



**!!!! WARNING !!!!**



**WELDING FUMES AND GASES CAN BE DANGEROUS TO YOUR HEALTH.**

**BEFORE USING THIS PRODUCT THE WELDER (END-USER) MUST READ AND UNDERSTAND THE COMPLETE PRODUCT WARNING LABEL AND MATERIAL SAFETY DATA SHEET (MSDS).**

**THE MATERIAL SAFETY DATA SHEET (MSDS) WHICH OUTLINES THE POTENTIAL HEALTH HAZARDS AND SAFETY INFORMATION RELATED TO THIS PRODUCT CAN BE DOWNLOADED FROM THE MSDS PORTION OF THIS WEBSITE. IT IS ALSO AVAILABLE FROM YOUR EMPLOYER AND WELDING SUPPLY DISTRIBUTOR.**

**DO NOT PROCEED WITH USE OF THIS PRODUCT UNTIL YOU READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET (MSDS) AND PRODUCT WARNING STATEMENT.**

**BE SURE TO CONSULT THE LATEST VERSION OF THE MSDS.**

**SEE THE PRODUCT WARNING LABEL AND MSDS FOR COMPLETE WARNING INFORMATION.**

# CROWN ALLOYS COMPANY

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## ALUMINUM ALLOYS

ANSI/AWS 5.10-92

- R A356.0** - Best filler alloy for joining and repairing 356.0 and A356.0 casting.
- |         |      |      |        |           |
|---------|------|------|--------|-----------|
| Si      | Fe   | Cu   | Mn     | Mg        |
| 6.5-7.5 | 0.20 | 0.20 | 0.10   | 0.25-0.45 |
| Cr      | Zn   | Ti   | Others | Al        |
| -       | 0.10 | 0.20 | 0.05   | Remainder |
- ER&R 1100** - 99% pure aluminum used to join high purity aluminums and where a soft weld is wanted.
- |    |         |           |        |     |
|----|---------|-----------|--------|-----|
| Si | plus Fe | Cu        | Mn     | Mg  |
|    | 0.95    | 0.05-0.20 | 0.05   | -   |
| Cr | Zn      | Ti        | Others | Al  |
| -  | 0.10    | -         | 0.15   | 99% |
- R4047 (718)** - High Silicon content insures good flow at lower temperature. Good tig or torch alloy for most aluminums.
- |           |      |      |        |           |
|-----------|------|------|--------|-----------|
| Si        | Fe   | Cu   | Mn     | Mg        |
| 11.0-13.0 | 0.8  | 0.30 | 0.15   | 0.10      |
| Cr        | Zn   | Ti   | Others | Al        |
| -         | 0.20 | -    | 0.15   | Remainder |
- ER&R 2319** - Best for welding grades 2014, 2036 and 2219 aluminum. Also to be used on casting grades 319.0, 333.0, 354.0, 355.0, C355.0, 380.0.
- |      |      |           |           |           |
|------|------|-----------|-----------|-----------|
| Si   | Fe   | Cu        | Mn        | Mg        |
| 0.20 | 0.30 | 5.8-6.8   | 0.20-0.40 | 0.02      |
| Cr   | Zn   | Ti        | Others    | Al        |
| -    | 0.10 | 0.10-0.20 | 0.15      | Remainder |
- ER&R 4043** - Most popular Aluminum Alloy. Easy to use on just about every grade of aluminum. Cannot be anodized due to its higher silicon content.
- |         |      |      |        |           |
|---------|------|------|--------|-----------|
| Si      | Fe   | Cu   | Mn     | Mg        |
| 4.5-6.0 | 0.8  | 0.30 | 0.05   | 0.05      |
| Cr      | Zn   | Ti   | Others | Al        |
| -       | 0.10 | 0.20 | 0.15   | Remainder |
- R4145 (716)** - To be used on aluminum grades: 1060, 1350, 3003, and aluminum castings 201.0, 224.0, 333.0, C355.0 and 380.0.
- |          |      |         |        |           |
|----------|------|---------|--------|-----------|
| Si       | Fe   | Cu      | Mn     | Mg        |
| 9.3-10.7 | 0.8  | 3.3-4.7 | 0.15   | 0.15      |
| Cr       | Zn   | Ti      | Others | Al        |
| 0.15     | 0.20 | -       | 0.15   | Remainder |
- ER&R 5356** - Second most popular Aluminum Alloy. It can be used on a large variety of aluminums. Will give good color match after anodizing with most base metals.
- |           |      |           |           |           |
|-----------|------|-----------|-----------|-----------|
| Si        | Fe   | Cu        | Mn        | Mg        |
| 0.25      | 0.40 | 0.10      | 0.05-0.20 | 4.7-5.5   |
| Cr        | Zn   | Ti        | Others    | Al        |
| 0.05-0.20 | 0.10 | 0.05-0.20 | 0.15      | Remainder |

### Procedure:

All Aluminum Wire to be welded with argon or argon and helium mix. Helium will give greater penetration but will increase spatter.

