

Electronics Division Technical Note No. 197

Solders and Fluxes

G. A. Ediss, M. Metcalfe, N. Peereboom and B. Simon
National Radio Astronomy Observatory

March 10, 2004

In this memo we give details of the different types and uses of solder and flux used within the NRAO.

In the CDL:

1) For most soldering uses -

Alloy: SN62 (62% Sn, 36% Pb, 2% Ag) solder

Manufacturer: Alpha Metals (now Cookson Electronics) Vaculoy with Reliacore 15 core (RMA flux). See www.alphametals.com/products/solder_barwire/selectorguide.html

(Also see Umicore #355 at <http://www.advancedmaterials.umicore.com/indium> with RMA flux, mildly activated rosin MIL-F-14256).

Cleaning: After soldering, the joints are cleaned with TCE.

Melting temperature: 179C (eutectic, see Figure 1)

2) Used SN62 to successfully solder to gold-plated surfaces for space-qualified amplifiers on NASA's W-MAP spacecraft. First, the gold-plated surface was soldered, then the solder was wicked off to remove scavenged gold, and finally re-soldered.

3) In gold thin-film circuits (to reduce gold scavenging) -

Alloy: Indalloy #2 (80% In, 15% Pb, 5% Ag)

Manufacturer: www.indium.com (also see Umicore #298300

<http://www.advancedmaterials.umicore.com/indium>)

Flux: Supersafe 334 Flux (Superior Flux and Mfg. Co., www.superiorflux.com).

Cleaning: After soldering, joined parts are cleaned with 60C water.

Melting temperature: 154C liquidus, 149C solidus, see Figure 1

4) For low temperature soldering (where two solders are required on same piece), the second lower temperature solder is

Alloy: B20E2 (52% Bi, 32% Pb, 16% Sn)

Manufacturer: Alpha Metals (Cookson Electronics),

www.alphametals.com/products/solder_barwire/selectorguide.html

(also see Umicore #203204, www.advancedmaterials.umicore.com/indium/)

Flux: Supersafe #30 Flux (Superior Flux and Mfg. Co., www.superiorflux.com).

Cleaning: After soldering, joined parts are cleaned in hot water.

Melting temperature: 96C eutectic

5) For stainless-steel soldering -

Alloy: Eutectic 157 (95% Sn, 5% Ag).

Manufacturer: Eutectic Corp., N94 W14355 Garwin Mace Dr., Menomonee Falls, WI 53051
(Tel: 800-558-8524)

Local agent: Wayne Oxygen, 1022 W. Main St., Waynesboro, VA 22980 (Tel: 540-949-4142)

Flux: #157 flux. Eutectic Corp.

Cleaning: After soldering, the parts are cleaned with hexane.

Melting temperature: 245C

Note: As an alternative, first plate with 100 microinches of copper, then use SN62 with rosin flux.

In Green Bank:

1) For surface mount work -

Alloy: R276 fluxed solder paste (63% Sn, 37% Pb) Mesh -325/+500

Manufacturer: Kester www.kester.com

Flux: Fluxed paste

Cleaning: Use any common spray flux remover to clean, such as Chemtronics rosin Flux-Off, #ES1035. www.chemtronics.com

Melting temperature: 183C

2) For general purpose soldering -

Alloy: Multicore Sn62 (62% Sn, 36% Pb, 2% Ag)

Manufacturer: Alpha Metals, see above

Flux: Rosin core

Cleaning: Use any common spray flux remover to clean

Melting temperature: 179C

3) For general purpose brass and copper soldering -
(Mostly used at the GB machine shop)

Alloy: Type 157 roll solder (95% Sn, 5% Ag)

Manufacturer: Eutectic Corp., see above

Flux: Eutectic ME-157PA solder paste

Cleaning: Clean with soap and hot water

Melting temperature: 245C

4) For stainless-steel soldering -

(Mostly used on stainless vacuum fitting at GB shop and cryogenic lab)

Alloy: ME1020XFC silver solder

Manufacturer: Eutectic Corp., see above

Flux: Eutectic ME-157PA solder paste
Cleaning: Clean with soap and hot water
Melting temperature: 566C

In Socorro:

Solder 1: Sn63 : Pb37 SqueeGee Paste

Application: SqueeGee & Screen PCB
Alloy: Sn63 : Pb 37 (as a paste, mesh –325/+500). M/C 90%
Liquidus/Solidus: 183C, eutectic
Manufacturer: EFD Inc¹ reference www.efdsolder.com
Part Number: PrintPlus 6-Sn63-277-E RMA
Packaging: 500 gram jar
Shelf Life: 6 months <21C. Longer when refrigerated 2-5C
Flux: RMA (in the paste)
Cleaning: isopropyl alcohol

Comment 1. Not for rework.

