



Thermal Edge Inc.™

TEMPERATURE CONTROL SOLUTIONS FOR ELECTRICAL ENCLOSURES

32 TIPS TO CONSIDER BEFORE

Purchasing an Electrical Enclosure Air Conditioner



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Although the selection of an air conditioner for cooling an electrical enclosure may appear to be a relatively simple task, there are a number of criteria that must be considered to ensure a good fit between the air conditioner selected and the requirements of the application.

If adequate attention is not given to factors such as the operating environment, ambient temperature extremes, and technical features required, there's a possibility the unit will not perform as expected or that an unforeseen situation could result in a failure of the unit, thus leading to equipment overheating and possible downtime.

This eBook provides designers and maintenance staffers with a number of practical tips to use in their evaluation and selection of enclosure air conditioners. For convenience, the book is divided into four sections:

- Technical features
- Environmental aspects
- Special requirements
- Manufacturer considerations

The first section deals with the technical aspects that apply to all enclosure air conditioners, and the second section on environmental aspects considers the effect specific environmental conditions will have on the selection of the unit. The last two sections cover some specific requirements and the advantages and disadvantages offered by the manufacturer.



Technical Features

1. **Capacity:** Ensure you carefully calculate the BTU/H required. The required capacity depends on the internal heat load plus the effects of thermal radiation on the enclosure from the sun, heat from nearby equipment, the ambient temperature, and the internal temperature you wish to maintain in the enclosure. When possible, use manufacturers' online calculators to calculate the required BTU of the air conditioner and allow for the fact that the actual cooling capacity of air conditioners from different manufacturers with the same nominal capacity may differ.
2. **Operating voltage:** Check that the operating voltage is compatible with voltages readily available in the electrical enclosure.
3. **On/off switch:** Make sure the enclosure air conditioner is fitted with an easily accessible on/off switch. Usually, it is accessed from inside the electrical enclosure. This ensures that the unit is able to be safely isolated for maintenance and repair work. An on/off switch is usually considered a piece of mandatory equipment.
4. **Open-door kill switch:** The kill switch ensures that the air conditioner is switched off when the electrical enclosure door is opened. This prevents the air conditioner from running continuously during maintenance of the electrical enclosure. Apart from producing excessive condensation in the air conditioner, it lessens the risk of dirt and debris being drawn into the evaporator coil and circulating fan.
5. **Condensate management:** Air conditioners remove moisture by cooling the air to below dew point. This condensate must be removed. Look for condensate removal systems that evaporate the condensate and avoid troublesome drains. Water dripping onto the floor adjacent to an electrical enclosure presents a serious risk of injury and exacerbates the risk of electric shock.
6. **Energy efficiency:** Establish the capacity of the air conditioner at the anticipated working conditions by referring to its BTU/H performance curves. Also, confirm the electrical power demand at that point. Energy-efficient air conditioners are generally fitted with more expensive high-efficiency rotary compressors, thermal expansion valves, and better insulation.
7. **Digital controller:** The air conditioner should be fitted with a full-function digital controller that provides an adjustable temperature control. The controller should also be able to monitor and control the refrigeration system and protect against

