Be Selective in Partnering with Your Next Soldering Equipment Supplier

By Reid Henry, President, Hentec Industries/RPS Automation

Abstract

While there are many selective soldering equipment suppliers available on the market, it is suggested to partner with a soldering equipment supplier who possesses vast experience in multiple soldering technologies. While wave and reflow soldering are allied technologies, component solderability testing and component lead tinning are essential to the formation of robust solder joints.

Key Terms: Selective soldering, system flexibility, operational costs, adjacent component clearance, robotic hot solder dip process, gold removal and tin whisker mitigation, BGA de-balling, component solderability testing

Background

In the 1990's, the primary passion and expertise for Robotic Process Systems was solely selective soldering equipment. With success at delivering automated soldering equipment to a global client base, Robotic Process Systems was able to be the first company to introduce selective soldering to North America. From 2001 to 2006, the company sold their selective soldering systems under an exclusive private label partnership with Tyco Corporation. In 2007, the CEO and the CFO at the time, led an investment group that purchased Robotics Process Systems, and re-branded the company as RPS Automation, LLC. In 2015, RPS Automation, LLC was bought by one of its own engineers, and the name was changed to the current name, Hentec Industries/RPS Automation. Hentec/RPS continues to develop, manufacture, and market its selective soldering, lead tinning, and solderability test systems and services to a global customer base while being independently owned and operated.

The Hentec/RPS Difference

With more than twenty-five plus years of experience in soldering automation, Hentec/RPS continues to design and manufacture a complete line of high precision selective soldering machines, lead tinning equipment, and solderability test systems. This includes component testing along with steam aging equipment for electronics and circuit board manufacturing and assembly. These systems are all designed and built in the USA and feature welded steel frames, factory direct calibration, are Mil spec compliant, UL and CE compliant, and are completely lead-free capable.

We stand apart for high quality soldering, precision robotics, low-maintenance machinery, extensive warranty coverage, long lasting, quality and durability. These strengths are the result of an aggressive commitment to research and development. Hentec/RPS systems set the standard for thermal performance, minimal adjacent keep-away, solder wave height stability, and software ease-of-use. Our systems offer superior soldering capabilities, leading thermal performance, exceptional accuracy and repeatability, low consumption of consumables, high precision, low dross and low maintenance, as well as easy and straightforward programming.

Worldwide Installations

Many global companies have selected Hentec/RPS as their partner of choice for selective soldering, component lead tinning and solderability test systems. Hentec/RPS believes that success is built one customer at a time. Our customers range from aerospace, military, communications, automotive manufacturers, industrial OEM, medical device manufacturers, contract manufacturers, and more. We are proud to have global installations in Australia, Brazil, Canada, China, France. Honduras, Hong Kong, Israel, Mexico, Philippines, Russia, Scotland, Singapore, Thailand, the United Kingdom, and the United States.

Our Commitment

The commitment to our customers begins with the Hentec/RPS engineering team designing reliable, innovative, and high-quality parts and machinery. Our production team's extensive expertise meets the strict regulations and performance demands of our multi-faceted customers. All while our customer service and support team dedicate themselves to implementing and maintaining a customer experience based on honesty, integrity, and a devotion to customers satisfaction. Our commitment includes exceptional training and service, reduced manufacturing costs, extensive warranty coverage, improved speed and productivity, and increased quality for our customers.

Selective Soldering Offerings

The Hentec/RPS Vector 300, 460 and 600 selective soldering systems are available as either manual load/unload or in-line systems providing better flexibility by offering both batch processing and in-line processing. Hentec/RPS systems also have better X-Y axis positioning accuracy for improved solder nozzle alignment and faster Z axis speed producing quicker process cycle times.

Figure 1. Vector 460 with manual load/unload (left), and electropolished stainless steel solder pot (right)

All Hentec/RPS systems feature expandable modular capabilities including in-line preheating and fluxing. Our electropolished stainless steel solder pots eliminate the need for expensive titanium solder pots. Hentec/RPS systems save valuable production time with fast solder pot warm-up and feature low dross production requiring less solder makeup as well as low nitrogen consumption for savings in operating costs. The Valence 2508 and 3508 systems are designed for high-mix, high-volume advanced level PCB production with both systems having a multi-station processing area utilizing an electromagnetic solder pump.