Comment 2. It is adequate for SqueeGee except for putting down newer high-performance microwave surface mount components. For example, see the “LP3” package from Hittite Microwave. www.hittite.com. For small packages, it is advantageous to use paste from a smaller mesh.

Solder 2. Sn63 : Pb 37 Syringe Paste

Application: Syringe & pneumatic dispenser²
Alloy: Sn63 : Pb 37 (as a paste, mesh –200/+325). M/C 85%
Liquidus/Solidus: 183C, eutectic
Manufacturer: EFD Inc., reference www.efdsolder.com
Part Number: SolderPlus 63RMA-A
Packaging: 10 cc / 25 gram EFD-style syringes
Shelf Life: 6 months <21C. Longer when refrigerated 2-5C
Flux: RMA (in the paste)
Cleaning: isopropyl alcohol

Comment 1. Can be used for rework.

Comment 2. It is adequate only for large packages. The relatively large size of the solder balls (mesh –200/+325) means that small packaged components (pad sizes 0.030” x 0.060” and smaller) receive adequate wetting only when too much solder is applied.

Comment 3. For new orders, it is recommended switching the solder to mesh –325/+500 or smaller.

¹ EFD supplies solder and pneumatic dispensers. 1-800-877-4377. Reference www.efdsolder.com

² Pneumatic dispenser: at Socorro, we have had success with the 1500DV pneumatic dispenser from EFD. www.EFD.com

Solder 3. Sn96.3 : Ag 3.7 Syringe Paste

<i>Application:</i>	Syringe & pneumatic dispenser
<i>Alloy:</i>	Sn96.3 : Ag 3.7 (as a paste, mesh -325/+500). M/C 85%
<i>Liquidus/Solidus:</i>	221C, eutectic
<i>Manufacturer:</i>	EFD Inc., reference www.efdsolder.com
<i>Part Number:</i>	6-Sn96-211-F RMA
<i>Packaging:</i>	10 cc / 25 gram EFD-style syringes
<i>Shelf Life:</i>	6 months <21C. Longer when refrigerated 2-5C
<i>Flux:</i>	RMA (in the paste)
<i>Cleaning:</i>	isopropyl alcohol

Comment 1. Can be used for rework.

Comment 2. It is adequate for some smaller packages, but the solder balls could be even smaller for work on packages EIA0603 and smaller.

Comment 3. Effective for multi-temperature soldering. Low scavenging of gold.

Solder 4. Au80 : Sn20 Solder Preforms

<i>Application:</i>	fluxless MMIC die attach onto gold surfaces
<i>Alloy:</i>	Au80 : Sn20 (in a 0.001" thick rectangular preform)
<i>Liquidus/Solidus:</i>	280C, eutectic
<i>Manufacturer:</i>	Aim Solder ³ , reference www.aimsolder.com
<i>Part Number:</i>	special order, perform dimensions are 75-80% of MMIC dimensions
<i>Packaging:</i>	one cc vial, normally 500 solder performs per vial @ ~\$1 each
<i>Shelf Life:</i>	10 year minimum at room temperature
<i>Flux:</i>	NO FLUX
<i>Cleaning:</i>	no cleaning required after solder flow

Comment 1. Requires a plasma cleaner to prepare the gold surface of the substrate before placing the solder perform and the MMIC.

Comment 2. The advantages of using Au80:Sn20 solder performs for die attach are:

- exactly enough solder under the MMIC, no operator error
- no cleanup of flux, carbonized residue or solder balls
- small repeatable solder fillet at the MMIC-substrate interface
- no corrosive residue, no chemical cleaners around the MMIC
- no silver flakes exfoliating from hardened silver epoxy (e.g., Epotek H20e).
- no gold scavenging

Solder 5. Sn63 : Pb37 Solder Wire, Diameter 0.020", Rosin Core

<i>Application:</i>	Tip wetting, larger and general purpose soldering
<i>Alloy:</i>	Sn63 : Pb37, spec: QQ-S-571F WRMAP-3
<i>Liquidus/Solidus:</i>	183C, eutectic
<i>Manufacturer:</i>	Kester, reference www.kester.com

³ AimSolder supplies solder products. Contact the Special Products Division for information about Au80:Sn20 solder performs. Reference www.efdsolder.com

Part Number: 24-6337-9702
Packaging: One pound spool (454 grams)
Shelf Life: 3 yrs. from date of manufacture
Flux: Kester #44 RA Rosin activated. IPC/J/STD 004. Flux designator ROM1.
Cleaning: isopropyl alcohol, acetone

Comment 1. Can be used for rework.

