METHOD OF COSTING (II)

(PROCESS COSTING, OPERATION COSTING, JOINT PRODUCTS AND BY-PRODUCTS)

PROCESS COSTING

Applicability

Where the material has to pass through two or more process for being converted into a final product.

Example → Steel, soap, chemicals, rubber, vegetable oil, paints, varnish etc.

Features

(i) Each plant or factory is divided into a number of processes, cost centres or departments and each such division is a stage of production or process.

(ii) Manufacturing activity is carried on continuously by means of one or more process run sequentially, selectively or parallely.

(iii) The output of one process becomes the input of another process.

(iv) The end product usually is of like units not distinguishable from one another.

(v) It is not possible to trace the identity of any particular lot of output to any lot of input materials.

(vi) production of a product may give rise to joint pro and / or By-products.

Costing procedure

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Cost of each process

↓ Material

↓ Labour

↓ Direct Expenses (Depreciation, repairs, maintenance, insurance etc)

↓ Overheads of production (Rent, power, lighting bills, gas and water bills etc.)

Operation Costing :—

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It is a refinement of process costing

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Determination of cost of each operation rather than the each process

↓

Better scope of control.

~~Unit operation cost~~ = ~~Cost at the end of each operation~~

Unit operation cost at the end of each operation = Total operation cost / Total output units.

Applicability → Where process costing consists of different operation.

Proforma

Process A A/c

	Qty	Rate	Amount		Qty	Rate	Amount
To Material				By Normal wastage ⊛			
To Labour				By Abnormal wastage ⊛⊛			
To Overhead				By Process B A/c			
To Abnormal gain (if any) ⊛⊛							

Process B A/c

To Process A A/c				⊛⊛⊛ By Finished stock A/c			
To Material, Labo							
To Labour							
To overhead							
To ⊛⊛⊛							

Forwarded Stock A/c

	Qty	Rate	Amount		Qty	Rate	Amount
To Process B A/c	x	x	x	By Balance c/d			
To Balance b/d							

Process Loss

Normal Loss (Absorbed by good units)

↓

Amount realised credited to respective process A/c

Abnormal Loss (Loss excess of pre-determined basis)

↓

Cost equal to the cost per unit of good units

↓

credited to process A/c

↓

not treated as a part of cost.

↓

Debited to Costing P/L A/c

Abnormal gain

↓

When actual figures exceeds the expected figures.

↓

computed on the basis of cost of normal production units.

Normal Loss A/c

	Qty	Rate	Amount		Qty	Rate	Amount
To Process A/c				By Cash A/c			
				By Abnormal Gain A/c			

Abnormal gain A/c

To Normal Loss A/c				By Process A/c			
To Costing P/L A/c							

Note (i) Adjustment between Normal Loss and Abnormal gain should be considered when these two are in same process. (i.e one process normal loss can't be adjustable with other process abnormal gain)

adjustment entry -

Abnormal gain A/c — Dr
(No: of Abnormal gain units × Net scrap value of normal loss respective process)
TO Normal Loss A/c

Then for cash received entry.

Cash A/c — — — Dr
[(Normal Loss units − Abnormal gain units) × Net Scrap value of normal loss units of respective process
TO. Normal Loss A/c]

Note (ii)

a) Cost per unit of process = Cost of Normal output / Normal output units

= (Total Cost − Scrap value) / (Total units − Normal Loss units)

b) value of abnormal loss = (Normal Cost of normal output / Normal out put) × Units of Abnormal Loss.

c) Abnormal A/c

TO Process A/c	XX	By Cash A/c (No: of units × Net realisable value of scrap units)	XX
		By Costing P/L A/c	XX
	XX		XX

COSTING OF Equivalent Production Units

(Valuation of Work-in-progress)

Equivalent production means converting the incomplete production units into their equivalent completed units

$$\text{Equivalent completed units} = \left(\begin{array}{l}\text{Actual number of units in the process of manufacture}\end{array}\right) \times \text{percentage of work completed.}$$

For instance if 25% of work has been done on the average of units still under process, then 200 such units will be equal to 50 completed units and the cost of work-in-progress will be equal to the cost of 50 finished units

Methods of Valuation of Work-in-progress

- FIFO
- LIFO
- Average Cost Method (or Weighted average cost method)

(i) FIFO Method :-

Under this method incomplete units are to be completed first. Under this method the units completed and transferred include completed units of opening work-in-progress and subsequently introduced units.

