process in current period  Total from beginning inventory before normal spoilage  Started and completed before normal spoilage (8,000 units)  Normal spoilage (100 units)  (A) Total costs of good units completed and transferred out  (B) Abnormal spoilage (50 units)  (C) Work in process, ending (2,000 units)  (A)+(B)+(C) Total costs accounted for | $ 2,533  1,500    4,033  33,600  420  38,053  210  4,200  $42,463 | $1,423 + $1,110  (0a × $1.20) + (500a × $3)  (8,000a × $1.20) + (8,000a × $3)  (100a × $1.20) + (100a × $3)  (50a × $1.20) + (50a × $3)  (2,000a × $1.20) + (600a × $3)  $13,603 + $28,860 | |

a Equivalent units of direct materials and conversion costs calculated in Step 2 in Solution Exhibit 18-19.

**18-21** (35 min.) **Weighted-average method, spoilage.**

# 1. Solution Exhibit 18-21, Panel A calculates equivalent units of work done to date for direct materials and conversion costs.

2. Solution Exhibit 18-21, Panel B summarizes total costs to account for, calculates the costs per equivalent unit for direct materials and conversion costs, and assigns total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process, using the weighted-average method.

## SOLUTION EXHIBIT 18-21

Weighted-Average Method of Process Costing with Spoilage,

La Croix Company for April 2014

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)** | | |
|  |  | **Equivalent Units** | | |
| **Flow of Production** | **Physical Units** | **Direct**  **Materials** | **Conversion**  **Costs** | |
| Work in process, beginning (given) | 2,400 |  |  | |
| Started during current period (given) | 12,000 |  |  | |
| To account for | 14,400 |  |  | |
| Good units completed and tsfd. out during current period: | 10,800 | 10,800 | 10,800 | |
| Normal spoilagea | 1,080 |  |  | |
| (1,080 100%; 1,080 100%) |  | 1,080 | 1,080 | |
| Abnormal spoilageb | 360 |  |  | |
| (360 100%; 360 100%) |  | 360 | 360 | |
| Work in process, endingc (given) | 2,160 |  |  | |
| (2,160  100%; 2,160  75%) | \_\_\_\_\_\_ | 2,160 | 1,620 | |
| Accounted for | 14,400 | \_\_\_\_\_\_ | ­­­­\_\_\_\_\_\_ | |
| Equivalent units of work done to date |  | 14,400 | 13,860 | |
|  |  |  |  | |
| aNormal spoilage is 10% of good units transferred out: 10% × 10,800 = 1,080 units. Degree of completion of normal spoilage |  |  |  | |
| |  | | --- | | in this department: direct materials, 100%; conversion costs, 100%. | |  |  |  | |
| bTotal spoilage = Beg. units + Units started - Good units transferred out – Ending units = 2,400 + 12,000 – 10,800 – 2,160 = 1,440; | | | | | |
| Abnormal spoilage = Total spoilage – Normal spoilage = 1,440 – 1,080 = 360 units. Degree of completion of abnormal spoilage | | | | | |
| |  | | --- | | in this department: direct materials, 100%; conversion costs, 100%. | | | | | | |
| cDegree of completion in this department: direct materials, 100%; conversion costs, 75%. | | | | | |  |  |
|  | | | | | |
|  | | | |  | | | | |  |

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **Total Production Costs** | **Direct**  **Materials** | **Conversion**  **Costs** | |
| **(Step 3)** | Work in process, beginning (given) | $ 34,572 | $21,240 | $ 13,332 | |
|  | Costs added in current period (given) | 208,968 | 97,560 | 111,408 | |
|  | Total costs to account for | $243,540 | $118,800 | $124,740 | |
|  |  |  |  |  | |
| **(Step 4)** | Costs incurred to date |  | $118,800 | $124,740 | |
|  | Divide by equivalent units of work done to date |  | 14,400 | ÷13,860 | |
|  | Cost per equivalent unit |  | $ 8.25 | $ 9.00 | |
|  |  |  |  |  | |
| **(Step 5)** | Assignment of costs |  |  |  | |
|  | Good units completed and transferred out (10,800 units) |  |  |  | |
|  | Costs before adding normal spoilage | $186,300 | (10,800d × $8.25) + (10,800 d × $9.00) | | |
|  | Normal spoilage (1,080 units) | 18,630 | (1,080d × $8.25) + (1,080d × $9.00) | | |
| (A) | Total costs of good units completed and transferred out | 204,930 |  | |  |
| (B) | Abnormal spoilage (360 units) | 6,210 | (360d × $8.25) + (360d × $9.00) | | |
| (C) | Work in process, ending (2,160 units): | 32,400 | (2,160d × $8.25) + (1,620d × $9.00) | | |
| (A) + (B) + (C) | Total costs accounted for | $243,540 | $118,800 + $124,680 | | |
|  |  |  |  |  | |
| dEquivalent units of direct materials and conversion costs calculated in step 2 of Solution Exhibit 18-21A. | | | | | |

**18-22** (35 min.) **FIFO method, spoilage.**

# 1. Solution Exhibit 18-22, Panel A calculates equivalent units of work done in the current period for direct materials and conversion costs.

Solution Exhibit 18-22, Panel B summarizes total costs to account for, calculates the costs per equivalent unit for direct materials and conversion costs, and assigns total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process, using the FIFO method.

## SOLUTION EXHIBIT 18-22

First-in, first-out (FIFO) Method of Process Costing with Spoilage,

La Croix Company for April 2014

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | |
| **Flow of Production** | **Physical**  **Units** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period (given)  To account for  Good units completed and transferred out during current period:  From beginning work in process||  2,400 × (100% −100%); 2,400 × (100% − 50%)  Started and completed  8,400 × 100%; 8,400 × 100%  Normal spoilage\*  1,080 × 100%; 1,080 × 100%  Abnormal spoilage†  360 × 100%; 360 × 100%  Work in process, ending‡  2,160 × 100%; 2,160 × 75%  Accounted for  Equivalent units of work done in current period | 2,400  12,000  14,400  2,400  8,400#  1,080  360  2,160  \_\_\_\_  14,400 | 0  8,400  1,080  360  2,160    12,000 | 1,200  8,400  1,080  360  1,620  \_\_\_  12,660 |

||Degree of completion in this department: direct materials, 100%; conversion costs, 50%.

#10,800 physical units completed and transferred out minus 2,400 physical units completed and transferred out from beginning work-in-process inventory.

\*Degree of completion of normal spoilage in this department: direct materials, 100%; conversion costs, 100%.

