

# Aluminum Alloys

Gas Metal Arc Welding  
(GMAW) MIG Wires

Gas Tungsten Arc Welding  
(GTAW) TIG Alloys

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"The Royal Line"

**CROWN ALLOYS COMPANY**

30105 Stephenson Hwy, Madison Heights, MI 48071  
(248) 588-3790 (800) 521-7878 [www.crownalloys.com](http://www.crownalloys.com)

## AWS A5.10/A5.10M:2012

### R A356.0 -

Best filler alloy for joining and repairing 356.0 and A356.0 casting. Available in TIG only.

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

#### Sizes and Part Numbers

TIG Diameter	Part Numbers	
	1# Package	5# Package
1/16 x 36"	ATA356/TL-BP	ATA356/TL
3/32 x 36"	ATA356/TN-BP	ATA356/TN
1/8 x 36"	ATA356/TO-BP	ATA356/TO

### ER & R 1100 -

99% pure aluminum used to join high purity aluminums and where a soft weld is wanted.

Si	plus 0.95	Fe	Cu	Mn	Mg
Cr		Zn	Ti	Others	Al
-		0.10	-	0.15	99%

#### Sizes and Part Numbers

TIG Diameter	Part Numbers	
	1# Package	5# Package
1/16 x 36"	AT1100/TL-BP	AT1100/TL
3/32 x 36"	AT1100/TN-BP	AT1100/TN
1/8 x 36"	AT1100/TO-BP	AT1100/TO

MIG Diameter	Part Numbers		
	1# (4") Spools	8" Spools	16# Spools
.035	AS1100/1F	AS1100/2F	AS1100/3F
3/64	AS1100/1K	AS1100/2K	AS1100/3K

### R 4047 - (718)

High Silicon content insures good flow at lower temperature. Good alloy for most aluminums. Commonly used as an aluminum brazing alloy. Available in TIG only.

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

#### Sizes and Part Numbers

TIG Diameter	Part Numbers	
	1# Package	5# Package
1/16 x 36"	AT4047/TL-BP	AT4047/TL
3/32 x 36"	AT4047/TN-BP	AT4047/TN
1/8 x 36"	AT4047/TO-BP	AT4047/TO

### 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

#### Sizes and Part Numbers

TIG Diameter	Part Numbers	
	1# Package	5# Package
1/16 x 36"	AT2319/TL-BP	AT2319/TL
3/32 x 36"	AT2319/TN-BP	AT2319/TN
1/8 x 36"	AT2319/TO-BP	AT2319/TO

MIG Diameter	Part Numbers		
	1# (4") Spools	8" Spools	16# Spools
.035	AS2319/1F	AS2319/2F	AS2319/3F
3/64	AS2319/1K	AS2319/2K	AS2319/3K

All chemical values are shown in ranges or maximum percentage.

**More alloys are available on the next page. See pages 3 & 4 for the proper aluminum MIG and TIG welding procedures.**

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## AWS A5.10/A5.10M:2012

**ER & R 4043 -** The most popular aluminum alloy. Easy to use on just about every grade of aluminum. 4043 can not 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

### Sizes and Part Numbers

TIG Diameter	Part Numbers	
	1# Package	5# Package
1/16 x 36"	AT4043/TL-BP	AT4043/TL
3/32 x 36"	AT4043/TN-BP	AT4043/TN
1/8 x 36"	AT4043/TO-BP	AT4043/TO
5/32 x 36"	AT4043/TP-BP	AT4043/TP
3/16 x 36"	AT4043/TQ-BP	AT4043/TQ

MIG Diameter	Part Numbers		
	1# (4") Spools	8" Spools	16# Spools
.030	AS4043/1E	AS4043/2E	AS4043/3E
.035	AS4043/1F	AS4043/2F	AS4043/3F
3/64	AS4043/1K	AS4043/2K	AS4043/3K
1/16	AS4043/1L	AS4043/2L	AS4043/3L

**R 4145 - (716)** To be used on aluminum grades: 1060, 1350, 3003, & aluminum castings 201.0, 224.0, 333.0, C355.0 and 380.0. Commonly used as an aluminum brazing alloy. Available in TIG only.

