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TECHNICAL BULLETIN

Bulletin Date: September 2004

Lead Free Soldering with Weller Products

Why the Switch to Lead Free?

As the worldwide electronics industry moves closer to the Lead Free enforcement date of July 1, 2006 to meet the European Union's WEEE (Waste Electrical and Electronic Equipment) and the RoHS (Restriction on Hazardous Substances) regulations, worldwide Original Equipment Manufacturers (OEM's) and Electronic Manufacturing Services (EMS) companies are preparing for Lead Free circuit board assemblies. The recommendation for the industry to adopt a maximum allowable percentage of 0.1 % by weight of Lead in "Lead Free" products, is fast approaching. Due to the drive to reduce the overall amount of Lead in manufacturer's products, changes are very rapidly occurring worldwide.

Cooper Industries and Cooper Hand Tools is committed to leading the environmental challenges of the future by complying with the European Union's WEEE and RoHS directive to ban hazardous materials by the July 1, 2006 deadline. Weller®, a Division of Cooper Hand Tools, is determined to play a significant role in the leadership of this challenge.

Weller®

Weller®, a leading manufacturer of electrical and electronic hand soldering products for approximately 60 years, has had a long experience in the use of Lead Free Solders. Many Weller customers in Japan and China have successfully worked with Lead Free solders for several years. As well, the use of Weller soldering tools have been used with Lead Free solders in the US plumbing industry since the ban on Lead occurred over a decade ago.

The Weller Silver Series line of high-powered soldering products now offers a new level of expertise in the field of Lead Free soldering. Companies worldwide will benefit from the advances in the products and technologies currently being offered by Weller.

Advances in Technology of Lead Free Solders

As new Lead Free solder alloys emerge in the marketplace, soldering equipment must also change to meet the ever-growing needs of increased temperatures for the higher melting point alloys. Weller's more recent advancement in the Silver Series technology of high wattage (65 to 80 Watt) soldering equipment, are prepared to handle these challenges.

Solders produced from high percentages of Tin (Sn); accompanied by small percentages of Silver (Ag), Copper (Cu) and occasionally Bismuth (Bi) are the leading candidates for new alloys in the electronics industry. Standard alloys of Sn 96.5/Ag 3.5 and Sn 96.5/Ag 3.0/Cu 0.5 are being chosen as the closest overall

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Lead Free Solders (Cont.)

replacements for Eutectic (Sn63 / Pb 37) and Near Eutectic (Sn 60/Pb 40 and SN 62/Pb 36/Ag 02) alloys currently being used in the market today. For quick reference, solder melting points are listed below. This listing shows the nominal changes between several “Lead Bearing” and “Lead Free” alloys. Not all alloys are listed and Weller is not necessarily recommending that the alloys listed should be chosen for any specific application. Please consult your solder manufacturer for more specific application recommendations.

Lead Bearing Alloys (Commonly Used)

Sn 63 / Pb 37 – 361° F / 183° C (Eutectic)

Sn 60 / Pb 40 – 361° F – 374° F / 183° C – 190° C (Non- Eutectic Solidus / Liquidus Temperatures)

Sn 62 / Pb 36 / Ag 02 – 354° F – 372° F / 179° C – 189° C (Non- Eutectic Solidus / Liquidus Temperatures)

Lead Free Alloys (Proposed for Hand Soldering Applications)

Sn 96.5 / Ag 3.5 – 430° F / 221° C (Eutectic)

Sn 96.5 / Ag 3.0 / Cu 0.5 – 423° F - 428° F / 217° C – 220° C (Non- Eutectic Solidus / Liquidus Temperatures)

Sn 99.3 / Cu 0.7 - 441° F / 227° C (Eutectic)

Advancements in Technology of Soldering Equipment

Along with an increase in the melting points of the new alloys, advancements in the way that hand soldering tools perform, are critical as well. The requirement to transfer heat to the application without significantly increasing the working temperature of the soldering tool being used can only be achieved by increasing the thermal capacity of the tool. An increase in the thermal capacity accompanied by the direct transfer of energy from the soldering iron's heating element to the tip, is how Weller has overcome the challenge of hand soldering for the industries growing needs. With one of the market's highest wattage electronically controlled soldering irons, which boast an impressive output of 80 Watts, the Weller Silver Series Model WSD81 Soldering tool meets the stringent demands for the new alloys.