†Degree of completion of abnormal spoilage in this department: direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: direct materials, 100%; conversion costs, 75%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs added in current period  Divided by equivalent units of work done in current period  Cost per equivalent unit  **(Step 5)** Assignment of costs:  Good units completed and transferred out (10,800 units) | $ 34,572  208,968  $243,540 | $21,240  97,560  $118,800  $97,560  ÷12,000  $ 8.13 | $ 13,332  111,408  $124,740  $111,408  ÷ 12,660  $ 8.80 |
| Work in process, beginning (2,400 units)  Costs added to beg. work in process in current period  Total from beginning inventory before normal spoilage  Started and completed before normal spoilage (8,400 units)  Normal spoilage (1,080 units)  (A) Total costs of good units completed and transferred out  (B) Abnormal spoilage (360 units)  (C) Work in process, ending (2,160 units)  (A)+(B)+(C) Total costs accounted for | $ 34,572  10,560  45,132  142,212  18,284  205,628  6,095  31,817  $243,540 | $21,240 + $13,332  (0a × $8.13) + (1,200a × $8.80)  (8,400a × $8.13) + (8,400a × $8.80)  (1,080a × $8.13) + (1,080a × $8.80)  (360a × $8.13) + (360a × $8.80)  (2,160a × $8.13) + (1,620a × $8.80)  $118,800 + $124,740 | |

a Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A.

2. The issues related to the determination of the percentage of spoilage considered normal are similar to the factors discussed in Chapter 17 regarding the importance of verifying the estimated completion percentages of ending work-in-process, especially with regard to conversion costs. A supervisor who wants to show better operating income performance might categorize more of the spoilage as normal, thereby reducing the amount that must be written off against income as the loss from abnormal spoilage. Managers must stress the value of consistent and unbiased estimates of normal spoilage percentages and drive home the importance of pursuing ethical actions and reporting the correct income figures, regardless of the short-term consequences of doing so.

In the above example, if all 1,440 units spoiled were considered normal spoilage, then the cost of goods completed and transferred out would increase to $211,723 ($205,628 + $6,095), while ending work-in-process would stay unchanged at $31,817. Of course, the $6,095 would no longer be written off as a period expense by the LaCroix facility in northeast Ohio.

**18-23** (10 min.) **Spoilage, journal entries.**

# Spoilage represents the amount of resources that go into the process but do not result in finished product. A simple way to account for spoilage in process costing is to calculate the amount of direct material that was spoiled. The journal entry to record the spoilage incurred in Safeclear’s production process is as follows:

Manufacturing overhead control (normal spoilage) 325

Work-in-process inventory (cost of spoiled laminated glass) 325

**18-24** (15 min.) **Recognition of loss from spoilage.**

1. The unit cost of making the 10,000 power adapters is:

$400,000 ÷ 10,000 units = $40 per unit

2. The total cost of the 375 spoiled units is:

$40 × 375 units = $15,000

3. The increase in the per-unit cost of goods sold as a result of the normal spoilage is:

$15,000 ÷ 9,625 good units = $1.56

Unit cost of goods sold for units remaining after the spoilage = $40 + $1.56 = $41.56.

(Or $400,000 ÷ 9,625 = $41.56)

4. The $15,000 cost for the 375 spoiled units is taken out of manufacturing costs and expensed in the period of the spoilage. The journal entry to record the abnormal spoilage incurred is:

Loss from abnormal spoilage 15,000

Work-in-process control 15,000

**18-25** (25 min.) **Weighted-average method, spoilage.**

1. Solution Exhibit 18-25, Panel A, calculates the equivalent units of work done to date for each cost category in September 2014.

2. Solution Exhibit 18-25, Panel B, summarizes total costs to account for, calculates the costs per equivalent unit for each cost category, and assigns total costs to units completed (including normal spoilage), to abnormal spoilage, and to units in ending work in process using the weighted-average method.

## SOLUTION EXHIBIT 18-25

Weighted-Average Method of Process Costing with Spoilage,

WaferCo for September 2014

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | |
| **Flow of Production** | **Physical**  **Units** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period (given)  To account for  Good units completed and transferred out  during current period:  Normal spoilage\*  345 × 100%; 345 × 100%  Abnormal spoilage†  292 × 100%; 292 × 100%  Work in process, ending‡ (given)  520 × 100%; 520 × 20%  Accounted for  Equivalent units of work done to date | 1,200  2,257  3,457  2,300  345  292  520    3,457 | 2,300  345  292  520    3,457 | 2,300  345  292  104    3,041 |

\*Normal spoilage is 15% of good units transferred out: 15%  2,300 = 345 units. Degree of completion of normal spoilage in this department: direct materials, 100%; conversion costs, 100%.

†Total spoilage = 1,200 + 2,257 – 2,300 – 520 = 637 units; Abnormal spoilage = Total spoilage − Normal spoilage = 637 − 345 = 292 units. Degree of completion of abnormal spoilage in this department: direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: direct materials, 100%; conversion costs, 20%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs incurred to date  Divided by equivalent units of work done to date  Cost per equivalent unit    **(Step 5)** Assignment of costs  Good units completed and transferred out (2,300 units) | $158,635  830,654  $989,289 | $142,321  573,278  $715,599  $715,599  ÷ 3,457  $ 207.00 | $ 16,314  257,376  $273,690  $273,690  ÷ 3,041  $ 90.00 |
| Costs before adding normal spoilage  Normal spoilage (345 units)  (A) Total cost of good units completed and transferred out  (B) Abnormal spoilage (292 units)  (C) Work-in-process, ending (520 units) | $683,100  102,465    785,565  86,724  117,000 | (2,300# × $207) + (2,300# × $90)  (345# × $207) + (345# × $90)  (292# × $207) + (292# × $90)  (520# × $207) + (104# × $90) | |
| (A)+(B)+(C) Total costs accounted for | $989,289 | $715,599 | $273,690 |

# Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A.

**18-26** (25 min.) **FIFO method, spoilage.**

1. Solution Exhibit 18-26, Panel A, calculates the equivalent units of work done in the current period for each cost category in September 2014.

Solution Exhibit 18-26, Panel B, summarizes WaferCo’s production costs for September 2014, calculates the costs per equivalent unit for each cost category, and assigns total costs to units completed and transferred out (including normal spoilage) to abnormal spoilage and to units in ending work in process under the FIFO method.

## SOLUTION EXHIBIT 18-26

First-in, First-out (FIFO) Method of Process Costing with Spoilage,

WaferCo for September 2014

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | |
| **Flow of Production** | **Physical**  **Units** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period (given)  To account for  Good units completed and transferred out  during current period:  From beginning work in process||  1,200 × (100% −100%); 1,200 × (100% − 30%)  Started and completed  1,100 × 100%; 1,100 × 100%  Normal spoilage\*  345 × 100%; 345 × 100%  Abnormal spoilage†  292 × 100%; 292 × 100%  Work in process, ending‡  520 × 100%; 520 × 20%  Accounted for  Equivalent units of work done in current period | 1,200  2,557  3,457  1,200  1,100#  345  292  520    3,457 | 0  1,100  345  292  520    2,257 | 840  1,100  345  292  104    2,681 |

||Degree of completion in this department: direct materials, 100%; conversion costs, 30%.

#2,300 physical units completed and transferred out minus 1,200 physical units completed and transferred out from beginning work in process inventory.

