

What's the best technique for temperature management of sensitive components in extreme environments?

The first consideration should be the type of enclosure used to house the components. The minimum rating should be NEMA 3, though NEMA 4X is often considered for greater protection. While enclosures provide immediate physical protection for electronics, unless insulated, they provide very little in regards to extreme temperatures. Therefore, thermal management systems are recommended and must be engineered for each application, based on numerous factors.

When designing a system for extremely low temperatures, the starting point is determining the size and type of heater to be used. The required heating power can be calculated by taking into account the lowest possible ambient temperature, the desired interior temperature, the size and material of the enclosure, and how it is mounted. Once the properly sized heater is chosen, whether it be a convection heater or a fan heater, it must be controlled with an appropriate regulator. From simple bi-metal switches to sophisticated electronic thermostats, these devices are fundamental in maintaining the desired temperature within the enclosure.

Extreme heat is also a concern for sensitive components. There are a variety of cooling devices that offer the appropriate air flow protection, including filter fans and fan trays, typically regulated by thermostats or other control devices. Newer innovations such as multi-directional air flow nozzles provide precise cooling of heat sources and the prevention of heat pocket formation. Each of these solutions relies on existing ambient temperatures, either inside or outside the enclosure. In the case of extremely high temperatures, the use of air conditioners or heat exchangers should be considered.

Options like these allow the appropriate, responsive solution to be selected for each unique environmental challenge. And with constant innovation, today's heating and cooling devices are becoming extremely energy efficient, even in harsher environments.

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