

Hermetic Package Cover Seal Technology

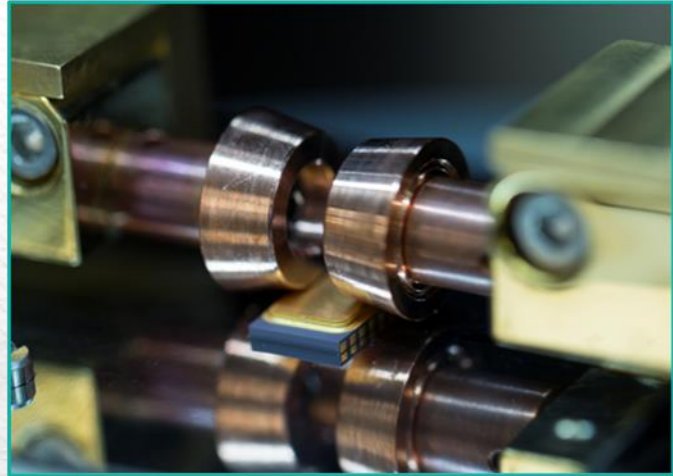
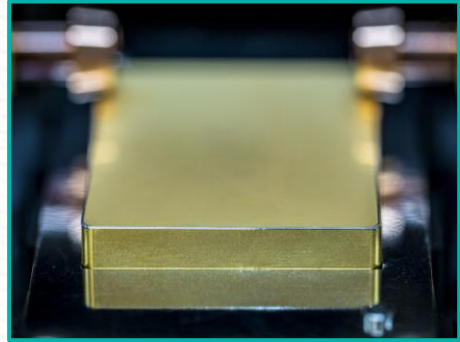
Design | Develop | Prototype | Equipment



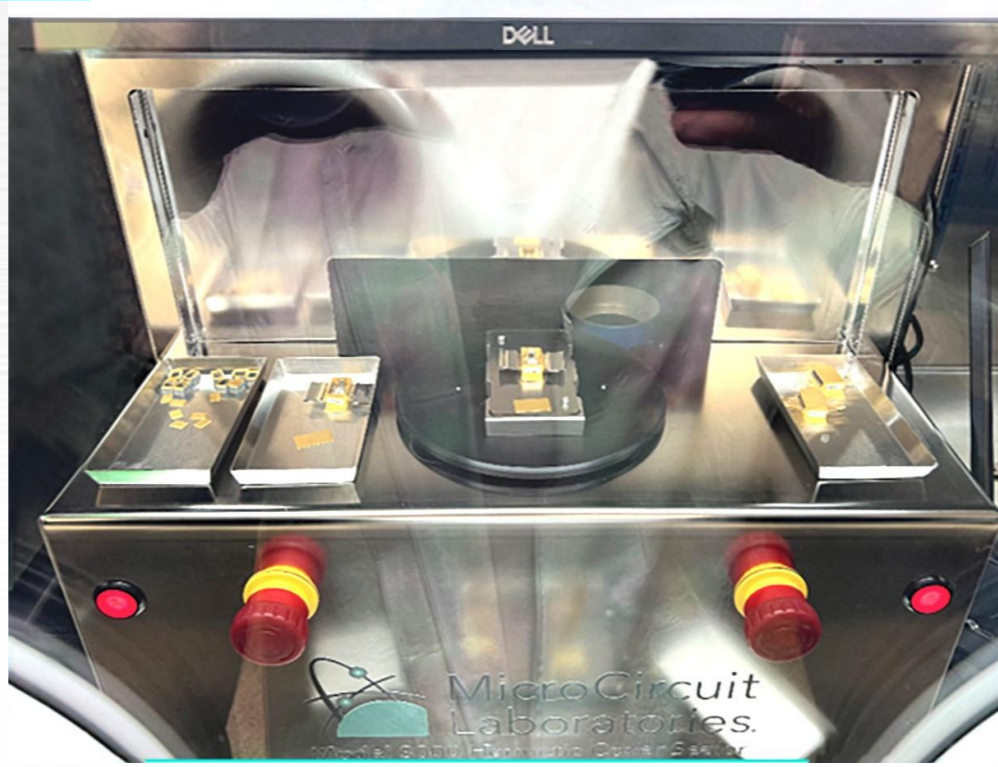
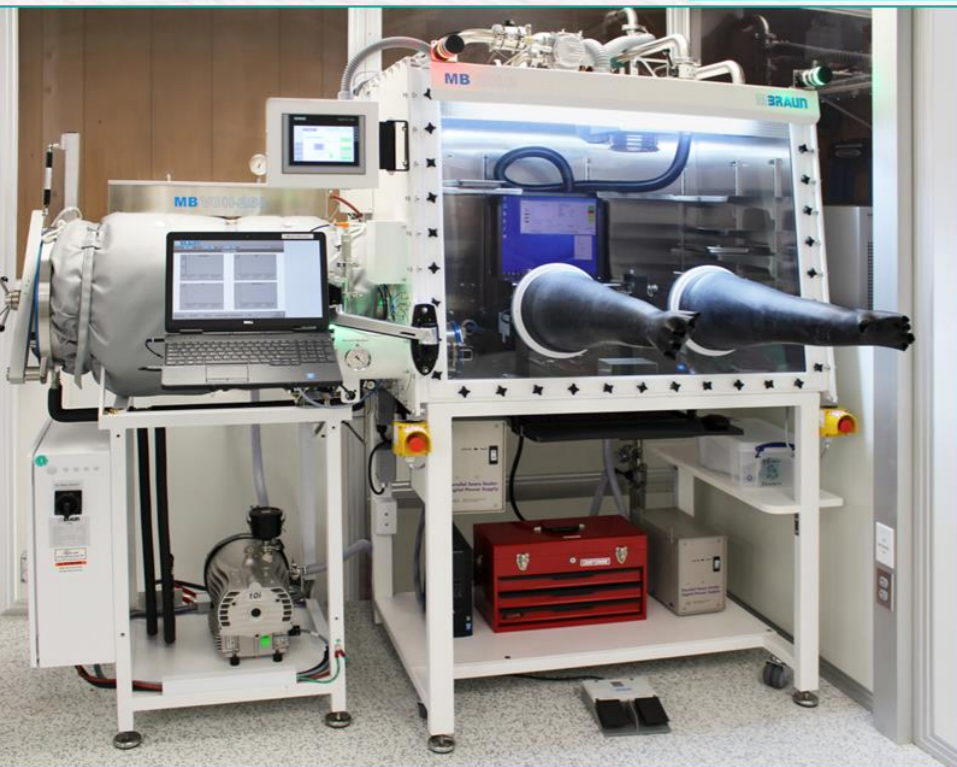
Low Hermetic Temperature Sealing



Wide Range of Package and Cover Configurations



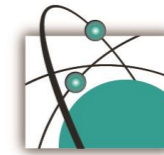
Package and Cover design considerations
Cover and Package Fit-up
Resistance Heating for Weld and Solder Seal
Thermal requirements
Sealing services and training
Hermeticity specifications and compliance



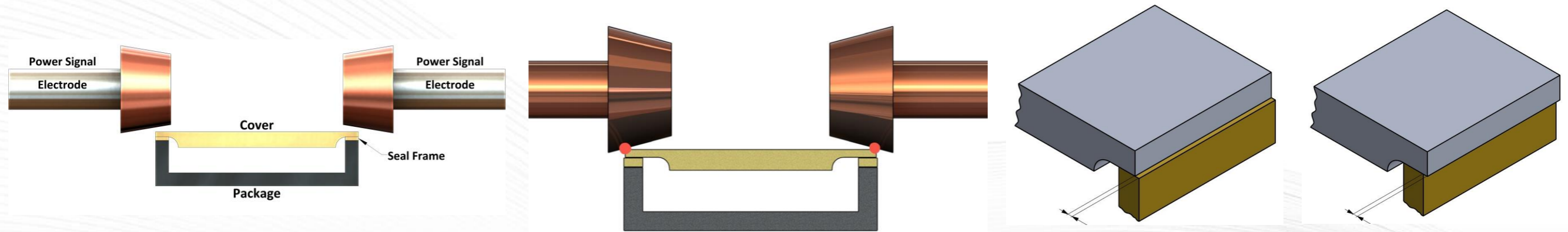
Seam Weld Hermetic Cover Seal Design

Low Temperature Hermetic Package Sealing

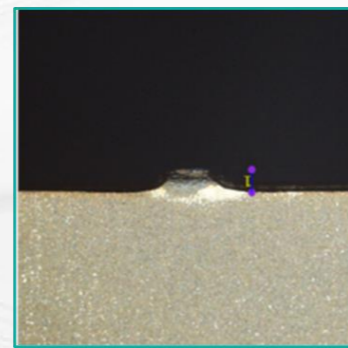
Considerations for Cover to Package Seal Ring Welding



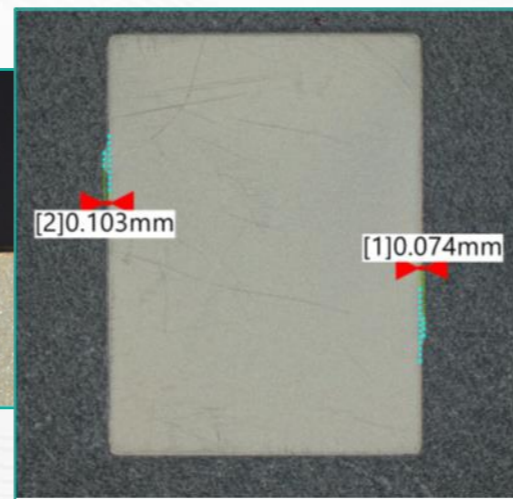
MicroCircuit Laboratories.



