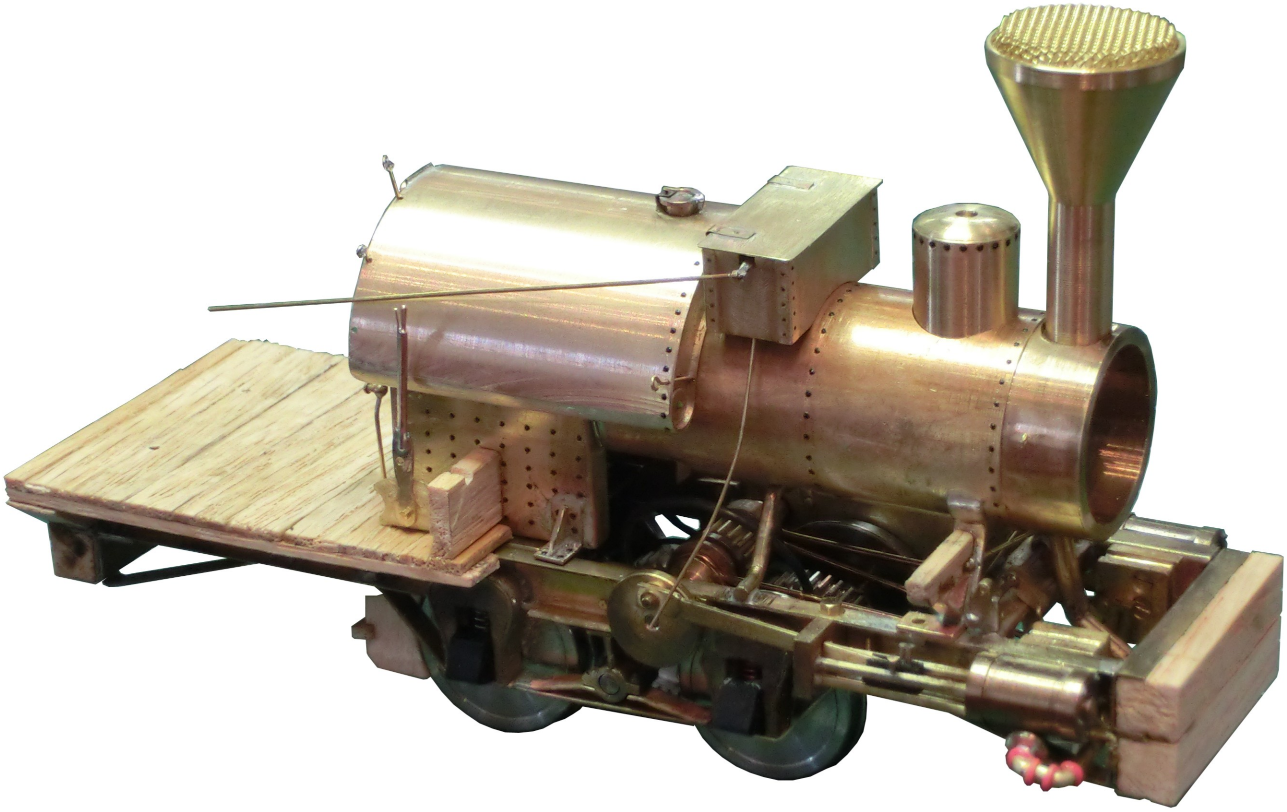
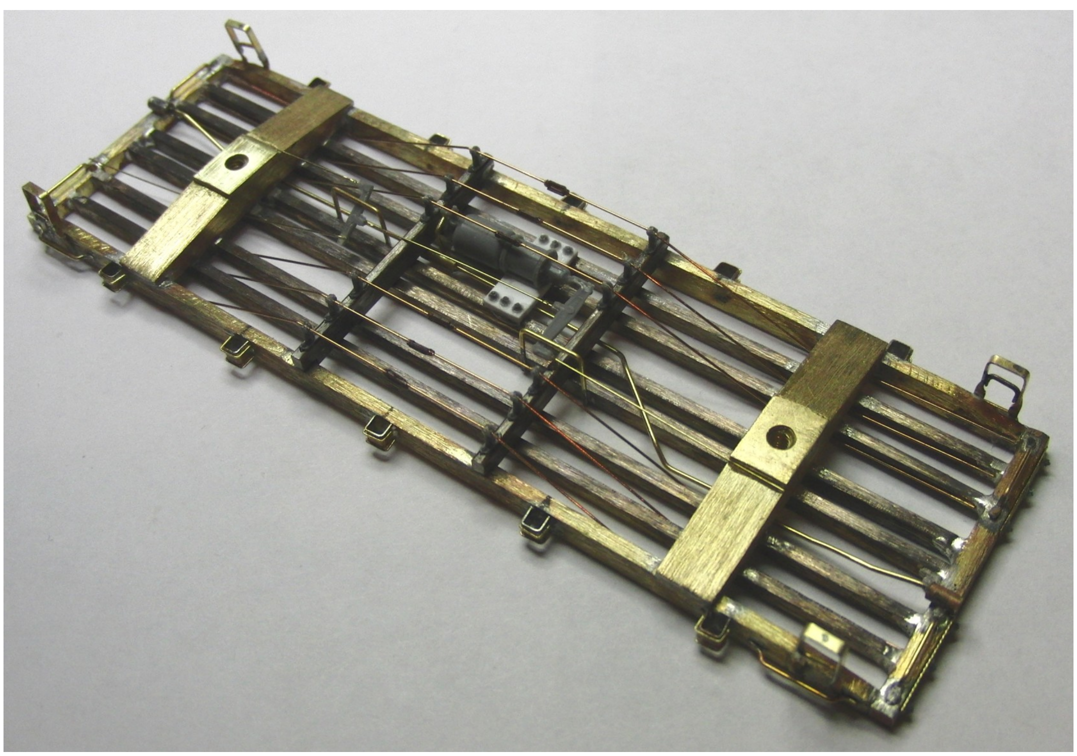
Resistance Soldering, The Basics





