# Estimating filler metal cost

In the world of welding, many methods may be used to calculate the actual cost of welding for a given job or contract. The cost in itself is obviously dependent on the process chosen, the complexity or simplicity of the assembly, the joint preparation and configuration, the price tag on the filler metal and other consumables, labor, overhead, operator skill and many other factors.

One factor in particular will remain stable; that is the actual amount of weld deposit required to fill a joint of given dimension and geometry.

The following tables are presented to enable you to calculate the amount of weld deposit required to fill most types and sizes of joints encountered in everyday practice.

Any weld configuration can be broken down into geometrically-shaped segments.

Figure 1 below shows such a breakdown. The segments once identified and dimensioned can then be used with values found in Table 3 to calculate the amount of weld deposit required to fill that particular joint.

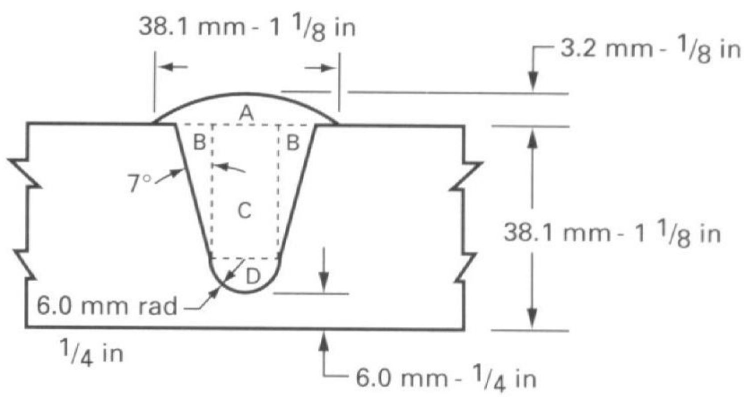


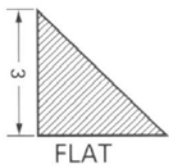
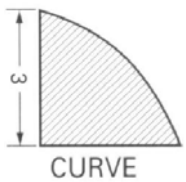
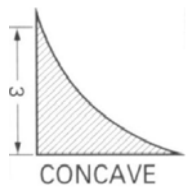

Fig 1. Weld cross section used to illustrate procedure for calculating weight of weld metal in Table 3

| Segment | Given dimensions or included angle | Weight of each segment from Table 3 |
|---|---|---|
| A | T = 3.2 mm – 1/8"<br>d = 28.6 mm – 1 1/8" | 0.473 g |
| B | Included angle = $7^o + 7^o = 14^o$<br>J = 38.1 – (6.0 + 6.0) = 26.1 | 0.621 * g |
| C | T = 6.0 + 6.0 = 12 mm – ½"<br>d = 38.1 – (6.0 + 6.0) = 26.1 | 2.530 * g |
| D | r = 6.0 mm – ¼" | 0.497 g |
| | Total value for the joint | 4.12 g |

* If (d) not in table: use value for closest smaller dimension of (d).

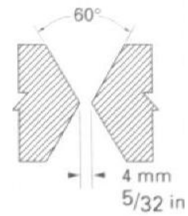
* If (t) and (d) not in table: use value at intersection of closest larger dimension for (t) and closest smaller dimension for (d).

## Table 1: Fillet welds

| |   |   |   |
|---|---|---|---|
| **Size of fillet mm - in** | **Weight of metal (g/mm)** | | |
| 3.2 – 1/8 | 0.048 | 0.058 | 0.055 |
| 5.0 – 3/16 | 0.107 | 0.129 | 0.124 |
| 6.0 – 1/4 | 0.192 | 0.231 | 0.219 |
| 8.0 – 5/16 | 0.299 | 0.360 | 0.342 |
| 9.5 – 3/8 | 0.430 | 0.519 | 0.493 |
| 11.0 – 7/16 | 0.586 | 0.707 | 0.671 |
| 13.0 – ½ | 0.765 | 0.923 | 0.877 |
| 14.3 – 9/16 | 0.969 | 1.168 | 1.109 |
| 15.9 – 5/8 | 1.196 | 1.444 | 1.369 |
| 19.0 – ¾ | 1.726 | 2.083 | 1.964 |
| 22.2 – 7/8 | 2.351 | 2.828 | 2.679 |
| 25.4 – 1 | 3.066 | 3.691 | 3.512 |
| 28.6 – 1 1/8 | 3.869 | 4.673 | 4.435 |
| 31.8 – 1 3/16 | 4.777 | 5.774 | 5.476 |
| 34.9 – 1 ¼ | 5.789 | 6.979 | 6.622 |
| 38.1 – 1 3/8 | 6.875 | 8.304 | 7.887 |
| 41.3 – 1 ½ | 8.081 | 9.747 | 9.256 |
| 44.5 – 1 5/8 | 9.361 | 11.295 | 10.730 |
| 47.6 – 1 ¾ | 10.759 | 12.977 | 12.322 |
| 50.8 - 2 | 12.248 | 14.777 | 14.033 |

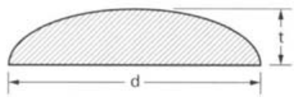
Note: Values are for leg size 10% oversize, consistent with normal shop practices.