Cover Protrusions in Seal Flange
 Cover Suppliers ≤ 0.051 mm
 JEDEC JESD9C < 0.025 mm



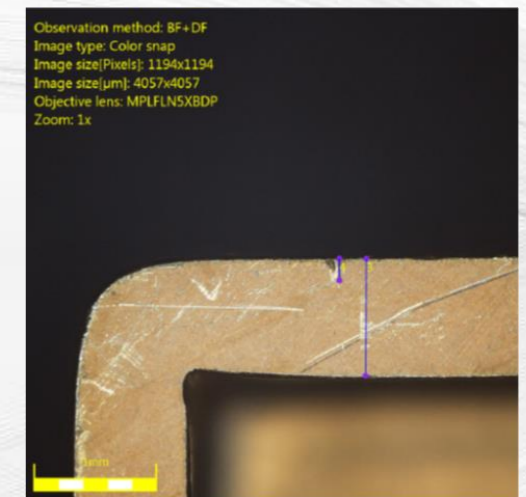
Fail



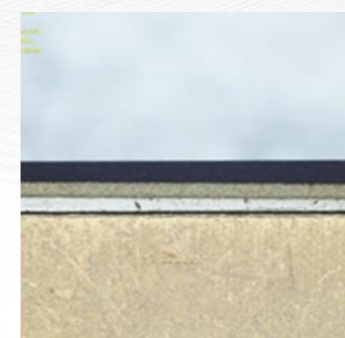
Fail



Pass



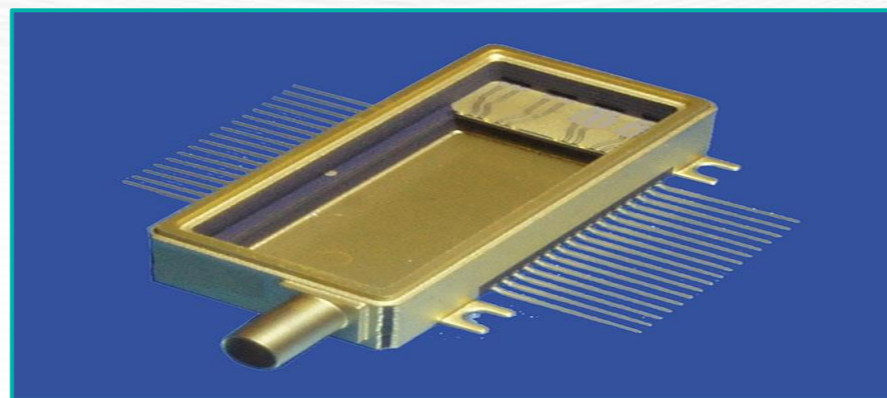
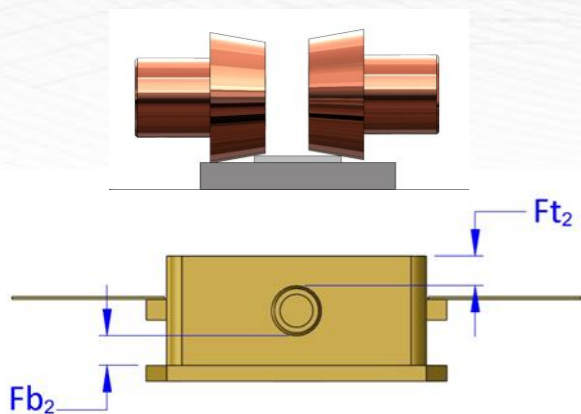
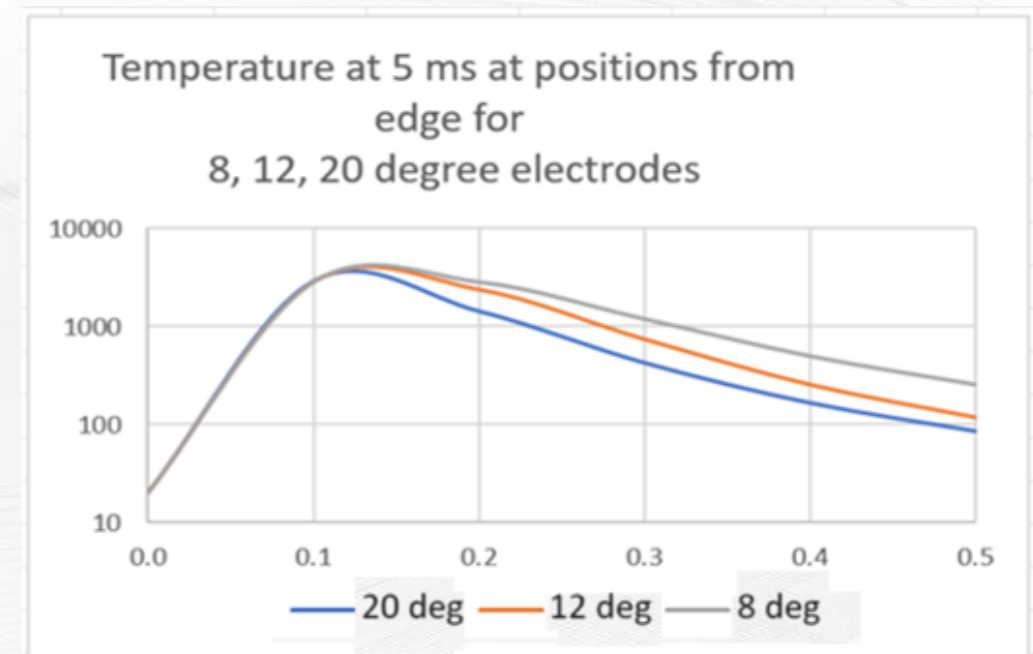
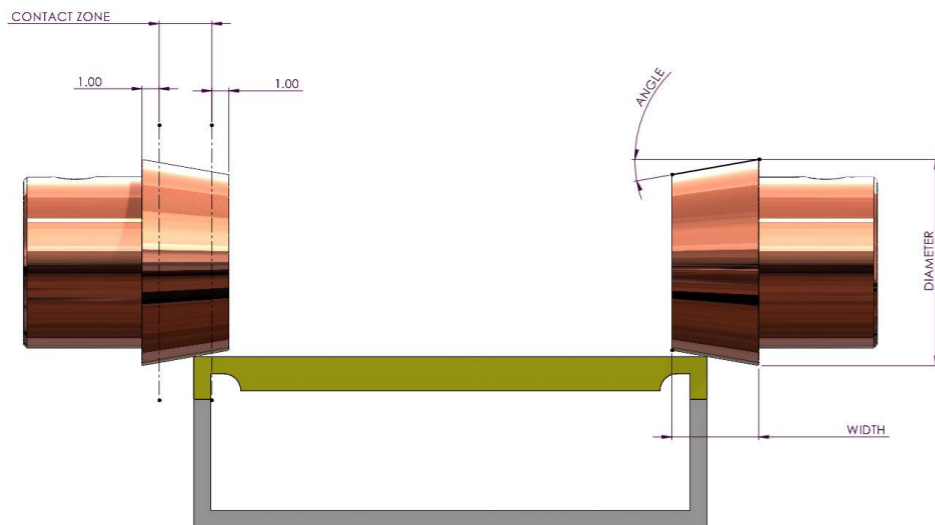
Nick in Seal Ring



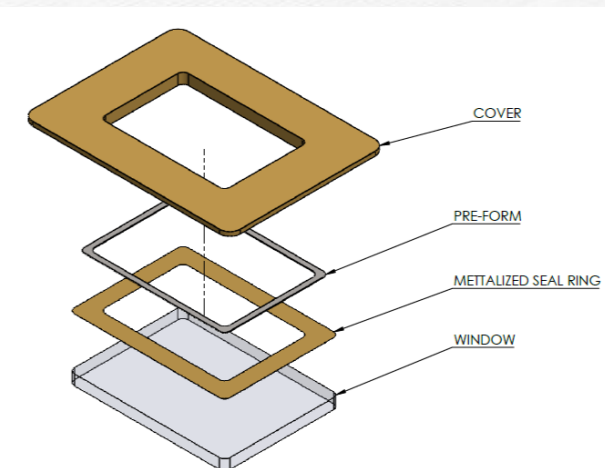
Low Temperature Sealing

Package and lid design considerations for Feedthroughs

- Perfect fit is optimum
- Cover overhang seal ring results in leak



Package with feedthroughs



Lid with window

Low Temperature Sealing

Lid alignment with robotic sealer

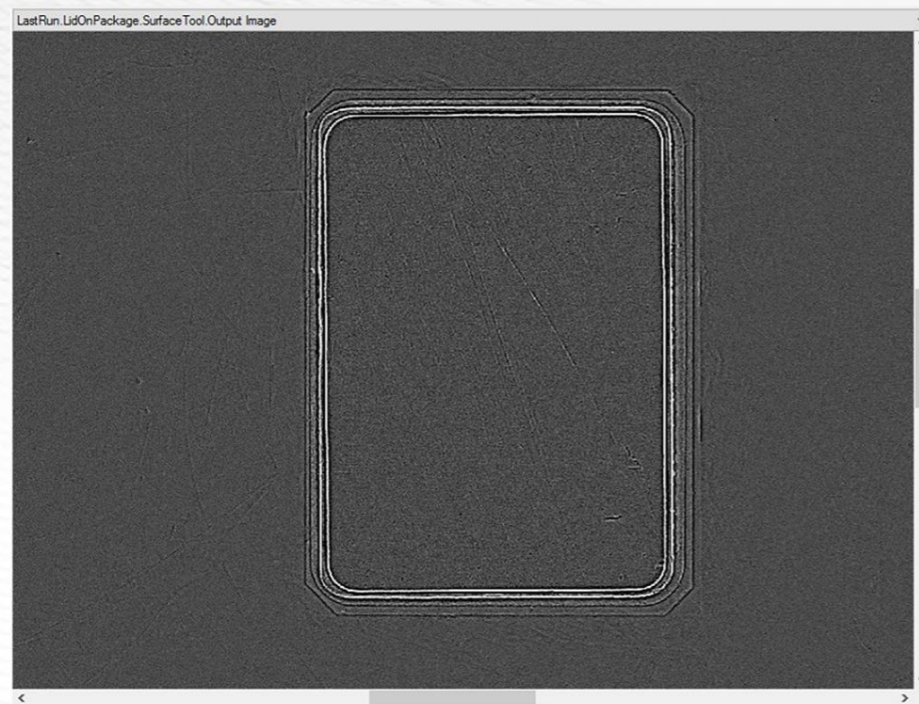


Using a vision system for alignment, the lid is placed centered on the package. Thus providing a uniform gap on the sides and top/bottom for the best possible seal. If overhang or too large a gap, an error is displayed