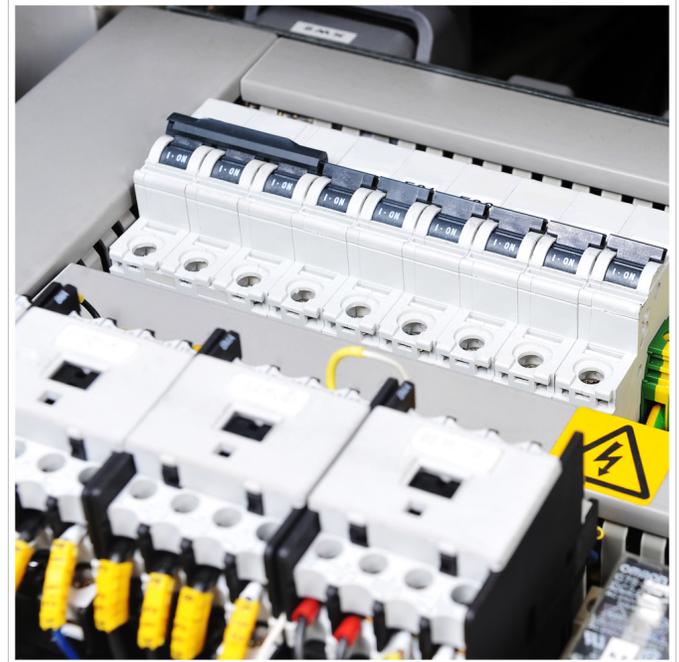
- refrigeration faults, including providing alarm signals for any faults.
8. **Independent high temperature alarm:** An independent high temperature alarm dry contact should be provided to give remote indication of a high temperature in the enclosure.
 9. **Remote control and monitoring:** Many organizations employ PLC or Scada supervisory systems that utilize serial communication protocols or Ethernet. For these organizations, the provision of an ability to remotely monitor and manage the enclosure air conditioner is essential. An alternative method would be a system for automated paging using emails or SMSs to notify the maintenance team of potential problems.
 10. **Monitor hot spots:** The temperature profile in an electrical enclosure is rarely uniform, and provisions should be made to monitor the temperature of specific items of equipment by using a remote temperature probe.
 11. **Enclosure protection standards:** The air conditioner must comply with the appropriate NEMA¹ standard for the electrical enclosure. Because an air conditioner requires a sealed enclosure, this would usually be NEMA 12 for indoor applications and NEMA 4 or NEMA 4X for outdoor dusty and wet environments.
 12. **Mounting options:** Identify any particular air conditioner mounting requirements. The size and location of the electrical enclosure will impact how the enclosure air conditioner can be mounted. Because many electrical enclosures are only 12 inches deep, ensuring the air conditioner manufacturer is able to supply narrow profile units that will fit on the side of the enclosure is important. The other possible alternative location is on the enclosure door, but verify the door and enclosure are strong enough and can handle the load. A top-mounted unit is generally a last resort because of airflow issues and the risk of water leaking into the enclosure.
 13. **Universal mounting adaptor:** If you are replacing an old air conditioner, a universal mounting adaptor will simplify the installation of an air conditioner from another manufacturer.



Environmental Aspects

14. **Environmental considerations:** Carefully evaluate the environment where the enclosure air conditioner is going to be installed. Is it hot, cold, damp, or wet? Will the enclosure be subject to the elements, or, if indoors, is it likely to be sprayed with water or gain heat from a nearby kiln? Are corrosive substances present?
15. **Outdoors and harsh environments:** Enclosures located outdoors or in harsh environments where they may be subject to rain, splashing, or hose-downs should be designed to NEMA 4 requirements. This will ensure water, dirt, and dust do not get into the enclosure.
16. **Water runoff:** Water pooling on the top of an enclosure air conditioner is undesirable, especially from a safety point of view. It also is likely to lead to corrosion. If there is any possibility of the enclosure air conditioner getting wet, even from condensation, make sure it is fitted with a sloping top to allow water that may accumulate to drain away.
17. **Corrosive environments:** If there's a risk of chemical corrosion caused by salt spray or other corrosive vapors and gases, the enclosure should be made from stainless steel and designed to meet NEMA 4X requirements. Additionally, ensuring that components (for example, the condenser coil) that are exposed to the environment are coated with anti-corrosive epoxy is wise. The level of corrosion protection required depends on the severity of the chemical contamination, and in severe environments, additional steps, such as the use of high silver content solder for brazing the copper pipes, may be required.
18. **Fully welded enclosure seams:** Pay particular attention to the method of manufacture of the air conditioner housing. The evaporator section must be completely sealed. This is best achieved through the use of fully welded seams that prevent the ingress of moisture and prevent the growth and accumulation of mold and dirt.
19. **Heavy-duty filters:** In dusty, dirty, and corrosive locations, the fitment of louvered frames with thick, extended service filters will maintain an adequate air flow but prevent the ingress of dirt and dust. Additionally, if splashing by water or chemicals is likely, shrouds that cover the filters and keep water out will extend their useful life.