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By Gary Butts #146478

Normal Soldering Tools

Soldering Pencil

Good small heat area, low heat capacity.

Soldering Iron

High heat capacity, large tip area is cumbersome for small parts.

Butane-Air and Acetylene-Air Torches

Very high heat capacity, relatively large heat area

Oxygen-Acetylene Torch

Very high heat capacity, smaller heat area

Resistance Soldering Rigs

Inexpensive Tweezers System

-Two heat ranges, 63W at High Power

-Manual heat range change

-Probe only

-With foot switch

-Approximate cost $175

Medium Range Tweezers System

-Continuous heat range, 0-250 Watts

-Probe only

-With foot switch

-Approximate cost $400

Medium Range Probe System

-Continuous heat range, 0-250 Watts

-Tweezers only

-With foot switch

-Approximate cost $485

High End Combination System

-Five heat range, 0-300 Watts

-Tweezers and Probe

-With foot switch

-Starter set of flux and solder assortment

-Approximate cost $680

Resistance Soldering Rigs

How do they work?

High current creates localized heat on the probes and in the parts

Heat=Power=(Current)²/Resistance (Joint and Probe)

Low Voltage = Safe to touch

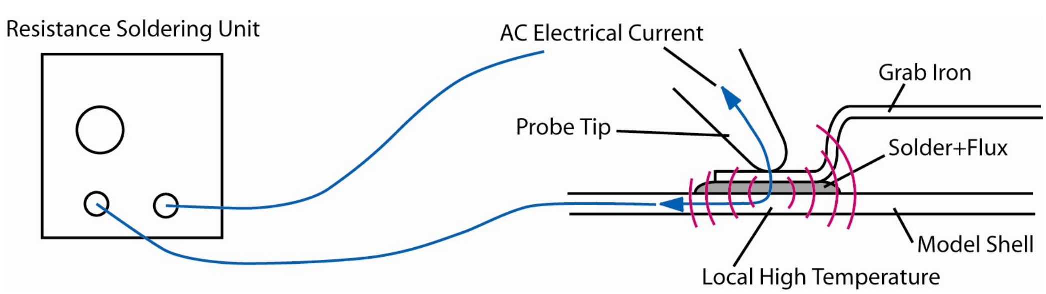
Setting	Voltage	Current	Power
1	1.1 (2.5)V	59A	65W*
2	1.3 (2.7)	62	81
3	1.5 (3.1)	74	111
4	1.65 (3.5)	88	145
5	1.85 (4.0)	103	191