Solder 6. Sn63 : Pb37 Solder Wire, Diameter 0.015”, Rosin Core

Application: Tip wetting, larger and general purpose soldering
Alloy: Sn63 : Pb37, spec: QQ-S-571F WRAP-3
Liquidus/Solidus: 183C, eutectic
Manufacturer: Kester, reference www.kester.com
Part Number: 24-6337-0007
Packaging: One pound spool (454 grams)
Shelf Life: 3 yrs. from date of manufacture
Flux: Kester #44 RA Rosin activated. IPC/J/STD 004. Flux designator ROM1.
Cleaning: isopropyl alcohol, acetone

Comment 1. Can be used for rework.

Solder 7. Sn91 : Zn9

Application: Tinning for solid aluminum surfaces.
Alloy: Sn91 : Zn 9 (as a wire, 0.010” diameter)
Liquidus/Solidus: 199C, eutectic
Manufacturer: Indium Corp, reference www.indium.com
Part Number: IPN #52078
Packaging: 0.010” diameter wire, 160 gram spool
Shelf Life: 12 months when refrigerated
Flux: Flux #3, see below
Cleaning: isopropyl alcohol, acetone

Comment 1. An inexpensive way to make an aluminum surface solderable with regular Sn63.

Flux A: Number #5 RMA

Application: Brush or syringe & pneumatic dispenser
Manufacturer: Indium Corp⁴, reference www.efdsolder.com
Part Number: IPN# 84032
Packaging: one pint jar (transfer to small syringe as needed)
Shelf Life: 12 months when refrigerated
Flux: RMA (in the paste)
Cleaning: isopropyl alcohol or acetone

⁴ Indium Corp. supplies fluxes and solders. 1-315-853-4900. Reference www.efdsolder.com

Comment 1. Flux #5 is generally recommended for prototyping.

Comment 2. RMA flux is superior to “no-clean” fluxes in a prototype environment due to superior joint strength and no potentially conductive residues.

Flux B: Number #3

<i>Application:</i>	Brush or syringe & pneumatic dispenser
<i>Manufacturer:</i>	Indium Corp, reference www.efdsolder.com
<i>Part Number:</i>	IPN# 84003
<i>Packaging:</i>	one pint jar (transfer to small syringe as needed)
<i>Shelf Life:</i>	12 months when refrigerated
<i>Flux:</i>	RMA (in the paste)
<i>Cleaning:</i>	isopropyl alcohol or acetone

Comment 1. Used with Sn91 : Zn9 solder (used for making an aluminum surface solderable with regular Sn63). Not a good flux for general prototyping with Sn63.

Comment 2. Flux #3 is more corrosive than RMA and rosin. Caution needs to be exercised to limit splatter when using it near microelectronics.

Comment 3. Flux #3 makes aluminum surfaces exceptionally clean. For proper cleaning, the surface temperature needs to be between 150C and 210C. The flux could be used without the solder as a surface cleaning step in assembling precision low-loss aluminum antennas or waveguides.

In TUCSON:

For the SMT (Surface Mount Technology) Lab -

1. To use a stencil to apply the solder onto the PCB's,

Alloy: Type R560 solder paste (Sn62/Pb36/Ag02) 90%, Mesh -325+500, Visc. PS. 1650-2300
[http://www.kester.com/en-us/datasheets/R560%20\(05Jan00\)logo.pdf](http://www.kester.com/en-us/datasheets/R560%20(05Jan00)logo.pdf)

Manufacturer: Kester (Distributor: Techni-Tool (800-832-4866))

Shelf Life: 6 months (0-10C)

Cleaning: 49-60°C deionized water

Melting temperature: 210C

2. To use a syringe to manually apply the solder to the PCB's

Alloy: Type R276SR solder (Sn62/Pb36/Ag02) 87%, Mesh -325+500, Visc. PS. 550-800
[http://www.kester.com/en-us/datasheets/R276%20\(26Oct99\)logo.pdf](http://www.kester.com/en-us/datasheets/R276%20(26Oct99)logo.pdf)

Manufacturer: Kester

Shelf Life: 6 months (0-10C)

Flux: J-STD-004. Classification ROL0.