Videos | http://bit.ly/YouTubeHentec

Website | http://www.rpsautomation.com

Figure 2. Valence 3508 featuring in-line operation (left), and electromagnetic solder pump (right)

All Hentec/RPS selective soldering systems feature dual monitors as standard for fast and easy programming and include a two (2) year system warranty and four (4) year solder pot warranty.

Selective Soldering Advantages

There are applications where component density requires the use of a solder nozzle with limited keep away when soldering fine-pitch through-hole components with limited adjacent nozzle clearance. To fit these tighter clearance applications, Hentec/RPS offers a proprietary Gaussian solder nozzle that produces a taller, more stable, and precise solder height with a minimum keep away of 0.5mm that is ideally suited for soldering micro-connectors and other fine-pitch through-hole components.

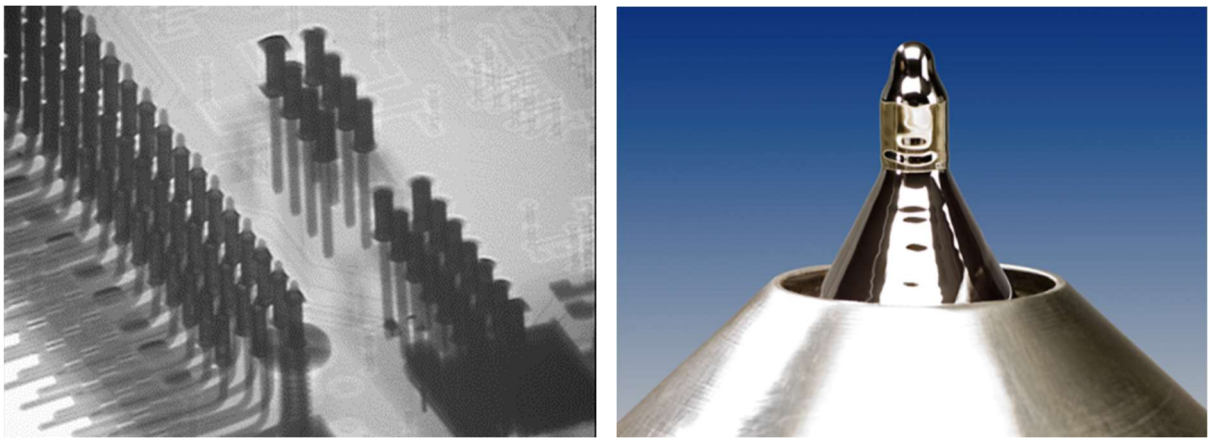

Figure 3. X-ray image of 1.0mm pitch micro-connector100% PTH fill (left), and Gaussian solder nozzle (right)

Wave nozzles are available for Hentec/RPS selective soldering systems that duplicate the function of a conventional wave solder process and can be used for soldering high thermal mass components such as multi-row connectors, backplanes or pin grid array (PGA) devices.

