Technical Data Sheet

LOCTITE® ALU

May 2021

PRODUCT DESCRIPTION

LOCTITE® ALU provides the following product characteristics:

Technology	Cored solder wire
Application	Aluminium soldering

FEATURES AND BENEFITS

- Easy, reliable soldering of aluminium and aluminium alloys.
- Greatly improved resistance to electrolytic corrosion compared to tin/zinc solders.
- Excellent flow on aluminium, most aluminium alloys and other metals.
- Solders most metals including stainless steel.
- Contains a unique flux. No separate flux required.
- Compatible with standard solders.
- Range of alloys available including lead free.
- Flux permits direct flame heating at soldering point.
- Suitable for use with gas heated iron. Thinner gauge sheet and wires solderable directly with soldering iron, hot plate, oven, induction, infra-red and resistance heating.

LOCTITE® ALU flux cored solder wires (available in 45D, 31D, 4D and 97CU3 alloys) have been specially formulated for use in aluminium soldering applications. They contain a unique combination of highly developed flux allowing wetting of many of the more difficult aluminium alloys with a solder alloy having better penetration and greatly improved resistance to electrolytic corrosion.

LOCTITE®45D is a general-purpose aluminium solder offering the best balance between price and ease of handling. It is a tin/lead/silver alloy of a special grade.

LOCTITE®31D and LOCTITE®4D are economical alloys recommended for use in applications such as soldering side contact joints in lamp bulbs used in dry warm sockets where electrolytic corrosion is not so much of a concern.

LOCTITE®97CU3 is a lead-free ROHS compliant alloy for use in most applications where lead containing aluminium solders have been historically used.

LOCTITE® ALU is **NOT** designed for use in electronic or electrical applications.

TYPICAL PROPERTIES

Solder Alloy

Henkel Code	Alloy	Melting Point, °C
45D	Sn18Pb80Ag2	178-270
31D	Sn20Pb80	183-275
4D	Sn15Pb85	227-288
97CU3	Sn97Cu3	227-310

Flux Properties

Classification, J-STD-004	ORH1
Classification, EN 29454-1	2.1.2

Cored Solder Wire - Typical Properties

Alloy	45D	31D	4D	97CU3
Density, g/cm³	10.1	10.0	10.2	7.5
Electrical Conductivity, %IACS	8.7	8.7	8.5	13.0
Tensile Strength Of Bulk Alloy, N/mm²	45	51	49	43
Flux Content By Weight (%)	2.3	2.3	2.3	2.0

CORROSION RESISTANCE

Most joints in aluminium will last for a considerable time if kept dry, whether made with tin/zinc or tin/lead solders. In the presence of moisture, however, particularly if the moisture contains dissolved salts, such joints may fail within a few days. This is due to electrolytic corrosion which attacks the metal at the aluminium-solder interface, causing complete loss of adhesion.

An accelerated corrosion test is widely used where the joint is immersed in 3% sodium chloride solution, noting the number of days to failure. The results show that, for joints of copper or aluminium to pure aluminium, failure occurs within a few days (rarely more than 21 days) if tin/zinc or tin/lead solders are used.

Joints soldered with LOCTITE® ALU 45D subjected to this accelerated corrosion test do not fail after 400 days and might, therefore, be expected to last indefinitely in many environments.

The presence of certain impurities such as bismuth, cadmium or zinc in the solder greatly reduces this expectation, and when making the solder, it is therefore necessary to use special grades of tin, lead and silver from which impurities are absent in order to get the best possible life.

Joints on aluminium alloys of good solderability with LOCTITE® ALU 45D generally withstand over 70 days immersion in sea water and over 400 days if carefully made. However, if the aluminium alloy is of poor solderability, the corrosion resistance of the joint is reduced. It should be remembered that the contact of solder with aluminium/copper alloys in the presence of moisture can cause blackening and corrosion of the aluminium alloy independently of any corrosion of the joint. The endurance in sea water of a joint to aluminium may be lower if the second joint member is nickel or steel rather than copper, brass or aluminium.
The test results summarised above were reached by an accelerated testing procedure and can only be taken as an approximate guide to possible behaviour in practice. The user should always test any design under conditions closely related to the expected conditions of service.

JOINT DESIGN
Correct joint design is very important. Many of the advantages of soldering may be lost if the joint design is inadequate. The area of mating surfaces must be sufficient to provide adequate strength, to give an efficient seal and to provide electrical or thermal conductivity as required. Solders have low tensile and peel strength and joints should be designed so that the solder is subjected only to shear stresses. Joint clearances should be 0.05 to 0.1mm for best strength and capillary effect. As aluminium expands with heat more than most metals (including those commonly used for jigs) it is most important that some arrangement of springs, weights or levers is devised for holding joint members while soldering in such a way that the parts are free to expand and contract. The holding devices should not be removed until the joint is completely cold. The joint should not be artificially cooled in case the cooling is non-uniform, setting up stresses that might tear the joint.