Comple cost of units in W.I.P (opening) = Cost of opening work-in-progress + Proportional Cost incurred on completing the same.

Total cost of units transferred = compte cost of W.I.P units + Cost of units completely processed during the period

Computation of equivalent units

Input units	Particulars	Output units	Equivalent production: % of work done during current period	Equivalent units
		(1)	(2)	(1) × (2)
xx	Opening W-I-P	xxx	(100% - % of completion at the beginning)	xx
xx	Units introduced			
	- completed	xxx	100%	xx
	- Normal loss	xxx	—	—
	- closing work in progress	xx	xx	xx
	- Abnormal loss	xx	100%	xx
xxx		xxx		xxx

Equal

Equivalent units (A)

Cost per equivalent units = (Total cost of the process (for the period) − Scrap value of normal loss) / Equivalent units (A)

This can be used for the purpose of calculation of cost of uncompleted units to complete (on equivalent basis) and cost of completely process units, cost of abnormal loss units, cost of closing W-I-P etc.

(2) ⇒ Thus exclude the cost of opening W-I-P.

(ii) LIFO Method

Under this method units lastly entering in the process are to be first to be completed. completed units will be shown at their current cost. Opening W.I.P units are not transferred till the end of the period then. Closing W.I.P of such units will be shown at the cost of the beginning W.I.P. (i.e Y. of completion unchanged, so no. additional cost incurred)

As similar to the previous method we have to calculate the equivalent units

Value of closing W.I.P = Cost of opening W.I.P units (if not completed) + cost of equivalent units introduced this period but not completed.

(iii) Average Cost Method

Example Let (60% complete)
Opening W.I.P = 1000 units
Introduced = 5000 units
Normal Loss = 200 units.
Transferred to next process = 5000 units
Abnormal Loss = 200 units
Closing W.I.P (75% Complete) 600 units.

Statement of equivalent production

	Units	Equivalent %	Production units
Transferred to next process	5000	100%	5000
Normal Loss	200	—	—
Abnormal Loss	200	100%	200
Closing W.I.P	600	75%	450
			[A] 5650

$$\text{Cost per Equivalent units} = \frac{\text{Cost of opening WIP} + \text{Cost of units introduced} - \text{Scrap value of normal Loss}}{\text{[A] Equivalent production units.}}$$

Note If different items of cost i.e. Material, Labour, Overhead etc given then following procedure should be followed. :-

Statement of Equivalent production. (——— Method)

Input	Output	Material % completion	Material Equivalent units	Labour % completion	Labour Eq: units	Overhead % com:	Overhead Eq: units
opening WIP	**						
Introduced	***						
- Completed	**	100%					
- Normal Loss	**	—	—	—	—	—	—
- Abnormal Loss	**	100%		100%		100%	
- Closing WIP	**						
			*** [A]		*** [B]		*** [C]

Statement of Cost per Equivalent unit

		Material (less scrap value)	Labour	overhead	Total
Total Cost	(1)	**	**	**	**
Equivalent unit	(2)	[A]	[B]	[C]	—
Cost per Equivalent unit	(1)/(2)	x	y	z	x+y+z = v

Cost of completed units transferred
= Completed units (Equivalent) × [V]

When average cost method is used.

Cost of closing W-I-P
- Material (Equivalent units × [X]) xx
- Labour (" × [Y]) xx
- Overhead (" × [Z]) xx

xxx

If we follow the FIFO method then the cost of completed units transferred is as ~~follows~~ under.

Cost of opening W-I-P Stock xxx

Add Cost incurred on opening W-I-P Stock (to complete)
- Material (Equivalent units × Equivalent cost per unit of material) xx
- Labour (" × Equivalent cost per unit of Labour) xx
- Overhead (" × Equivalent cost per unit of Overhead) xx

xx

xxx

Add Cost of completed units during the period
(Equivalent units × Equivalent total cost per unit of) xxx

Cost of units transferred to next process xxx

Intere-Process Profit :—

process I → transferred at (Cost + % of profit) / Market value → process II

Inter-process profits = Transfer price − Cost price.