LCC lid undersized by 0.05 mm on all sides

Cover 8.78 x 6.24 mm

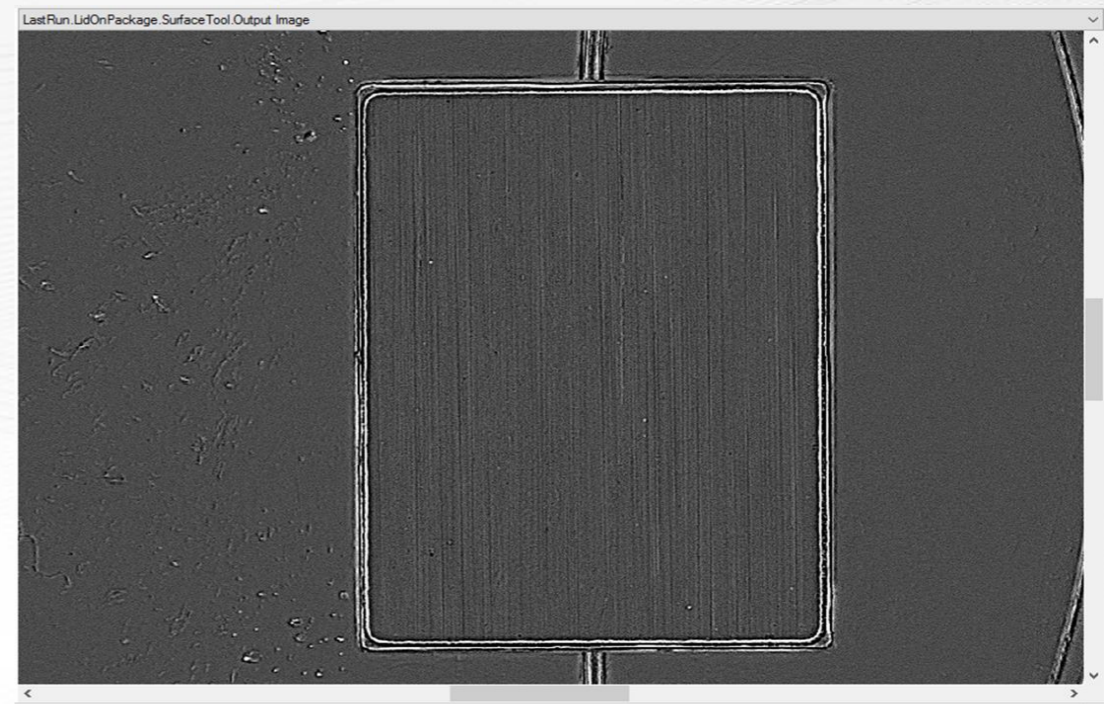
Seal Ring 8.89 x 6.36 mm



Small Package

Cover 8.31 x 6.21 mm

Seal Ring 8.33 x 6.19 mm



Low Temperature Sealing

Lid alignment with robotic sealer



Larger Package

14P Fiber Ceramic FT

Cover 20.6 x 12.54 mm

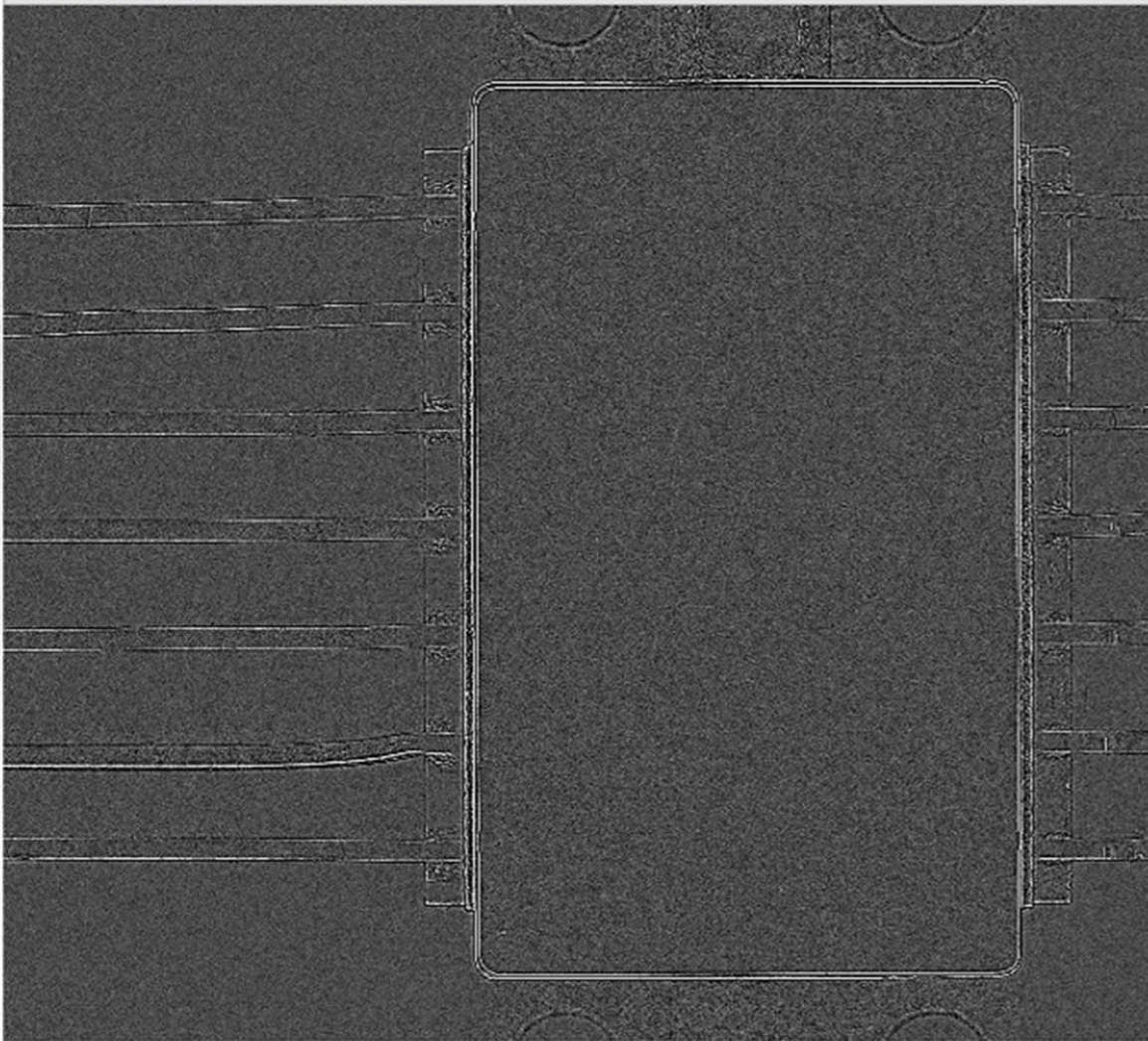
Seal Ring 20.82 x 12.64 mm

18P Fiber Ceramic FT

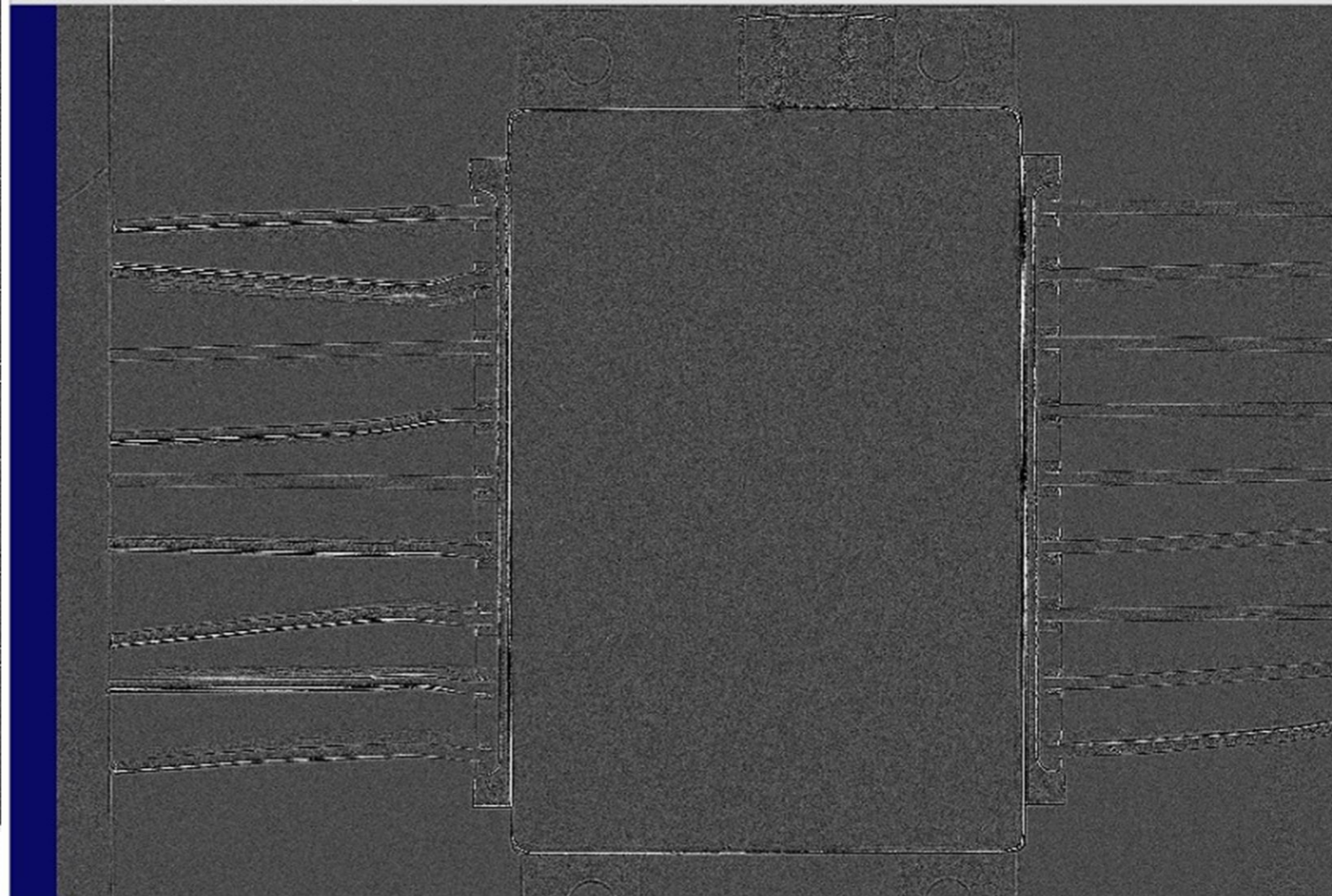
Cover 27.39 x 18.74 mm

Seal Ring 27.49 x 18.86 mm

LastRun.LidOnPackage.SurfaceTool.Output Image



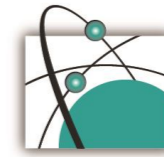
LastRun.LidOnPackage.SurfaceTool.Output Image



