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Size 8 PEI Retainer

Overview

Positronic made a product change as part of ongoing continuous improvement initiatives. This change encompassed replacing the Beryllium Copper (BeCu) retention clip on size 8 pin and socket contacts in a variety of connector families including but not limited to: Combo-D, Power Connection Systems (PCS), Scorpion and Infinity. The BeCu retention clip was replaced with a similar geometry retainer manufactured through an injection molding process utilizing a high temperature, high performance polyetherimide (PEI) with an absence of filler material.

Impact of the Change

The decision to change the BeCu retention clip to PEI with modified geometry allows for enhanced performance characteristics in the following areas:

- 1) Improved contact retention as validated to EIA-364-29
- 2) Improved maintenance aging as validated to EIA-364-24
- 3) Improved contact insertion and removal forces as validated to EIA-364-05

Evaluation of the thermal properties of the PEI material was also taken into consideration with this change. The specific blend of PEI has an acceptable Relative Thermal Index (RTI) and acceptable Long Term Property Evaluation which are based on the dimensional characteristics of the retainer. The RTI of the material meets and exceeds finished connector series' maximum operating temperatures in the 120 to 130°C range as governed by UL746B Standard for Polymeric Materials.

PEI is an amorphous plastic with high temperature properties when compared to other thermoplastics. Unlike the crystalline or semi-crystalline thermoplastics, the amorphous nature of PEI prevents a state of liquidity when exposed to elevated temperature. This material, per the manufacturer, has a Vicat Softening Point of 218°C tested to ASTM D1525 at a rate of B/50. The material also has an injection mold processing melt temperature window of 350 to 400°C. The properties of the thermoplastic material support high temperature applications of this material.

Limitations of the Design

Though the PEI retainer has material properties and design characteristics which are described as high temperature and high performance, the retainer has functional and application-specific limitations. Industry standard practices include various assembly processes for the contact in a finished connector. This may include board mounted soldering, solder cup cable termination and cable crimping covered by shrink tubing.

Board mount connections: Wave solder at a maximum temperature of 260°C for 10 seconds. This provides minimum exposure of the solder temperature to the connector and retainer therefore minimizing temperature effects on the retainer.

Cable terminations (63/37 solder types and RoHS compliant solder): 350°C +/- 10°C solder temperatures for 5 seconds. During the validation of the PEI retainers, groups of 30 solder cup contacts were exposed to a Resistance to Solder Heat Test as specified by Mil-Std-202, method 210, Condition A. Test samples were exposed to 350°C +/- 10°C solder temperature for 5 seconds while affixing a cable termination with Kester 135 Rosin Type "R" Flux, S/N 63 Solder. Acceptance criteria for this test was the absence of visual defects and deformation under 10X magnification. All samples tested passed this criterion

and were recorded on the test report, "When inspected at 10X magnification, PEI retainers showed no evidence of damage or distortion".

Shrink tubing: For removable contacts, use heat shield to cover the retainer area of the contact to keep heat exposure of the retainers to a minimum. A typical application for shrink tubing is performed by taking a heat gun and applying direct turbulent heat to the tubing until it shrinks to a tight fit. Common industry heat guns have temperature ranges of 400°C to 540°C. This temperature range has been known to create issues with the retainer as the heat application process indirectly propagates heat to the PEI material. Common industry shrink tubing include Polyolefin tubing (minimum shrink temperature of 90°C to 121°C), Kynar types (minimum shrink temperature of 175°C), and Fluoropolymer types (minimum shrink temperature of 175°C to 300°C).

In an experiment to determine the temperature at which a retainer will deform, a type K thermocouple was utilized to map the temperature profile of a heat gun on maximum temperature. At a distance from the source which was measured at 300°C +/- 10°C with a type K thermocouple, contact assemblies with retainers installed were exposed to the 300°C. At 30 seconds, the retainers bubbled and deformed to the point of which the retainers were out of functional and dimensional characteristics. Minimizing the exposure of direct heat to the retainer while applying shrink tubing is a process that should be controlled through engineering or procedural means.

Summary and Solutions

Due to the limitations of design material characteristics, Positronic makes the following recommendations:

- 1) Positronic recommends board mount connections to be wave soldered up to a temperature of 260°C for 10 seconds max.
- 2) Positronic recommends for 63/37 solder types and RoHS compliant solder when soldering cable terminations to solder cup contacts: 350°C +/- 10°C solder temperatures for 5 seconds max.
- 3) Positronic recommends for use of shrink tubing: For removable contacts, use heat shield to cover the retainer area of the contact to keep heat exposure of the retainers to a minimum.
- 4) Due to the mechanical properties and dimensional design of the retainer, the retainers can be removed by hand prior to the application of heat to the shrink tubing or soldering process. Conversely, the retainer can be installed by hand with no tools. Positronic can supply contacts bulk packaged with retainers for installation after the heat is applied.