20. **Solar heat load:** The effect of solar radiation on enclosures situated in direct sunlight is significant and must be taken into account when calculating the heat load.
21. **High ambient temperatures:** In locations where the ambient temperature is high, such as near heat-generating equipment or in unventilated machine rooms, make allowance for the effect these temperatures have on the capacity of the air conditioner.
22. **High altitude:** The effectiveness of an air conditioner decreases with altitude in direct proportion to the reduction in air density. At 3,000 feet above sea level, the capacity is reduced by more than 10 percent.
23. **Vibration:** Copper pipes may form cracks and fracture and precautions are required to protect units when there's excessive vibration such as on cranes, ships, and off-road vehicles. Special measures to reduce the effect of vibration include shock-absorbing loops of copper piping, the use of flexible refrigerant lines, and clamps that minimize vibration.
24. **Hazardous areas:** Electrical equipment installed in hazardous locations must comply with the requirements of the National Electrical Code² and meet additional requirements from local authorities.



Special Requirements

25. **Low and high ambient temperature packages:** During cold weather, air conditioner compressors may have difficulty starting, and often, they must be fitted with a low-temperature protection package to keep the compressor warm by energizing it at a low voltage. Conversely, in consistently high ambient temperatures, compensating for the drop in compressor performance by various technical changes may be necessary.
26. **Enclosure heating options:** If the enclosure temperature drops below dew point, water will condense on electrical components, possibly causing damage or failure. If this is likely, a heater package should be fitted to maintain the minimum enclosure temperature above dew point.
27. **Redundant systems for critical applications:** Occasionally, it is necessary to provide redundant cooling for safety critical electrical enclosures. Such a system employs two full-sized air conditioners so that if one fails, the other will provide adequate cooling. To ensure reliable operation, each unit is automatically cycled, and, if necessary, both units are able operate in abnormal conditions.

Manufacturer Considerations

28. **Lead time:** The lead time to supply a new enclosure air conditioner is an important consideration because delays in supplying new or replacement units could lead to downtime and equipment damage. Ideally, normal equipment supply lead times should not exceed one week for standard units and two weeks for air conditioners fitted with optional equipment. Note, an extended delivery on a new unit will likely mean replacement units and spares will be similarly delayed.
29. **Cost:** Although the unit cost is important, your analysis should include a comparison of the features offered as standard and the cost of optional features you may require. Commonly, vendors offer low prices for stripped-down standard units and then charge high prices for extras that are standard from other manufacturers. Look for value for your money.
30. **Certifications:** Verify the air conditioner is certified by a Nationally Recognized Testing Laboratory (NRTL). This is a mandatory requirement for enclosure air

conditioners installed in the U.S., and air conditioners must also be tested against an appropriate standard such as the UL 484 Standard for Room Air Conditioners³.

31. **Technical support:** The safe and continued operation of enclosure air conditioners is essential to protect the electrical equipment in the electrical enclosure, and to that end, manufacturer's technical support must be readily available by means of telephone or email and can be accessed online. Always verify this is the case.
32. **Manufacturer's location and support:** In the same way, the ability of the manufacturer to supply parts and resolve technical or warranty issues is paramount, but this is much more difficult if the manufacturer is in a remote location.

Selecting an Enclosure Air Conditioner



These tips will help you ensure you select the most appropriate enclosure air conditioner for your application. Bear in mind, these considerations cannot cover every possible contingency, and in some instances, solutions to a specific problem may impact other technical requirements.

Nevertheless, these tips will help you identify the important characteristics for your enclosure air conditioner and form the basis for technical discussions with enclosure air conditioner manufacturers.

¹ [NEMA Enclosure Requirements](#)

² [OSHA Hazardous Area Locations](#)

³ [UL 484 Standard for Room Air Conditioners](#)