



**PROVEN RELIABILITY:**  
10,000s of devices already in the field



**LOW POWER CONSUMPTION:**  
Don't compromise performance for cost



**THERMAL DESIGN EXPERTISE:**  
Leverage expertise to avoid pitfalls

## TECs for Non-hermetic Laser Packages

### Challenges in the market:

Optical component and module suppliers are under heavy pressure to reduce costs, and they need to innovate to meet cost reduction targets without sacrificing performance or reliability. Sales price and cost-per-bit of cutting-edge optical components are dropping by double-digit percentages each year. Unlike traditional telecom manufacturers, hyperscale datacoms such as Facebook, Google and Amazon order bulk volumes at large discounts, contributing to price erosion.

New technologies like non-hermetic laser packages can help companies achieve aggressive cost reduction goals. Today's manufacturers are seeking non-hermetic alternatives for cooled laser packages, but **many of these solutions may fall short in extreme environments.**

**Can implement for a range of application-specific designs.**

**The non-hermetic requirement needs to be considered during the design phase.**

### Phononic's reliability-tested, non-hermetic TECs are the solution:



**Proven reliability:** While other non-hermetic TECs are still in R&D, we leverage our experience with refrigeration products and countless hours of reliability testing. We have **tens of thousands of non-hermetic devices in the field** at hospitals and pharmacies around the world, guaranteeing that when you design in our non-hermetic TEC, it will pass reliability targets.



**Low power consumption:** Some approaches to non-hermetic TECs drastically degrade cooling performance, increasing laser package power consumption. Our non-hermetic TEC platform has a negligible impact on performance relative to hermetic-rated TECs. As such, your laser package design won't **compromise performance for cost.**



**Thermal design expertise:** We have extensive experience designing cooling systems that are resistant to condensation and other challenges. The cooling engines in our compressor-free refrigerators face harsh environments every day. We offer expertise to help you design and commercialize a non-hermetic laser package and **avoid pitfalls early in the design cycle.**

Non-hermetic TECs are compatible with most current laser package assembly processes, including wire bonding, Argon plasma cleaning, solder reflow or epoxy cure. We can help you evaluate if your process flow is compatible with our non-hermetic solution.



### HIGH RELATIVE HUMIDITY:

Dew point very close to ambient temperature



### COOLED LASERS TYPICALLY OPERATE 40°-60°C:

At high ambient temperature and humidity conditions, condensation is likely

**Contact us** today to assess your system requirements. We'll partner with you on cooled non-hermetic TEC design and development for your application.

## Condensation and environmental challenges:

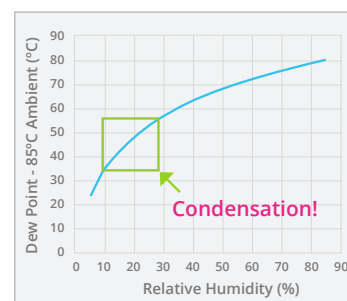
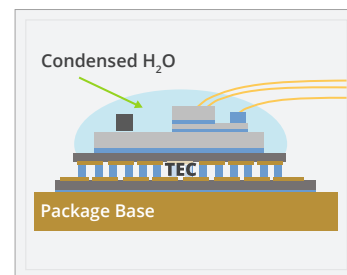
The environmental challenges facing cooled, non-hermetic packages are very different from those facing hermetically-sealed packages. Humidity, condensation, corrosion, and even ice formation are potential problems that can severely impact laser performance and reliability.

Condensation inside the laser package, which happens when the laser Chip-On-Carrier (CoC) assembly is cooled below the dew point of the environment, is a major concern. It can lead to corrosion, create electrical shorting pathways and interrupt coupling of the laser's light emission to the optical fiber, ultimately degrading TOSA performance. These environmental effects can degrade laser slope efficiency or increase coupling losses, which in turn reduce data transmission rate, reach and the usable lifetime of the laser.

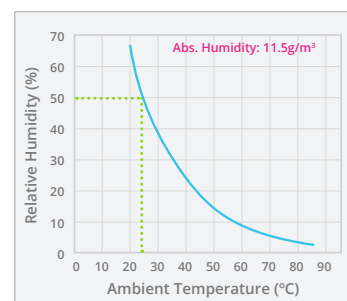
Phononic's engineers will work with you during the design process to eliminate environmental risks to your laser package.

### Considerations:

- Both operating conditions and reliability testing conditions for the non-hermetic transceiver or TOSA must be evaluated.
- While un-cooled non-hermetics are relatively straightforward – the laser generates heat during operation, so it is always above ambient temperature (and thus above dew point) – cooled non-hermetics can operate at conditions where the laser assembly is far enough below ambient temperature to condense moisture from the air. Liquid water can collect on the cooled side of the TEC, and all over the laser diode assembly.
- Standard Temperature, Humidity, Bias (THB) reliability testing at 85°C/85% RH will result in condensation on the TEC and LD assembly. The dew point at this condition is just 3°C below ambient. If powered 85/85 testing is a requirement, measures must be taken in the design and manufacture of the laser package to prevent ambient moisture from entering. There are several options, including gasketing combined with ultrasonic welding or sealing using epoxies or acrylics.



- Relative humidity is also dependent on ambient temperature. Air with a certain, fixed absolute humidity (measured in grams of water per cubic meter of air) will see relative humidity decrease with increased temperature. Typical data center ambient conditions are at relatively low risk for condensation. On the other hand, outdoor ambient conditions like those seen for wireless access infrastructure are at potentially high risk for condensation. So, package manufacturers should take measures to regulate and control the *absolute* humidity inside the package.



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