White Paper | 2008

The effect of sunshades on internal heat of an enclosure

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Date: 16 Oct 07

Introduction

Sunshades are used extensively in Australia to prevent radiated heat from direct sunlight warming the surface of a body above ambient temperature. However there seems to be very little information quantifying the effect, and the difference in temperature that can be obtained.

B&R manufactures electrical enclosures which often contain equipment that is heat sensitive. When designing electrical systems for these critical applications, it is important to know the operating temperature inside the enclosure to ensure it is within acceptable bounds. Often in remote locations sunshades are used rather than more active forms of cooling, however there is little data to confirm how these will actually perform.

To examine the effect of sunshades more closely B&R conducted testing, of which is detailed below.

Test method

The test enclosures

Two identical SR06042/S enclosures (316 stainless steel with a 30 degree sloping roof and effective dimensions of 600 x 400 x 225 mm (H x W x D) were mounted side by side, one with sunshades and the other without. This is shown in Figure 1.

Temperature sensors were placed centrally inside the enclosures and towards the top.

The enclosures along with an ambient sensor were positioned in a location that experienced direct sun from approximately 08:00 to 15:00.

Note: no internal heat loads were used, the enclosures were empty. Internal heat sources would vary the results shown here.

Figure 1 Enclosures tested

The sensors

The sensors used were a “button” type as shown in Figure 2. These logged the temperature every 5 minutes over a period of 16 days. The quoted accuracy of these sensors is ±1ºC but previous testing has shown them to typically be within ±0.5ºC.

Figure 2 Button sensors

Results

Figure 3 shows the results of the tests with the enclosure internal temperature plotted against the ambient temperature.

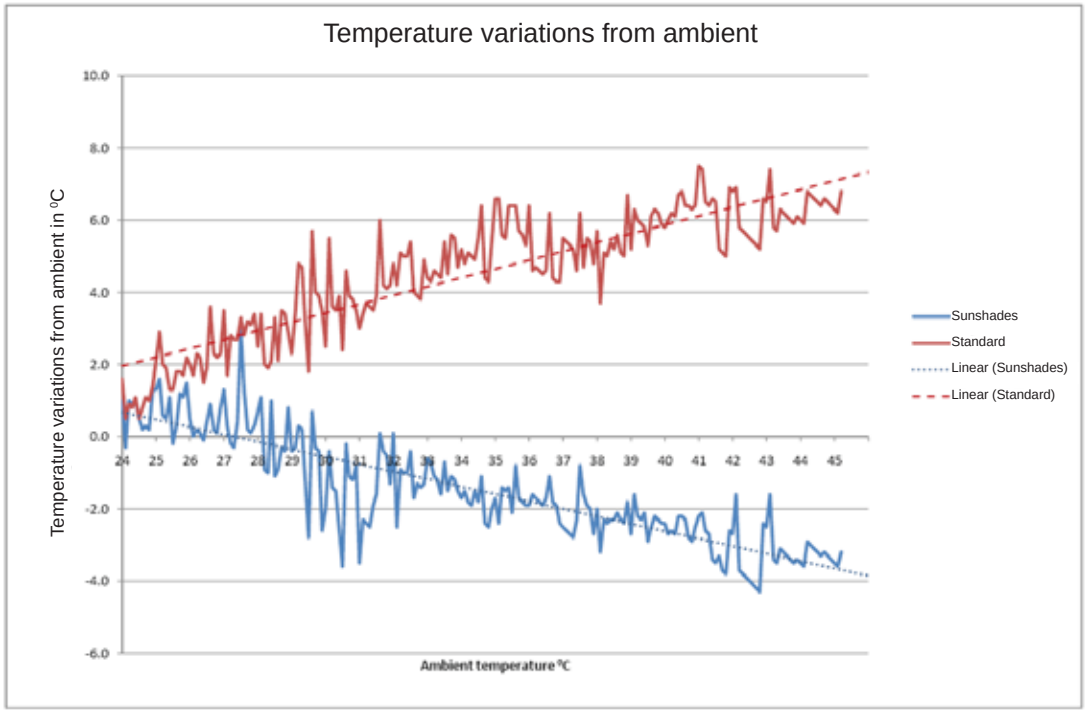

Figure 3 Plot of test results showing internal temperature variations vs ambient.