Seam Weld Hermetic Cover Seal Welding Process

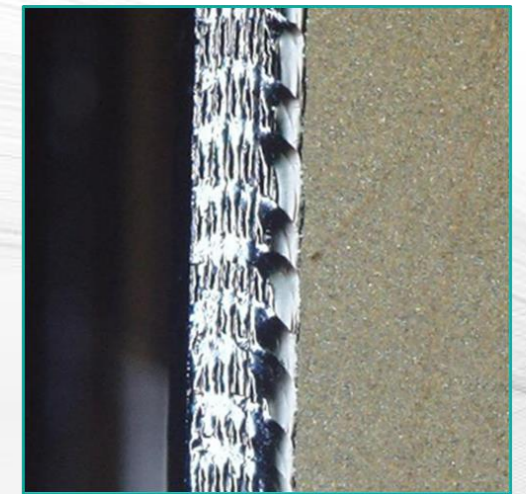
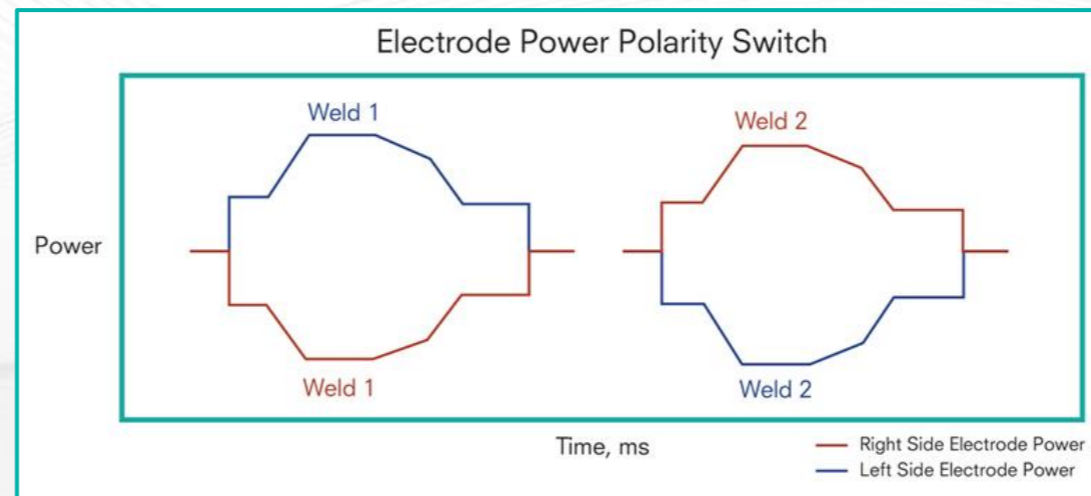
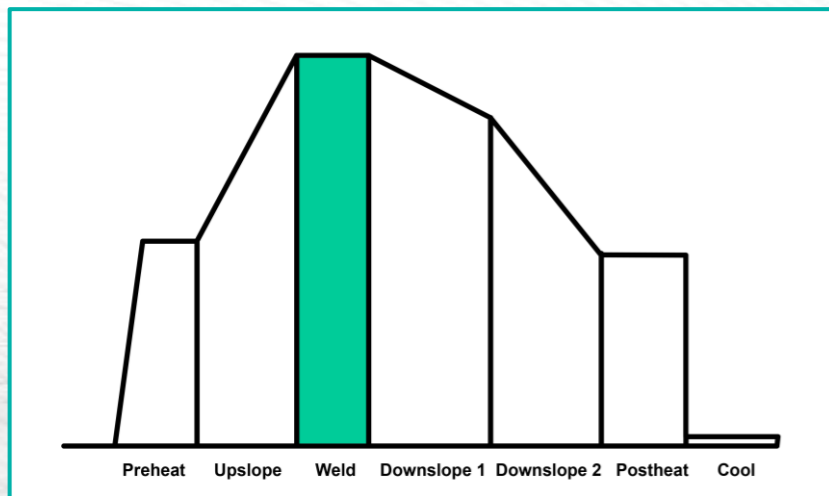
Low Temperature Hermetic Package Sealing

Aerospace Wave Synthesis Resistance Welding

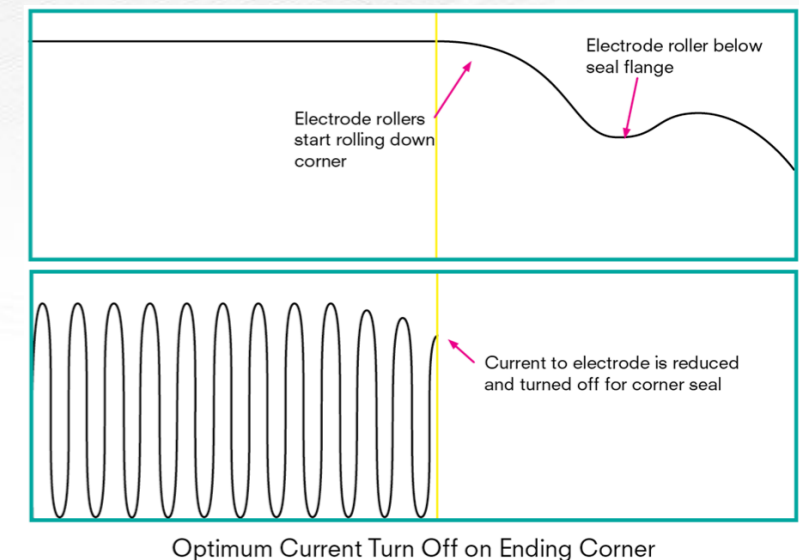
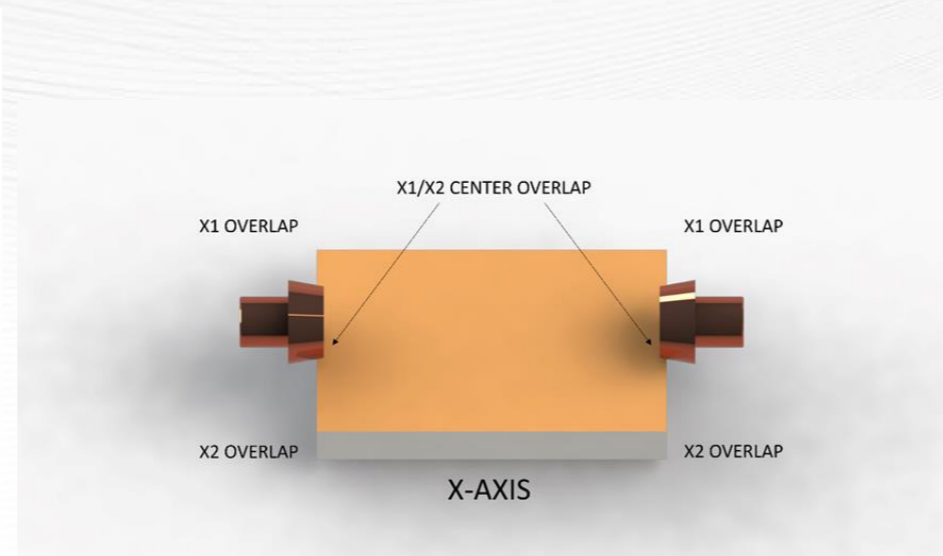
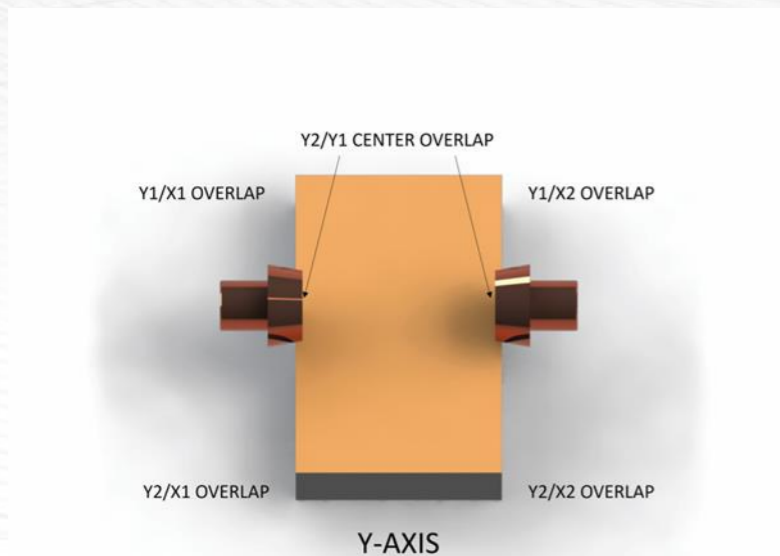


MicroCircuit
Laboratories.