\*Normal spoilage is 15% of good units transferred out: 15% × 2,300 = 345 units. Degree of completion of normal spoilage in this department: direct materials, 100%; conversion costs, 100%.

†Abnormal spoilage = Actual spoilage − Normal spoilage = 637 − 345 = 292 units. Degree of completion of abnormal spoilage in this department: direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: direct materials, 100%; conversion costs, 20%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs added in current period  Divided by equivalent units of work done in current period  Cost per equivalent unit    **(Step 5)** Assignment of costs:  Good units completed and transferred out (2,300 units) | | $158,635  830,654  $989,289 | $ 142,321  573,278  $715,599  $573,278  ÷ 2,257  $ 254.00 | $ 16,314  257,376  $273,690  $257,376  ÷ 2,681  $ 96.00 |
| Work in process, beginning (1,200 units)  Costs added to beg. work in process in current period  Total from beginning inventory before normal spoilage  Started and completed before normal spoilage  (1,100 units)  Normal spoilage (345 units)  (A) Total costs of good units completed and  transferred out  (B) Abnormal spoilage (292 units)  (C) Work in process, ending (520 units) | $158,635  80,640    239,275  385,000  120,750    745,025  102,200  142,064 | $142,321 + $16,314  (0§ × $254) + (840§ × $96)  (1,100§ × $254) + (1,100§ × $96)  (345§ × $254) + (345§ × $96)  (292§ × $254) + (292§ × $96)  (520§ × $254) + (104§ × $96) | |
| (A)+(B)+(C) Total costs accounted for | $989,289 | $715,599 | + $273,690 |

§Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A.

2. The cost per equivalent unit of beginning inventory and of work done in the current period differ substantially:

|  |  |  |
| --- | --- | --- |
|  | **Beginning**  **Inventory** | **Work Done in**  **Current Period** |
| Direct materials  Conversion costs  Total cost per unit | $118.60 ($142,321 ÷ 1,200 equiv. units)  45.32 ($ 16,314 ÷ 360 equiv. units)  $163.92 | $254.00  96.00  $350.00 |

|  |  |  |
| --- | --- | --- |
|  | **Direct**  **Materials** | **Conversion**  **Costs** |
| Cost per equivalent unit (weighted-average) | $207\* | $90\* |
| Cost per equivalent unit (FIFO) | $254\*\* | $96\*\* |

\* from Solution Exhibit 18-25, Panel B

\*\*from Solution Exhibit 18-26, Panel B

The cost per equivalent unit differs between the two methods because each method uses different costs as the numerator of the calculation. FIFO uses only the costs added during the current period whereas weighted-average uses the costs from the beginning work-in-process as well as costs added during the current period. Both methods also use different equivalent units in the denominator.

The following table summarizes the costs assigned to units completed and those still in process under the weighted-average and FIFO process-costing methods for our example.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **FIFO**  **(Solution Exhibit 18-26B)** | **Wtd.-Avg.**  **(Solution Exhibit 18-25B)** | **Difference** |
| Cost of units completed and transferred out  Abnormal spoilage  Work in process, ending  Total costs accounted for | $745,025  102,200  142,064  $989,289 | $785,565  86,724  117,000  $989,289 | − $40,540  + $15,476  + $25,064 |

The FIFO ending inventory is higher than the weighted-average ending inventory by $25,064. This is because FIFO assumes that all the lower-cost prior-period units in work in process are the first to be completed and transferred out while ending work in process consists of only the higher-cost current-period units. The weighted-average method, in contrast, smoothes the cost per equivalent unit by assuming that more of the higher-cost units are completed and transferred out, while some lower-cost units in beginning work in process are placed in ending work in process. It similarly costs the abnormal spoilage incurred during the period using a blended cost rate rather than the higher current-period cost (as in the FIFO method, which assigns $15,476 more in costs to that spoilage). As a result, the FIFO method results in a relatively lower cost of units completed and transferred out and a higher ending work-in-process inventory.

WaferCo’s managers should consider the weighted-average method because it leads to a higher cost of goods completed and transferred (and sold), thereby lowering taxes. The managers may have an incentive, however, to use the FIFO method and show a higher level of current income if their compensation increases with higher operating income or if there are debt covenants that would be violated by showing lower income. WaferCo’s managers may also consider advantage of the FIFO method, which is that it provides better information for managing the business because it keeps separate the costs of the current period from costs incurred in previous periods.

**18-27** (30 min.) **Standard-costing method, spoilage.**

1. Solution Exhibit 18-26, Panel A, shows the computation of the equivalent units of work done in September 2014 for direct materials (2,257 units) and conversion costs (2,681 units). (This computation is the same for FIFO and standard-costing.)

The direct materials cost per equivalent unit of beginning work in process and of work done in September 2014 is the standard cost of $240 given in the problem.

The conversion cost per equivalent unit of beginning work in process and of work done in September 2014 is the standard cost of $100 given in the problem.

Solution Exhibit 18-27 summarizes the total costs to account for and assigns these costs to units completed (including normal spoilage), to abnormal spoilage, and to units in ending work in process using the standard costing method.

SOLUTION EXHIBIT 18-27

Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory;

##### Standard Costing Method of Process Costing with Spoilage,

WaferCo for September 2014

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | **Total**  **Production**  **Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning\*  Costs added in current period at standard prices  Costs to account for  **(Step 4)** Standard costs per equivalent unit (given)    **(Step 5)** Assignment of costs at standard costs:  Good units completed and transferred out  (2,100 units) | | $ 324,000  809,780  $1,133,780  $ 340 | (1,200 × $240)  (2,257 × $240)  $829,680  $ 240 | (360 × $100)  (2,681 × $100) $304,100    $ 100 |
| Work in process, beginning (1,200 units)\*  Costs added to beg. work in process in current period  Total from beginning inventory before normal  spoilage  Started and completed before normal spoilage  (1,100 units)  Normal spoilage (345 units)  (A) Total costs of good units completed and  transferred out  (B) Abnormal spoilage (292 units)  (C) Work in process, ending (520 units)  (A)+(B)+(C) Total costs accounted for | $324,000  84,000    408,000  374,000  117,300  899,300  99,280  135,200  $1,133,780 | (1,200 × $240) + (360 × $100)  (0§ × $240) + (840§ × $100)    (1,100§ × $240) + (1,100§ × $100)  (345§ × $240) + (345§ × $100)  (292§ × $240) + (292§ × $100)  (520§ × $240) + (104§ × $100)  $829,680 + $304,100 | |

\*Work in process, beginning has 1,200 equivalent units (1,200 physical units ×100%) of direct materials and 360 equivalent units (1,200 physical units × 30%) of conversion costs.

§Equivalent units of direct materials and conversion costs calculated in Step 2 in Solution Exhibit 18-25, Panel A.

2. To show better performance, a department supervisor might report a higher degree of completion resulting in understated cost per equivalent unit and overstated operating income. If performance for the period is very good, the department supervisor may be tempted to report a lower degree of completion reducing income in the current period. This has the effect of reducing the costs carried in ending inventory and the costs carried to the following year in beginning inventory. In other words, estimates of degree of completion can help to smooth earnings from one period to the next.