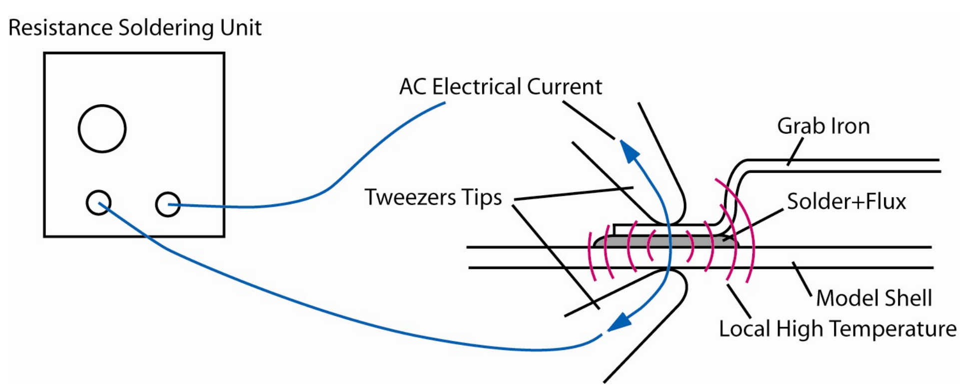
( ) : Open circuit voltage

*Compare to normal 60W soldering pencil

High heat concentrated in a very small area gives a rapid <u>local</u> temperature rise. This allows us to quickly form joints without having to heat large areas of our models which can endanger other close by solder joints.

When the current (foot switch) is off or the probe or tweezers are not pinched, there is no current flow and therefore no heat is generated. There may be residual heat in the probe tips from the previous joint formation which cools relatively rapidly.





Solder

In the absence of contamination, solder forms an alloy with the parent metal at temperatures well below the melting point of the parent.

Common solder alloys

40/60	460 degrees F (230 degrees C)
50/50	418 degrees F (214 degrees C)
60/40	374 degrees F (190 degrees C)
63/37	364 degrees F (183 degrees C)
95/5	434 degrees F (224 degrees C)

-60/40 most common and general use solder
-95/5 Tin-Antimony alloy, lead free

Melting temperature of most Brass alloys 1800 degrees F
Melting temperature of most Copper alloys: 2000 degrees F
Melting temperature of Nickel-Silver: 2000

Solder

Forms of solder

Wire, Bar:	Solid solder alloy
Flux core:	A hollow tube of solder with flux dispersed inside
Paste:	A mixture of fine solder particles with stiff flux.

Flux

Why use flux?

Corrosive (acid) flux

-Used to clean the oxidation from the parent metals to facilitate the alloying process. As the surface of the metals are heated the flux boils increasing the effectiveness of the acid to clean residue and oxidation from the parent and solder metal.

-Best for Brass, Monel, Steel

-Must be cleaned to prevent continued corrosion (etching) of the joint metals

Soap and water + brush

Dishwasher?

Ultra-sonic cleaner

Non-Corrosive (rosen) flux

-Used to promote solder flow and reduce oxidation.

-Best for Copper

-Does not have to be cleaned but leaves a residue

Clean the residue with Acetone

Flux

Corrosive (Acid) and Rosin fluxes are available

In either paste or liquid forms

Pre Clean

Direct contact with the parent metal is required to form the solder alloy

Remove all paint, grease, etc

Most Brass models have a protective lacquer coating that must be removed to form a good joint and will burn black when heated.

Acetone works well for paint and grease removal

Micro-brush, Q-tip or Pipe cleaner

Tinning

Used to pre form the initial molecular alloy on the parent metal(s).

Facilitates rapid joint formation

Insures a "quality" bond

Solder Wick

Use to remove excess solder or completely remove through hole components

Steps to Resistance soldering

1. Clean the surfaces to bare metal.

   Remove flaking paint and corrosion by scraping, sanding, filing etc.

   Remove paint residue with Acetone.

2. Add flux

   Either liquid or solder/flux paste mix.

3. Tin

   Where possible tin both surfaces with solder prior to forming the joint.

4. Position the parts.

   Fixture or mechanically hold the parts if possible. Holding the parts by hand is convenient by can lead to burned finger tips! The parts do get hot.

5. Apply heat

   Use either type of probe to just melt and flow the solder. Apply solder simultaneously if not using solder paste. Do not linger, the joint is formed the instant the solder melts and flows together. Remove the heat by releasing the current with a foot pedal but leave the probe or tweezers in place until the joint chills solid.

6. Remove excess solder

   Solder Wick

   Xacto blade

7. Remove the flux residue

   Clean corrosive flux with soap and water.

   Clean rosin flux with Acetone.

Probe Resistance Soldering tool

- Requires a ground lead to complete the current flow
  - Metal vice
- Use similar to a torch
  - Best for
    - Rear heating
    - Large components
    - Flowing joints
    - Stitching
- Always heat the larger (thicker) part with the probe
- Best on:
- "T" Butt Joint, Front and Back heat eyebrows, running boards
- Through hole grab irons, clean-outs, NBW castings
- Flat grab irons, steps, etc. on large surfaces

Tweezers Resistance Soldering tool

- No ground lead required
- Use similar to Tweezers
  - Best for
  - Small components: grab irons, glad hands, steps
  - Clamping action between components
  - Edge joints on small flanges
  - Grab irons close to an edge
  - Eyelets