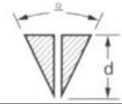
## Table 2: Double V-groove

| Joint configuration |   |
|---|---|
| **Plate thickness mm - in** | **60°** |
| 25.4 – 1 | 2.694 |
| 28.6 – 1 1/8 | 3.229 |
| 31.8 – 1 3/16 | 3.884 |
| 34.9 – 1 ¼ | 4.598 |
| 38.1 – 1 3/8 | 5.313 |
| 41.3 – 1 ½ | 6.131 |
| 44.5 – 1 5/8 | 6.950 |
| 50.8 – 2 | 8.825 |
| 54.0 – 2 1/8 | 9.792 |
| 57.2 – 2 ¼ | 10.893 |
| 60.3 – 2 3/8 | 11.980 |
| 63.5 – 2 1/2 | 13.200 |
| 66.7 – 2 5/8 | 14.391 |
| 69.9 – 2 ¾ | 15.626 |
| 76.2 – 3 | 18.453 |
| 79.4 – 3 1/8 | 19.793 |
| 82.6 – 3 ¼ | 21.758 |
| 88.9 – 3 ½ | 24.555 |
| 95.3 – 3 ¾ | 27.977 |
| 101.6 – 4 | 31.549 |
| 114.3 – 4 ½ | 39.288 |
| 127.0 – 5 | 48.068 |
| 139.7 – 5 ½ | 57.592 |
| 152.4 – 6 | 68.009 |
| 165.1 – 6 ½ | 79.319 |
| 177.8 – 7 | 91.373 |
| 190.5 – 7 ½ | 104.171 |
| 203.2 – 8 | 118.309 |
| 228.6 – 9 | 148.668 |
| 254.0 - 10 | 182.449 |

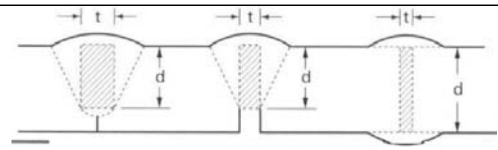
Note: Reinforcement plus 10% width of groove.