- DC Welding with Precision Power Pulse for No Crack Weld and Au/Ni rich alloy; Quick Release
- Polarity Switching on Every Weld For Strongest Weld and Uniform Electrode Wear
- “Peltier Effect” shift in location of the nugget within molten material

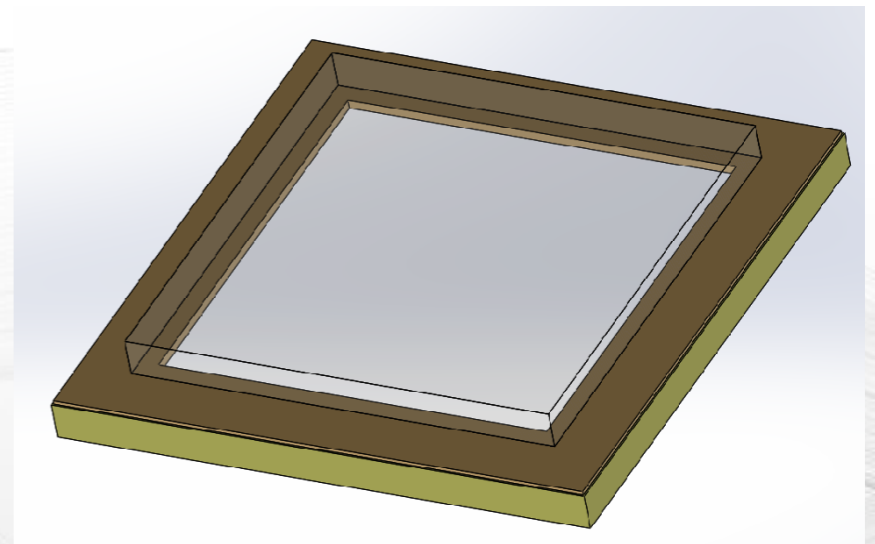


Precision Position Based Welding With Adaptive Control on Every Package



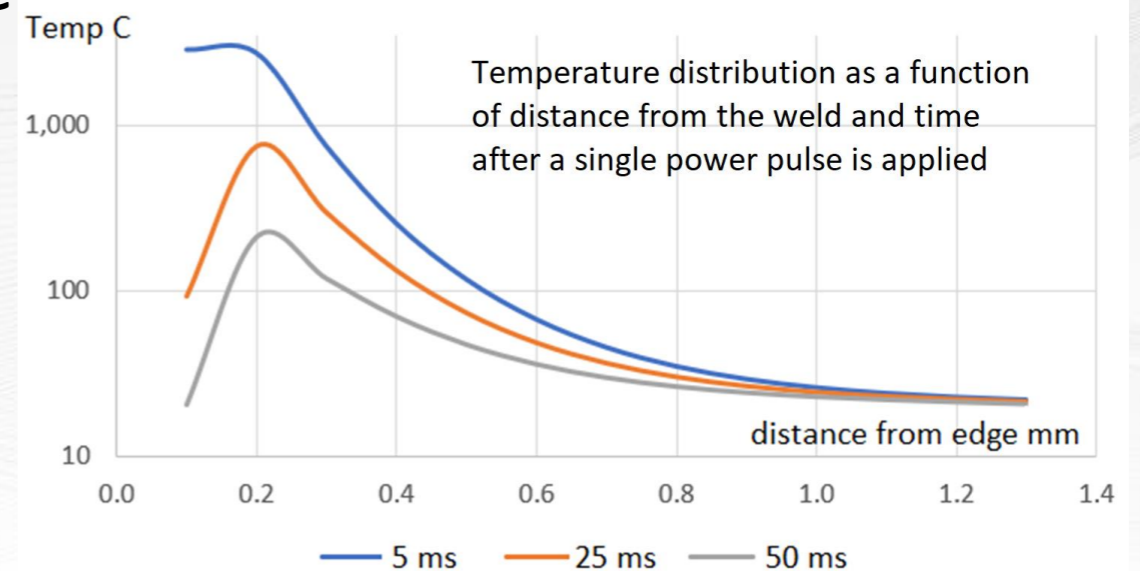
Low Temperature Hermetic Cover Seal

Packages with critical thermal requirements such as covers with optical windows or feedthroughs on the sides which cannot withstand high temperatures require thermal management which insures that temperatures close to the weld are kept at a minimum.



MCL's power supply allows for precise control of the power pulse waveform which is essential for applications where there is little process latitude.

MCL's position based pulse control allows welding at ultra-slow speeds for low temperatures at 1mm from the edge of the package

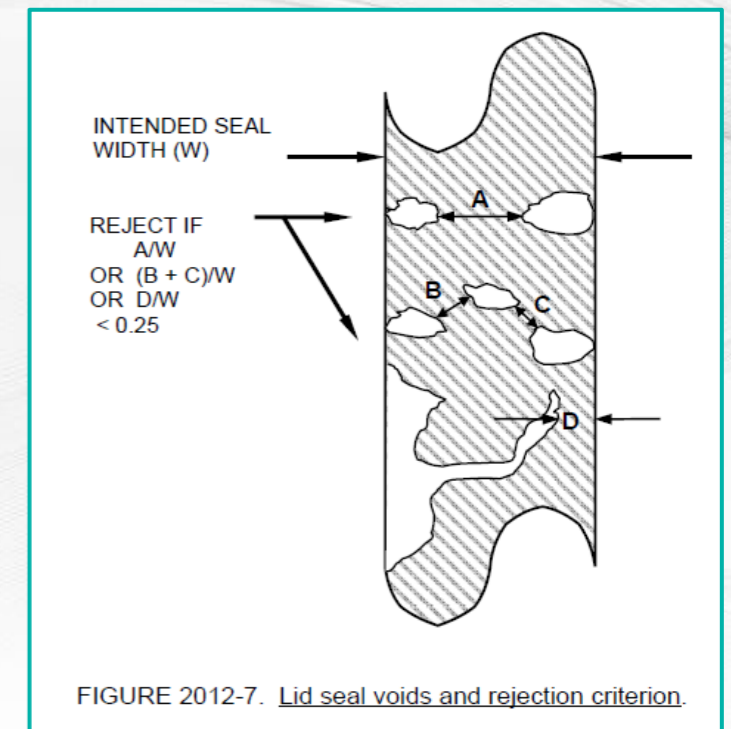
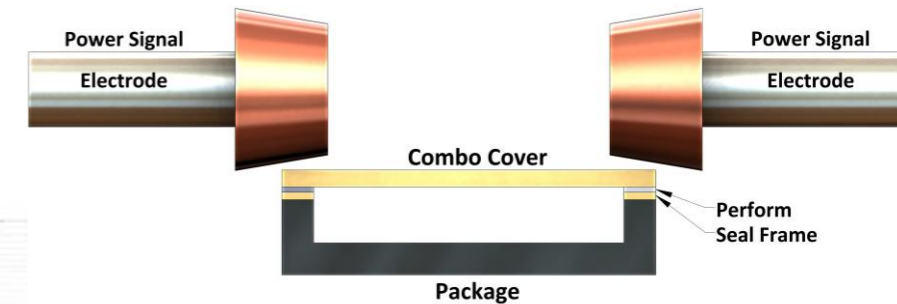


Seam AuSn Solder Hermetic Cover Seal

Low Temperature Hermetic Cover Seal

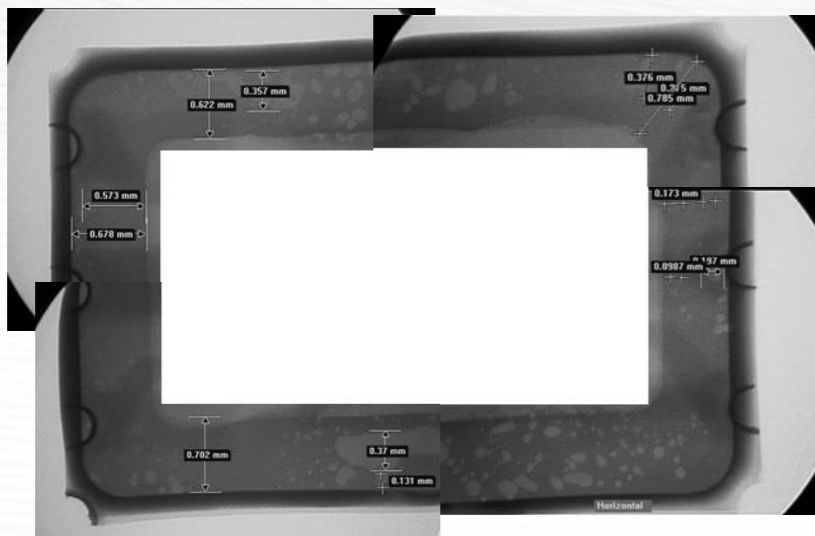
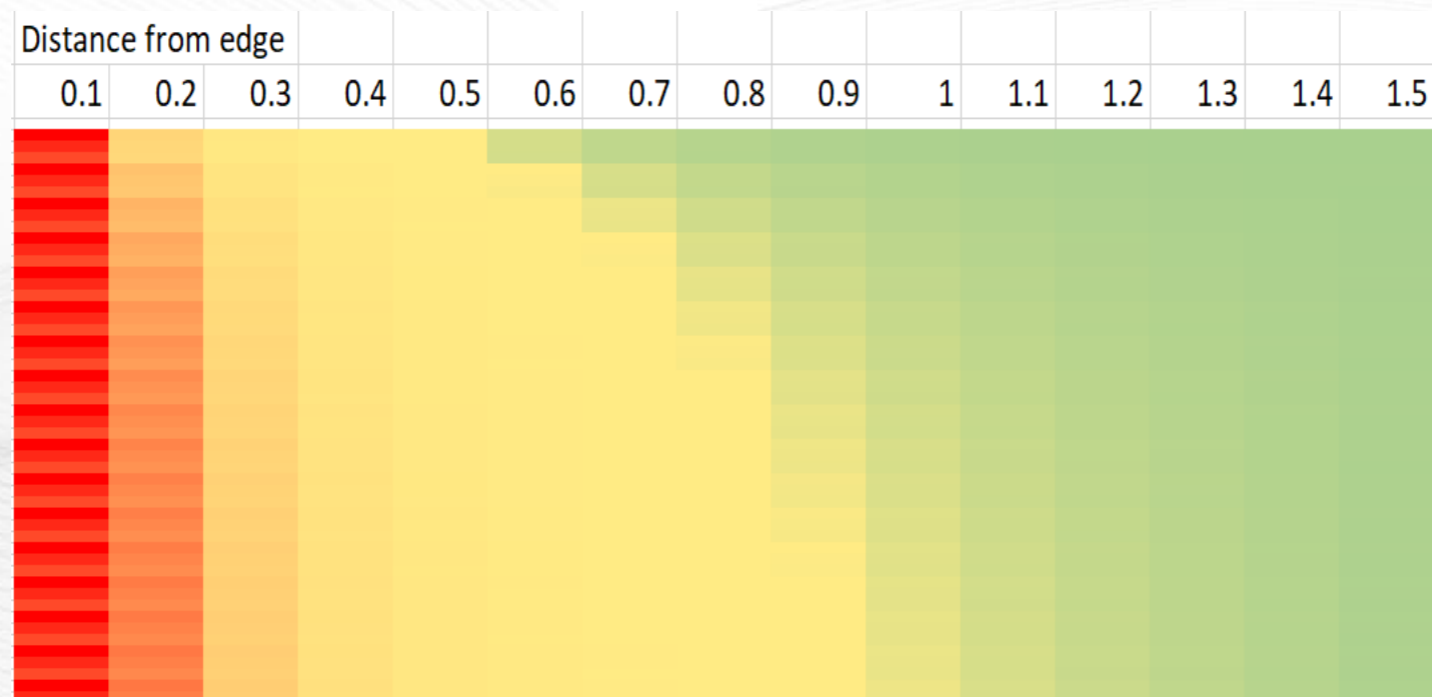


