Process Costing

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Introduction

Process costing is one of the basic techniques of management accounting. However, without a thorough understanding of its underlying principles process costing calculations may present difficulties for students. This article attempts to provide a brief but comprehensive review of process costing and assist students in their approach to answering examination questions. First, a brief description of process costing is provided including key terms used in process costing. Next, a basic approach to answering process costing questions is suggested. Finally, a simple example demonstrates how each process costing method may be applied.

Process costing is used when identical items are continuously mass produced and manufacturing involves one or more processes. Examples of products requiring process costing include paint, food, chemicals and beer. Process costing systems typically have the following characteristics:

- Costs are accumulated by cost centre with no attempt made to assign costs to specific batches.
- Costs are accumulated based on a time period rather than a particular job.
- Process accounts are maintained for each department or cost centre.
- Completed costs from each department or cost centre become the raw materials for the subsequent department or cost centre.

Typically, all materials are input at the start of a manufacturing process while labour and overhead costs (*conversion costs*) incurred to convert the materials into outputs occur uniformly throughout the process until goods are complete. The outputs from the process may comprise completed and uncompleted units and there may also be spoiled units some of which are expected to arise from the process (*normal loss*) and others which are not anticipated (*abnormal loss*). Sometimes it is possible to sell spoiled units of production to generate a small income or *scrap value*. The key terms used in process costing are summarised in Figure 1.

The difficulties associated with process costing relate to the allocation of costs incurred to the outputs obtained. As mentioned above outputs may include closing work in progress, normal loss, abnormal loss or abnormal gain and completed units which may incorporate opening work in progress that was completed during the period. How each of these outputs is accounted for using process costing is considered below:

Closing work in progress (Closing WIP)
Units of product that are not fully finished at the end of the process will usually be complete in terms of materials but require further conversion costs to finish them. In this situation, the degree of completion may be established in terms of finished units (e.g. 100 units 40% complete; stating these incomplete units in terms of finished units ≈ 40 'equivalent' finished units) and costs may be allocated to the incomplete units based on the 'equivalent' number of finished units.

Normal loss

Where units of product are expected to be spoiled as part of the production process (even though the manufacturing process is operating efficiently) no cost is allocated to these units. The cost of the spoiled units is thus absorbed into the cost of unspoiled units representing a normal occurrence in the production process.

Abnormal loss/gain

If the number of units that are spoiled during the production process is higher or lower than expected (i.e. higher or lower than the normal loss) both materials and conversion costs are allocated to these units in the same way as for completed units and work in progress. This is done to highlight the abnormal loss or gain so that the cause may be investigated and the production process may be improved.

Opening work in progress (Opening WIP)

Partially completed units at the start of a period have costs attached to them from the previous period. There are two methods of accounting for these costs, weighted average costing (WA) and first in first out costing (FIFO). The difference between the two methods is in the treatment of opening WIP. Under WA the opening WIP costs are added to the costs of the period under review and spread across all production. The advantages of WA are that all units completed during the period are assigned the same cost and the method itself is easier to understand and use than FIFO. With FIFO the opening WIP costs are kept separate from the costs incurred during the period under review and are added to the cost of units completed and transferred from the process. The FIFO method is considered to provide more accurate information about cost behaviour than WA.

Figure 1 - Key terms used in process costing

Conversion cost: this comprises both labour and overhead costs.

Work in progress (WIP): units of product that are not fully completed and which degree of completion may be calculated with some degree of accuracy.

Equivalent units: work in progress units that, using the degree of completion of the units, may be stated in terms of finished units e.g. 100 units that are 40% complete are considered equivalent to 40 units (100 x 40%) that are 100% complete.

Normal loss: this is a loss or reduction in output that is inherent in the production process that cannot be eliminated e.g. liquids that evaporate. As this loss occurs under efficient operating conditions it is unavoidable or uncontrollable.

Abnormal loss: this is a loss that is not inherent in the production process; it is not expected to occur under efficient operating conditions e.g. improper mixing of materials. This loss arises due to inefficiency and so is avoidable or controllable.

Abnormal gain: this is a gain that is not inherent in the production process; similar to the abnormal loss, it is not expected to occur under efficient operating conditions. It arises when the actual loss in a process is less than expected.

Scrap value: this is the income obtained by selling any spoiled units of production i.e. any normal or abnormal losses.

Suggested approach to answering process costing questions

(1) Prepare a statement reconciling total units input to the process with the total outputs from the process in terms of closing work in progress, completed units, normal loss, abnormal loss or abnormal gain.

(2) For total outputs from the process, calculate equivalent units for each of the categories: previous process costs (where applicable), materials and conversion costs (labour and overheads).

(3) Set out costs corresponding to each equivalent unit category at (2) above based on costing approach adopted (i.e. WA or FIFO).

(4) Calculate cost per equivalent unit for each cost category: previous process costs (where applicable), materials and conversion costs (labour and overheads).

(5) Allocate costs to each ouput: closing WIP, abnormal loss or abnormal gain and completed units using cost per equivalent unit calculated at (4) above and based on costing approach adopted (i.e. WA or FIFO.