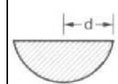
## Table 3: Butt joint segments



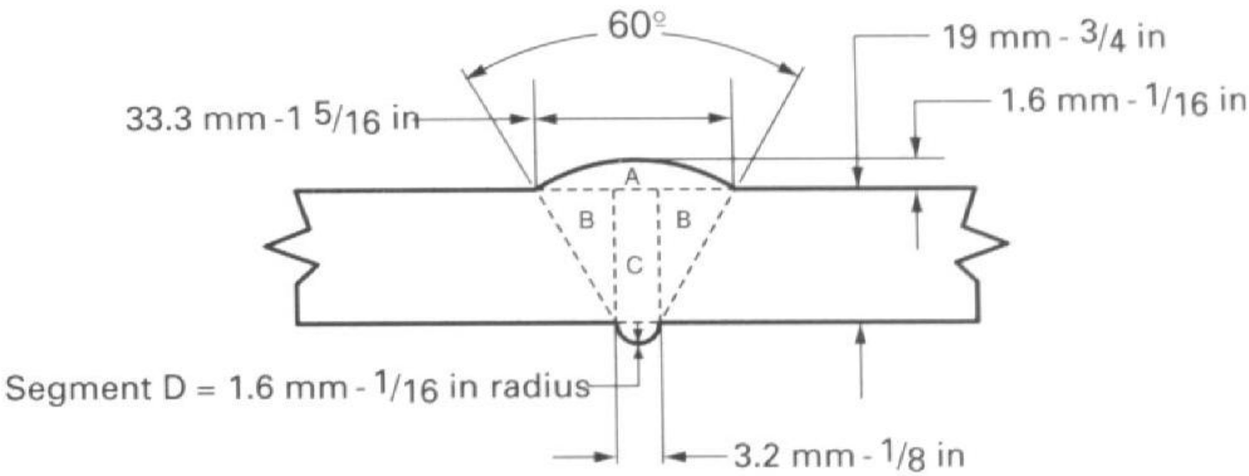

| Dimension d (mm-in) | Dimension t (mm – in) 1.6 – 1/16 | 3.2 – 1/8 | 5.0 – 3/16 | 6.0 – ¼ | Included angle, 0° 14 | 20 | 60 | 70 | 90 |
|---|---|---|---|---|---|---|---|---|---|
| 3.2 – 1/8 | | | | | 0.010 | 0.014 | 0.046 | 0.055 | 0.080 |
| 5.0 – 3/16 | 0.040 | | | | 0.222 | 0.031 | 0.103 | 0.125 | 0.179 |
| 6.0 – ¼ | 0.052 | | | | 0.039 | 0.055 | 0.183 | 0.222 | 0.315 |
| 8.0 – 5/16 | 0.065 | | | | 0.061 | 0.088 | 0.286 | 0.345 | 0.494 |
| 9.5 – 3/8 | 0.079 | 0.158 | | | 0.088 | 0.125 | 0.411 | 0.497 | 0.711 |
| 11.0 – 7/16 | 0.092 | 0.185 | 0.277 | | 0.119 | 0.171 | 0.560 | 0.679 | 0.970 |
| 13.0 – ½ | 0.106 | 0.211 | 0.315 | | 0.155 | 0.223 | 0.731 | 0.885 | 1.265 |
| 14.3 – 9/16 | 0.119 | 0.237 | 0.356 | | 0.196 | 0.283 | 0.924 | 1.121 | 1.607 |
| 15.9 – 5/8 | 0.132 | 0.263 | 0.396 | | 0.243 | 0.348 | 1.140 | 1.184 | 1.979 |
| 17.5 – 11/16 | 0.144 | 0.290 | 0.435 | 0.579 | 0.293 | 0.421 | 1.380 | 1.682 | 2.396 |
| 19.0 – 3/4 | 0.165 | 0.315 | 0.473 | 0.631 | 0.348 | 0.502 | 1.652 | 1.994 | 2.842 |
| 20.6 – 13/16 | 0.170 | 0.342 | 0.513 | 0.685 | 0.409 | 0.589 | 1.935 | 2.336 | 3.333 |
| 22.2 – 7/8 | 0.185 | 0.369 | 0.554 | 0.729 | 0.475 | 0.683 | 2.232 | 2.708 | 3.869 |
| 23.8 – 15/16 | 0.198 | 0.396 | 0.592 | 0.789 | 0.546 | 0.784 | 2.575 | 3.080 | 4.464 |
| 25.4 – 1 | 0.211 | 0.420 | 0.622 | 0.842 | 0.621 | 0.891 | 2.917 | 3.542 | 5.060 |
| 27.0 – 1 1/16 | 0.223 | 0.448 | 0.671 | 0.896 | 0.701 | 1.006 | 3.304 | 3.988 | 5.715 |
| 28.6 – 1 1/8 | 0.237 | 0.473 | 0.710 | 0.948 | 0.786 | 1.128 | 3.691 | 4.494 | 6.399 |
| 30.2 – 1 3/16 | 0.250 | 0.500 | 0.752 | 1.000 | 0.875 | 1.257 | 4.122 | 5.000 | 7.143 |
| 31.8 – 1 ¼ | 0.263 | 0.527 | 0.790 | 1.051 | 0.969 | 1.393 | 4.659 | 5.536 | 7.917 |
| 33.3 – 1 5/16 | 0.277 | 0.554 | 0.829 | 1.106 | 1.069 | 1.533 | 5.030 | 6.101 | 8.721 |
| 34.9 – 1 3/8 | 0.290 | 0.579 | 0.869 | 1.156 | 1.174 | 1.682 | 5.521 | 6.697 | 9.554 |
| 36.5 – 1 7/16 | 0.302 | 0.606 | 0.908 | 1.211 | 1.244 | 1.845 | 6.027 | 7.307 | 10.447 |
| 38.1 – 1 ½ | 0.315 | 0.632 | 0.946 | 1.263 | 1.396 | 2.009 | 6.578 | 7.977 | 11.370 |
| 39.7 – 1 9/16 | 0.329 | 0.658 | 0.988 | 1.316 | 1.518 | 2.173 | 7.128 | 8.646 | 12.352 |
| 41.3 – 1 5/8 | 0.342 | 0.685 | 1.027 | 1.369 | 1.637 | 2.351 | 7.709 | 9.361 | 13.364 |
| 42.9 – 1 11/16 | 0.356 | 0.710 | 1.066 | 1.423 | 1.771 | 2.545 | 8.319 | 10.120 | 14.405 |
| 44.5 – 1 ¾ | 0.371 | 0.737 | 1.106 | 1.473 | 1.905 | 2.738 | 8.944 | 10.849 | 15.477 |
| 46.0 – 1 13/16 | 0.382 | 0.763 | 1.146 | 1.533 | 2.039 | 2.932 | 9.599 | 11.623 | 16.519 |
| 47.6 – 1 7/8 | 0.396 | 0.790 | 1.185 | 1.577 | 2.188 | 3.125 | 10.268 | 12.441 | 17.709 |
| 49.2 – 1 15/16 | 0.408 | 0.817 | 1.225 | 1.637 | 2.322 | 3.348 | 10.953 | 13.304 | 19.048 |
| 50.8 - 2 | 0.421 | 0.842 | 1.263 | 1.682 | 2.485 | 3.572 | 11.682 | 14.167 | 20.239 |




