

Thermal Management Trends for enclosures

While most customers want energy efficiency in air conditioners, they don't seem to want to pay the initial up cost in a DC air conditioner. Of course, battery backup and the perception that battery life longevity is determined by temperature has been a hindrance in increasing temperatures or switching to alternative solutions. With most new battery purchases being Lithium-Iron Phosphate, you will need to educate yourself in order to change to more energy efficient thermal solutions, this includes information on increasing the temperature in your enclosure to save energy and increase the life of the AC.

Enclosure temperatures currently set at 72F to 82F should be on everyone's list for cost reductions, with a goal of 85F to 90F. DC Voltage, 48 VDC air conditioner units are on everyone's wish list, however with current cost over \$500 more than a conventional AC the market is slow to purchase. Educating the customer base on energy savings is your best bet in purchasing these units. A 4000 BTU DC AC consumes about half the energy of a similar unit in 115V or 230V. Once a DC AC reaches the set point the controller reduces fan and compressor speeds, consuming less energy.

Below a little information on batteries, as a general resource for determining temperature.

Lead Acid

Lead acid batteries often have a fairly narrow temperature window and cannot function or offer long life cycles in cold or hot weather. For example, in equatorial climates lead acid batteries require replacement approximately every five years. These batteries also tend to have a storage capacity rated at 75°F and the rated usable capacity can vary greatly when operating beyond this ideal temperature window.

Lithium-Iron Phosphate

Lithium-iron phosphate (also known as lithium ferrous phosphate or LFP) batteries generate very little heat during cycling, have no risk of thermal runaway and therefore do not require ventilation or cooling. In fact, some LFP batteries are warranted to operate safely in environments up to 140°F without any ancillary temperature monitoring or maintenance equipment. These batteries often do not see efficiency or rating fluctuations when operating at low or high temperatures.

Enclosures

When it comes to outdoor battery banks, it is not only essential that the batteries are able to perform safely in a wide temperature range, but also that the containers and cabinets are able to withstand a wide range of

environments. In the United States, this means looking for solutions that offer an outdoor enclosure with a rating of NEMA 3R or higher.

Additional information on battery warranties

<https://simpliphpower.com/company/news/blog/battery-performance-and-warranties-look-for-these-seven-things-in-your-battery-warrantys-fine-print/>

Additional information on trends customers are looking for in future applications.

Heat Exchangers

48V DC, with the increase in hardened electronics and the desire to reduce energy cost, there continues to be an interest in heat exchangers.

As an example, an enclosure with 400 watts of heat load, OD 50 DX

- Energy efficient a 40 W/F HTX running on 48VDC consumes approximately \$150 in energy, 40 W/F heat exchanger with 400 watts heat load, hardened electronics with Ambient temperature 110F internal estimated at 120F. Based on 8640 hours operation, at .12 per KWH, the actual cost will be less with a fan speed control board
- Versus an air conditioner 2,000 BTU with 400 watts heat load temperature set at 82F, 8,640 hours of operation with heater, \$954 yearly energy cost.

Emergency Cooling

48 DC, customers are looking at this solution more closely as the loss of power seems to be increasing, a closed loop HTX 48VDC with an AC and controller logic to monitor internal temperatures is a good solution, however this can be much more costly than a filtered air solution.

Thermosiphons

These are gaining more attention as new battery technology is advanced and electronics are hardened, typically these units are 48VDC, large units capable of removing over 400 watts of heat very efficiently. These units are rated at over 110 W/F, use micro coils and a refrigerant but no compressor.

Contact the DDB Unlimited Sales Group to learn more