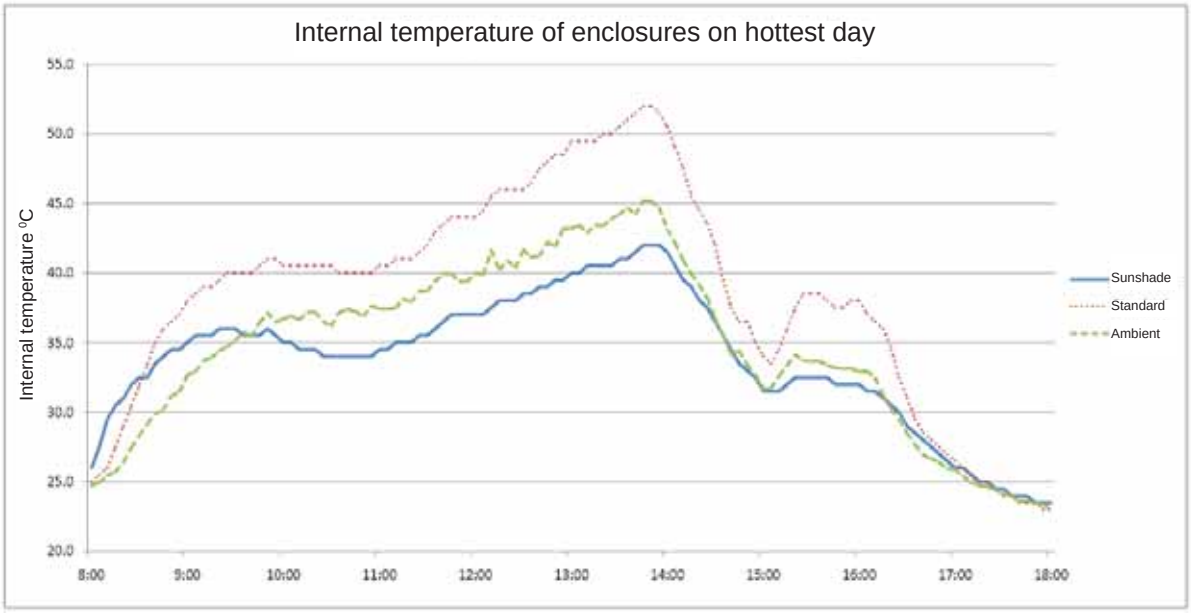

Figure 4 Variation in Internal temperature of enclosures during hottest day

Figure 4 shows the variation in temperature over the warmest day. The noticeable drop in temperature at around 14:00 is attributed to a cool change due to clouds which happened around this time.

Comments

At 24ºC ambient the internal temperature of both enclosures was around 1ºC above the ambient. It can be assumed that at this point there was very little sun so there was no effect from the sunshades.

At 35ºC ambient the enclosures with sunshaded showed a 1.5ºC lower temperature than the measured ambient (more below), while the enclosure with no protection was around 6ºC hotter (or around 4.5ºC warmer than ambient).

At 45ºC ambient the enclosures with sunshaded showed a 3.5ºC lower temperature than the measured ambient, while the enclosure with no protection was around 10.5ºC hotter (or around 7ºC warmer than ambient).

It is interesting to note that at high ambient temperatures the sunshade enclosure was cooler than ambient by some 3ºC. There are various reasons why this could be happening. The most likely is that the ambient air temperature measurement method we used includes some additional effects. However there are also other possibilities such as the heat on the sunshade heating the air between the enclosure and the shade and with hot air rising a air flow is created which has a cooling effect on the enclosure skin.

Conclusion

The results show that a sunshaded enclosure experiences a significantly lower internal temperature than an unshaded enclosure. Over the 16 days of testing the maximum internal temperature of the sunshaded enclosure was 42ºC while without the shades the enclosure reached 53ºC.

These results show that a sunshaded enclosure is very effective in minimising internal temperatures when the application requires the enclosure to be mounted outdoors directly exposed to the sun.