| Dimension d (mm-in) | Dimension t (mm – in) 1.6 – 1/16 | 3.2 – 1/8 | 5.0 – 3/16 | 6.0 – ¼ | 9.5 – 3/8 | 13.0 – ½ | Dimension d (mm-in) |
|---|---|---|---|---|---|---|---|
| 3.2 – 1/8 | 0.040 | 0.079 | 0.119 | 0.158 | 0.237 | 0.315 | 0.124 |
| 5.0 – 3/16 | 0.060 | 0.199 | 0.177 | 0.237 | 0.356 | 0.473 | 0.280 |
| 6.0 – ¼ | 0.079 | 0.158 | 0.237 | 0.315 | 0.473 | 0.632 | 0.497 |
| 8.0 – 5/16 | 0.098 | 0.198 | 0.296 | 0.394 | 0.580 | 0.790 | 0.790 |
| 9.5 – 3/8 | 0.119 | 0.237 | 0.356 | 0.473 | 0.711 | 0.948 | 1.116 |
| 11.0 – 7/16 | 0.135 | 0.277 | 0.415 | 0.552 | 0.829 | 1.106 | 1.518 |
| 13.0 – ½ | 0.158 | 0.315 | 0.473 | 0.632 | 0.948 | 1.263 | 1.979 |
| 14.3 – 9/16 | 0.177 | 0.356 | 0.533 | 0.711 | 1.066 | 1.421 | |
| 15.9 – 5/8 | 0.198 | 0.394 | 0.592 | 0.790 | 1.185 | 1.577 | |
| 17.5 – 11/16 | 0.217 | 0.435 | 0.652 | 0.869 | 1.304 | 1.741 | |
| 19.0 – 3/4 | 0.237 | 0.473 | 0.711 | 0.948 | 1.421 | 1.890 | |
| 20.6 – 13/16 | 0.256 | 0.513 | 0.769 | 1.027 | 1.548 | 2.054 | |
| 22.2 – 7/8 | 0.277 | 0.552 | 0.829 | 1.106 | 1.652 | 2.217 | |
| 23.8 – 15/16 | 0.296 | 0.592 | 0.888 | 1.185 | 1.771 | 2.366 | |
| 25.4 – 1 | 0.315 | 0.632 | 0.933 | 1.263 | 1.860 | 2.530 | |
| 27.0 – 1 1/16 | 0.336 | 0.671 | 1.007 | 1.342 | 2.009 | 2.679 | |
| 28.6 – 1 1/8 | 0.356 | 0.711 | 1.066 | 1.421 | 2.128 | 2.842 | |
| 30.2 – 1 3/16 | 0.375 | 0.750 | 1.125 | 1.503 | 2.247 | 3.006 | |
| 31.8 – 1 ¼ | 0.394 | 0.790 | 1.185 | 1.577 | 2.366 | 3.155 | |
| 33.3 – 1 5/16 | 0.415 | 0.829 | 1.244 | 1.652 | 2.485 | 3.319 | |
| 34.9 – 1 3/8 | 0.435 | 0.869 | 1.304 | 1.741 | 2.604 | 3.482 | |
| 36.5 – 1 7/16 | 0.454 | 0.908 | 1.362 | 1.816 | 2.723 | 3.631 | |
| 38.1 – 1 ½ | 0.473 | 0.948 | 1.421 | 1.890 | 2.842 | 3.795 | |
| 39.7 – 1 9/16 | 0.494 | 0.988 | 1.481 | 1.979 | 2.961 | 3.944 | |
| 41.3 – 1 5/8 | 0.513 | 1.027 | 1.548 | 2.054 | 3.080 | 4.107 | |
| 42.9 – 1 11/16 | 0.533 | 1.066 | 1.592 | 2.128 | 3.200 | 4.271 | |
| 44.5 – 1 ¾ | 0.552 | 1.106 | 1.652 | 2.217 | 3.319 | 4.420 | |
| 46.0 – 1 13/16 | 0.573 | 1.144 | 1.711 | 2.292 | 3.438 | 4.584 | |
| 47.6 – 1 7/8 | 0.580 | 1.185 | 1.771 | 2.366 | 3.557 | 4.732 | |
| 49.2 – 1 15/16 | 0.612 | 1.223 | 1.830 | 2.455 | 3.676 | 4.896 | |
| 50.8 - 2 | 0.632 | 1.263 | 1.890 | 2.530 | 3.795 | 5.060 | |

## Example of calculation:




Segment A dimensions are: (d) = 33.3 mm (1 5/16”), (t) = 1.6 mm (1/16”)
Segment B dimensions are: (d) = 19 mm (3/4”) @ 60$^o$ included angle
Segment C dimensions are: (d) = 19 mm (3/4”), (t) = 3.2 mm (1/8”)
Segment D dimensions are : (d) = 1.6 mm (1/16”)
Total length of weld required is 3000 mm (118 in)

## Calculation: from Table 3:

Segment A where dimensions (d) and (t) intersect, we read 0.277 g/mm
Segment B where dimensions (d) and 60$^o$ included angle intersect, we read 1.652 g/mm
Segment C where dimensions (d) and (t) intersect, we read 0.473 g/mm
Segment D radius is 1.6 mm (1/16”) but nearest dimension (d) is 3.2 mm (1/8”), and we read 0.124 g/mm

By adding values obtained in all segments A + B + C + D, we arrive at the following: 0.277g + 1.652g + 0.473g + 0.124g, total is 2.526g for each millimetre of length x 3000 mm (118”).

