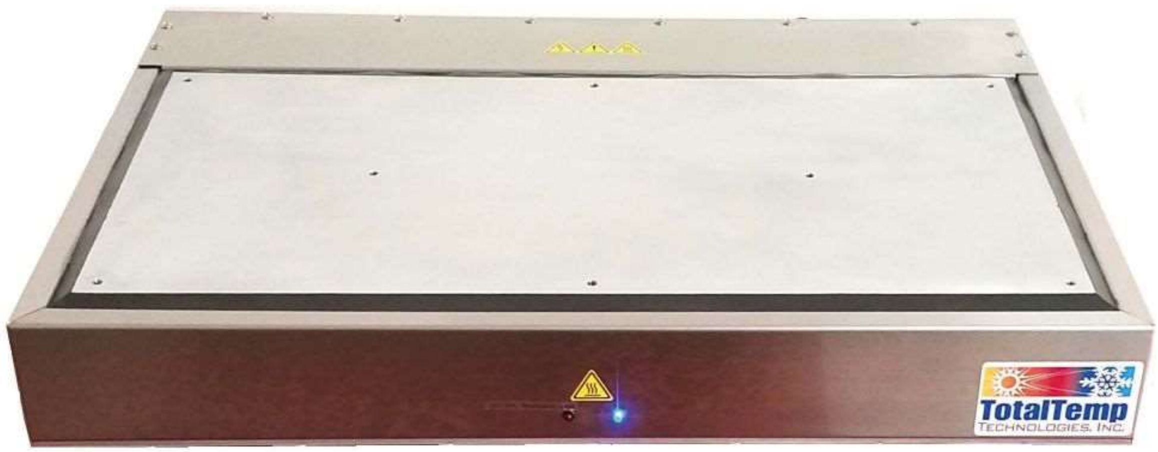

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CHOOSING THE BEST METHODS FOR BENCHTOP THERMAL TESTING

There are many trade-offs to consider when facing a new plan to test electronic or RF products / components

// JOHN BOOHER

When selecting a temperature chamber, larger seems like a good choice when future needs are not known, and financial commitments are being made for test equipment. However, aiming for the right sized chamber is most often a better choice.

COSTS

Consider the following, larger usually means more initial cost. Regarding operating costs, larger chambers will not only have more energy costs. Often when testing multiple units in a chamber, people don't think of the idle time spent with the chamber and the devices that are waiting for enough units to make a complete chamber load.

Additionally consider the possibility of aborting the test of a larger chamber load if one or more fail early.

There are some hidden costs. A larger chamber puts more load on HVAC costs. They also use more valuable lab space and typically take longer to achieve temperature. Time and space both equal money in most cases. When testing smaller items and tests which require technician access, often there is a considerable advantage to being able to do the testing at the work bench as opposed to repeated trips across the lab to load and unload test stations.

THINK THROUGH GOING CHEAP

Saving money always sounds good. There are many bargain chambers and platforms on the market. Some penalties for going cheap might include poor performance or reliability. A temperature chamber with low air flow will appear to get to temperature quickly while a product in the chamber has not come close to the required temperature. Without secondary sensors, this issue may not even be revealed. This is especially evident with active loads or massive products. Many chambers have generic sizes with no custom options, user hostile controller interfaces or poor customer support. Whether communicating with the controller over a bus interface or the front panel or getting help to resolve an issue, a well-designed and supported system is critical.

HEAT TRANSFER METHOD

From science class, the three methods to transfer heat are: conduction, convection, and radiation. Conduction is always a more effective heat transfer method. Some parts are not amenable to conductive heat transfer because of tall geometry or no significant flat surfaces to make direct contact with. Convection is often a go-to solution because it works well in most cases. Chambers require less prior planning such as making sure product can have good contact to a surface as well as making sure gradients across tall packages are managed.

The third heat transfer method is radiant heat which is effective but extremely difficult to control well and typically only used when conduction or convection is not possible. As a best of both solution, advanced temperature controllers and systems offer the combination of both Conduction and Convection to make fast well controlled temperature changes while managing gradients.

1 // The SD288 cryogenically cooled thermal platforms offer extremely fast temperature transision rates

"WHEN TESTING SMALLER ITEMS, OFTEN THERE IS A ADVANTAGE TO DOING THE TESTING AT THE BENCH AS OPPOSED TO REPEATED TRIPS ACROSS THE LAB"

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2 // The C230 temperature Chamber is designed for an extended temperature range

3 // Thermal platform with combined convection chamber

MAKING THE RIGHT COOLING CHOICE

There are many trade-offs that can be considered when choosing the correct cooling method.

For example, if you don't care much about pull down speed and aren't going to have requirements below -40°C, single stage refrigeration is often a good choice for self-contained functionality. This is especially true when you don't need to remove much heat (active loads) or go below -40°C. Cascade refrigeration which is considerably more expensive to purchase along with higher operation costs becomes a good choice, maintaining the self-contained approach down as low as ~-75°C.

Liquid nitrogen cooling is generally a good choice for active loads, speed, and very low temperatures (below -40°C). This is especially true if your facility has liquid nitrogen in house already. Portable tanks and distribution systems have their trade-offs of course. Large scale use with a distribution system will clearly make the low cost of liquid nitrogen show. Liquid nitrogen has seemingly unlimited heat removal capability for speed or controlling the temperature of massive and active heat loads. The simplicity of one moving part, that is the control solenoid also makes liquid nitrogen a good choice for reliability, simplicity, and eliminating additional possible system failure modes.

Liquid CO_2 cooling remains a good choice although it is in less current favor today. In many cases it makes for the ultimate lowest cost per BTU heat removal cooling method. However, there are three issues with using liquid CO_2, two of which negatively affect the argument for CO_2. First the lower limit for Liquid CO_2 is about -60°C. Second, CO_2 plumbing and valves tend to be a lot more troublesome due to the increased chance that the plumbing could get plugged up with a dry ice blockage or even water ice. The third issue is the perceived environmental hazard of CO_2 which stops many people from considering it. The reality of this issue is that CO_2 for industrial use is captured from the environment for distribution, so releasing the same CO_2 has no net increase in greenhouse gasses.

TotalTemp Technologies offers the technology and support for your specific temperature testing requirements. \\

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