To guard against the possibility of bias, managers should ask supervisors specific questions about the process they followed to prepare estimates. Top management should always emphasize obtaining the correct answer, regardless of how it affects reported performance. This emphasis drives ethical actions throughout the organization.

**18-28** (20–30 min.) **Spoilage and job costing.**

1. Cash 420

Loss from Abnormal Spoilage 3,360

Work-in-Process Control 3,780

Loss = ($9.00 × 420) – $420 = $3,360

Remaining cases cost = $9.00 per case. The cost of these cases is unaffected by the loss from abnormal spoilage.

2. a. Cash 840

Work-in-Process Control 840

The cost of the remaining good cases = [($9.00 × 2,100) – $840] = $18,060

The unit cost of a good case now becomes $18,060 ÷ 1,680 = $10.75

b. Cash 840

Manufacturing Department Overhead Control 2,940

Work-in-Process Control 3,780

The unit cost of a good case remains at $9.00.

c. The unit costs in 2a and 2b are different because in 2a the normal spoilage cost is charged as a cost of the job that has exacting job specifications. In 2b, however, normal spoilage is due to the production process, not the particular attributes of this specific job. These costs are, therefore, charged as part of manufacturing overhead and the manufacturing overhead cost of $2 per case already includes a provision for normal spoilage.

3. a. Work-in-Process Control 420

Materials Control, Wages Payable Control,

Manufacturing Overhead Allocated 420

The cost of the good cases = [($9.00 × 2,100) + $420] = $19,320

The unit cost of a good case is $19,320 ÷ 2,100 = $9.20

b. Manufacturing Department Overhead Control 420

Materials Control, Wages Payable Control,

Manufacturing Overhead Allocated 420

The unit cost of a good case = $9.00 per case

c. The unit costs in 3a and 3b are different because in 3a the normal rework cost is charged as a cost of the job that has exacting job specifications. In 3b, however, normal rework is due to the production process, not the particular attributes of this specific job. These costs are, therefore, charged as part of manufacturing overhead and the manufacturing overhead cost of $2 per case already includes a provision for this normal rework.

**18-29** (15 min.) **Reworked units, costs of rework.**

1. The two alternative approaches to account for the materials costs of reworked units are as follows:

a. To charge the costs of rework to the current period as a separate expense item as abnormal rework. This approach would highlight to Heyer Appliances the costs of the supplier problem.

b. To charge the costs of the rework to manufacturing overhead as normal rework.

2. The $125 circulation motor cost is the cost of the actual motors included in the dishwashers. The $110 motors from the first supplier were never used in any dishwasher and that supplier is now bankrupt. The units have now been disposed of at zero disposal value.

3. The total costs of rework due to the defective circulation motors include the following:

a. the labor and other conversion costs spent on substituting the new circulation motors;

b. the costs of any extra negotiations to obtain the replacement circulation motors;

1. any higher price the existing supplier may have charged to do a rush order for the replacement circulation motors; and
2. ordering costs for the replacement circulation motors.

**18-30** (25 min.) **Scrap, job costing.**

1. Journal entry to record scrap generated by a specific job and accounted for at the time scrap is sold is as follows:

Cash or Accounts Receivable 480

Work-in-Process Control 480

To recognize asset from sale of scrap.

A memo posting is also made to the specific job record.

2. Scrap common to various jobs and accounted for at the time of its sale can be accounted for in two ways:

a. Regard scrap sales as a separate line item of revenues (the method generally used when the dollar amount of scrap is immaterial):

Cash or Accounts Receivable 4,500

Scrap Revenues 4,500

To recognize revenue from sale of scrap.

b. Regard scrap sales as offsets against manufacturing overhead (the method generally used when the dollar amount of scrap is material):

Cash or Accounts Receivable 4,500

Manufacturing Department Overhead Control 4,500

To record cash raised from sale of scrap.

3. Journal entry to record scrap common to various jobs at the time scrap is returned to storeroom:

Materials Control 4,500

Manufacturing Department Overhead Control 4,500

To record value of scrap returned to storeroom.

When the scrap is reused as direct material on a subsequent job, the journal entry is as follows:

Work-in-Process Control 4,500

Materials Control 4,500

To record reuse of scrap on a job.

Explanations of journal entries are provided here but are not required.

**18-31** (30 min.) **Weighted-average method, spoilage.**

Solution Exhibit 18-31 summarizes total costs to account for, calculates the equivalent units of work done to date for each cost category, and assigns total costs to units completed (including normal spoilage), to abnormal spoilage, and to units in ending work in process using the weighted-average method.

## SOLUTION EXHIBIT 18-31

Weighted-Average Method of Process Costing with Spoilage,

Cleaning Department of the Seafood Company for May

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units;

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | |
| **Flow of Production** | **Physical Units** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period (given)  To account for  Good units completed and transferred out  during current period:  Normal spoilage\*  2,460 × 100%; 2,460 × 100%  Abnormal spoilage†  1,500 × 100%; 1,500 ×100%  Work in process, ending‡ (given)  5,040 × 100%; 5,040 × 30%  Accounted for  Equivalent units of work done to date | 3,600  30,000  33,600  24,600  2,460  1,500  5,040    33,600 | 24,600  2,460  1,500  5,040    33,600 | 24,600  2,460  1,500  1,512    30,072 |
|  |  |  |  |

\*Normal spoilage is 10% of good units transferred out: 10%  24,600 = 2,460 units. Degree of completion of normal spoilage in this department: direct materials, 100%; conversion costs, 100%.

†Total spoilage = 3,600 + 30,000 – 24,600 – 5,040 = 3,960 units; Abnormal spoilage = 3,960 – 2,460 = 1,500 units. Degree of completion of abnormal spoilage in this department: direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: direct materials, 100%; conversion costs, 30%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs incurred to date  Divided by equivalent units of work done to date  Cost per equivalent unit    **(Step 5)** Assignment of costs  Good units completed and transferred out (24,600 units) | $ 7,269  100,159  $107,428 | $ 5,316  55,500  $60,816  $60,816  ÷33,600  $ 1.81 | $ 1,953  44,659  $46,612  $46,612  ÷30,072  $ 1.55 |
| Costs before adding normal spoilage  Normal spoilage (2,460 units)  (A) Total costs of good units completed and  transferred out  (B) Abnormal spoilage (1,500 units)  (C) Work in process, ending (5,040 units)  (A)+(B)+(C) Total costs accounted for | $82,656  8,266  90,922  5,040  11,466  $107,428 | (24,600# × 1.81) +  (2,460# × 1.81) +  (1,500# × 1.81) +  (5,040# × 1.81) +  $60,816 + | (24,600# × 1.55)  (2,460# × 1.55)    (1,500# ×1.55)  (1,512# × 1.55)  $46,612 |

#Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A above.

