

SUPERIOR FLUX

ALUMINUM

SOLDERING

PRODUCT

GUIDE

Updated

09-Jul-2019

*Products
and
Techniques
For
Soldering
Aluminum
Alloys*



Aluminum Soldering - Product Guide

Aluminum Soldering Considerations

Aluminum is a metal that it is hard to solder due to the high surface tension difference between it and molten solder alloy. This occurs because aluminum rapidly forms a tenacious oxide layer whenever it is exposed to oxygen in the air. The oxide layer is responsible for the high surface tension difference between the aluminum and the solder and impedes the solder from spreading evenly on an aluminum surface. There are hundreds of aluminum alloys available in the marketplace; it is important to identify the form of aluminum that is being soldered. Once this is done, an appropriate soldering technique can be chosen for soldering the specific aluminum alloy under consideration. Direct aluminum soldering eliminates using expensive plating techniques to prepare the aluminum surface for soldering.

Aluminum Flux

Aluminum flux can be used with certain solders to directly solder aluminum. Solder alloys that work well for soldering aluminum include tin-zinc, tin-silver, tin-lead-silver, and tin-copper. The fluxes listed below are active for soldering aluminum from 180°C – 315°C. The solder alloys used for soldering are usually soldered in the 240°C – 290°C range.

Superior 1260 – Original, high activity, organic-based, chloride-free, viscous aluminum soldering flux. For aluminum, copper, nickel, brass, and mild steel soldering.

Superior 1261 – High activity, organic-based, chloride-free, more fluid aluminum soldering flux. Gives smooth, even hot dip solder coating on 1350 aluminum wire using 99.3Sn/0.7Cu and SN100C solder.

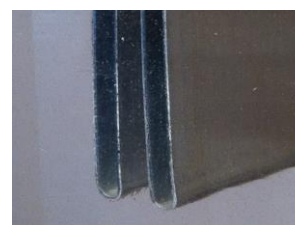
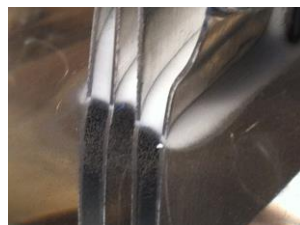
Superior 1265 – Version of the 1260 aluminum soldering flux in a unique paste form for applications requiring dispensing of flux to a particular area.



Aluminum Cleaner

The cleaner prepares the aluminum surface by removing surface oxides and is also used for cleaning aluminum surfaces after soldering.

Superior Aluminum Cleaner is a non-hazardous, slightly acidic solution used for removing tenacious aluminum surface oxides from aluminum alloys immediately prior to applying soldering flux. Can also be used as a cleaner to remove post-flux soldering residues.





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Aluminum Flux Cored Solder

Superior AFCW is a zinc-free, cored wire solder designed for point source (heated by torch or hot plate) direct aluminum soldering applications for a wide range of aluminum alloys.

It is important to heat the aluminum to the 300-380°C (536° - 716°F) activity range of the flux core in this solder wire and allow the solder wire to melt on the heated aluminum alloy surface. It is available as 0.062 inch (1.575 millimeter) diameter wire solder.



Direct Aluminum Solderpaste

Aluminum soldering can also be accomplished by using solderpaste, which is solder alloy and flux held together by a binder. The paste is applied followed by reflow soldering. There are many combinations possible; five common ones are listed below.

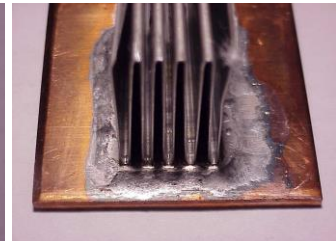
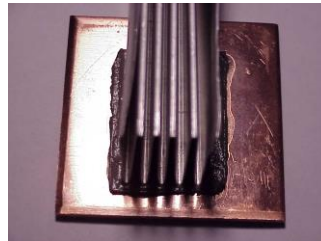
Superior AL26-33-75 – Water-soluble formulation (tin-silver) designed for direct aluminum to copper soldering. The presence of silver in the solder alloy creates a true intermetallic bond between solder and aluminum. Active range 240° - 290°C.