Solder sealing relies on solder melting and adhering to the surfaces of the package and lid. When the temperature and speed are correct, the solder melts in a 1-2 mm region then solidifies as the electrode rolls away. If the entire width is not melted at the same time, attempts to re-melt it result in voids, which may become leaks at some spots. To re-melt the solidified solder requires a higher temperature than the original since the eutectic Au-Sn solder has changed by infusion of Au from the plating. **Successful solder sealing requires both Wave Sculpting to modulate heat and Adaptive Force Control to control solder reflow width.**

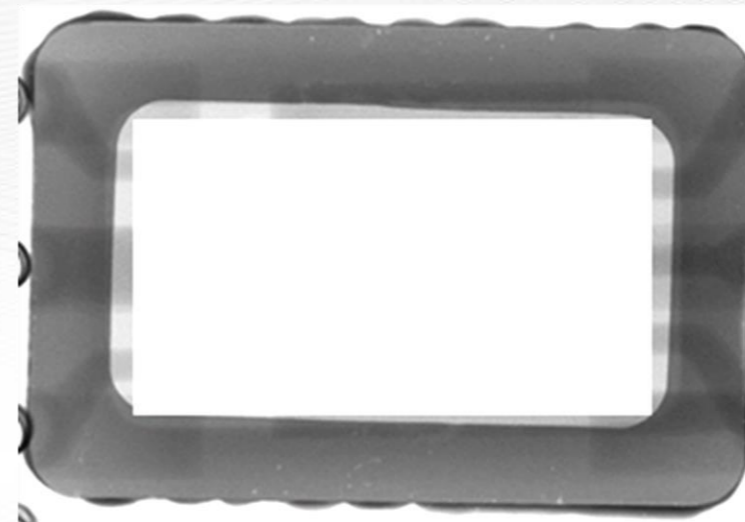


Low Temperature Hermetic Cover Seal

Low temperature solder sealing takes place at 310-340C for 280°C for AuSn or lower for other solders. For lowest voiding the solder can be melted only once. Per chart below, the temperature of the lid rises as the heating takes place.



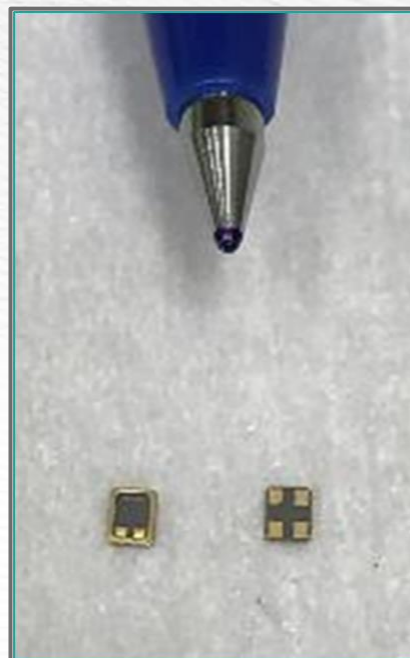
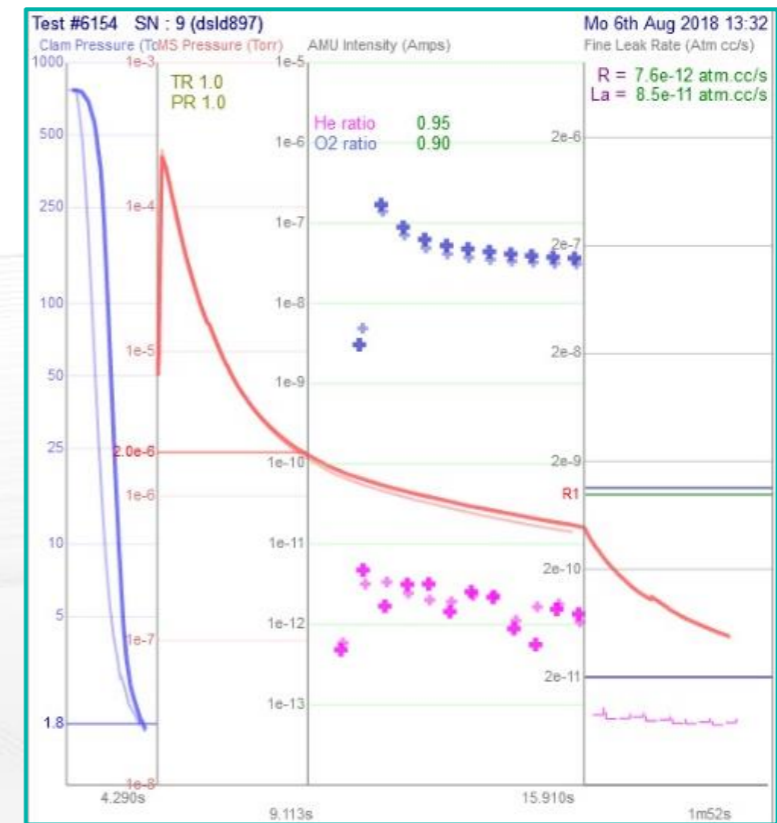
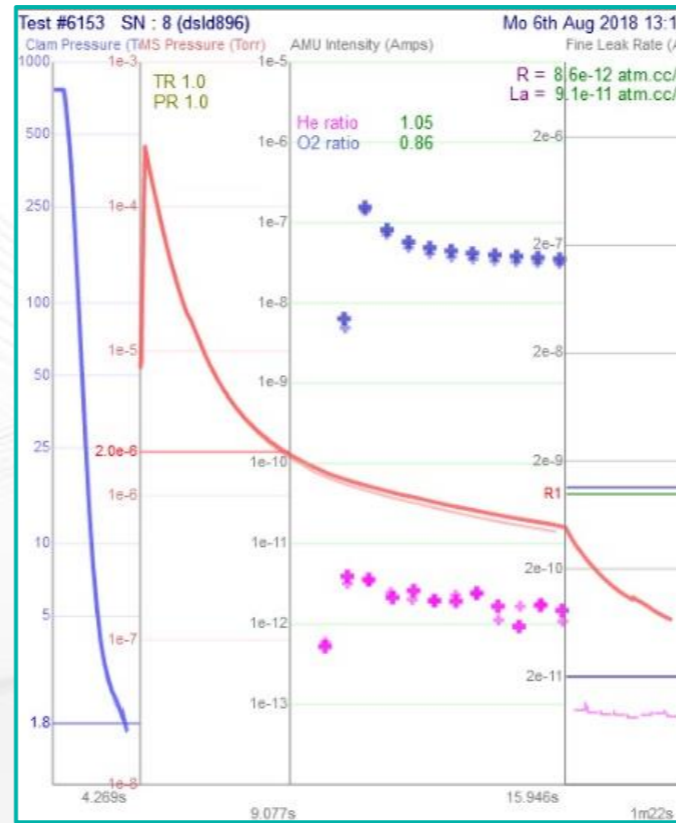
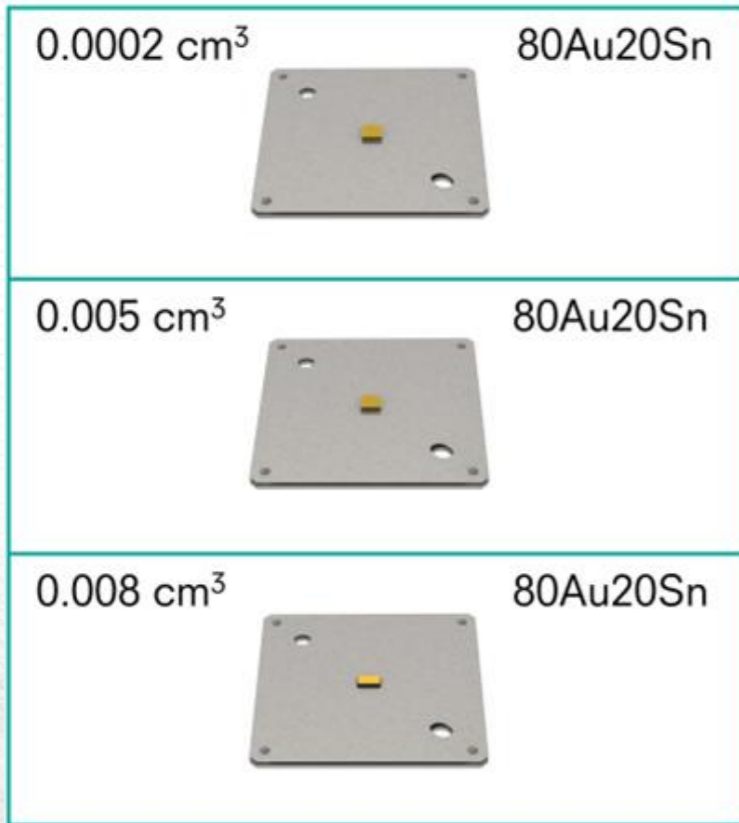
Fail Test Method 2012.9



