



## ALUMINIUM FILLER WIRE CONSUMABLES

Aluminium is joined with most of known joining processes. It is readily joined by welding, brazing, soldering, adhesive bonding or mechanical fastening.

Aluminium is light in weight, yet some of its alloys have strength exceeding mild steel. It retains good ductility at subzero temperature, has high resistance to corrosion and it is not toxic. Aluminium has good electrical and thermal conductivity as well as high reflectivity to both heat and light.

### Designation for Wrought Alloys Groups

Aluminium, (99% and greater)	1XXX
Major Alloying elements	
Copper	2XXX
Manganese	3XXX
Silicon	4XXX
Magnesium	5XXX
Magnesium & Silicon	6XXX
Zinc	7XXX
Other elements	8XXX
Unused Series	9XXX

### Filler Metal Selection

The end use of the weldment and desired performance are important consideration in selecting an aluminium alloy filler metal.

The primary factors commonly considered when selecting an aluminium alloy filler metal are:

- 1) Freedom from cracks
- 2) Tensile or shear strength of weld metal
- 3) Weld ductility
- 4) Service temperature
- 5) Corrosion resistance
- 6) Colour match after anodizing

When fillet welding thick assemblies, substantial cost saving may be realized by using higher strength filler metal that permits a reduction in weld passes. When making foundry repair of castings, homogeneous structure is often desired for the weld, so filler metal should have the same composition as the casting alloy.

### Cracking:

In general the non-heat treatable aluminium alloys can be welded with filler metal of same basic composition as the base alloy.

The relative sensitivity to cracking based upon weld composition of four aluminium alloys system (Al-Si 4XXX, Al-Mg 5XXX series, Al-Cu 2XXX series and Al-Mg 2 Si 6XXX series) shows that high silicon content and high magnesium alloys are easy to weld due to low sensitivity to cracking.

Filler metals with high silicon content (4XXX series) should not be used to weld high magnesium content 5XXX series alloys; excessive magnesium-silicide eutectics develops in weld structure decreases ductility and increase crack sensitivity.

### Strength:

In many cases several filler metals are available that meet minimum as welded mechanical properties. Typical all weld tensile strengths and minimum shear strengths of several filler metals are listed in following table:

### Filler Alloy Minimum Shear Strength All Weld Metal U.T.S

Filler Alloy	Minimum Shear Strength MPa	All Weld Metal U.T.S MPa
1100	52	93
2319	110	258
4043	79	200
5183	128	283
5356	117	262
5554	117	230
5556	138	290
5654	83	221

Based on above filler metal alloys 5356, 5183, and 5556 provide high shear strength for structural fillet weld.

The 1XXX and 5XXX ALLOY series produce very ductile welds.

### Elevated and Cryogenic Temperature and service:

Filler metals containing in excess of 3% Mg nominal composition (alloys 5183, 5356, 5556 and 5654) are not suitable for application where temperatures are sustained above 66°C, because they can be sensitized to stress-corrosion cracking.

Filler metal alloy like the 5554 alloy and other filler metals having less than 3% Mg are suitable for sustained elevated temperature service. All aluminium filler metals are suitable for cryogenic temperature application.

### Corrosion Resistance:

Aluminium - magnesium filler metals are highly resistant to general corrosion when used with base alloys having similar magnesium content. At the same time aluminium - silicon filler wires such as 4043 or alloy 4047, would be preferred for improved corrosion resistance over alloy 5356 when welding alloy 6061 base metal for immersed service application.

### Colour Match:

Colour match between the weld metal and base metal is often desired for ornamental or architectural applications that are given chemical or electrochemical finishes. Final colour is highly dependant upon composition of filler alloy and how closely it matches with specific elements in base Metals.

Silicon in an alloy will create a grey to black colour with increasing percentage of silicon, these welds made with Al-Si filler metal will exhibit a sharp colour contrast with all base alloys except those clad with an Al-Si alloy or with Al-Si casting alloys.

Chromium causes an alloy to develop yellow or gold shading when anodically treated so as in a 5XXX alloy series, metal with similar chromium content as base metal would be preferred filler metal.