Advantages

(i) comparison between the cost of output and its market price at the stage of completion is facilitated.

(ii) Each process is made to stand by itself as to the profitability.

Disadvantages

(i) The use of inter process profits involves complication.

(ii) The system shows profits which are not realised because of stock not sold out.

Note

(i) Process Account are to be maintained with three columns (i.e Total, Cost and Profit)

(ii) No unrealised profit in closing Stock or Opening Stock in 1st process.

(iii) Cost of closing stock = (Cost / Total amount) × value of closing Stock

Unrealised profit = Value of closing Stock − Cost of closing Stock

OR

Unrealised profit = Closing Stock × (Transfer price / Total Cost of transferee process) × % of profit on transfer price added in the transferor process.

(iv) Finished Stock A/c

	Total	Cost	Profit		Total	Cost	Profit
To opening Stock	–	–	–	By Sales	–	–	–
To Process A	–	–	–				
	–	–	–				
Less closing Stock	–	–	–				
			⊛				
Cost of goods sold	–	–	–				
To Profit	–		–				
	–	–	–		–	–	–

(v) Total unrealised profit (or reserve for unrealised profit)

On Stock in Process 1 (Say)	⊛
On Stock in process 2 (Say)	xx
On Finished Stock ⊛	xx
Total.	xxx

(vi) Costing P/L A/c

To Total profit	xxx		By Profit on Process I (Say)	xx
			By Profit on process II (Say)	xx
			By Finished Stock A/c	xx
				xxx

(vii) Closing Stock for Balance Sheet purpose should be calculated after deducting the unrealised profit.

(viii) Profit on Finished Stock is the balancing figure between Sales and Cost.

JOINT PRODUCTS AND BY-PRODUCTS

Joint products and By-products

Joint products are defined as the products which are produced simultaneously from same basic raw materials by a common process or processes but none of the products is relatively of more importance or value as compared with the other. For example petrol, kerosene oil, fuel oil, lubricating oil, wax, tar and asphalt are the examples of joint products.

By products, on the other hand are the products of minor importance. Jointly produced with other products of relatively more importance or value by the common process and using the same basic raw materials. These products remain irreparable upto the point of split off. For example, in Dairy industries, butter or cheese is the main product, but butter milk is the by-product.

Points of Distinction

(i) Joint products are the products of equal economic importance, while the by-products are of lesser importance.

(ii) Joint products are produced in the same process, whereas by products are produced from the scrap or the discarded materials of the main product.

(iii) Joint products are not produced incidentally, but by-products emerge incidentally also

Co-products:- Joint products and co-products are used synonymously in common parlance, but strictly speaking a distinction can be made between two. Co-products may be defined as two or more products which are ~~complementary~~ contemporary but do not emerge necessarily from the same material in the same process. For instance, wheat and grain produced in two separate farms with separate processing of cultivation, are the co-products. Similarly timber boards made from different trees are co-products.