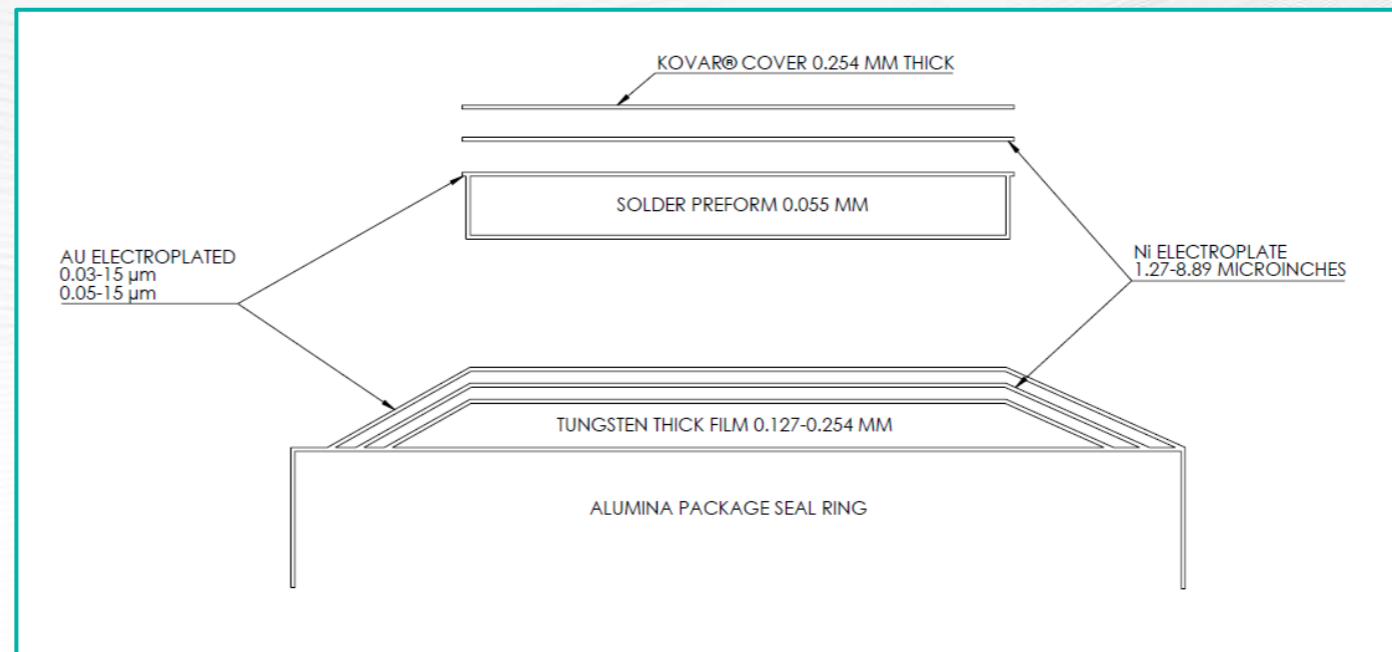
Pass Test Method 2012.9

80Au20Sn Combo Cover Sealing

Leak Rates to Detection Limit of He Leak Test Equipment with A5 Method



1.6 x 1.2 mm Chip
Carrier





Parallel Seam Sealing Equipment

Confidential

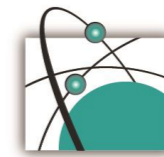
Robotic Cover Sealer (RCS), Patent Pending

Hermetic Cover Seal Processor

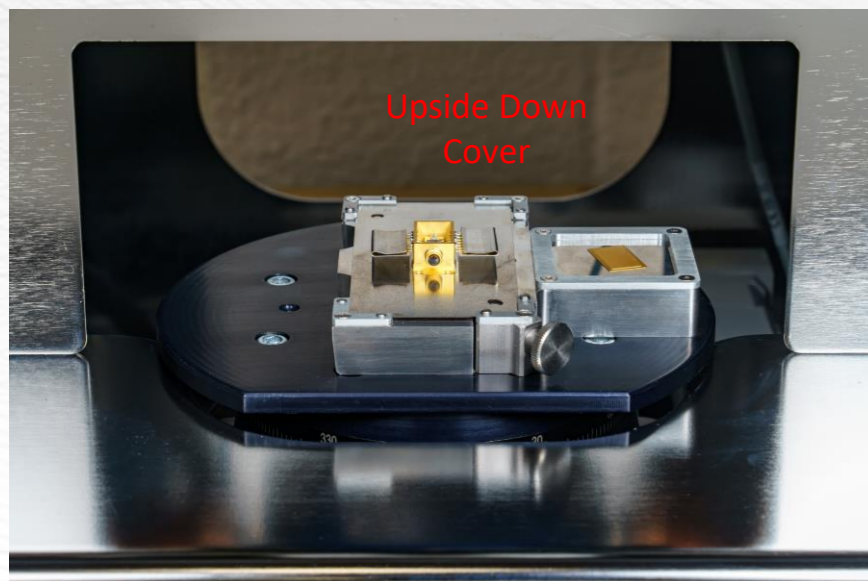
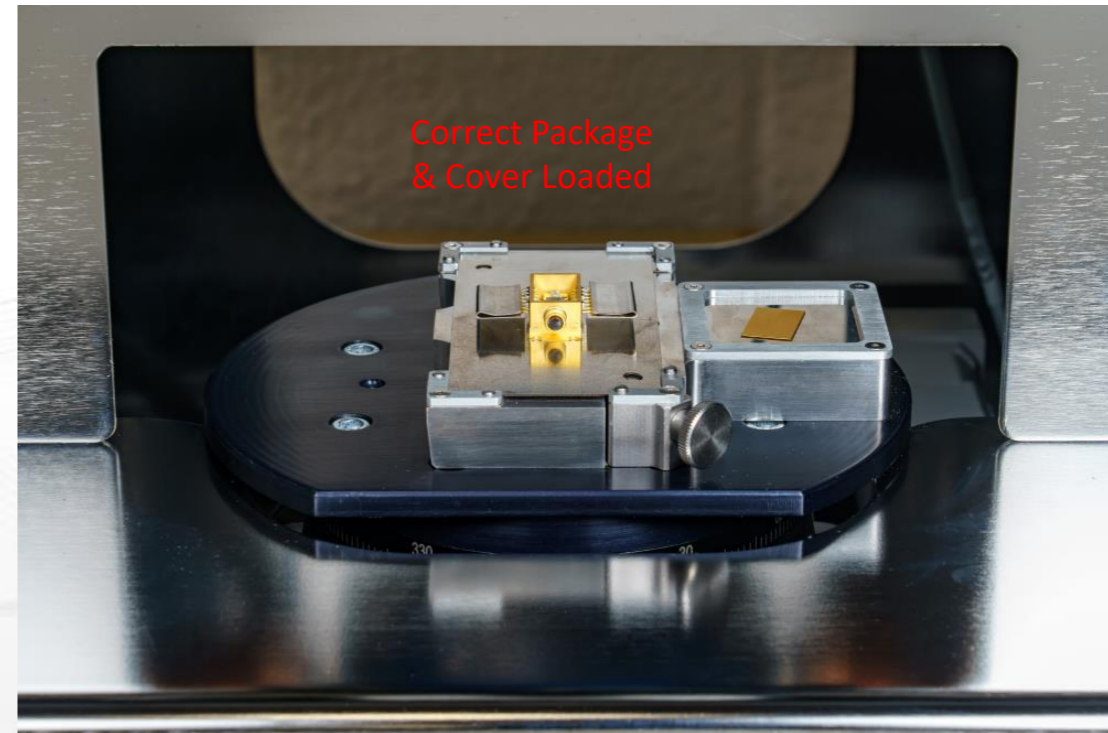
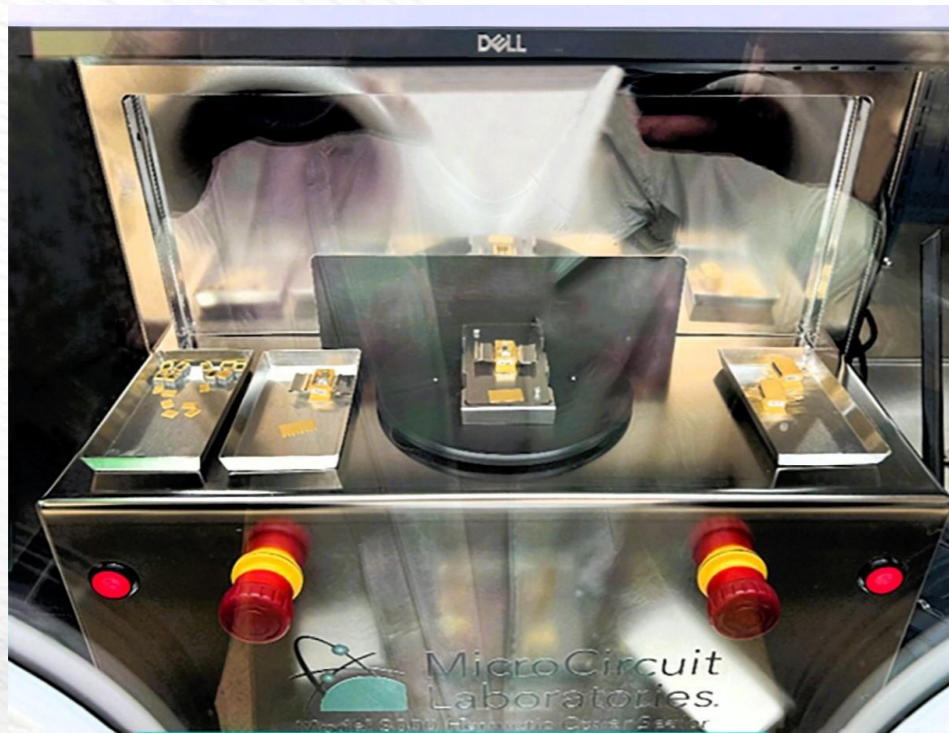


Low Temperature Hermetic Package Sealing

Easy to User Automation



MicroCircuit
Laboratories.



