UNIT IV

PRODUCTION COST ESTIMATION

Content 3:

COST ESTIMATION IN WELDING SHOP

A lap welded joint is to be made as shown in Fig.

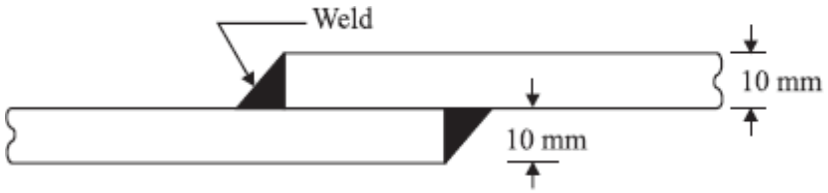


Fig. 5.4. Lap joint

Estimate the cost of weld from the following data:

Thickness of plate = 10 mm
Electrode diameter = 6 mm
Minimum arc voltage = 30 Volts
Current used = 250 Amperes
Welding speed = 10 meters/hour
Electrode used per meter of weld = 0.350 kg
Labour rate = Rs. 40 per hour
Power rate = Rs. 3 per kWh
Electrode rate = Rs. 8.00 per kg
Efficiency of welding m/c = 50 percent
Connecting ratio = 0.4
Overhead charges = 80 percent of direct charges
Labour accomplishment factor = 60 percent

Solution :

Time per meter run of weld = $\frac{1}{10}$ hrs = 6 minutes.

Cost of power consumed per meter run of weld = $\frac{30 \times 250}{1{,}000} \times \frac{6}{60} \times \frac{1}{0.5} \times \frac{1}{0.4} \times$

= Rs. 11.25

$$\text{Cost of labour per meter of weld length} = \frac{\text{Cost of labour per hour}}{\text{Welding speed in m/hr}} + \frac{1}{\text{Labour accomplishment factor}}$$

$$\text{Cost of labour} = \frac{4}{10} \times \frac{100}{60}$$

$$= \text{Rs. } 6.66/\text{meter of weld length}$$

Cost of electrodes per meter of weld = 0.350×8

$$= \text{Rs. } 2.80$$

Total direct cost per meter of weld = Rs. $11.25 + 6.66 + 2.80$

$$= \text{Rs. } 20.71$$

Overhead charges per meter of weld = Rs. $\frac{20.71 \times 80}{100}$

$$= \text{Rs. } 16.60$$

Total charges for welding one meter length of joint = Rs. $20.71 + 16.60$

$$= \text{Rs. } 37.31$$

As this is a double fillet weld, lap joint length of weld = $1.5 \times 2 = 3$ meters

Total charges of making the welded joint = Rs. 37.31×3

$$= \text{Rs. } 112$$

Example 2: Calculate the welding cost from the following data:

Plate thickness	= 12 mm
Form of joint	= 60°V
Root gap	= 2 mm
Length of joint	= 2 meters
Electrode diameters	= 3.5 mm and 4.0 mm
Electrode length	= 350 mm
Electrodes required per meter weld For 100 per cent efficiency and 50 mm stub length	= 10 nos. of 3.5 mm dia and 24 nos. of 4 mm dia
Average deposition	= 80 percent
Melting time per electrode	= 1.3 minutes for 3.5 mm dia 1.50 minutes for 4 mm dia electrode
Connecting ratio	= 2
Hourly welding rate	= Rs. 40
Overhead charges	= 40 percent of welding cost.

Solution:

(*i*) No. of 3.5 mm dia electrodes required per meter length of weld with 100 percent deposition efficiency and 50 mm stub length = 10 nos.

Electrodes required for 2 meter length of weld with 80 percent deposition efficiency and 50 mm stub length

$$= \frac{2 \times 10 \times 100}{80}$$
$$= 25 \text{ nos.}$$

(*ii*) No. of 4 mm dia electrodes required for 2 meter weld length with 80 percent deposition efficiency and 50 mm stub length

$$= \frac{2 \times 24 \times 100}{80}$$
$$= 60 \text{ nos.}$$

(iii) Time required melting 25 electrodes of 3.5 mm dia and 60 electrodes of 4 mm dia and with connecting ratio of 2

$$= 2 \times (25 \times 1.3 + 1.5 \times 60)$$
$$= 245 \text{ minutes}$$

(*iv*) Welding cost @ Rs. 40 per hour

$$= \frac{245}{60} \times 40$$

$$= \text{Rs. } 163$$

Overhead charges = 40 percent of direct charges

$$= \text{Rs. } 163 \times 0.4$$
$$= \text{Rs. } 65$$

Total cost of welding = 163 + 65

$$= \text{Rs. } 228$$

Example2 : Work out the welding cost for a cylindrical boiler drum $2\frac{1}{2}$ m×1m diameter which is to be made from 15 mm thick m.s plates. Both the ends are closed by arc welding of circular plates to the drum. Cylindrical portion is welded along the longitudinal seam and welding is done both in inner and outer sides. Assume the following data:

(i) Rate of welding = 2 meters per hour on inner side and 2.5 meters per hour on outer side

(iii) Cost of electrode =Rs. 0.60 per meter
(iv) Power consumption =4 kWh/meter of weld
(v) Power charges =Rs. 3/kWh
(vi) Labour charges =Rs. 40/hour
(vii) Other overheads =200 percent of prime cost
(viii) Discarded electrodes =5 percent
(ix) Fatigue and setting up time =6 percent of welding time.