We see we will need to deposit 7578g of metal or 7.578kg. If we round off this value to 8kg, we now have a base from which we can work to calculate the cost.

No matter how complex or simple an assembly may be, once all of the segments have been identified and quantified, the next step is to choose a process to accomplish the work.

The following table comprises typical average deposition efficiencies for different processes. Please note that the efficiencies listed for SMAW are based on and include 50 mm (2”) stub loss.

## Table 4: Deposition efficiency

| PROCESS | DEPOSITION EFFICIENCY |
|---|---|
| Submerged Arc | 99% |
| Gas Metal Arc (Ar-O2) } spray | 98% |
| Gas Metal Arc (Ar-CO2) } spray | 96% |
| Gas Metal Arc (CO2) short circuit | 93% |
| Metal Cored } FCAW | 93% |
| Gas Shielded } FCAW | 85% |
| Self Shielded } FCAW | 82% |
| * Shielded Metal Arc (300 mm – 12 in long) | 59% |
| * Shielded Metal Arc (350 mm – 15 in long) | 62% |
| * Shileded Metal Arc (450 mm – 18 in long) | 66% |

*50 mm stub loss is included here. See Table 5 for corrections for various stub lengths.

## Tabe 5: Actual efficiency including stub loss

**STUB LOSS CORRECTION TABLE**
**FOR COVERED ELECTRODES**
**EFFICIENCY INCLUDING STUB LOSS**

| | Deposition Efficiency | 50 MM – 2 in STUB | 75 mm – 3 in STUB | 100 mm – 4 in STUB | 125 mm – 5 in STUB |
|---|---|---|---|---|---|
| 300 mm – 12 in ELECTRODE | 60% | 50.0% | 45.0% | 40.0% | 35.0% |
| | 65% | 54.2% | 46.7% | 43.3% | 37.9% |
| | 70% | 58.3% | 52.5% | 46.6% | 40.8% |
| | 75% | 62.5% | 56.2% | 50.0% | 43.7% |
| | 80% | 66.6% | 60.0% | 53.3% | 46.6% |
| 350 mm – 14 in ELECTRODE | 60% | 51.4% | 47.1% | 42.9% | 38.3% |
| | 65% | 55.7% | 51.1% | 46.4% | 41.0% |
| | 70% | 60.0% | 55.0% | 50.0% | 45.0% |
| | 75% | 64.3% | 56.9% | 53.6% | 46.2% |
| | 80% | 68.5% | 62.8% | 57.1% | 51.4% |
| 450 mm – 18 in ELECTRODE | 60% | 53.3% | 50.0% | 46.6% | 43.3% |
| | 65% | 57.7% | 54.2% | 50.5% | 46.9% |
| | 70% | 62.2% | 56.3% | 54.4% | 50.5% |
| | 75% | 66.6% | 62.5% | 56.3% | 54.2% |
| | 80% | 71.1% | 66.6% | 62.2% | 57.7% |

## Cost calculation (cont'd)

We previously established that the job at hand required 8kg of weld deposit.

Now let us choose the SMAW process using 350 mm long covered electrodes and a 50 mm stub loss.

From Table 4 we get a deposition efficiency of 62%. This simply means that for each electrode melted, only 62% of its weight will become weld deposit.

So in order to determine how many kilograms of electrodes we will have to purchase for the job, we will apply the following formula:

$$\text{Quantity to purchase} = \frac{\text{Weld deposit required}}{\text{Deposition efficiency}}$$

$$\text{Quantity} = \frac{8\text{ kg}}{85\%} \quad \text{or} \quad \frac{8\text{ kg}}{0.85} \quad \text{or} \quad \frac{8\text{ kg}}{85/100} = 9.4\text{ kg}$$

We will have to purchase 12.9 kg of electrodes.

Again we will have to round off this figure to the nearest larger quantity available in standard packaging. This would mean we would actually have to purchase 3 x 5 kg packages for this single assembly.

Now for comparison purposes, let us choose a different process. Let's say we use gas shielded FCAW.

Table 4 tells us the deposition efficiency here is 85%, so we repeat our calculations and find the following:

$$\text{Quantity to purchase} = \frac{\text{Weld deposit required}}{\text{Deposition efficiency}}$$

$$\text{Quantity} = \frac{8\text{ kg}}{85\%} \quad \text{or} \quad \frac{8\text{ kg}}{0.85} \quad \text{or} \quad \frac{8\text{ kg}}{85/100} = 9.4\text{ kg}$$

With a total of 9.4 kg, again rounded off, we could purchase a 12.5 kg spool of FCAW electrode wire to do the same work. But we must remember in this case to add in the cost of shielding gas required.