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

### Sizes and Part Numbers

TIG Diameter	Part Numbers	
	1# Package	3# Package
1/16 x 36"	AT4145/TL-BP	AT4145/TL
3/32 x 36"	AT4145/TN-BP	AT4145/TN
1/8 x 36"	AT4145/TO-BP	AT4145/TO

**ER & R 5356 -** Second most popular aluminum alloy. It can be used on a large variety of aluminums. Will yield 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

### Sizes and Part Numbers

TIG Diameter	Part Numbers	
	1# Package	5# Package
1/16 x 36"	AT5356/TL-BP	AT5356/TL
3/32 x 36"	AT5356/TN-BP	AT5356/TN
1/8 x 36"	AT5356/TO-BP	AT5356/TO
5/32 x 36"	AT5356/TP-BP	AT5356/TP
3/16 x 36"	AT5356/TQ-BP	AT5356/TQ

MIG Diameter	Part Numbers		
	1# (4") Spools	8" Spools	16# Spools
.030	AS5356/1E	AS5356/2E	AS5356/3E
.035	AS5356/1F	AS5356/2F	AS5356/3F
3/64	AS5356/1K	AS5356/2K	AS5356/3K
1/16	AS5356/1L	AS5356/2L	AS5356/3L

All values are shown in ranges or maximum percentage.

**More alloys are available on the previous page. See pages 3 and 4 for the proper aluminum MIG and TIG welding procedures.**

# Aluminum MIG (GMAW) Welding Procedure

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## Procedure

It is critical that aluminum be as clean as possible before any welding is attempted. Remove oil and dirt with a degreaser/solvent. It is also beneficial to remove the thin aluminum oxide layer. This invisible, thin and continuous protective oxide layer forms on aluminum surfaces when exposed to air. This tenacious oxide layer is beneficial in that it gives aluminum its good corrosion resistance and durability. However, its presence can affect welding adversely and therefore must be removed. Aluminum surfaces with a heavy oxide layer should first be cleaned chemically or mechanically. Wiping the aluminum with a proprietary deoxidizer or dipping the edge of the aluminum in a strong alkaline solution, then water, then nitric acid, then water again are good chemical methods for removing the aluminum oxide layer. The oxide layer can also be removed mechanically using a clean stainless steel wire brush or file. These methods should be employed immediately before welding since the oxide layer will begin to form again after cleaning.

Be sure to keep all aluminum filler alloys covered and stored in a low humidity chamber (dry box). If the base aluminum is stored in cold places (outside, unheated warehouses), be sure to bring it to room temperature to drive off condensation. Too much moisture will result in unacceptable levels of porosity. Aluminum can be preheated to no more than 230°F in order to help eliminate porosity and weld cracking.

Aluminum MIG welding requires quite a few procedural changes when compared to MIG welding with steel. See the helpful hints below:

- Use "U-Type" drive rolls. Other types of drive rolls will distort the soft aluminum or shave wire causing more burn-backs. Ensure that the drive roll groove edges are chamfered, not sharp. Do not exceed the drive roll pressure for aluminum.
- Use nonmetallic (teflon or nylon) inlet and outlet guides.
- Use the correct contact tip size. The longer the contact tip the better the wire feed. The contact tip bore diameter should be approximately 10% larger than the electrode diameter.
- Use a flexible liner (conduit) made out of Teflon, nylon or plastic. This improves the feedability of the soft aluminum wire and avoids abrasive flaking of the aluminum which can clog liners resulting in burn-back.

## Aluminum Gas Metal Arc Welding (MIG)

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

Wire Diameter (inches)	Welding Current (amperage)	Arc Voltage (volts)	Wire Feed Speed (ipm)	Argon Gas Flow <sup>1</sup> (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

<sup>1</sup>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.

### Spray Transfer - Direct Current Electrode Positive (DCEP)

Wire Diameter (inches)	Welding Current (amperage)	Arc Voltage (volts)	Wire Feed Speed (ipm)	Argon Gas Flow <sup>1</sup> (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

<sup>1</sup>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.

All suggested settings are approximate. Welds should be tested to comply to your specifications.

# Aluminum TIG (GTAW) Welding Procedure

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## Procedure

It is critical that aluminum be as clean as possible before any welding is attempted. Remove oil and dirt with a degreaser/solvent. It is also beneficial to remove the thin aluminum oxide layer. This invisible, thin and continuous protective oxide layer forms on aluminum surfaces when exposed to air. This tenacious oxide layer is beneficial in that it gives aluminum its good corrosion resistance and durability. However, its presence can affect welding adversely and therefore must be removed. Aluminum surfaces with a heavy oxide layer should first be cleaned chemically or mechanically. Wiping the aluminum with a proprietary deoxidizer or dipping the edge of the aluminum in a strong alkaline solution, then water, then nitric acid, then water again are good chemical methods for removing the aluminum oxide layer. The oxide layer can also be removed mechanically using a clean stainless steel wire brush or file. These methods should be employed immediately before welding since the oxide layer will begin to form again after cleaning.