**18-32** (25 min.) **FIFO method, spoilage.**

For the Cleaning Department, Solution Exhibit 18-32 summarizes the total costs for May, calculates the equivalent units of work done in the current period for direct materials and conversion costs, and assigns total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work in process under the FIFO method.

# SOLUTION EXHIBIT 18-32

First-in, First-out (FIFO) Method of Process Costing with Spoilage,

Cleaning Department of the Seafood Company for May

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | | |
| **Flow of Production** | **Physical**  **Units** | **Direct**  **Materials** | **Conversion**  **Costs** | |
| Work in process, beginning (given) | | 3,600 |  | |  | |
| Started during current period (given) | | 30,000 |  | |  | |
| To account for | | 33,600 |  | |  | |
| Good units completed and transferred out during current period: | |  |  | |  | |
| From beginning work in process|| | | 3,600 |  | |  | |
| 3,600 × (100% −100%); 3,600 × (100% − 60%) | |  | 0 | | 1,440 | |
| Started and completed | | 21,000# |  | |  | |
| 21,000 × 100%; 21,000 × 100% | |  | 21,000 | | 21,000 | |
| Normal spoilage\* | | 2,460 |  | |  | |
| 2,460 × 100%; 2,460 × 100% | |  | 2,460 | | 2,460 | |
| Abnormal spoilage† | | 1,500 |  | |  | |
| 1,500 × 100%; 1,500 × 100% | |  | 1,500 | | 1,500 | |
| Work in process, ending‡ | | 5,040 |  | |  | |
| 5,040 × 100%; 5,040 × 30% | | \_\_\_\_\_ | 5,040 | | 1,512 | |
| Accounted for | | 33,600 | \_\_\_\_\_ | | \_\_\_\_\_ | |
| Equivalent units of work done in current period | |  | 30,000 | | 27,912 | |

|| Degree of completion in this department: direct materials, 100%; conversion costs, 60%.

#24,600 physical units completed and transferred out minus 3,600 physical units completed and transferred out from beginning work-in-process inventory.

\*Normal spoilage is 10% of good units transferred out: 10% × 24,600 = 2,460 units. Degree of completion of normal spoilage in this department: direct materials, 100%; conversion costs, 100%.

†Total spoilage = 3,600 + 30,000 – 24,600 – 5,040 = 3,960 units; Abnormal spoilage = 3,960 – 2,460 = 1,500 units. Degree of completion of abnormal spoilage in this department: direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: direct materials, 100%; conversion costs, 30%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Direct**  **Materials** | | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs added in current period  Divided by equivalent units of work done in current period  Cost per equivalent unit    **(Step 5)** Assignment of costs:  Good units completed and transferred out (24,600 units) | | $ 7,269  100,159  $107,428 | $ 5,316  55,500  $60,816  $55,500  ÷30,000  $ 1.85 | $ 1,953  44,659  $46,612  $44,659  ÷27,912  $ 1.60 | |
| Work in process, beginning (3,600 units)  Costs added to beg. work in process in current period  Total from beginning inventory before normal spoilage  Started and completed before normal spoilage (21,000 units)  Normal spoilage (2,460 units)  (A) Total costs of good units completed and transferred out  (B) Abnormal spoilage (1,500 units)  (C) Work in process, ending (5,040 units)  (A)+(B)+(C) Total costs accounted for | $ 7,269  2,304  9,573  72,450  8,487  90,510  5,175  11,743  $107,428 | $5,316 + $1,953  (0§ × $1.85) + (1,440§ × 1.6)  (21,000§×1.85) + (21,000§× 1.6)  (2,460§ × 1.85) + (2,460§ × 1.6)  (1,500§ × 1.85) + (1,500§ ×1.6)  (5,040§ ×1.85) + (1,512§ × 1.6)  $60,816 + $46,612 | | |

§Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A.

**18-33** (35 min.) **Weighted-average method, Packaging Department (continuation of 18-31).**

For the Packaging Department, Solution Exhibit 18-33 summarizes total costs to account for, calculates the equivalent units of work done to date for each cost category, and assigns costs to units completed (including normal spoilage), to abnormal spoilage, and to units in ending work in process using the weighted-average method.

## SOLUTION EXHIBIT 18-33

Weighted-Average Method of Process Costing with Spoilage,

Packaging Department of the Seafood Company for May

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | | |
| **Flow of Production** | **Physical Units** | **Transferred-**  **in Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period (given)  To account for  Good units completed and transferred out  during current period:  Normal spoilage\*  2,112 × 100%; 2,112 × 100%; 2,112 × 100%  Abnormal spoilage†  288 × 100%; 288 ×100%, 288 × 100%  Work in process, ending‡ (given)  8,400 × 100%; 8,400 × 0%; 8,400 × 40%  Accounted for  Equivalent units of work done to date | 12,600  24,600  37,200  26,400  2,112  288  8,400    37,200 | 26,400  2,112  288  8,400    37,200 | 26,400  2,112  288  0  \_\_\_\_\_\_  28,800 | 26,400  2,112  288  3,360  \_\_\_\_\_  32,160 |

\*Normal spoilage is 8% of good units transferred out: 8%  26,400 = 2,112 units. Degree of completion of normal spoilage in this department: transferred-in costs, 100%; direct materials, 100%; conversion costs, 100%.

†Total spoilage =12,600 + 24,600 – 26,400 – 8,400 = 2,400 units. Abnormal spoilage = 2,400 – 2,112 = 288 units. Degree of completion of abnormal spoilage in this department: transferred-in costs, 100%; direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 40%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Transferred-in Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs incurred to date  Divided by equivalent units of work done to date  Cost per equivalent unit    **(Step 5)** Assignment of costs  Good units completed and transferred out (26,400 units) | $ 51,338  143,362  $194,700 | $ 33,698  90,922\*  $124,620  124,620  ÷37,200  $ 3.35 | $ 0  5,760  $5,760  5,760  ÷ 28,800  $ 0.20 | $23,475  40,845  $64,320  64,320  ÷32,160  $ 2.00 |
| Costs before adding normal spoilage  Normal spoilage (2,112 units)  (A) Total cost of good units completed and transferred out  (B) Abnormal spoilage (288 units)  (C) Work in process, ending (8,400 units)  (A)+(B)+(C) Total costs accounted for | $146,520  11,722  158,242  1,598  34,860  $194,700 | 26,400# × ($3.35 + $0.20 + $2)  2,112#  × ($3.35 + $0.20 + $2)  288# × ($3.35 + $0.20 + $2)  (8,400# × $3.35) + (0# × $0.20) + (3,360# × $2)  $124,620 + $5,760 + $64,320 | | |

\*Total costs of good units completed and transferred out in Panel B (Step 5) of Solution Exhibit 18-31.

#Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A above.

**18-34** (25 min.) **FIFO method, Packaging Department (continuation of 18-32).**

Solution Exhibit 18-34 summarizes the total Packaging Department costs for May, shows the equivalent units of work done in the Packaging Department in the current period for transferred-in costs, direct materials, and conversion costs, and assigns total costs to units completed and transferred out (including normal spoilage), to abnormal spoilage, and to units in ending work-in-process under the FIFO method.