Appendix A: Retainer Installation and Removal Experiments

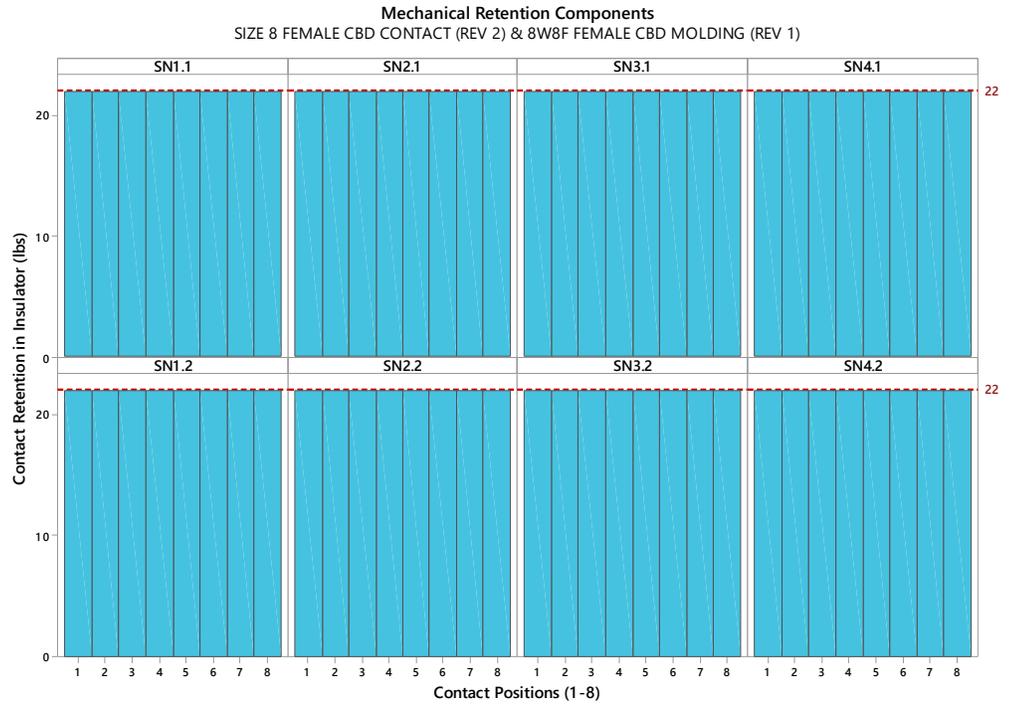
Description of Experiment:

Thirty-two (32) size-8 female CBD contacts with the new PEI retainer clip were installed into four (4) 8W8F insulators; each insulator contained eight (8) contact positions.

The retention value was set to a minimum of 22-lbs and each contact position was tested. Each contact was then removed from the insulator and reinstalled for a second set of retention values.

All contact positions passed the minimum 22-lbs retention before and after contact removal.

Retention Before and After Contact Removal

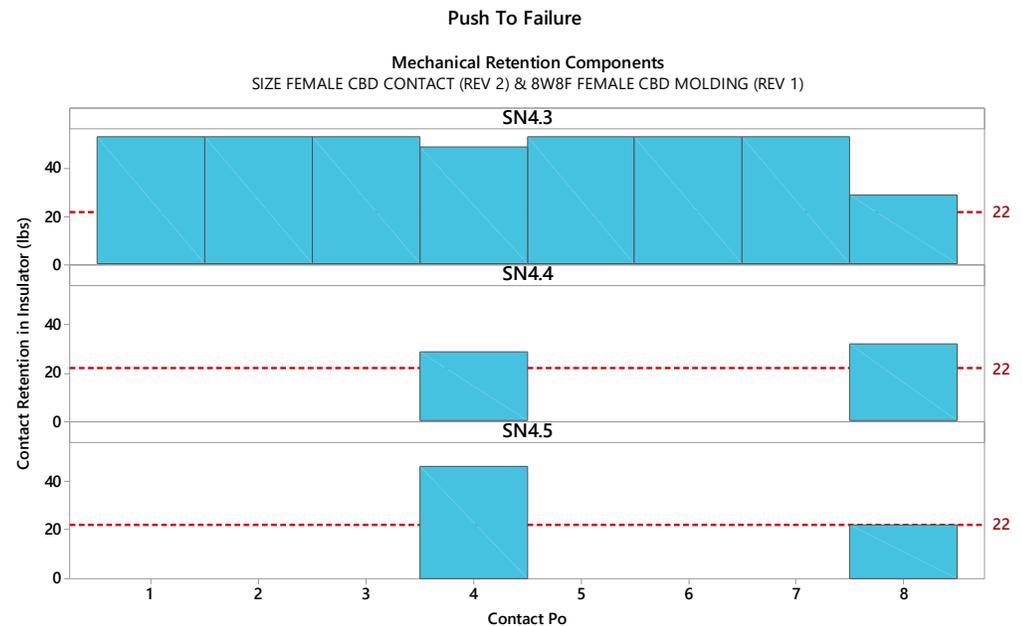


Description of Experiment:

SN4 was subjected to a “push to failure” style retention testing. Each contact was pushed until the value exceeded the capability of the equipment or until failure.

Trial 3 of SN4 resulted in Positions 1-3 & 5-7 exceeding the capability of the equipment (>53 lbs). Positions 4 and 8 pushed out with values of 48.9 lbs and 28.9 lbs respectively. These values still exceeded the minimum of 22-lbs retention.

Trials 4 and 5 of SN4 focused on “push to failure” of positions 4 and 8 of SN4 Trial 3. Trial 4 resulted in a reinstallation of the contacts that were pushed out and values of 28.6 lbs (position 4) and 32.3 lbs (position 8) were obtained. Trial 5 resulted in a reinstallation of the contacts that were pushed out and values of 46.55 (position 4) and 22.40 (position 8) were obtained.



Statistics	SN4.3	SN4.4	SN4.5
Average	49.475	30.45	34.475
Minimum	28.9	28.6	22.4
Maximum	53	32.3	46.55