In order to calculate shielding gas requirements, the following factors will have to be known:

1. Deposition rate in kg/h for the electrode or wire being used. This rate is dependent on the following parameters i.e. amperage, voltage, diameter of electrode, type of covering (SMAW) electrode extension (GMAW-FCAW).

2. Gas flow rate in L/minute.

3. Arc time required to perform the welding operation.

The following table shows typical deposition rates for different electrodes at typical parameters.

## SHIELDED METAL ARC WELDING

## Table 6A: Covered electrodes

| LA 6010 | | |
|---|---|---|
| Diameter mm | Amps | Deposition Rate kg/h |
| 3.2 | 100 | 0.9 |
| | 130 | 1.0 |
| 4.0 | 140 | 1.2 |
| | 170 | 1.3 |
| 5.0 | 160 | 1.5 |
| | 190 | 1.6 |

| ULTRA 11 | | |
|---|---|---|
| Diameter mm | Amps | Deposition Rate kg/h |
| 3.2 | 120 | 1.0 |
| 4..0 | 150 | 1.7 |
| 5.0 | 180 | 1.9 |
| 6.0 | 250 | 2.5 |

| LA 6013 | | |
|---|---|---|
| Diameter mm | Amps | Deposition Rate kg/h |
| 4.0 | 140 | 1.2 |
| | 160 | 1.4 |
| | 180 | 1.6 |
| 5.0 | 180 | 1.5 |
| | 200 | 1.7 |
| | 220 | 1.8 |
| 6.0 | 290 | 2.8 |
| | 310 | 2.9 |
| | 330 | 3.2 |

| LA 6013P | | |
|---|---|---|
| Diameter Mm | Amps | Deposition Rate kg/h |
| 3.2 | 110 | 0.9 |
| | 155 | 1.0 |
| 4.0 | 125 | 1.1 |
| | 175 | 1.3 |

| LA 7014 | | |
|---|---|---|
| Diameter mm | Amps | Deposition Rate kg/h |
| 3.2 | 120 | 1.0 |
| | 150 | 1.4 |
| 4.0 | 160 | 1.4 |
| | 200 | 1.7 |
| 5.0 | 230 | 2.0 |
| | 270 | 2.5 |
| 6.0 | 350 | 3.2 |
| | 400 | 3.9 |

| LA 7024 | | |
|---|---|---|
| Diameter mm | Amps | Deposition Rate kg/h |
| 3.2 | 140 | 1.9 |
| | 180 | 2.3 |
| 4.0 | 180 | 2.4 |
| | 210 | 2.8 |
| | 240 | 3.3 |
| 5.0 | 245 | 3.4 |
| | 270 | 3.7 |
| | 290 | 4.1 |
| 6.0 | 400 | 5.7 |

| LA 18 PLUS | | |
|---|---|---|
| Diameter Mm | Amps | Deposition Rate kg/h |
| 2.5 | 70 | 0.6 |
| | 90 | 0.7 |
| | 110 | 0.8 |
| 3.2 | 120 | 2.1 |
| | 140 | 1.2 |
| | 160 | 1.5 |
| 4.0 | 140 | 1.3 |
| | 170 | 1.5 |
| | 200 | 1.7 |

| LOW ALLOY, IRON POWDER ELCTRODES LA 7018, 8018, 9018, 10018, 11018, 12018 | | |
|---|---|---|
| Diameter Mm | Amps | Deposition Rate kg/h |
| 2.5 | 70 | 0.6 |
| | 90 | 0.7 |
| | 110 | 0.8 |
| 3.2 | 120 | 1.1 |
| | 140 | 1.2 |
| | 160 | 1.5 |
| 4.0 | 140 | 1.3 |
| | 170 | 1.5 |
| | 200 | 1.7 |
| 5.0 | 200 | 2.0 |
| | 250 | 2.2 |
| | 300 | 2.4 |
| 6.0 | 300 | 3.3 |
| | 350 | 3.8 |
| | 400 | 4.0 |

## SHIELDED METAL ARC WELDING

## Table 6B: GMAW-FCAW

| GMAW<br>LA HT-75G LAA S-3 LA S-6 | | |
|---|---|---|
| Diameter mm | Amps | Deposition Rate kg/h |
| 0.8 | 75 | 0.9 |
| | 100 | 1.2 |
| | 150 | 1.9 |
| | 200 | 3.2 |
| 0.9 | 80 | 1.4 |
| | 100 | 1.3 |
| | 150 | 2.0 |
| | 200 | 2.8 |
| | 250 | 4.2 |
| 1.2 | 100 | 1.0 |
| | 125 | 1.3 |
| | 150 | 1.7 |
| | 200 | 2.6 |
| | 250 | 3.3 |
| | 300 | 4.7 |
| | 350 | 6.1 |
| 1.6 | 250 | 3.0 |
| | 275 | 3.9 |
| | 300 | 4.2 |
| | 350 | 5.2 |
| | 400 | 6.5 |
| | 450 | 8.0 |