Cleaning: No clean

3. To rework or populate PCB's that do not fit through the IR oven and any through-hole components -

Alloy: Rosin Core "44" (Sn62/Pb36/Ag02) Core 66
[http://www.kester.com/en-us/datasheets/44\(A013\).pdf](http://www.kester.com/en-us/datasheets/44(A013).pdf)

Manufacturer: Kester

Flux: Kester #44 rosin activated

Cleaning: No clean or isopropyl alcohol/acetone

Note: The diameters we use are .010, .015 and .040 depending on the component size.

4. Flux

The flux comes in a flux pen, Kester #186. It is a Rosin flux, type RMA, classification ROL0. Use any common flux remover to clean.

[http://www.kester.com/en-us/datasheets/186series\(C-91A-0306\).pdf](http://www.kester.com/en-us/datasheets/186series(C-91A-0306).pdf)

From <http://www.brocku.ca/earthsciences/people/gfinn/petrology/binary1.htm>

1. **Eutectic (Point E)** - lowest temperature point on a T-X (Isobaric = constant P) diagram at which liquid coexists with solid. On this diagram, the eutectic is the point of intersection between the liquidus and solidus.
2. **Liquidus** - surface on a phase diagram above which no solids exist.
3. **Solidus** - surface or line on a phase diagram below which no liquid exists. In this case, the solidus is a horizontal line representing a constant T = isotherm.

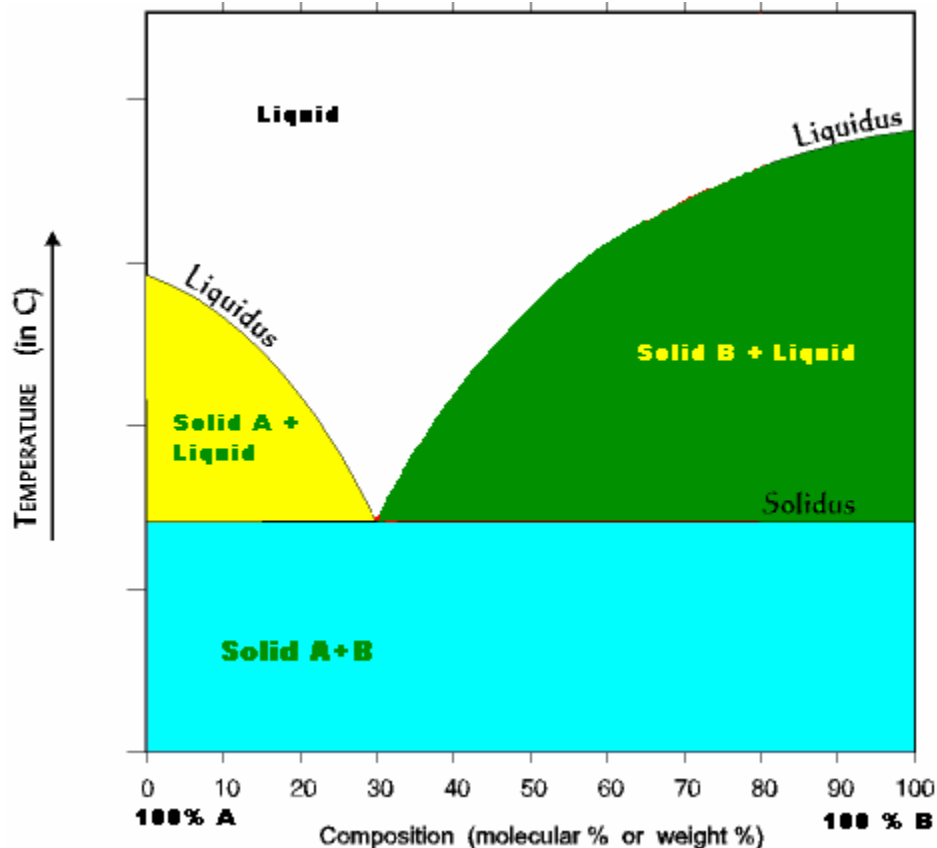


Figure 1