# SOLUTION EXHIBIT 18-34

First-in, First-out (FIFO) Method of Process Costing with Spoilage,

# Packaging Department of the Seafood Company for May

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | | |
| **Flow of Production** | **Physical**  **Units** | **Transferred-**  **in Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period (given)  To account for  Good units completed and transferred out during  current period:  From beginning work in process||  12,600 × (100% − 100%); 12,600 ×  (100% − 0%); 12,600 × (100% − 70%)  Started and completed  13,800 × 100%; 13,800 × 100%; 13,800 × 100%  Normal spoilage\*  2,112 × 100%; 2,112 × 100%; 2,112 × 100%  Abnormal spoilage†  288× 100%; 288 × 100%; 288 × 100%  Work in process, ending‡  8,400 × 100%; 8,400 × 0%; 8,400 × 40%  Accounted for  Equivalent units of work done in current period | 12,600  24,600  37,200  12,600  13,800#  2,112  288  8,400    37,200 | 0  13,800  2,112  288  8,400    24,600 | 12,600  13,800  2,112  288  0    28,800 | 3,780  13,800  2,112  288  3,360    23,340 |

||Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 70%.

#26,400 physical units completed and transferred out minus 12,600 physical units completed and transferred out from beginning work-in-process inventory.

\*Normal spoilage is 8% of good units transferred out: 8% × 26,400 = 2,112 units. Degree of completion of normal spoilage in this department: transferred-in costs, 100%; direct materials, 100%; conversion costs, 100%.

†Total spoilage = 12,600 + 24,600 – 26,400 – 8,400 = 2,400 units.

Abnormal spoilage = 2,400 – 2,112 = 288 units. Degree of completion of abnormal spoilage in this department: transferred-in costs, 100%; direct materials, 100%; conversion costs, 100%.

‡Degree of completion in this department: transferred-in costs, 100%; direct materials, 0%;

conversion costs, 40%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Transferred-**  **in Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs added in current period  Divided by equivalent units of work done in  current period  Cost per equivalent unit    **(Step 5)** Assignment of costs:  Good units completed and transferred out (26,400 units) | | $ 56,565  137,115  $193,680 | $ 33,090  90,510\*  $123,600  $90,510  ÷24,600  $ 3.679 | $ 0  5,760  $5,760  $5,760  ÷28,800  $ 0.20 | $23,475  40,845  $64,320    $40,845  ÷23,340  $ 1.75 |
| Work in process, beginning (12,600 units)  Costs added to beg. work in process in  current period  Total from beginning inventory before normal spoilage  Started and completed before normal spoilage (13,800 units)  Normal spoilage (2,112 units)  (A) Total costs of good units completed and  transferred out  (B) Abnormal spoilage (288 units)  (C) Work in process, ending (8,400 units)  (A)+(B)+(C) Total costs accounted for | $56,565  9,135  65,700  77,680  11,888  155,268  1,621  36,784  $193,673+ | $33,090 + $0 + $23,475  (0 × $3.679) + (12,600§ × 0.20) + (3,780§ × $1.75)  13,800§ × ($3.679 + $0.20 + $1.75)  2,112§ × ($3.679 + $0.20 + $1.75)    288§ × ($3.679 + $0.20 + $1.75)  (8,400§×$3.679) + (0§×$0.20) + (3,360§×$1.75)  $139,233 + $5,760 + $64,320 | | |
|  |  |  | | |

\*Total costs of good units completed and transferred out in Step 5, Panel B of Solution Exhibit 18-32.

§Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A.

+Difference of $7 ($193,673 relative to $193,680) due to rounding.

**18-35** (30 min.) **Physical units, inspection at various levels of completion, weighted-average process costing.**

1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Inspection** | **Inspection** | **Inspection** |
|  | **at 30%** | **at 60%** | **at 100%** |
| Work in process, beginning (40%)\*  Started during November  To account for | 2,400  12,000  14,400 | 2,400  12,000  14,400 | 2,400  12,000  14,400 |
| Good units completed and transferred out  Normal spoilage | 9,000a  1,224b | 9,000a  1,512c | 9,000a  1,080d |
| Abnormal spoilage (1,800 – normal spoilage)  Work in process, ending (70%)\*  Accounted for | 576  3,600  14,400 | 288  3,600  14,400 | 720  3,600  14,400 |

\*Degree of completion for conversion costs at the dates of the work-in-process inventories

a2,400 beginning inventory + 12,000 started – 1,800 spoiled – 3,600 ending inventory = 9,000.

b12% × (12,000 units started – 1,800 units spoiled) = 12% × 10,200 = 1,224; beginning work-in-process inventory is excluded because it was already 40% complete at November 1 and past the inspection point.

c12% × (14,400 units – 1,800 ) = 12% × 12,600 = 1,512 because all units passed the 60% completion inspection point in November.

d 12% × 9,000 = 1,080 because 9,000 units are fully completed and inspected during November.

1. There are different amounts of normal and abnormal spoilage because the spoilage is detected at different points in the process. At the 30% inspection point, the beginning work-in-process inventory has already passed inspection and consists entirely of good units. At the 60% inspection point, the beginning work in process as well as units started this period must pass through the inspection point in the month of November. At the 100% inspection point, only the finished units have been inspected. Those in ending work in process have not yet been inspected. The finished units that are transferred out are good, but the others have not been inspected yet. Of course, in all three cases the total spoilage is 1,800 units (given in the problem).

3. Solution Exhibit 18-35 summarizes total costs to account for, calculates the equivalent units of

work done to date for each cost category, and assigns total costs to units completed (including normal spoilage), to abnormal spoilage, and to units in ending work in process using the weighted-average method.

## SOLUTION EXHIBIT 18-35

Weighted-Average Method of Process Costing with Spoilage,

Assembly Department of SunEnergy for November 2014

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | |
| **Flow of Production** | **Physical Units** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period (given)  To account for  Good units completed and transferred out  during current period:  Normal spoilage (at 60% inspection point)  1,512 × 100%; 1,512 × 60%  Abnormal spoilage(at 60% inspection point)  288 × 100%; 288 ×60%  Work in process, ending‡ (given)  3,600 × 100%; 3,600 × 70%a  Accounted for  Equivalent units of work done to date | 2,400  12,000  14,400  9,000  1,512  288  3,600    14,400 | 9,000  1,512  288  3,600    14,400 | 9,000  907.2  172.8  2,520    12,600 |
|  |  |  |  |

aDegree of completion in this department: direct materials, 100%; conversion costs, 70%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs incurred to date  Divided by equivalent units of work done to date  Cost per equivalent unit    **(Step 5)** Assignment of costs  Good units completed and transferred out (9,000 units) | $ 199,800  1,444,000  $1,639,800 | $ 76,800  240,000  $316,800  $316,800  ÷14,400  $ 22 | $ 123,000  1,200,000  $1,323,000  $1,323,000  ÷ 12,600  $ 105 |
| Costs before adding normal spoilage  Normal spoilage (1,512# units, 907.2# units)  (A) Total costs of good units completed and  transferred out  (B) Abnormal spoilage (288# units, 172.8# units)  (C) Work in process, ending (3,600# units, 2,520# units)  (A)+(B)+(C) Total costs accounted for | $1,143,000  128,520  1,271,520  24,480  343,800  $1,639,800 | (9,000 × $22) +  (1,512 × 22) +  (288 × 22) +  (3,600 × 22) +  $316,800 + | (9,000 × 105)  (907.2 × 105)    (172.8 × 105)  (2,520 × 105)  $1,323,000 | |

#Equivalent units of direct materials and conversion costs calculated in Step 2 in Panel A on the previous page.

