Reasons for Determining Welding Costs

Knowing which factors affect welding costs can enable a company to focus its energies on changes that will reduce costs, leading the business to improve its competitiveness.

Three Basic Approaches

Welding costs can be estimated using one of three approaches:

- Cost per unit – the most accurate method
- Cost per length – appropriate for single pass long welds
- Cost per weight – easiest cost estimating method, regardless of the welding process.

Example of Cost Per Unit Method

A welded assembly is made in a discrete welding cell. The total cycle time for the part is 2 min.- 45 sec. Five welds are made on the part: two 2,45 cm long fillet welds, two plug welds and one 7,62 cm long square edge groove weld. MIG/MAG is used for all the welds, using the same weld procedure: 0,9 mm E70S-3 electrode; 7,62 m/min wire feed speed; 75%Ar / 25%CO₂ shielding gas; 1m³/hour gas flow rate.

The shielding time is 20 sec each for the two fillet welds, 8 sec each for the two plug welds and 18 sec for the groove weld. Total “arc on” time is 74 sec. The remainder of the welding cycle time involves removal of the parts from the bin, cleaning oil of the parts, fixturing the pieces, manipulating the fixture, removing the part, cleaning off spatter, visually inspecting the welds and stacking the welded components onto a rack.

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\text{L&O* /unit} = (\text{welding-related time/unit}) \times (\text{L&O rate}) \\
= (2.75 \text{ min}) \times (1 \text{ hr/60 min}) \times (30\€/\text{hr}) \\
= 1,375\€/\text{piece}
\]

\[
\text{Filler metal cost/unit} = (\text{wire fed speed}) \times (\text{welding time}) \times (\text{wt. of electrode/m}) \times (\text{electrode cost/Kg}) \\
= (7,62\text{m/min}) \times (74 \text{ sec}) \times (1 \text{ min/ 60 sec}) \times (0,0042\text{Kg/m}) \times (3\€/\text{Kg}) \\
= 0,1184\€/\text{piece}
\]

\[
\text{Shielding gas cost/piece} = (\text{flow rate}) \times (\text{welding time}) \times (\text{gas cost/m³}) \\
= (1 \text{ m³/hr}) \times (74 \text{ sec}) \times (1 \text{ hr/3600 sec}) \times (3\€/\text{m³}) \\
= 0,062\€/\text{piece}
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\text{Cost/Unit} = (\text{L&O/unit}) + (\text{filler metal + shielding material cost/unit}) \\
= 1,556 \€/\text{unit}
\]

* Labor and overhead
Example of Cost Per Length Method

A bridge girder is being fabricated using 8 mm fillet welds for the web-to-flange connection, as well as the stiffener-to-web connections. The girder is 40 m long, and 5,5 m deep. Stiffeners are placed every 3 m. An operating factor of 40% is assumed. All welds will be made with SAW, using the following parameters: 2 mm EM13K electrode; F7A2 Flux, with a 1,5:1 ratio of flux to electrode; 5m/min wire feed speed; and 0,254m/min travel speed.

**L&O cost/length** = (L&O rate) / (travel speed) x (operating factor) 
= (30€/hr) x (1 hr/ 60 min) / (0,254m/min.) x (0.40) = 5€/m

**Filler metal cost/length** = (wire feed speed) x (wt. of electrode/m) x (cost of electrode/Kg) / (travel speed) = (5m/min) x (0,0201Kg/m) x (2,53€/Kg)/ (0,254m/min) = 1€/m

**Shielding cost/length (flux)** = (wt. of weld metal/length) x (ratio of flux to weld metal) x (cost of flux/Kg) = (0,36Kg/m) x (1,5) x (€1.7/Kg) = 0,918€/m

**Cost/length** = (L&O cost/length) + (filler metal and shielding cost/length) = 5€/m + 1€/m + 0,918€/m = 6,918€/m

This girder has four web-to-flange welds that are 40m long, and 24 stiffeners (12 on each side). With two 5,5m stiffener-to-web welds, there are a total of (4 x 40) + (24 x 2 x 5,5) or 424 m of weld on each girder. The cost of making the 8 mm fillet welds is estimated therefore at 424 x 6,918€ or 2933,2€.

Example of Cost Per Weight Method

In a weld overlay application, a 0,03m layer is to be applied to a 0,035m diameter roll that is 1,22 m long. Two 2 mm diameter electrodes are to be used in a parallel electrode configuration, with the following welding parameters: 200 ipm (per electrode); 14,50Kg/hr deposit. The build-up requires a volume of metal that can be estimated as follows: (final volume) - (initial volume) = 1.26 m³. For steel, this would equate to 256.73 kg of weld deposit.

**L&O Cost/Kg** = (L&O rate) / (deposition rate) x (operating factor) 
= (29€/hr)/(14,5 Kg/hr) x 40% = 5€/Kg

**Filler metal cost/Kg** = (cost of filler metal/Kg) / (electrode efficiency) = 1,15 €/Kg x 100% = 1,15€/Kg

**Shielding cost/Kg (flux)** = (cost of flux/Kg) x (ratio of flux to filler metal) = 0,9 x 1,5 = 1,35€/Kg

**Cost/Kg** = (L&O cost/Kg.) + (filler metal and shielding cost/Kg) = 5€/Kg + 1.15€/Kg + 1.35€/Kg = 7.5€/Kg

For 256.73 kg of build-up, the cost would be: 1925.5€ per roll

CONCLUSION

Determining the cost of welding is critical as manufacturers struggle to remain competitive in a global economy. Simplified calculations make this task easier, although the simplification takes it’s risks.

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