# ALUMINUM WELDING WIRE

## GTAW (TIG) Welding Parameters

### Aluminum Manual Welding - Alternating Current - High Frequency

| Metal Thickness (inches) | Joint Type  | Tungsten Diameter (inches) | Filler Rod Diameter (inches) | Welding Current (amperage) | Argon Gas Flow (ft <sup>3</sup> /h) |
|--------------------------|-------------|----------------------------|------------------------------|----------------------------|-------------------------------------|
| 1/16                     | Butt/Corner | 1/16"                      | 1/16"                        | 60 - 85                    | 15 - 20 (flat)                      |
| 1/16                     | Lap         | 1/16"                      | 1/16"                        | 70 - 90                    | 15 - 20 (flat)                      |
| 1/16                     | Fillet      | 1/16"                      | 1/16"                        | 75 - 100                   | 15 - 20 (flat)                      |
| 1/8                      | Butt        | 3/32"                      | 3/32"                        | 125 - 150                  | 20 - 25 (flat)                      |
| 1/8                      | Corner      | 3/32"                      | 3/32"                        | 120 - 140                  | 20 - 25 (flat)                      |
| 1/8                      | Lap/Fillet  | 3/32"                      | 3/32"                        | 130 - 160                  | 20 - 25 (flat)                      |
| 3/16                     | Butt/Corner | 1/8" - 5/32"               | 1/8"                         | 180 - 225                  | 20 - 30 (flat)                      |
| 3/16                     | Lap/Fillet  | 1/8" - 5/32"               | 1/8"                         | 190 - 240                  | 20 - 30 (flat)                      |
| 1/4                      | Butt/Corner | 5/32" - 3/16"              | 3/16"                        | 240 - 280                  | 20 - 30 (flat)                      |
| 1/4                      | Lap         | 5/32" - 3/16"              | 3/16"                        | 250 - 280                  | 20 - 30 (flat)                      |
| 1/4                      | Fillet      | 5/32" - 3/16"              | 3/16"                        | 250 - 320                  | 20 - 30 (flat)                      |

Higher gas flows are required for out-of-position welds (40-60 ft<sup>3</sup>/h).

Use pure tungsten (Green Band) only.

# ALUMINUM WELDING WIRE

## GMAW (MIG) Welding Parameters

### Aluminum and Aluminum Alloys - Short Circuit Transfer Direct Current Electrode Positive (DCEP)

| Wire Diameter (inches) | Welding Current (amperage) | Arc Voltage (volts) | Wire Feed Speed (ipm) | Argon Gas Flow (ft <sup>3</sup> /h) |
|------------------------|----------------------------|---------------------|-----------------------|-------------------------------------|
| .030                   | 50 - 120                   | 15 - 18             | 300 - 580             | 25 - 45                             |
| .035                   | 65 - 140                   | 17 - 19             | 250 - 450             | 30 - 45                             |
| 3/64                   | 75 - 170                   | 16 - 20             | 200 - 350             | 30 - 60                             |

For out-of-position welding use gas flows on the high side of the range.

For 1XXX, 2XXX and 4XXX series electrodes use the lower amperage and higher arc voltage.

For 5XXX series electrodes use a welding amperage on the high side of the range and an arc voltage on the lower end of the range.

### Aluminum and Aluminum Alloys - Spray Transfer Direct Current Electrode Positive (DCEP)

| Wire Diameter (inches) | Welding Current (amperage) | Arc Voltage (volts) | Wire Feed Speed (ipm) | Argon Gas Flow (ft <sup>3</sup> /h) |
|------------------------|----------------------------|---------------------|-----------------------|-------------------------------------|
| .030                   | 95 - 200                   | 22 - 28             | 470 - 680             | 25 - 45                             |
| .035                   | 110 - 220                  | 22 - 28             | 350 - 475             | 30 - 45                             |
| 3/64                   | 130 - 290                  | 22 - 28             | 235 - 375             | 30 - 60                             |
| 1/16                   | 160 - 360                  | 24 - 30             | 180 - 300             | 35 - 80                             |
| 3/32                   | 190 - 450                  | 24 - 32             | 100 - 210             | 60 - 85                             |

For out-of-position welding use gas flows on the high side of the range.