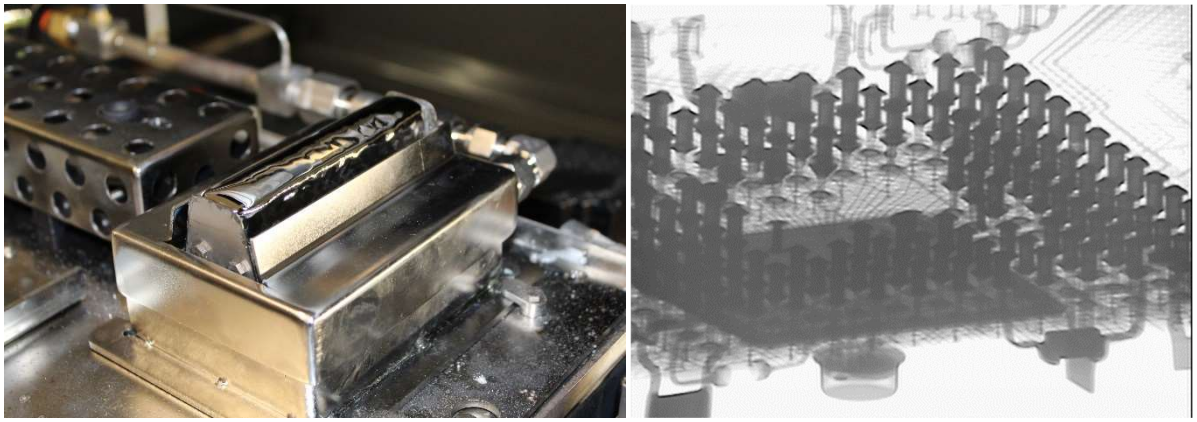

Figure 4. 4” wide wave solder nozzle (left), and X-ray image of high mass PGA with complete PTH fill (right)

Hentec/RPS offers either a 2” or 4” wide wave nozzle that can be integrated into all Vector selective soldering systems for soldering of high thermal mass through-hole components.

Component Lead Tinning

The removal of gold plating from SMT and through-hole component leads as well as tin whisker mitigation is an increasing concern for high reliability applications. The Hentec/RPS Odyssey 925, 1325 and 1750 component lead tinning machines perform component re-conditioning in accordance with all relevant GEIA-STD-0006, MIL-PRF-38535, MIL-PRF-38524E and ANSI-J-STD-002 standards. The full line of Odyssey 925, 1325 and 1750 component lead tinning machines are MIL spec compliant and specifically designed to perform component re-conditioning including re-tinning, gold removal and BGA de-balling for high reliability and military applications.

Fine-pitch quad flat packs (QFP) devices as small as 6mm x 6mm and as large as 50mm x 50mm can be re-tinned with a lead pitch down to 0.3mm (0.012’) can be re-tinned with bridge free results.

Figure 5. Odyssey 1325 lead tinning system (left), quad flat pack (QFP) device during re-tinning (right)

Manual load/unload, and automatic load/unload, lead tinning machines can re-condition many types of through-hole and surface mount components including dual in-line package (DIP), single in-line package (SIP), quad flat pack (QFP), ball grid array (BGA), axial and radial through-hole devices.

These lead tinning machines are CE compliant and feature high repeatability operation with internal preheating, dynamic or static flux baths, and single or multi-pot solder bath stations. Some ball grid array devices (BGA) may need to be converted from a SnPb finish to a lead-free finish or from a RoHS finish to a SnPb finish for various high-reliability requirements. The first step in this conversion process is de-balling so that the original solder balls are removed from the BGA device exposing the pads of the interposer.

Figure 6. Ball grid array device before de-balling (left), and ball grid array being de-balled (right)

This de-balling process is followed by either manual or automated re-balling consisting of fluxing, alignment, and attachment of new solder spheres of the replacement alloy, reflowing, inspection, cleaning, and re-packaging. Post re-balling can also include shear testing, XRF alloy verification, visual inspection to confirm sphere size, alignment and condition, X-ray inspection for excessive voiding and component marking using either thermally printed labels or laser marking.

Solderability Testing

Solderability testing determines how well molten solder will wet on solderable surfaces of electronic components The most common solderability test methods being the dip-and-look method and the wetting balance method. The dip-and-look method is a qualitative type test performed by comparative analysis after specimens are dipped in a bath of flux and molten solder. The wetting balance method is a quantitative type test based upon the interpretation of a wetting curve measuring the buoyancy of a specimen using a load cell. There are several solderability test standards, but the most common standards are MIL-STD-883 Method 2003, IPC J-STD-002 and MIL-STD-202 Method 208.

While the wetting balance test method is precise and measures the wetting forces between molten solder and a test specimen as a function of time, it requires the interpretation of a wetting curve by skilled personnel in a laboratory environment. Another disadvantage is that wetting curves can be easily distorted if the system is not properly calibrated or performed incorrectly by unskilled personnel.