For applications that require more precise soldering techniques, the Weller Silver Series Models WSL and WSL2 combine to offer one of the closest “Tip to Grip” handle designs (37 mm / 1.46” Tip Reach) on the market. Along with 65 Watts of continuous, controlled power, the Weller WMP Model soldering iron offers an additional option to the future of Lead Free soldering task.

With the added features of Temperature “Lockout” for process control, Auto “Setback” and Auto “Off” for improving tip life, °F to °C conversion capabilities, the Weller Silver Series products offer the latest advantages to hand soldering equipment.

All Weller Electronic soldering products meet or exceed the stringent requirements for EOS (Electrical Over Stress) and ESD (Electro Static Dissipative) standards, as well as all applicable MIL-STD and J-STD requirements (2 mV TRMS, 2 Ohms Tip to Ground Resistance, etc.).

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For UL, CUL or CE approval listings, please contact your local Weller® representative.

Advancements in Technology of Soldering Tips

Due to the nature of the higher Tin (Sn) content of the Lead Free alloys, advancements in soldering iron tip technologies also must change. It has been determined that the higher Tin content may cause a shorter life expectancy on soldering tips because of the fact that Iron (Fe) plating is used as the protective covering (commonly referred to as Electroplating) on all electronic grade-soldering tips. Iron (Fe) "migrates" or "leaches" more quickly into the higher Tin (Sn) content of the Lead Free alloys as opposed to the previously used Tin (Sn) / Lead (PB) solders that have been used for decades. Due to this phenomena, an increase in the thickness of Iron (Fe) applied to the soldering tips is the only known way to improve tip life.

Recommendations for Soldering

- For rework or repair, always use the same alloy that was originally used for production assembly.
- Select the lowest possible working temperature for any application, even if Lead Free.
- Choose the largest possible soldering tip to perform the application.
- Transfer of heat through a properly "Tinned" tip will provide the quickest and most efficient solder connection.
- The use of higher "Thermal Capacity" tools, especially in Lead Free applications, will allow the use of lower temperatures and better quality workmanship.
- For high reliability soldering, use only precision temperature controlled, EOS/ESD approved soldering stations.
- Enable the "Setback" or "Auto-Off" features of your soldering stations to help extend tip life.
- When applicable, pre-heat the circuit board before reworking or repairing to improve soldering efficiency.

Soldering Iron Tip Maintenance

- Use only original Weller tips in your Weller soldering station.
- Keep the tip "Tinned" at all times. Never wipe the tip clean of solder and leave the Iron Plating exposed to air, which promotes rapid oxidation. Always re-tin the tip immediately after cleaning.
- Use Distilled or De-ionized water for your tip cleaning sponge. Tap water sometimes contains chemicals that may contaminate the soldering tips due to the elevated temperatures of soldering equipment.
- Only use high temperature sponges that are designated for use with soldering equipment. Common household cleaning sponges can overheat or melt on a hot soldering iron tip, destroying the "wettability" of the surface. Sponges that are not specified for soldering applications often contain sulfur, which is prohibited from high reliability soldering applications.
- Keep your soldering tool sponge damp, not drenched with water nor allowed to dry too much. Sponges that are too wet may considerably lower your soldering iron's tip temperature causing delays in your soldering application. Sponges that are too dry, may burn when contacted by the tip, even when using a sponge designed for soldering applications.

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- When possible, avoid the use of highly active Fluxes. Always confirm with the Solder Manufacturer that the Flux in use in the application is recommended for hand soldering and is capable of properly cleaning the work, as well as the soldering iron tip.
- When using liquid or dispensable type Fluxes, be sure to check with the Solder or Flux Manufacturer, to be sure that they are compatible with the application. As well, the Flux should be compatible with and capable of properly cleaning the soldering iron tip.
- Always use a properly "Tinned" tip for soldering and only apply a minimal amount of force to the tip to transfer heat. Pressure does not effectively transfer heat, solder does. Do not bend or modify tip surfaces. Doing so will shorten the tip life by fracturing or cracking the Iron plating and exposing the core material (Copper) on the soldering tip.
- Never file a soldering iron tip. To do so will drastically shorten tip life.