Be sure to keep all aluminum filler alloys covered and stored in a low humidity chamber (dry box). If the base aluminum is stored in cold places (outside, unheated warehouses), be sure to bring it to room temperature to drive off condensation. Too much moisture will result in unacceptable levels of porosity. Aluminum can be preheated to no more than 230°F in order to help eliminate porosity and weld cracking.

## Aluminum Manual Gas Tungsten Arc Welding (TIG)

<sup>1</sup>Use a pure tungsten (green band) or 2% ceriated tungsten (gray band) when welding with a traditional transformer rectifier machine. Both types of tungsten should be **balled** before welding. **Set the machine to Alternating Current High Frequency (ACHF) when using a traditional transformer welder.**

Use an alloyed tungsten **sharpened to a blunted point** when welding with the newer inverter welding power sources. Traditional pure tungsten (green band) does not work well with these machines. There are some health concerns regarding the use of thoriated tungsten, therefore a 2% ceriated (gray band) tungsten is often used instead. **Set the machine to Alternating Current (AC) when using an inverter power source.**

Metal Thickness (inches)	Joint Type	Tungsten <sup>1</sup> Diameter (inches)	Filler Rod Diameter (inches)	Welding Current <sup>4</sup> (ACHF) (amperage)	Gas Cup Size	Argon <sup>2</sup> Gas Flow (ft <sup>3</sup> /h)
1/16	Butt/Corner	1/16"	1/16"	55 – 80	¼ - 3/8"	15 – 20 (flat)
1/16	Lap	1/16"	1/16"	60 – 80	¼ - 3/8"	15 – 20 (flat)
1/16	Fillet	1/16"	1/16"	55 – 90	¼ - 3/8"	15 – 20 (flat)
1/8	Butt	3/32"	3/32"	115 – 140	3/8 – 7/16"	20 – 25 (flat)
1/8	Corner	3/32"	3/32"	100 – 130	3/8 – 7/16"	20 – 25 (flat)
1/8	Lap/Fillet	3/32"	3/32"	100 – 150	3/8 – 7/16"	20 – 25 (flat)
3/16	Butt/Corner	1/8 – 5/32"	1/8"	180 – 225	5/8"	20 – 30 (flat)
3/16	Lap/Fillet	1/8 – 5/32"	1/8"	190 – 240	5/8"	20 – 30 (flat)
1/4	Butt/Corner	5/32 – 3/16"	5/32"	200 – 260 <sup>3</sup>	5/8 – ¾"	20 – 30 (flat)
1/4	Lap	5/32 – 3/16"	5/32"	210 – 265 <sup>3</sup>	5/8 – ¾"	20 – 30 (flat)
1/4	Fillet	5/32 – 3/16"	5/32"	210 – 300 <sup>3</sup>	5/8 – ¾"	20 – 30 (flat)
3/8	Fillet/Corner	5/32 – 3/16"	5/32 – 3/16"	240 – 270 <sup>3</sup>	5/8 – ¾"	25 – 35 (flat)
3/8	Lap	5/32 – 3/16"	5/32 – 3/16"	230 – 270 <sup>3</sup>	5/8 – ¾"	25 – 35 (flat)
3/8	Butt	5/32 – 3/16"	5/32 – 3/16"	180 – 275 <sup>3</sup>	5/8 – ¾"	25 – 35 (flat)

<sup>2</sup>Higher gas flows are required for out-of-position welds (40-60 ft<sup>3</sup>/h). Use an Argon/Helium blend or pure Helium when welding on thick aluminum and additional penetration is needed.

<sup>3</sup>A water-cooled torch should be considered when welding with more than 225 – 250 amps.

<sup>4</sup>Inverter-based welders generally require less heat input (lower amps).



**!!!! 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 THE NEW 16 SECTION SAFETY DATA SHEET (SDS).**

**THE SAFETY DATA SHEET (SDS) WHICH OUTLINES THE POTENTIAL HEALTH HAZARDS AND SAFETY INFORMATION RELATED TO THIS PRODUCT CAN BE DOWNLOADED FROM THE SDS 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 SAFETY DATA SHEET (SDS) AND PRODUCT WARNING STATEMENT.**

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

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