| FLUX CORED ARC WELDING<br>FLUX CORED ELECTRODES<br>Gas shielded type LA T-9, LA T-9 PLUS, LA T-91, LA T-91 C40, LA T-91 C60 Ni1 LA T-91 K2, LA 91-T12M Wire for mild and Low alloy steels | | |
|---|---|---|
| Diameter mm | Amps | Deposition Rate kg/h |
| 1.2 | 160 | 1.8 |
| | 180 | 2.0 |
| | 200 | 2.4 |
| | 220 | 2.9 |
| | 240 | 3.2 |
| | 280 | 4.1 |
| 1.4 | 170 | 1.8 |
| | 190 | 2.0 |
| | 210 | 2.3 |
| | 240 | 2.8 |
| | 270 | 3.4 |
| | 300 | 4.1 |
| 1.6 | 180 | 1.8 |
| | 200 | 2.0 |
| | 220 | 2.2 |
| | 250 | 2.7 |
| | 275 | 3.1 |
| | 300 | 3.6 |
| | 350 | 4.8 |
| 2.0 | 250 | 2.7 |
| | 350 | 5.0 |
| | 450 | 7.0 |
| 2.4 | 400 | 5.2 |
| | 450 | 6.5 |
| | 500 | 7.6 |
| Results were obtained with Co2. **BLUESHIELD** gas is sometimes used to improve usability especially for out of position applications. | | |

Arc time is calculated by applying this formula:

$$\text{Arc time} = \frac{\text{kg of weld deposit required}}{\text{Deposition rate in kg/h}}$$

In the second part of our example, the wire size was not specified, nor were the parameters, as they were not pertinent to the calculations made to determine the total amount of electrodes to be purchased.

But now, to complete a gas cost calculation, a wire diameter and parameters must be chosen: so from Table 6B, let us use 1.2 mm diameter at 220 A.

This will give us 2.9 kg/h deposition rate. The arc time required will be:

$$\text{Arc time} = \frac{\text{total weld deposit required}}{\text{deposition rate}}$$

or $\frac{8 \text{ kg}}{2.9 \text{ kg/h}}$ or 2.75 hours

Assuming a gas flow rate of 20 L/min, we can then proceed to the total quantity of gas required:

Gas required = Gas Flow rate in L/min x 60 minutes x arc time in hour

$$\text{Gas required} = \frac{\text{2OLx6Omi x2.75hours}}{\text{min x hours}} = 3300\text{L}$$

We now have to multiply the total quantity of shielding gas by the cost of the gas on litre basis to establish total gas cost.

Total gas cost = total gas required x gas cost $/L
Total gas cost for our example is 3300 L x $/L

If the cost is say $0.02/ litre, we would have a cost $\frac{\text{of 3300 L x \$0.02}}{\text{L}}$ or $66.00

This cost added to the cost of filler metal will give you a fair idea of what to expect as expenses are concerned for the example discussed herein. However, it is only partial picture of welding since no consideration was afforded to other factors s those mentioned in the first paragraph i.e. labor and overhead, power cost, preparation time, etc.

We strongly suggest that, for an in-depth calculation of actual cost for a given project you contact your nearest Customer Service Centre and ask about our *'**BLUESHIELD*** CONSULTANT program.

All the values shown in Tables 1, 2 and 3 are based on the specific density of mild alloy steels. If you have identical joint geometries in stainless steel, aluminum, c etc. and would like to use the tables to quantify a job in one of these other base me

the following table will save you some time.

## Table 7 :Conversion factors

| | Factor * | Comparable weight of |
|---|---|---|
| Weight Of Steel | X 0.35 | Aluminum |
| | X 1.08 | Brass |
| | X 1.1 | Copper |
| | X 1 | Austenitic Stainless Steel |

* These factors are a close approximation, some minute variances may exist in actuality.

Simply proceed as if Tables 1, 2 or 3 were mere numbers. Once you have tabulalted the total amount of weld deposit required for a given assembly, simply use the appropriate factor shown in Table 7 to convert your findings.

Example: Referring to the sample calculation done previously, it had been determined that 8 kg of weld deposit were required. This was for mild steel. The same assembly out of aluminum would then require: 8 kg x 0.35, or 2.8 kg of aluminum weld deposit.