Alloy 1188 filler metal will produce a good colour match in welds of 1XXZ alloy series as well as with alloys 3003, 5005 and 5050.

Alloy 5356 filler metal is good choice for welding the 5XXX and 6XXX series alloys when colour matching needed.

The selection of the correct filler metal greatly influences the service life of an aluminium weldment. A guide to selection of filler metal for general purpose welding of various alloy combinations including casting is presented in the table below:

### Guide to the Selection of Filler Metal

Base Metal	201.0, 206.0, 224.0	319.0, 333.0, 354.0, 355.0, C355.0	356.0, A356.0, 357.0, A357.0, 413.0, 443.0, A444.0	511.0, 512.0, 513.0, 514.0, 535.0	7004, 7005, 7039, 701.0, 712.0	6009, 6019, 6070	6005, 6061, 6063, 6101, 6151, 6201, 6351, 6951	5456	5454	5154, 5254'	5086	5083	5052, 5652'	5005, 5050	3004, Alc.3004	2219	2014, 2036, Alc.3003	1100, 3003, Alc.3003	1060, 1070, 1080, 1350
1060,1070, 1080, 1350	ER4145	ER4145	ER4043	ER5356	ER5356	ER4045	ER4043	ER5356	ER4043	ER5356	ER5356	ER5356	ER4043	ER1100	ER4043	ER4145	ER4145	ER1100	ER1188
1100, 3003 Alc.3003	ER4145	ER4145	ER4043	ER5356	ER5356	ER4043	ER4043	ER5356	ER4043	ER5356	ER5356	ER5356	ER4043	ER1100	ER4043	ER4145	ER4145	ER1100	—
2014, 2036 Alc.3003	ER4145	ER4145	ER4145	—	—	ER4145	ER4145	—	—	—	—	—	—	ER4145	ER4145	ER4145	ER4145	—	—
2219	ER2319	ER4145	ER4043	ER5356	ER4043	ER4043	ER4043	ER5356	ER4043	ER5356	ER5356	ER5356	ER4043	ER4043	ER4043	ER4043	ER2319	—	—
3004, Alc.3004	—	ER4043	ER4043	ER5356	ER5356	ER4043	ER4043	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	—	—	—
5005, 5050	—	ER4043	ER4043	ER5356	ER5356	ER4043	ER4043	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	—	—	—
5052,5652'	—	ER4043	ER4043	ER5356	ER5356	ER4043	ER4043	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	—	—	—
5083	—	—	ER4043	ER5356	ER5183	—	ER5356	ER5183	ER5356	ER5356	ER5356	ER5356	ER5183	—	—	—	—	—	—
5086	—	—	ER5356	ER5356	ER5356	—	ER5356	ER5356	ER5356	ER5356	ER5356	ER5356	—	—	—	—	—	—	—
5154, 5254'	—	—	ER4043	ER5356	ER5356	—	ER5356	ER5356	ER5356	ER5356	ER5654	—	—	—	—	—	—	—	—
5454	—	ER4043	ER4043	ER5356	ER5356	ER4043	ER5356	ER5356	ER5356	—	—	—	—	—	—	—	—	—	—
5456	—	—	ER5356	ER5356	ER5556	—	ER5356	ER5556	ER5356	—	—	—	—	—	—	—	—	—	—
6005, 6061, 6063, 6101, 6151, 6201, 6351, 6951	ER4145	ER4145	ER4043	ER5356	ER5356	ER4043	ER4043	—	—	—	—	—	—	—	—	—	—	—	—
6009, 6010, 6070	ER4145	ER4145	ER4043	ER4043	ER4043	ER4043,	—	—	—	—	—	—	—	—	—	—	—	—	—
7004, 7005, 7039, 710, 712.0	—	ER4043	ER4043	ER5356	ER5356	—	—	—	—	—	—	—	—	—	—	—	—	—	—
511.0, 512.0, 513.0	—	—	ER4043	ER5356	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
514.0, 535.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
356.0, A356.0, 357.0, A357.0, 413.0	ER4145	ER4145	ER4043	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
443.0, A444.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
319.0, 333.0, 354.0	ER4145	ER4145	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
355.0, C355.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
201.0, 206.0, 224.0	ER2313	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

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