Solution:

Diameter of drum = 1 meter
Length of drum = 2.5 meter

As the cylindrical portion is welded on both sides and both the ends are closed by welding circular plates, the welding on circular plates being on one side only.

Length of weld = 2 × p × dia of drum + (2 × length of drum)
= 2 × p × 1 + (2 × 2.5)
= 11.28 meters (11.3 meters.)

(*i*) To calculate direct material cost: In this example the cost of electrodes is the direct materiel cost.

Length of electrode required = 1.5 m/m of weld
Net electrode length required for 11.3 meters weld length = 1.5 × 11.3
= 16.95 meters

Discarded electrode = 5 percent

Total length of electrodes required = $16.95 + \frac{5 \times 16.95}{100}$

= 17.8 meters

Cost of electrodes = 0.6 × 17.8
= Rs. 10.68.

(*ii*) To calculate direct labour cost :

To calculate the labour charges, first we have to calculate the time required for making the weld (assuming that side plates have single side welding and longitudinal seam is welded on both sides).

Length of weld on inside of drum = 2.5 meter
Length of weld on outside of drum = 2 × p × 1 + (2.5)
= 8.8 meters

Time taken for inside weld = $\frac{2.5 \times 1}{2}$

= 1.25 hrs

Time taken for outside weld $= \frac{8.8 \times 1}{2.5}$

$= 3.5$ hrs

Net time required for welding = 1.25 + 3.5

= 4.75 hrs

Fatigue and setting up allowances = 4.75 × 0.06

= 0.28 hrs

Total time required = 4.75 + 0.28

= 5 hrs

Direct labour cost = 40 × 5

= Rs. 200

ii) To calculate cost of power consumed

Power consumption = 4 × 11.3

= 45.2 kWh

Cost of power consumed = 45.2 × 3

= Rs. 135.6

v) To calculate the overhead charges:

Prime cost = Direct material cost + Direct labour cost + Direct other expenses

Prime cost

= 10.68 + 200 + 135.60

= Rs. 346

Overheads $= \frac{200}{100} \times 346$

= Rs. 692

(*v*) Total cost of making boiler drum = 10.68 + 200 + 135.6 + 692

= Rs. 1038

Example 3: A container open on one side of size 0.5 m × 0.5 m × 1 m is to befabricated from 6 mm thick plates Fig. 5.5. The plate metal weighs 8 gm/cc. If the joints are to bewelded, make calculations for the cost of container. The relevant data is:

Cost of plate =Rs. 10 per kg

Sheet metal scarp (wastage) =5 percent of material

Cost of labour =10 percent of sheet metal costCost of welding material =Rs. 20 per meter of weld.

Solution:

(*i*) To calculate material cost:

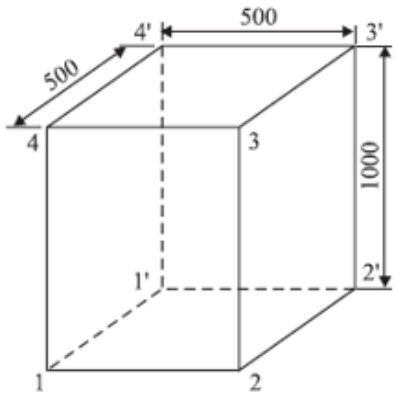


Fig. 5.5. Welded water tank

Net volume of material used = (4 × 50 × 100 × 0.6) + (50 × 50 × 0.6)

= 13,500 cc

Net weight of container = Volume × density of material

= 13,500 × 8

= 1,08,000 gm

= 108 kgs

Sheet metal scrap = 5 percent of net weight

$$= \frac{108 \times 05}{100}$$

= 5.40 kg |

Total weight of sheet metal required for fabrication of one container

= 108 + 5.4

= 113.4 kg

Cost of sheet metal per container = 113.4 × 10

= Rs. 1134

(*ii*) To calculate labour charges:

Cost of labour = 10 percent of sheet metal cost

$$= \frac{10}{100} \times 1134$$

= Rs. 113

(iii) To calculate cost of welding material:

Length to be welded = (4 × 50) + (4 × 100)

= 600 cm = 6 meters

Cost of welding material = 6 × 20

= Rs. 120

(iv)Cost of container = Cost of sheet metal material + Cost of labour + Cost of welding material

= 1134 + 113 + 120

= Rs. 1367

Example 4: Calculate the cost of welding two pieces of mild steel sheets 1 meter long and 7 mm thick. A 60° V is prepared by means of gas cutting before welding is to the commenced. The cost of Oxygen is Rs. 7/cu meter and of acetylene is Rs. 4/cu meter. The filler metal costs Rs. 20 per kg. The following data is also available:

For gas cutting (For 10 mm thick plate)

Cutting speed =20 m/hr
Consumption of Oxygen =2 cu meter/hr
Consumption of acetylene =0.2 cu meter/hr

Data for Rightward Welding (For 7 mm thick plate)

Consumption of Oxygen =0.8 cu meter/hr
Consumption of acetylene =0.8 cu meter/hr
Dia of filler rod used =3.5 mm
Filler rod used per meter of weld =3.4 meters
Rate of welding =3 meters/hr
Density of filler metal =8 gm/cc

Solution: Cost of V preparation:

Time taken to cut two plates of one meter length each for edge preparation 2×1

$$= \frac{2 \times 1}{20} = 0.1 \text{ hr}$$

Consumption of oxygen for cutting = 2×0.1
= 0.2 cu meters
Cost of oxygen for cutting = 0.2×7
= Rs. 1.4
Consumption of acetylene for cutting = 0.2×0.1
= 0.02 cu meter
Cost of acetylene for cutting = 4×0.02
= Re. 0.08
Total cost of gases for cutting = 1.40 + 0.08
= Rs. 1.48

Cost of welding

(*i*) Cost of filler rod :

Length of weld = 1 meter
Length of filler rod used = 3.4×1== 3.4 meters = 340 cms

Weight of filler rod used = $= \frac{\pi}{4}\left(\frac{3.5}{10}\right)^2 \times 340 \times 8$

= 261.8 gms = 0.262 kgs

Cost of filler rod used = 0.262 × 20
= Rs. 5.24

(*ii*) Cost of gases:

Time taken for welding $= \frac{1}{3} \times 1 = \frac{1}{3}$ hr

Volume of oxygen consumed for welding $= \frac{1}{3} \times 0.8 = 0.26$ cu meter

Cost of oxygen consumed for welding = 0.26 × 7 = Rs. 1.82

Volume of acetylene consumed for welding $= \frac{1}{3} \times 0.8 = 0.26$ cu meters

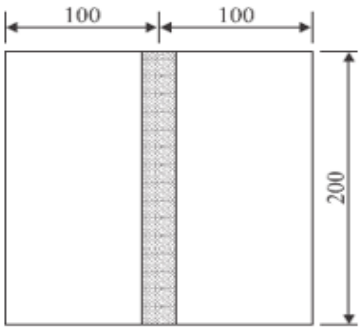
Cost of acetylene consumed for welding = 0.26 × 4 = Rs. 1.04
Cost of gases for welding = 1.82 + 1.04 = Rs. 2.86
Total cost of making the weld = 1.48 + 5.24 + 2.86
= Rs. 9.58

Example 5 : Calculate the cost of welding two plates 200 mm × 100 mm × 8 mm thick to obtain a piece 200 mm × 200 mm × 8 mm approximately using rightward welding technique Fig. 5.6. The following data is available:

Cost of filler material =Rs. 60 per kg
Cost of oxygen =Rs. 700 per 100 cu meters
Cost of acetylene =Rs. 700 per 100 cu meters
Consumption of oxygen =0.70 cu m/hr
Consumption of acetylene =0.70 cu m/hr
Diameter of filler rod =4 mm
Density of filler material =7.2 gms/cc
Filler rod used per meter of weld =340 cm
Speed of welding =2.4 meter/hr

Labour is paid Rs. 20 per hour and overheads may be taken as 100 percent of labour cost.

Solution:



Total length of weld = 200 mm

Filler rod used = $\frac{200}{1000} \times 340$

= 68 cm

Volume of filler rod used = X-sectional area of rod × length of rod π

$= \frac{\pi}{4} (0.4)^2 \times 68$

$= 8.5 \text{ cm}^3$

Weight of filler rod = 8.5 × 7.2 = 61.2 gms

60

Cost of filler material $= 61.2 \times \frac{60}{1000}$

= Rs. 3.67

Time to weld 200 mm length = $\frac{200}{1,000 \times 2.4}$

= 0.08 hrs

Oxygen consumed = 0.08 × 0.7 = 0.056 cu m

Acetylene consumed = 0.08 × 0.7 = 0.056 cu m

700

Cost of oxygen consumed $= 0.056 \times \frac{700}{100}$

= Rs. 0.40

Cost of acetylene consumed $= 0.056 \times \frac{700}{100}$

= Rs. 0.40

Labour cost

Time to weld = 0.08 hours

Add 80 percent of time to weld for edge preparation, finishing and handling time.

Total labour time = 0.08 × 1.8 hrs

= 0.144 hrs

Labour cost = 0.144 × 20 = Rs. 3

Overheads = 100 percent of labour cost

= Rs. 3

Cost of making the joint = 3.67 + 0.40 + 0.40 + 3.00 + 3.00

= Rs. 10.50