B&R Enclosures Pty Ltd

Keeping your equipment cool

Technical Information

INTRODUCTION

Keeping internal equipment operating at optimal temperatures can be difficult to manage. Sometimes the internal equipment needs to be cooled and other times it needs to be heated depending on a number of considerations. Regardless, the objective remains that the equipment should be protected at all temperatures. All applications have various considerations and solutions which combine to create a complex decision-making process.

1.0 CONSIDERATIONS

a. **Operating temperature of internal equipment**
Some equipment is relatively tolerant of high or low temperature and does not need close consideration, however there are pieces of equipment that do, such as batteries and electronics. The first point of call is to understand the equipment requirements and their function. For example in some cases industrially hardened electronics can be used in cases where high temperatures are always expected, in other cases where batteries are used high temperatures can seriously degrade their performance. One also needs to be aware that the occasional short term heating effects may not be too detrimental to the equipment and so the average effect is important rather than the exception, in fact it is sometimes impossible to plan for the exception.

b. **Internal heat sources**
Electronics or control equipment often draw some current and therefore do generate heat which goes to heating the internals of an enclosure. Depending on the dissipated wattage of these devices it could become significant. Heat inside an enclosure also tends to rise to the top so one can expect a higher temperature at the top as opposed to the bottom of the enclosure. For this reason sometimes it is prudent to place more sensitive equipment at the bottom of the enclosure. The temperature difference between the top and bottom of an enclosure could vary by 10-60% (reference AS 60890-2009). Importantly, never neglect high current carry cables as they will also generate heat.

c. **Partitions inside the enclosure**
For any enclosure the top surface is the most important to dissipate internal heat. Therefore if an enclosure has an internal partition, heat build-up below the partition can cause excessive heating. Caution needs to be exercised when planning an internal partition. If a partition is unavoidable then try to ensure that the partition has good ventilation to allow for the most effective flow of air. If one is segregating mains power from data circuit for example then the maximum size of this ventilation opening is 12mm (IP23 Wiring Rules, work to 11mm to be sure).

2.0 CLIMATIC CONDITIONS

a. **Temperature**
Ambient temperature plays a major role in understanding how the internal temperature of an enclosure will operate. Generally speaking, unless there is some active means such as air-conditioners, the internal temperature of an enclosure cannot be less than the ambient. Therefore if the application is in for example, Cooper-Pedy then one can expect relatively high internal temperature on the hottest days of the year, which sometimes can be in excess of 50°C. Ambient temperature is also cyclic as night and day cycles and it is true that the internal temperature of an enclosure may only reach a high temperature for a short period of time which may not cause any damage to some types of equipment.

b. **Solar Irradiation**
Everyone would well know the heating effect of the sun, however this varies dramatically depending on a number of conditions. The latitude and altitude of the application can have a strong bearing on the internal temperature of an enclosures. Conditions such as wind, clouds, rain and airpollution. All have a varying effect on the internal temperaturet. It is often difficult to allow for these effects due to the uncertainty of variables however the use of sunshades can simplify these considerations (see solutions below).

c. **Wind**
Wind is one of those parameters that is often ignored however it does have a bearing on the average temperatures one could experience inside an enclosure. For example if one lives in a windy, coastal environment, the wind could play a significant role in keeping internal temperatures down. The enclosure location is therefore always a key consideration.

d. **Colour of enclosure**
The colour of an enclosure plays a significant role on the internal temperature of an enclosure. A black enclosure will absorb more heat from the sun than a white enclosure. Most people would know this intuitively. Therefore choosing a light colour helps to minimise internal temperature rise.

2.0 CLIMATIC CONDITIONS (CONT'D)

e. Position of Enclosure (not location)
The position of an enclosure will also have a large effect on the internal temperature. For example, an indoor enclosure will not experience solar irradiation so many heating effects of solar irradiation are negated. However, outdoors in the middle of a paddock, both a solar and internal heat source should be considered. Additionally an enclosure effectively dissipates its internal heat through the surface area of the enclosure and therefore if an enclosure is mounted against a wall this effectively removes that surface from the cooling equation. Therefore positioning of the enclosure needs to be carefully considered.