Superior AL261-193-75 – Water-soluble solderpaste with a specialty alloy (tin-bismuth-silver) for low temperature soldering of aluminum to copper. Active range 180° - 240°C.

Superior AL28-103-75 – Water-soluble paste (tin-copper-nickel – SN100C) for direct aluminum to aluminum (1XXX and 3XXX alloys). Active range 300° - 380°C.

Superior AL2627-103-65 – Most active solder paste for aluminum; it is a water-soluble paste (tin-copper-nickel) for aluminum to aluminum (including 6XXX aluminum) or stainless steel soldering. Active range 300° - 380°C.

Superior AL26-103-25 – Direct aluminum tinning paste (tin-copper-nickel) applied to thick aluminum surfaces, rapidly heated (280°C), rinsed off, making surface easier to solder with aluminum solder paste.





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Aluminum Soldering Issues: Important questions to focus on to find a solution

Does This Connection Have To Pass Salt Fog Testing – Aluminum soldering connections usually cannot survive exposure to salt water. A new solder alloy has been developed to pass the salt fog test, **ALUSAC-35**, available as wire, **AFCW ALUSAC-35** cored wire, **ALUSAC-35** solder foil/preform, and **AL2627-213-65 Direct Aluminum Solderpaste**. All salt resistant connections need to use this alloy (melting point is 241-341°C) with a recommended soldering temperature of 380 °C.

What Aluminum Alloy Is Being Used – It is important to know the aluminum alloy used.

- Aluminum such as 1XXX (like 1145) or 3XXX (like 3003) are relatively easy to solder.
- Aluminum such as 6XXX (like 6061), 5XXX (like 5052), or 2XXX (like 2024) are much harder to solder and may only be done with the **AL2627-** style solderpaste or **AFCW** wire.
- Aluminum such as 4XXX (like 4047) or most cast aluminum alloys are high in silicon and cannot be soft soldered.

Soldering Methods – Some common methods are:

- *Point Source Soldering* – Uses torch heat or induction coil to heat up a particular point of connection then soldering can be done by touching the heated area with the flux cored **AFCW** wire or with solder wire coated with aluminum soldering flux.
- *Reflow Soldering* – Uses hot plate or oven will cause the **Direct Aluminum Solderpaste** or **Superior 1261** aluminum soldering flux and solder to reflow connecting two parts. The heating must be completed within 8 minutes to prevent the chemistry for the activators from breaking down.
- *Molten Solder Dipping* – Dipping **Superior 1261** flux coated aluminum into molten solder (SN100C works best) at 300-350°C will coat the aluminum with solder and make the surface solderable with ordinary copper soldering fluxes.
- *Pre-Tinning Soldering Method* – Another way of rendering an aluminum surface solderable easily is to put **Superior Aluminum Tinning Paste** on a surface; heat and reflow the paste on the surface; then rinse with hot water and dry the surface. The surface can then be more easily soldered with the **Direct Aluminum Solderpaste**.
- *Tinning Paste and Solder Foil Soldering* – A one step way of doing the pre tinning methodology, uses the **Superior Aluminum Tinning Paste** as the flux applied to both sides of the solder foil. The aluminum tinning paste will pre-tin the surfaces and will assist the solder foil in soldering to the connecting parts.

Using Superior Aluminum Cleaner

- Cleaning the aluminum parts immediately before soldering in the nonhazardous **Superior Aluminum Cleaner** (heated to 50-55°C) for 1-2 minutes, rinsing with water, and then drying will improve soldering results if done immediately before soldering.
- Aluminum surfaces can be most efficiently cleaned after soldering by immersing the parts into the nonhazardous **Superior Aluminum Cleaner** (heated to 50-55°C) for 1-2 minutes, rinsing with water, and then drying.