SOLDERABILITY OF METALS AND ALLOYS USING LOCTITE® ALU FLUX

Wrought aluminium alloys

"Pure" aluminium (up to 1% impurities), Aluminium-manganese	Excellent
Aluminium + up to 3% magnesium	Good
Aluminium + up to 1.5% each magnesium and silicon	Good
Aluminium copper	Good
Aluminium + over 3% magnesium	Poor

Cast aluminium alloys

"Pure" aluminium (up to 0.5% impurities)	Good if rough cast surface is first machined off
Aluminium-copper	Good if rough cast surface is first machined off
Aluminium-silicon	Un-solderable

Other aluminium finishes

Anodised surfaces	Not solderable without first removing the anodising **
Aluminium-silicon coatings	Un-solderable

** Anodising cannot be applied over solder

Other metals and alloys

Tin plate, copper, brass	Excellent
Nickel and nickel silver	Excellent
Steel, stainless steel and zinc alloy die-castings	Good
Chromium, titanium	Un-solderable

DIRECTIONS FOR USE

Soldering Technique
The only treatment necessary for surfaces of wrought aluminium before soldering is to wipe off dirt and grease. Cast surfaces should be machined before soldering. The flux residue is not in itself very corrosive, but it does absorb moisture from the atmosphere and should therefore be washed off with water in which it is readily soluble. The joint should be carefully made with neat fillets showing a low contact angle to ensure maximum protection.

Heating
The thermal conductivities of aluminium and its alloys are only about half that of copper, and in some types of joint it is therefore necessary to ensure that the joint surroundings as well as the joint itself are well heated in order to reduce mechanical distortion introduced by the higher thermal expansion of aluminium. Although the thermal capacity of aluminium is about 2.5 times that of an equal weight of copper, it is only three-quarters that of an equal volume of copper, owing to the difference in density. Combined with the lower thermal conductivity of aluminium this means that a volume of aluminium should heat more quickly than an equal volume of copper. The opposite impression may be gained because aluminium articles are often made of relatively thick material, and also because the oxide skin on aluminium may have an insulating effect, preventing the absorption of heat. Any of the usual forms of heating may be used, but they should be of sufficient temperature and heat capacity to raise the work piece to 350°C as quickly as possible. For many jobs a gas-heated iron will be found preferable to an electrically heated one as it can supply heat more rapidly. Direct flame heating of the work piece gives excellent results, though with acetylene or hydrogen flames great care must be taken not to overheat the work. Propane and butane are extremely suitable gases. In theory butane has slightly greater heat capacity but it cannot be used in cold weather when the bottle is near or below freezing point, whereas propane bottles can be used down to about -35°C.

For the small workshop, butane is the best gas. Cheap and very effective butane torches are available in most hardware shops, and the butane can be bought in disposable tin-plate cartridges.

The best technique is to heat the area adjacent to the joint and apply LOCTITE® ALU direct to the joint so that it is melted by the surface rather than the heat source itself. When using a soldering iron it is best to use a copper tip for optimum heat transfer because LOCTITE® ALU flux carbonises on iron plated solder tips.

Cleaning:
The residues of LOCTITE® ALU should be removed as soon as possible after soldering using hot water.

STORAGE AND SHELF LIFE

Storage:

It is recommended to store LOCTITE® ALU in a dry environment at room temperature.

Shelf Life:

The cored solder wire is classified as a non-shelf life item. Thus, no expiry date is required to be printed on the labels. However, the quality and manufacturing records for cored solder wire is only maintained no longer than 2 years from the date of manufacture. Thus, any quality feedback after that stipulated period cannot be addressed.

DATA RANGES

The data contained herein may be reported as a typical value and/or a range. Values are based on actual test data and are verified on a periodic basis.

GENERAL INFORMATION

For safe handling information on this product, consult the Material Safety Data Sheet (MSDS).

Not for Product Specifications

The technical information contained herein is intended for reference only. Please contact Henkel Technologies Technical Service for assistance and recommendations on specifications for this product.

Conversions

(°C x 1.8) + 32 = °F
kV/mm x 25.4 = V/mil
mm / 25.4 = inches
µm / 25.4 = mil
N x 0.225 = lb
N/mm x 5.71 = lb/in
N/mm² x 145 = psi
MPa x 145 = psi
N·m x 8.851 = lb·in
N·m x 0.738 = lb·ft
N·mm x 0.142 = oz·in
mPa·s = cP

Reference 2