For 1XXX, 2XXX and 4XXX series electrodes use the lower amperage and higher arc voltage.

For 5XXX series electrodes use a welding amperage on the high side of the range and an arc voltage on the lower end of the range.

## ALUMINUM WELDING WIRE

### GMAW (MIG) Welding Tips

- ◆ **Use the proper welding power source.** A constant current unit is best for welding aluminum because it does not permit the high current surges produced by constant voltage machines. These surges cause arcing inside the guide tube which results in deposits that impede wire feed.
- ◆ **Use "U"-groove type drive rolls.** Do not use "V"-groove or knurled surface drive rolls. These types can distort or shave wire causing more burn-backs. Ensure that the drive roll groove edges are chamfered, not sharp. Make sure that drive roll pressure isn't excessive, because that will tend to distort the wire. The drive rolls should also be properly aligned.
- ◆ **Use straight nozzle or straight barrel torches.** Do not use goose-neck or curved nozzle torches because they increase the amount of friction in the wire feed system. Straight torches require less wire feed roll pressure to operate effectively.
- ◆ **Use nonmetallic ( teflon, nylon or plastic ) liners and inlet/outlet guides.** Teflon, nylon or plastic will reduce friction in the wire feed system. When aluminum particles from the wire drive rolls accumulate in the liner or guides, the liners and/or guides should be replaced. In some cases liner life can be prolonged by blowing the particles out using argon, however, the liner and guides will have to be replaced eventually.
- ◆ **Clear total length of aluminum wire from liner after a burn-back.** Otherwise, the slightest kink in the wire left in the liner may cause another jam.
- ◆ **Torch cables or conduits should not be more than 12 feet long in a push system.** When welding with smaller diameter wires (.030 or .035) the torch cables should be 10 feet or less. The 5XXX series wire tends to be stiffer and therefore can be pushed greater distances. If longer torch cables are necessary, then a push/pull system or spool gun *must* be employed.
- ◆ **Use correct contact tip size ( I.D. and length ).** The longer the contact tip the better the wire will feed. Also, the contact tip bore diameter should be approximately 10% larger than the wire diameter. If there is too much clearance between the wire and the contact tip, arcing will occur. Continuous arcing causes a buildup of particles on the inner diameter surface of the tip which increases drag forces and produces burn-backs due to unsteady feeding.

## ALUMINUM WELDING WIRE

### GMAW (MIG) Welding Tips (continued)

- ◆ **Maintain correct cup to contact tip distance.** The contact tip should be recessed inside the cup from 1/16 inch to 1/4 inch maximum.
- ◆ **Protect and store the base aluminum as well as the aluminum consumables.** The base aluminum should be stored inside a dry room and covered to prevent a buildup of shop dust. Do NOT leave aluminum wire in the feeder overnight. Store in a cabinet with temperature and humidity control. Humidity should be less than 30%. If the wire or base aluminum is not dry and clean porosity may form in the weld.
- ◆ **Shielding gas purity.** Shielding gas used for welding aluminum should have a dew point no higher than -70°F. Using a shielding gas with a higher dew point may result in porosity in the weld. A simple way to check for argon purity is to strike a gas tungsten arc on a clean piece of 6061 aluminum. Holding the torch stationary, form a puddle. If the puddle has a bright, silvery appearance, the gas is pure enough for welding. If a brown spot appears to be floating on the puddle, there is a problem with gas purity.
- ◆ **Check for water and inert gas leaks.** Use tygon inert gas hose. Do NOT interchange water and inert gas lines. Remember: The argon may be of adequate purity, but the shielding gas may pick up impurities because of a contaminated gas hose or because of holes in the gas hose or loose connections.
- ◆ **Oxide removal with wire brushing.** Many fabricators have found it helpful to wire brush the area to be welded after chemical cleaning and before the final wipe with acetone. This should be done with a stainless steel wire brush used only for wire brushing aluminum. The wire brush is dedicated to brushing *aluminum only* to avoid introducing impurities from other work pieces.
- ◆ **Avoid the serious crater cracks.** Don't start welding at the very beginning of what needs to be joined. Start one inch beyond the beginning. Weld one inch backwards and then continue with the rest of the weld. Exit the weld with an accelerated sweeping motion. Do NOT pull off abruptly.
- ◆ **Ways to avoid weld cracking.** Weld as cool and as fast as possible. Avoid puddling of the base aluminum. Keep dilution to a minimum (more filler alloy and less base material). Increase joint spacing or increase bevel angle which facilitates the application of more filler wire.