## Approximate quantity of electrodes per kilogram

| Type of covering | Electrode name | Diameter/length | Qty |
|---|---|---|---|
| Cellulosic | LA 6010<br>Ultra 11 | 2.5 mm (3/32in) x 300 mm (11.8 in)<br>3.2 mm (1/8 in) x 350 mm (13.8 in)<br>4.0 mm (5/32 in) x 350 mm (13.8 in)<br>5.0 mm (3/16 in) x 350 mm (13.8 in) | 72<br>38<br>24<br>16 |
| Rutile | LA 6013 | 2.5 mm (3/32 in) x 300 mm (11.8 in)<br>3.2 mm (1/8 in ) x 350 mm (13.8 in)<br>4.0 mm (5/32 in) x 350 mm (13.8 in)<br>5.0 mm (3/16 in) x 350 mm (13.8 in) | 74<br>37<br>23<br>15 |
| | LA 6013P | 3.2 mm (1/8 in) x 350 mm (13.8 in)<br>4.0 mm (5/32 in) x 350 mm (13.8 in) | 36<br>22 |
| | LA 7014 | 2.5 mm (3/32 in) x 300 mm (11.8 in)<br>3.2 mm (1/8 in) X 350 mm (13.8 in)<br>4.0 mm (5/32 in) x 350 mm (13.8 in)<br>5.0 mm (3/16 in) x 350 mm (13.8 in) | 56<br>29<br>19<br>12 |
| | LA 7024 | 2.5 mm (3/32 in) x 300 mm (11.8 in)<br>3.2 mm (1/8 in) x 350 mm (13.8 in)<br>4.0 mm (5/32 in) x 350 mm (13.8 in)<br>4.0 mm (5/32in) x 450 mm (17.7 in)<br>5.0 mm (3/16 in) x 450 mm (17.7 in)<br>6.0 mm (1/4 in) x 450 mm (17.7 in) | 37<br>20<br>13<br>10<br>8<br>5 |
| | LA 24-HD | 4.0 mm (5/32 in) x 450 mm (17.7 in)<br>5.0 mm (3/16 in ) x 450 mm (17.7 in) | 9<br>7 |
| Basic | LA 7018 | 2.5 mm (3/32 in) x 300 mm (11.8 in) | 50 |
| | LA 18 Plus | 3.2 mm (1/8 in) x 350 mm (13.8 in) | 28 |
| | LA 18 LMP | 4.0 mm (5/32 in) x 350 mm (13.8 in) | 19 |
| | Nuclearc LA 7018 | 5.0 mm (3/16 in) x 450 mm (17.7 in)<br>6.0 mm (1/4 in) x 450 mm (17.7 in) | 10<br>7 |
| | LA Excelarc 18 | 2.5 mm (3/32 in) x 300 mm (11.8 in)<br>3.2 mm (1/8 in) x 350 mm (13.8 in)<br>4.0 mm (5/32 in) x 350 mm (13.9 in)<br>5.0 mm (3/16 in) x 450 mm (17.7 in) | 50<br>28<br>19<br>10 |
| | LA Excelarc 18AC | 2.5 mm (3/32 in) x 300 mm (11.8 in)<br>3.2 mm (1/8 in) x 350 mm (13.8 in)<br>4.0 mm (5/32 in) x 350 mm (13.8 in) | 50<br>29<br>19 |
| | All low-alloy<br>Classifications | 2.5 mm (3/32 in) x 300 mm (11.8 in)<br>3.2 mm (1/8 in) x 350 mm (13.8 in)<br>4.0 mm (5/32 in) x 350 mm (13.8 in)<br>5.0 mm (3/16 in) x 350 mm (13.8 in)<br>6.0 mm (1/4 in) x 450 mm (17.7 in) | 50<br>29<br>20<br>13<br>6 |
| | LA 7028 | 3.2 mm (1/8 in) x 350 mm (13.8in)<br>4.0 mm (5/32in) x 350 mm (18.8 in)<br>5.0 mm (3/16in) x 450 mm (17.7in) | 20<br>14<br>8 |

## Weight of wire per 1000 mm (3.3 ft) length

**Solid wire**
**Mild steel**
**(Approximate)**

| Diameter | Kg/1000 mm – lb/ft |
|---|---|
| 0.8 mm – 0.030 in | 0.004 – 0.0027 |
| 0.9 mm – 0.035 in | 0.005 – 0.0034 |
| 1.2 mm – 0.045 in | 0.008 – 0.0054 |
| 1.4 mm – 0.052 in | 0.012 – 0.0081 |
| 1.6 mm – 1/16 in | 0.018 – 0.0121 |
| 2.0 mm – 5/54 in | 0.027 – 0.0181 |
| 2.4 mm – 3/32 in | 0.04 – 0.027 |
| 3.2 mm – 1/8 in | 0.06 – 0.04 |
| 4.0 mm – 5/32 in | 0.09 – 0.06 |

**Flux cored &**
**Metal cored**
**Mild steel**
**(Approximate)**

| Diameter | Kg/1000 mm – lb/ft |
|---|---|
| 1.2 mm – 0.045 in | 0.007 – 0.0047 |
| 1.4 mm – 0.052 in | 0.008 – 0.0054 |
| 1.6 mm – 1/16 in | 0.0125 – 0.0084 |
| 2.0 mm – 5/64 in | 0.0177 – 0.0119 |
| 2.4 mm – 3/32 in | 0.0291 – 0.0195 |
| 2.8 mm – 7/64 in | 0.0349 – 0.0234 |
| 3.2 mm – 1/8 in | 0.0418 – 0.028 |