**18-36** (15 min.) **Spoilage in job costing.**

1. Normal spoilage rate= Units of normal spoilage ÷ Total good units completed

= 6 ÷ 40

= 15%.

2.

a. Journal entry for spoilage related to a specific job:

Materials Control (spoiled goods at current disposal value) 6 × $235 1,410

Work-in-Process Control (Job #10) 1,410

Note: The costs incurred on the bad units (6 × $1,100) are already part of the balance in WIP.

The cost of the 40 good units is (40 × 1,100) + (6 × $865) = $49,190

b. Journal entry for spoilage common to all jobs:

Materials Control (spoiled goods at current disposal value) 6 × $235 1,410

Manufacturing Overhead Control (normal spoilage) 5,190

Work-in-Process Control (Job #10) 6,600

Note: In developing the predetermined O/H rate, the budgeted manufacturing overhead would include expected normal spoilage costs.

c. Journal entry for abnormal spoilage:

Materials Control (spoiled goods at current disposal value) 6 × $235 1,410

Loss from Abnormal Spoilage 6 × $865 5,190

Work-in-Process Control (Job #10) 6,600

Note: If the spoilage is abnormal, the net loss is highlighted and always charged to an abnormal loss account.

**18-37** (10 min.) **Rework in job costing, journal entry (continuation of 18-36).**

a. Journal entry for rework related to a specific job:

Work-in-Process Control (Job #10) 1,800

Various Accounts 1,800

(To charge rework costs to the job)

b. Journal entry for rework common to all jobs:

Manufacturing Overhead Control (rework costs) 1,800

Various Accounts 1,800

c. Journal entry for abnormal rework:

Loss from Abnormal Rework 1,800

Various Accounts 1,800

**18-38** (10 min.) **Scrap at time of sale or at time of production, journal entries (continuation of 18-36).**

a. Journal entry for recognizing immaterial scrap at time of sale:

Cash or Accounts Receivable 700

Scrap Revenues 700

(To record other revenue sale of scrap)

b. Journal entry for recognizing material scrap related to a specific job at time of sale:

Cash or Accounts Receivable 700

Work-in-Process Control (Job #10) 700

c. Journal entry for recognizing material scrap common to all jobs at time of sale:

Cash or Accounts Receivable 700

Manufacturing Overhead Control 700

d. Journal entry for recognizing material scrap as inventory at time of production and recording at net realizable value:

Materials Control 700

Work-in-Process Control (Job #10) 700

Cash or Accounts Receivable 700

Materials Control 700

(When later sold)

**18-39** (20−25 min.) **Physical units, inspection at various stages of completion (chapter appendix).**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Inspection** | **Inspection** | **Inspection** |
|  | **at 15%** | **at 40%** | **at 100%** |
| Work in process, beginning (20%)\*  Started during March  To account for | 2,200  21,000  23,200 | 2,200  21,000  23,200 | 2,200  21,000  23,200 |
| Good units completed and transferred out  Normal spoilage | 19,500a  1,152b | 19,500a  1,284c | 19,500a  1,170d |
| Abnormal spoilage (1,800 – Normal spoilage)  Work in process, ending (70%)\*  Accounted for | 648  1,900  23,200 | 516  1,900  23,200 | 630  1,900  23,200 |

\*Degree of completion for conversion costs at the dates of the work-in-process inventories

a2,200 beginning inventory + 21,000 – 1,800 spoiled – 1,900 ending inventory = 19,500.

b6% × (21,000 units started – 1,800 units spoiled) = 6% × 19,200 = 1,152; beginning work-in-process inventory is excluded because it was already 20% complete at March 1 and past the inspection point.

c6% × (23,200 units – 1,800) = 6% × 21,400 = 1,284 because all units passed the 40% completion inspection point in March.

d6% × 19,500 = 1,170 because 19,500 units are fully completed and inspected during March.

**18-40** (20 min.) **Job costing, rework.**

1. Manufacturing Overhead Control (rework costs) 3,600

Materials Control ($24 × 50) 1,200

Wages Payable ($18 × 50) 900

Manufacturing Overhead Allocated ($30 × 50) 1,500

Normal rework on 50 units but not attributable to any specific controller

Loss from Abnormal Rework ($72 × 30) 2,160

Materials Control ($24 × 30) 720

Wages Payable ($18 × 30) 540

Manufacturing Overhead Allocated ($30 × 30) 900

Total costs of abnormal rework on 30 controllers

(Abnormal rework = Actual rework – Normal rework

= 80 – 50 = 30 controllers)

2. Total rework costs for controllers in August 2014 are as follows:

Normal rework costs allocated to controllers $3,600

Abnormal rework costs for controllers 2,160

Total rework costs $5,760

3. Manufacturing costs of job #9 before rework:

200 units × ($120+$24+$76) $44,000

Add: Normal rework costs 3,600

Total cost of job #9 $47,600

Unit cost of job (Total /200 units) $238

Work-in-Process Control (Job #9) 44,000

Materials Control ($120 × 200) 24,000

Wages Payable ($24 × 200) 4,800

Manufacturing Overhead Allocated ($76 × 200) 15,200

Manufacturing costs for 200 controllers on Job #9

Work-in-Process Control (Job #9) 3,600

Materials Control ($24 × 50) 1,200

Wages Payable ($18 × 50) 900

Manufacturing Overhead Allocated ($30 × 50) 1,500

Normal rework for 50 controllers attributable to Job #9

**18-41** (45 min.) **Weighted-average method, inspection at 80% completion.**

The computation and allocation of spoilage is the most difficult part of this problem. The units in the ending inventory have passed inspection. Therefore, of the 200,000 units to account for (25,000 beginning + 175,000 started), 25,000 must have been spoiled in August [200,000 – (125,000 completed + 50,000 ending inventory)]. Normal spoilage is 17,500 [0.10 × (125,000 + 50,000)]. The 7,500 remainder is abnormal spoilage (25,000 – 17,500).