Apportionment of joint Costs

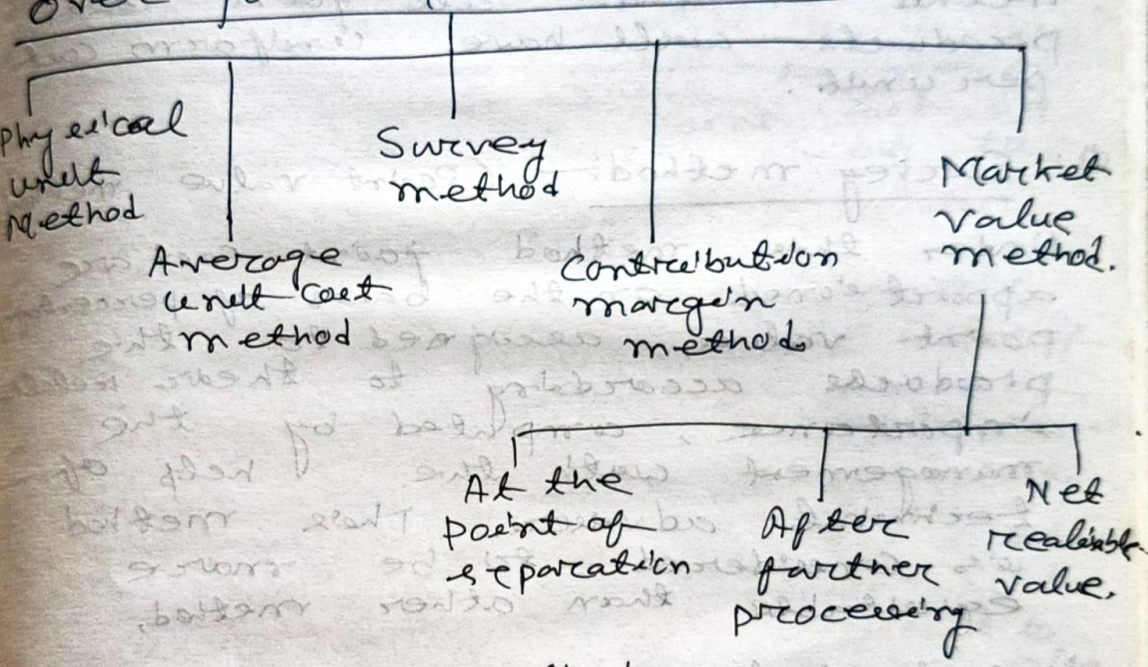
For accounting purpose, each joint product is treated as individual product after split off point. A separe account is opend for each joint product. All apportioned joint costs and costs after separation are debited to this account. The cost accounting of joint products involves the apportionment of the total joint cost among various joint products. Thus joint costs up to the split-off points are allocated on some equitable basis and when all the joint products become individual products. the further processing costs are allocated directly to each product.

Thus the apportionment of joints costs over different products produced involve the following two cases

(i) When two or more products are simultaneously produced and there is by-product.

(ii) When there are both joint products and by-products.

Method of apportioning joint cost over joint products



(i) Physical unit method

Assumption → Joint products are capable of being measured in the same units.

The basis use for apportioning joint cost over the joint products is the physical volume of material present in the joint products at the point of separation. Any loss arising during the stage of processing is also apportioned over the products on the same basis. The main defect of this method is that it gives equal

importance and value to all the joint products.

[Apportioned Joint Cost = $\frac{\text{Total joint Cost}}{\text{Total physical units}}$ × Physical units of each product]

(ii) Average unit Cost method

$$\text{Average Cost per unit} = \frac{\text{Total joint Costs}}{\text{Units produced}}$$

↑

Joint cost are to be apportioned on the basis of this cost per unit,

The effect of application of this method is that cell joint cost. products will have uniform cost per unit.

(iii) Survey method:— (Point value method)

Under this method joint cost are apportioned on the basis of percentage/ point values, assigned to the products according to their relative importance, computed by the management with the help of technical advisers. This method is considered to be more equitable than other method,

(iv) Contribution margin method:

Under this method

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Joint Cost

↓

segregated

Fixed

↓

After the point of separation, all the variable cost incurred be added to the variable cost determined earlier (R)

Variable

↓

This portion are to be apportioned on the basis of Unit produced (average method) are physical quantities. (R)

Now we have to find out contribution.
[Sales − Variable cost (as earlier)]

Calculate a contribution ratio. The Fixed costs are then apportioned over the joint products on the basis of the contribution ratio.

(v) Market value method :-

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Most popular and convenient method
↓

The products are made to bear a proportion of the joint cost on the basis of their ability to absorb the same.

Market value = weighted market value
= Units produced × price of a unit of joint product.

a) Market value at the point of separation

This method is used for the apportionment of joint costs to joint products upto the split off point. It is difficult to apply this method if the market value of the products at the point of separation are not available.

procedure → For apportionment of joint cost a multiplying factor is to be determined.

Let joint cost ₹ 64,500.
two products A = 200 units
B = 200 units
Sales revenue @ ₹ 86,000 @ ₹ 170 per unit of product A and @ ₹ 260 per unit of product B.