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Superior Flux has worked with many chemistries and platforms to give the user a wide range of solutions when it comes to soldering aluminum. The most important issue to consider is what aluminum alloys are to be soldered. Soldering to copper metals is fairly easy because elemental tin (present in many solders) readily forms an intermetallic bond with copper. Tin, however, will not make a metallurgical bond to aluminum. Other elements, especially zinc or silver, have to be added to the solder, which then can create an intermetallic bond between themselves and the aluminum once the aluminum oxides have been removed. Using the **Superior Aluminum Cleaner** greatly improves the chance that a given aluminum alloy can be evenly soldered. Finally, the choice of fluxing vehicle is largely dependent on the aluminum alloy being soldered, the heating method used, and the mass of the product to be soldered (heating faster is always desirable). As stated before, if the soldered part has to withstand salt fog testing, use the **ALUSAC-35** as your solder alloy or use the **AL2627-213-65 Direct Aluminum Solderpaste**.

Fluxing Methodology by Aluminum Alloy and Heating Method

Aluminum Alloys by XXXX* (Aluminum Association Designation)	Superior 1260, or 1261 Flux**, 1265 Dispensable Paste with 91/9 Tin-Zinc or 96.5/3.5 Tin-Silver (240° – 290°C)	Direct Aluminum Solder Paste AL26-33-75 with 96.5/3.5 Tin-Silver*** (240° – 290°C)	Direct Aluminum Solder Paste AL28-103-75 with SN100C Solder (300° – 380°C)	AFCW Flux-Cored Solder Wire or Rods 96.5/3.5 Tin-Silver or 99.3/0.7 Tin Copper (300° – 380°C)	Pre-Tinning with Superior 1261 Flux** in Molten SN100C Solder Bath***** (300-320°C)	Direct Aluminum Solder Paste AL2627-103-65 with SN100C Solder (300° – 380°C)	Pre-Tinning with Direct Aluminum Solder Paste AL26-103-25 with SN100C Solder (240° – 290°C)
Heating Method	Hot Plate/ Soldering Iron/Induction	Solder Reflow Oven/ Hot Plate/ Induction	Solder Reflow Oven/ Hot Plate/ Induction	Soldering Iron/ Torch/ Hot Plate/ Induction	Molten Solder Pot	Solder Reflow/ Oven/ Hot Plate/ Induction	Solder Reflow Oven/ Hot Plate/ Induction
1XXX	YES	YES	YES	YES	YES	YES	YES
2XXX	NO	NO	NO****	NO****	YES	YES	YES
3XXX	YES	YES	YES	YES	YES	YES	YES
4XXX	NO	NO	NO	NO	NO	NO	NO
5XXX	NO****	NO	NO****	NO****	YES	YES	YES
6XXX	YES	NO****	NO****	YES	YES	YES	YES
7XXX	NO	NO	NO	NO	NO	NO	YES

*Depends on the ultimate concentration of trace elements in each individual alloy; some 8XXX and 9XXX alloy aluminum can contain elements that may hinder or block soldering.

The **Superior 1261 is a more fluid form of **Superior 1260** and can be used in all applications that Superior 1260 is used.

***The **Superior Direct Aluminum Soldering Paste** is also available as a low temperature solder paste (**Superior AL261-193-75**) that can solder copper to aluminum at 180-240°C.

****In soldering aluminum to aluminum these products are not recommended, however, soldering copper to aluminum these products can work because of the ease of soldering to the copper, giving the joining a “base” to work from. Using the **Superior Aluminum Cleaner** immediately prior to soldering greatly improves the solderability of many aluminum alloys.

*****SN100C (tin-copper with nickel and germanium) works best for this operation, however tin-copper, tin-zinc, and tin-silver can also be used.