Solution Exhibit 18-41, Panel A, calculates the equivalent units of work done for each cost category. We comment on several points in this calculation:

* Ending work in process includes an element of normal spoilage because all the ending WIP have passed the point of inspection––inspection occurs when production is 80% complete, while the units in ending WIP are 95% complete.
* Spoilage includes no direct materials units because spoiled units are detected and removed from the finishing activity when inspection occurs at the time production is 80% complete. Direct materials are added only later when production is 90% complete.
* Direct materials units are included for ending work in process, which is 95% complete, but not for beginning work in process, which is 25% complete. The reason is that direct materials are added when production is 90% complete. The ending work in process, therefore, contains direct materials units; the beginning work in process does not.

Solution Exhibit 18-41, Panel B, summarizes total costs to account for, computes the costs per equivalent unit for each cost category, and assigns costs to units completed (including normal spoilage), to abnormal spoilage, and to units in ending work in process using the weighted-average method. The cost of ending work in process includes the assignment of normal spoilage costs because these units have passed the point of inspection. The costs assigned to each cost category are as follows:

Cost of good units completed and transferred out

(including normal spoilage costs on good units) $4,693,375

Abnormal spoilage 169,275

Cost of ending work in process (including normal

spoilage costs on ending work in process) 1,835,350

Total costs assigned and accounted for $6,698,000

## 

## SOLUTION EXHIBIT 18-41

Weighted-Average Method of Process Costing with Spoilage,

Finishing Department of the Horsheim Company for August

PANEL A: Summarize the Flow of Physical Units and Compute Output in Equivalent Units

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **(Step 1)** | **(Step 2)**  **Equivalent Units** | | |
| **Flow of Production** | **Physical Units** | **Transferred-**  **in Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| Work in process, beginning (given)  Started during current period (given)  To account for  Good units completed and transferred out  during current period:  Normal spoilage on good units\*  12,500 × 100%; 12,500 × 0%; 12,500 × 80%  Work in process, ending‡ (given)  50,000 × 100%; 50,000 × 100%; 50,000 × 95%  Normal spoilage on ending WIP\*\*  5,000 × 100%; 5,000 × 0%; 5,000 × 80%  Abnormal spoilage†  7,500 × 100%; 7,500 × 0%; 7,500 × 80%  Accounted for  Equivalent units of work done to date | 25,000  175,000  200,000  125,000  12,500  50,000  5,000  7,500    200,000 | 125,000  12,500  50,000  5,000  7,500    200,000 | 125,000  0  50,000  0  0    175,000 | 125,000  10,000  47,500  4,000  6,000    192,500 |

\*Normal spoilage is 10% of good units that pass inspection: 10%  125,000 = 12,500 units. Degree of completion of normal spoilage in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.

‡Degree of completion in this department: transferred-in costs, 100%; direct materials, 100%; conversion costs, 95%.

\*\*Normal spoilage is 10% of the good units in ending WIP that have passed the inspection point, 10% × 50,000 = 5,000 units. Degree of completion of normal spoilage in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.

†Abnormal spoilage = Actual spoilage − Normal spoilage = 25,000 − 17,500 = 7,500 units. Degree of completion of abnormal spoilage in this department: transferred-in costs, 100%; direct materials, 0%; conversion costs, 80%.

PANEL B: Summarize the Total Costs to Account for, Compute the Cost per Equivalent Unit, and Assign Costs to the Units Completed, Spoiled Units, and Units in Ending Work-in-Process Inventory

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Total**  **Production**  **Costs** | **Transferred-**  **in Costs** | **Direct**  **Materials** | **Conversion**  **Costs** |
| **(Step 3)** Work in process, beginning (given)  Costs added in current period (given)  Total costs to account for  **(Step 4)** Costs incurred to date  Divided by equivalent units of work done to date  Cost per equivalent unit    **(Step 5)** Assignment of costs  Good units completed and transferred out (125,000 units) | $ 312,250  6,385,750  $6,698,000 | $ 207,250  1,618,750  $1,826,000  $1,826,000  ÷200,000    $ 9.13 | $ −  1,638,000  $1,638,000  $1,638,000  ÷ 175,000  $ 9.36 | $ 105,000  3,129,000  $3,234,000    $3,234,000  ÷ 192,500  $ 16.80 |
| Costs before adding normal spoilage  Normal spoilage (12,500 units)  (A) Total costs of good units completed and transferred out  (B) Abnormal spoilage (7,500 units)  Work in process, ending (50,000 units)  WIP ending, before normal spoilage  Normal spoilage on ending WIP  (C) Total costs of ending WIP  (A)+(B)+(C) Total costs accounted for | $4,411,250  282,125  4,693,375  169,275  1,722,500  112,850  1,835,350  $6,698,000 | 125,000# × ($9.13 + $9.36 + $16.80)  (12,500# × $9.13) + (0# × $9.36) + (10,000# × $16.80)  (7,500# × $9.13) + (0# × $9.36) + (6,000# × $16.80)  (50,000# × $9.13) + (50,000# × $9.36) + (47,500# × $16.80)  (5,000# × $9.13) + (0# × $9.36) + (4,000# × $16.80)  $1,826,000 + $1,638,000 + $3,234,000 | | |

#Equivalent units of transferred-in costs, direct materials, and conversion costs calculated in Step 2 in Panel A.

2. The issues related to the determination of the percentage of spoilage considered normal are similar to the factors discussed in Chapter 17 regarding the importance of verifying the estimated completion percentages of ending work in process, especially with regard to conversion costs. A supervisor who wants to show better operating income performance might categorize more of the spoilage as normal, thereby reducing the amount that must be written off against income as the loss from abnormal spoilage. Managers must stress the value of consistent and unbiased estimates of normal spoilage percentages and drive home the importance of pursuing ethical actions and reporting the correct income figures, regardless of the short-term consequences of doing so.

In the Horsheim Company situation, if all 25,000 units spoiled were considered normal spoilage, the $169,275 in abnormal spoilage would no longer exist and would not be a period expense for August. Instead, it would be reassigned as normal spoilage to the cost of goods completed and transferred out, as well as the ending work in process (because the latter has also passed the point of inspection). The simplest way to calculate the effect is to divide the current abnormal spoilage cost of $169,275 in the ratio of the number of good units currently in each category (125,000 for units completed and transferred out and 50,000 for ending work in process). The new amounts would therefore be given as follows:

Cost of goods completed and transferred out:

$4,693,375 + ($169,275)(125,000/175,000) = $4,814,285.71

Cost of goods in ending work-in-process inventory:

$1,835,350 + ($169,275)(50,000/175,000) = $1,883,714.29.

An alternative approach to this calculation is to note that the total number of spoiled units is 25,000, on a base of 175,000 good units that have passed inspection. If all spoilage is normal, then this equates to considering normal spoilage as one-seventh of good units that pass inspection. So, the normal spoilage on good units completed and transferred out during August is (125,000 units/7) = 17,857.14 units, whereas the normal spoilage on good units in ending work in process is (50,000 units/7) = 7,142.86 units. One could use these numbers in Step 1 of Panel A (rather than the 12,500 units and 5,000 units currently considered normal spoilage in each category) and work through the calculations in Step 2 and in Panel B to verify that the final cost figures are in fact the ones given above.