Development and Test equipment

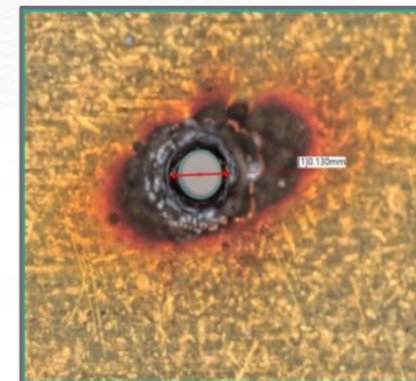
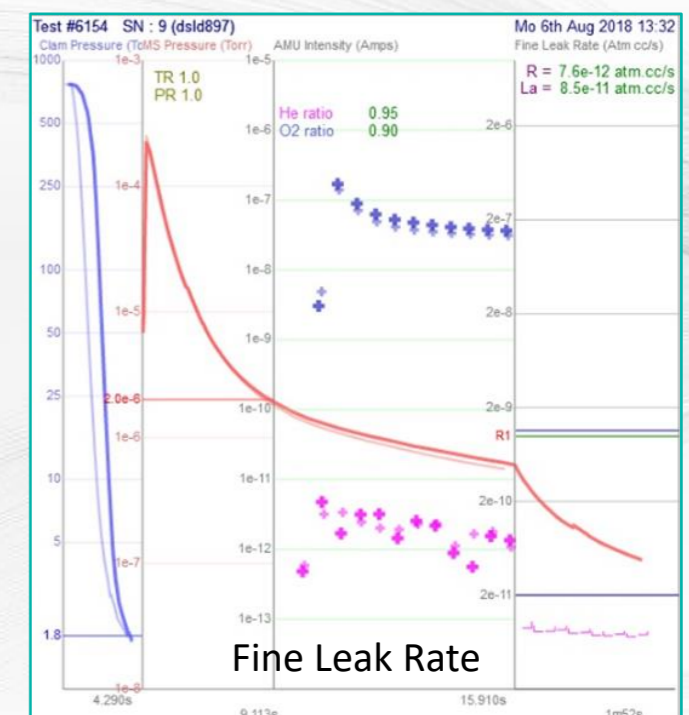
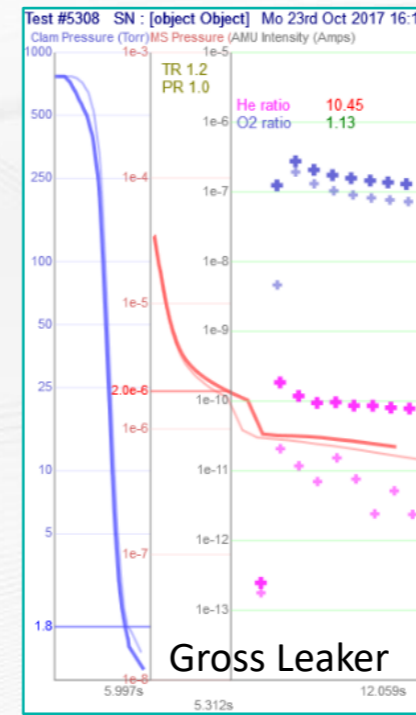
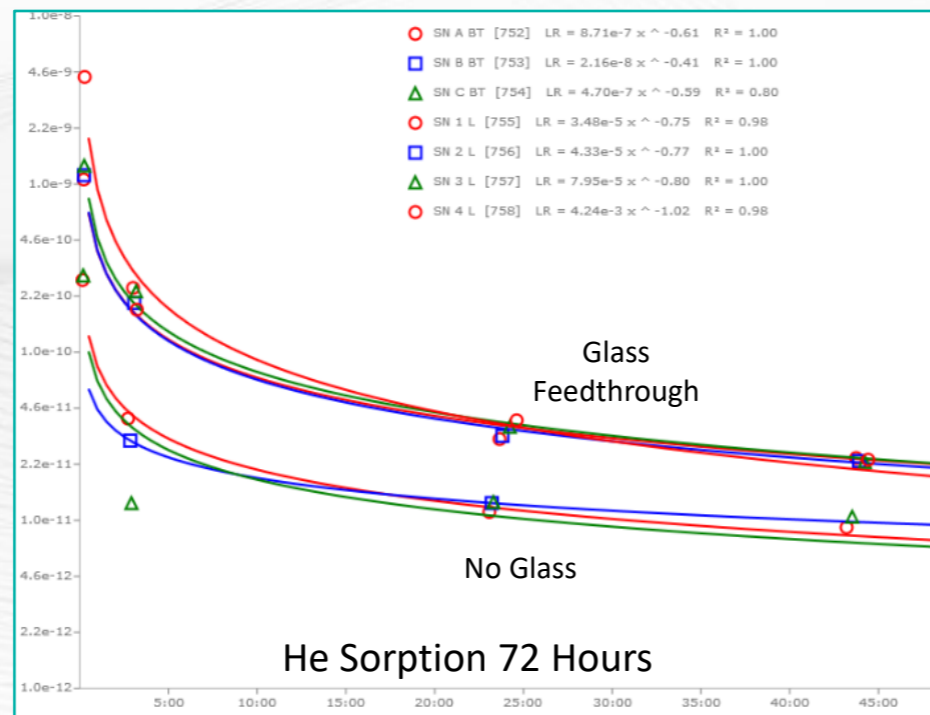
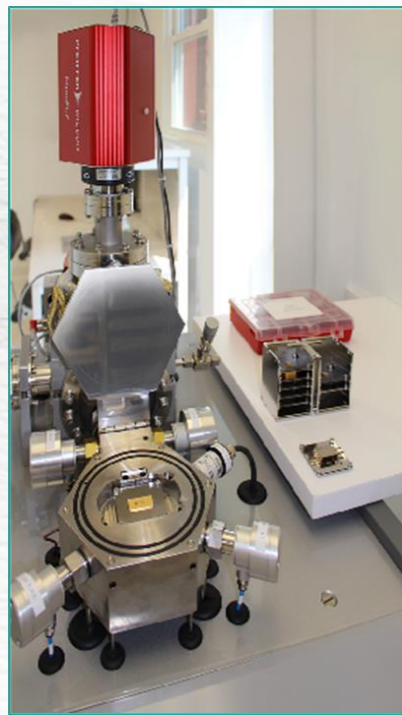
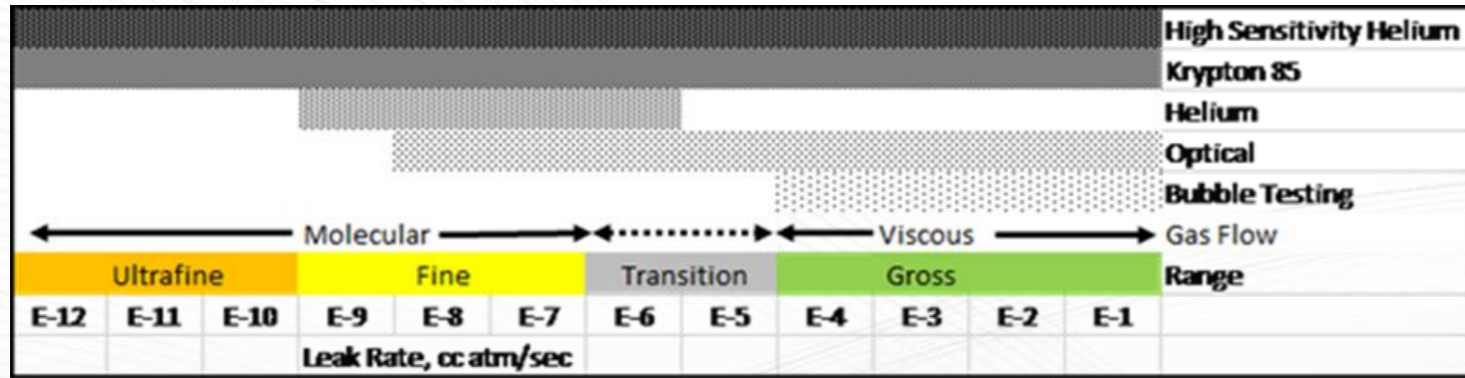
Automatic Dry Gross and Fine Leak Testing
MIL-STD-883 Test Method 1014; A5 Method

Low Temperature Hermetic Package Sealing



MIL-STD-883 Test Method 1014.17 Seal; Test Condition A5

MIL-STD-750 Test Method 1071.16 Hermetic Seal; Test Condition H3



Small Lot Processing & Test

Tooling Through Test



- MCL Robotic Cover Sealer (RCS), Patent Pending
- VEECO SSEC Model 2400e Parallel Seam Sealer
- MBraun Automatic Glovebox Systems
- Avio 750 Manual Cover Tack Stations
- ORS 310 HSHLD® A5 Gross & Fine Leak Test
- (6) LACO Helium Bomb Chambers
- Hitachi SEM
- Bruker EDS
- Allied TechCut 5x™ Precision High Speed Saw
- Ion Mill
- Keyence 7000 Digital Microscope
- Olympus DSX 500 Opto-Digital Microscope
- Glenbrook Real Time X-Ray
- B&W PIND Testing
- SPI Laser Sheet Metal Cutter
- Roessler Vibratory Polisher
- Class 10 Cleanroom with SIMCO Air Ionizers, ESD Flooring; Separate Gown Room, etc.



Low Temperature Hermetic Package Sealing Deliverables



TABLE VII. Test limits for all fine leak methods. 1/ 2/

Internal Free Volume of package (cm ³)	L Failure Criteria atm-cm ³ /sec (air) Hybrid Class H, and Monolithic Classes B, S, Q and V	L Failure Criteria atm-cm ³ /sec (air) Hybrid Class K only
≤ 0.05	5 X 10 ⁻⁸	1 X 10 ⁻⁹
>0.05 - ≤ 0.4	1 X 10 ⁻⁷	5 X 10 ⁻⁹
> 0.4	1 X 10 ⁻⁶	1 X 10 ⁻⁸

MIL-STD-883 Test Method 1014.17
MIL-STD-750 Test Method 1071.16

	Space Seal	MCL Seal
0.42 cm ³ 	1E-8 atm-cm ³ /sec Air	2E-10 atm-cm ³ /sec Air
0.58 cm ³ 	1E-8 atm-cm ³ /sec Air	4.4E-10 atm-cm ³ /sec Air
0.68 cm ³ 	1E-8 atm-cm ³ /sec Air	2E-10 atm-cm ³ /sec Air
6.48 cm ³ 	1E-8 atm-cm ³ /sec Air	1.6E-9 atm-cm ³ /sec Air
0.05 cm ³ 	1E-9 atm-cm ³ /sec Air	4.4E-10 atm-cm ³ /sec Air

		Space Seal	MCL Seal
0.0002 cm ³ 	80Au20Sn	1E-9 atm-cm ³ /sec Air	1E-10 atm-cm ³ /sec Air
0.005 cm ³ 	80Au20Sn	1E-9 atm-cm ³ /sec Air	1E-10 atm-cm ³ /sec Air
0.008 cm ³ 	80Au20Sn	1E-9 atm-cm ³ /sec Air	1E-10 atm-cm ³ /sec Air
0.02 cm ³ 		1E-9 atm-cm ³ /sec Air	1E-10 atm-cm ³ /sec Air
0.05 cm ³ 		1E-9 atm-cm ³ /sec Air	4.8E-10 atm-cm ³ /sec Air

Abstract:

With deep understanding of the hermetic package sealing process combined with current automation technology, precision automation is now possible. Automatic sealing with exact fit covers provides highest manufacturing yields and enables new package configurations to minimize board space needed for GEO, MEO and LEO satellites. Productivity increases are realized by adaptive sealing on each individual package and the elimination of human intervention or complex jigs/fixtures specifically for the cover sealing process. Utilizing HSHD™ technology, change over from one package type to another requires a single PC program from a familiar GUI. Aerospace resistance weld power technology and proprietary electrodes provides for widest margins on material sets which are not always to specifications.

Success is when Customers are delighted!