3.0 SOLUTIONS

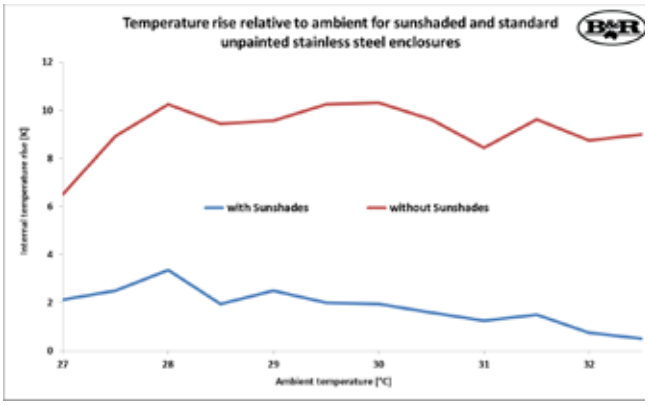
a. Larger enclosure
One of the first solutions to excessive heat would be to use a larger enclosure and for the same reason it is important to not under-size the enclosure, which for economic reasons is often the case. Undersizing of an enclosure can lead to equipment degradation and therefore only give short term economic gain. AS60890 standard gives an excellent method to calculate the enclosure size provided that the enclosure is an indoor enclosure. The standard also allows for the calculation of the effects of ventilation.

b. Ventilation
The second defence line is to include some sort of ventilation. This allows hot air inside the enclosure to rise and escape out of the enclosure and not build up. If static ventilation is not enough, due to high internal heat sources, then consider the use of fans. The advantage of ventilation is its relative low maintenance nature. However, if fans are used one needs to consider that the fan filter material may need cleaning or replacing from time to time.

c. Heat exchanger
Heat exchanges are highly effective at removing heat from an enclosure however the external ambient temperature needs to be moderate as a heat exchanger cannot reduce the temperature internally below its external temperature. In fact there is always a differential required to achieve some sort of internal cooling. Careful selection of the size of the heat exchanger is critical to its effectiveness.

d. Air Conditioner
An air-conditioner on the other hand is an active means that does extract heat from the inside of an enclosure, just like the way a fridge works. The sizing of the air-conditioner is important as a bigger system is needed for higher power extraction. For example if the enclosure houses variable speed drives which typically dissipate high heat then a larger air-conditioner may be needed.

e. Sunshades
For outdoor applications where one needs to consider solar irradiation then sunshades is another simple and effective way to control the internal temperature of an enclosure. Sunshades effectively screen the enclosure from the effects of solar irradiation and allow the enclosure to seem like it is an indoor enclosure. Additionally the space between the sunshades and the enclosure cause a chimney effect that draws air across the surface of the enclosure thus effectively increasing the cooling effect which is shown in figure 1. The design and shape of these sunshades has a significant bearing on their effectiveness as not all sunshades are made equal.



Head Office
51 Stradbroke Street Heathwood QLD 4110 Australia
PO Box 1151 Browns Plains BC QLD 4118 Australia
T: +61 7 3714 1000 F: +61 7 3714 1081

QLD Office – Sales & Warehouse
51 Stradbroke Street Heathwood QLD 4110 Australia
PO Box 1151 Browns Plains BC QLD 4118 Australia
T: +61 7 3714 1111 **F:** +61 7 3714 1091

North QLD Office – Sales & Warehouse
25 Dalrymple Road Garbutt QLD 4814 Australia
PO Box 7615 Garbutt QLD 4815 Australia
T: +61 7 4727 1900 **F:** +61 7 4755 0675

NSW & ACT Office – Sales & Warehouse
Unit 12/100 Belmore Road North Riverwood NSW 2210 Australia
PO Box 90 Riverwood NSW 2210 Australia
T: +61 2 9915 9555 **F:** +61 2 9584 0055

Newcastle – Distribution
Ross Joice Agencies Pty Ltd
109-111 Broadmeadow Road Broadmeadow NSW 2292 Australia
T: +61 2 4961 4433 **F:** +61 2 4961 2498

VIC & TAS Office – Sales & Warehouse
50-52 Sunmore Close Heatherton VIC 3202 Australia
T: +61 3 9552 0552 **F:** +61 3 9551 8636

SA & NT Office – Sales & Warehouse
505 Grand Junction Way Wingfield SA 5013 Australia
T: +61 8 8417 6222 **F:** +61 8 8268 3675

Northern Territory – Distribution
Jewell Distributors Pty Ltd
Cnr Hidden Valley & Beaton Roads Berrimah NT 0828 Australia
T: +61 8 8947 0870 **F:** +61 8 8947 0764

WA Office – Sales & Warehouse
6 Montgomery Way Malaga WA 6090 Australia
T: +61 8 6310 4777 **F:** +61 8 9249 6776

National Sales
T: 1300 Enclosures (1300 362 567)
F: 1300 796 599
E: sales@brenclosures.com.au

brenclosures.com.au