Multiplying factor = $\frac{64,500}{86,000} \times 100$

= 75 %.

Joint cost apportioned over product A = Sales revenue of product A × 75%

= 34,000 × 75%

= ₹ 25,500

Joint cost apportioned over product B = Sales revenue of product B × 75%

= 52,000 × 75%

= ₹ 39,000

Alternatively (*) The joint cost may be apportioned in the ratio of sales values of different joint products.

b) Market value after processing:

Here the sales value of finished product is considered. Principle of apportionment is same as (a).

Let. Sales prices of product A and B after further processing is ₹ 200 and ₹ 300 respectively.

∴ pre-separation cost is 64,500. will be apportioned in the ratio of 2:3 as follows. (*)

~~A = (200 units × 200) × 64,500~~

1,00,000

A = 64,500 × 40,000 / 1,00,000

= ₹ 25,800

B = 64,500 × 60,000 / 1,00,000

= ₹ 38,700.

Sales revenue
A = 200 × 200 = 40,000
B = 200 × 300 = 60,000

(**) Total joint cost / Total Sales value × Sales revenue of each product

This method is unsuitable, when all the joint products are not subjected to further processing. The net realisable value method which is discussed as below overcomes the short coming of this method.

c) Net realisable value method :-

From the sales value of the joint product (at finished stage) are deducted

(i) estimated profit margin
(ii) selling and distribution expenses, if any, and
(iii) post-split off costs.

The resultant figure so obtained is known as net realisable value of joint products. Joint costs are apportioned in the ratio of net realisable value. This method is extensively used in many industries.

$$\text{Apportioned joint cost} = \frac{\text{Total joint cost}}{\text{Total net realisable value}} \times \text{Net realisable value of each product}$$

Note

(i) Fixed cost should not be considered as joint cost, it should be deducted at the time of calculation of overall profits from all joint products

(ii) Total joint cost = Raw Material cost + Manufacturing expenses (including wages and overheads)

(iv) If the revenue over joint cost ~~to be higher~~ ~~than~~ at the time of sales without further processing than the sales after further processing ie higher than the further production of such product is profitable.

Methods of apportioning joint cost over by-products :—

(i) Market value or Value on realisation :—

Total Cost	xxx
Less Net realisation value of by-product	xx
Cost of main product (Cost of production of main product)	xxx

Now Net realisation value of by product

= Sales value of by product — Further processing cost of the by-product — Selling, Distribution and Adm: expenses attributable to the by-product.

(ii) Standard Cost or technical estimates

~~Sta~~ By-product ⟶ Valued at ~~stand cost~~ Standard Cost.

↓

Determining factor

(i) Average cost recorded in the past
(ii) Technical estimates of the number of units of ore/gas raw material going into the main product and the number forming the by-product or by adopting some other consistent basis.

This method may be adopted where the by-product is not saleable in the condition in which it emerges or comparative prices of similar products are not available.

c) Comparative price:—

By-product ⟶ valued at the price of similar or alternative material.

d) Re-use basis:— In some cases the by-product may be of such a nature that it can be reprocessed in the same process as part of the input of the process. In that case the value put on the by-product should be same as that of the materials introduced into the process. If, however, the by-product can be put into an earlier process only, the value should be the same as for the materials introduced into the process.

Treatment of By-product in Cost Accounting :—

(i) When they are of small total value:

Amount realised from by product

Method - 1	Method - 2
Credited to P/L A/c no credit in Cost A/c It is treated as Misc income or additional sales revenue.	Total Cost Rs Less Sale proceeds of by-product X It may be (1) Product on Cost or (2) Cost of Sales

(ii) When the by-products are of considerable total value:— In this case By-product ⟶ regarded as Joint product

Determination of exact cost of by-product

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Apportioned joint cost over by-products and joint products

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Basis for apportionment

① Relative market value method

② Physical output method (at the point of separation)

③ Ultimate selling prices (of sold)

(iii) When they require further processing

Net realisable value of by-product = Realisable Value of by-product − Further processing cost

If it is small, it should be treated as (i)

If it has considerable sales value, it should be treated as (ii)