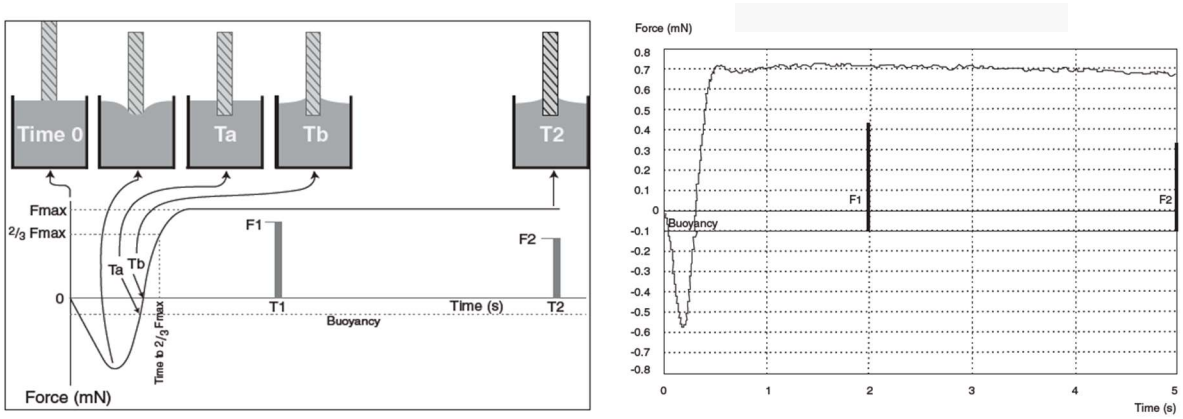

Figure 7. Wetting balance solderability test method (left), and wetting curve of highly solderable lead (right)

An advantage of the dip-and-look method is since it is based on comparative analysis it can be performed rapidly by shop floor personnel with minimal training as well as requiring significantly lower capital investment then a wetting balance test system.

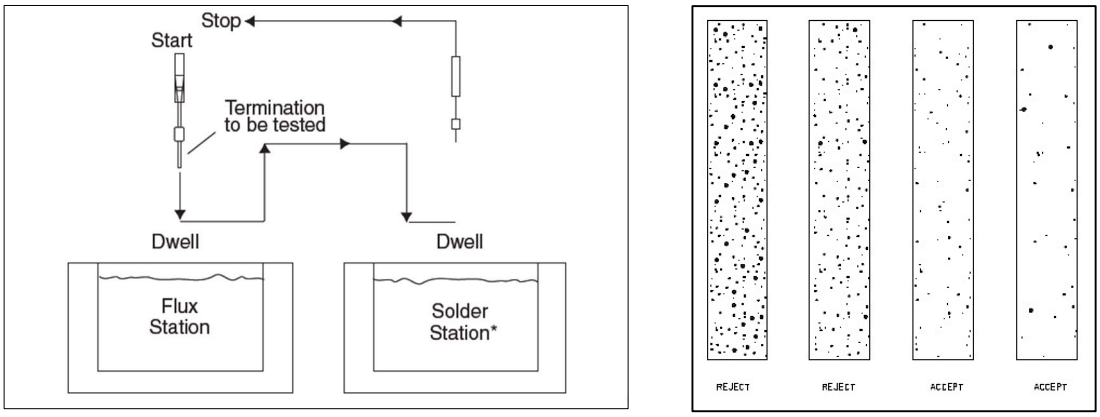

Figure 8: Dip-and-look solderability test method, (left), and dip-and-look specimens at 10X magnification (right)

The Hentec/RPS Pulsar dip-and-look test system can also be configured for low-volume lead tinning of component terminations that exhibit poor solderability due to oxidation or prolonged storage.

Figure 9: Pulsar dip-and-look solderability test equipment (left), and Photon steam aging system (right)

For some high-reliability applications additional solderability testing may be required and can include steam aging which is used to simulate elongated storage conditions. The Hentec/RPS Photon steam aging system is designed to generate artificial aging simulating elongated storage conditions of

electronic components and is especially suited for high-reliability applications or end-of-life product builds.

Summary

Selective soldering is an essential process of forming solder joints for most electronic packaging and circuit board assembly applications. Partnering with a selective soldering equipment supplier who has vast experience in multiple soldering technologies such as component solderability testing and component lead tinning is critical to ensuring successful implementation.

Choosing a selective partner who can offer rapid and flexible programming by means of easy-to-use software with a clear and highly visible display that imports a scanned image of a printed circuit board, or Gerber files, offering the user simplistic elegance in operation allowing for optimum efficiency is an essential requirement.

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