(6) Prepare a 'T' account for the process showing both units and € value columns. Include the units input and costs given in the question, and the output in units and costs as calculated at (2) and (5) above. The inputs and outputs both in terms of units and costs should balance the process account.

A worked example

RX Limited manufactures dog biscuits. All of the ingredients are added at the start of the mixing process. The company expects that a normal loss of 5% of new raw materials input to the process will occur. At the end of every month some batches are partially completed (WIP). The following information relates to the month of June:

Detail	*Degree - of completion*	*€*
Opening WIP – 1,600 kgs		
- Materials	100%	2,160
- Conversion costs	50%	400
Costs incurred during the period		
- Materials - 10,000 kgs		13,680
- Conversion costs		5,992
Output – 10,220 kgs		
Closing WIP – 780 kgs		
- Materials	100%	
- Conversion costs	60%	

RX Limited: Solution - using WA costing method

			Equivalent units		
		Physical units kgs	Materials	Conversion costs	
Inputs					
Opening WIP		1,600			
Units input		10,000			
Total inputs		11,600			
Outputs					
Completed		10,220	10,220	10,220	
Normal loss (5% x 10,000 input)		500	-	-	
Closing WIP (note 3)		780	780	468	
Abnormal loss (note 1)		100	100	100	
Total outputs	(b)	11,600	11,100	10,788	
Costs (note 2)			€	€	
Opening WIP (given)			2,160	400	
Current costs (given)			13,680	5992	
Total costs	(a)		15,840	6,392	
					Total
Cost per equivalent unit	(a)/(b)		€1.427	€0.5925	€2.0195
Allocated			€	€	€
Completed			14,584	6,056	20,640
Closing WIP (note 3)			1,113	277	1,390
Abnormal loss			143	59	202
Total costs allocated			15,840	6,392	22,232

Process Cost Account					
	Kgs	€		Kgs	€
Opening WIP	1,600	2,560	Completed	10,220	20,640
Inputs – Materials	10,000	13,680	Normal loss	500	-
- Conversion costs		5,992	Abnormal loss	100	202
			Closing WIP	780	1,390
	11,600	22,232		11,600	22,232

Notes:

1. Abnormal loss is the figure that balances the inputs to the production process with the outputs from the process.
2. The WA method spreads the total costs, both opening WIP costs and current period costs, over all production.
3. Closing WIP (780 kgs): Materials = 780 kgs completed product and for conversion costs 468 (60% x 780 kgs) equivalent kgs of completed product.

RX Limited: Solution - using FIFO costing method

			Equivalent units		
		Physical units kgs	Materials	Conversion costs	
Inputs					
Opening WIP (note 4)		1,600	-1,600	-800	
Units input		10,000			
Total inputs		11,600			
Outputs					
Completed		10,220	10,220	10,220	
Normal loss (5% x 10,000 input)		500	-	-	
Closing WIP (note 3)		780	780	468	
Abnormal loss (note 1)		100	100	100	
Total outputs	(b)	11,600	9,500	9,988	
Costs (note 5)			€	€	
Current costs (given)	(a)		13,680	5992	
					Total
Cost per equivalent unit	(a)/(b)		€1.44	€0.60	€2.04
Allocated			€	€	€
Closing WIP (note 3)			1,123	280	1,403
Abnormal loss			144	60	204
Completed units					
Opening WIP (given)			2,160	400	
Add costs to complete (note 6)				480	
			2,160	880	
Units started and completed		(note 7)	12,413	5,172	
Total completed units			14,573	6,052	20,625
Total costs allocated			15,840	6,392	22,232

Process Cost Account					
	Kgs	€		Kgs	€
Opening WIP	1,600	2,560	Completed	10,220	20,625
Inputs - Materials	10,000	13,680	Normal loss	500	-
- Conversion costs		5,992	Abnormal loss	100	204
			Closing WIP	780	1,403
	11,600	22,232		11,600	22,232

Notes**:**

4. Opening WIP (1,600 kgs): Materials = 1,600 kgs completed product and conversion costs 800 (50% x 1,600 kgs) equivalent kgs of completed product. These opening WIP completed/equivalent units are subtracted from the outputs to give the current period equivalent units over which current period costs are to be spread.
5. In calculating the cost per equivalent unit FIFO only includes current period costs.
6. FIFO assumes that opening WIP is completed first and when assigning costs to output opening WIP is allocated costs to complete the units. In this example, opening WIP is complete as regards materials but requires to 50% x 1,600 kgs ≈ 800 kgs of additional (equivalent unit) conversion costs.
7. To allocate costs to completed production FIFO subtracts opening WIP units from the total units completed to obtain the units that were started and completed during the period. For both materials and conversion costs this is 8,620 kgs (10,220 – 1,600).

Conclusion

Process costing may be used when identical items are mass produced and manufacturing may involve more than one process. In answering process costing questions it is important to understand key terms and establish whether WA or FIFO is being used as this has implications for the allocation of costs to outputs from the process. Having read this article and worked through the example, hopefully you should have a better understanding of how process costing works whether WA or FIFO is used. To enhance your learning further it would be beneficial to attempt, under examination conditions, some process costing questions from previous exam papers.