Hoffman®
A Pentair Company

Solar Heat Gain

When evaluating the thermal management needs of outdoor electrical enclosures, solar loading should be considered. Variables include the amount of solar exposure, enclosure color and material type, highest sustained atmospheric temperature, heat build-up from internal components, and heat reflectance from the surrounding location.

A test to compare the shielding effect on internal temperarture rise was performed on similar enclosures exposed to the sun. The enclosures are the same color (RAL 7035 light gray) and material. The enclosure on the left is unshielded, the enclosure on the right is shielded on top and applicable sides.

The Effects of Enclosure Color and Finish

The percent of solar energy absorbed by the enclosure depends on surface color, finish and texture.

Surface	Solar Radiation absorption	Low Temp Radiation 25°C
Polished Aluminum	.15	.06
White	.14	.97
Yellow	.30	.95
Cream	.25	.95
Light Grey, Green Blue	.50	.87
Med. Grey, Green Blue	.75	.95
Dark Grey, Green Blue	.95	.95
Black	.97	.96

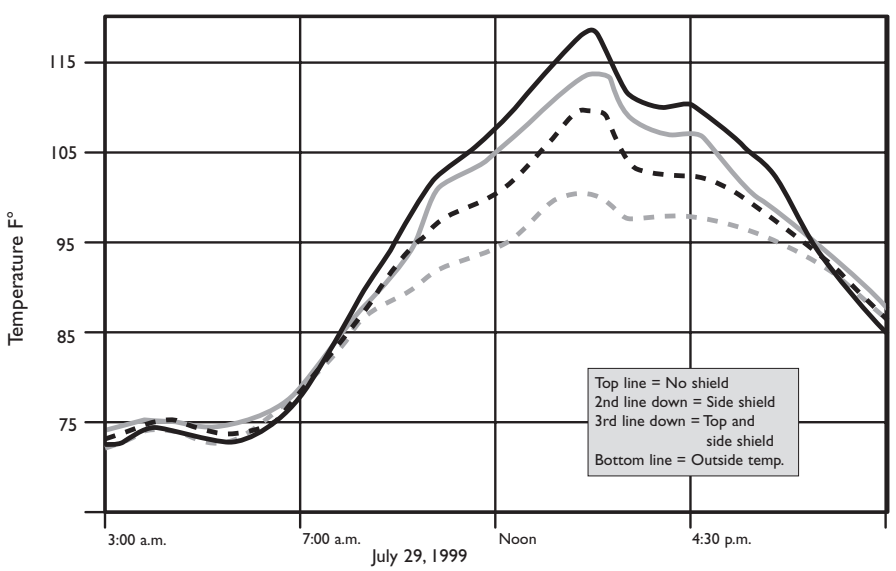
Absorption values of the finish will increase with age. Color and finish will also affect the amount of low temperature heat energy radiated to surrounding surfaces or sources.

Standardized Test Evaluation

Telcorida (Bellcore) GR-487 provides a test procedure for evaluating the solar load on electrical/ electronic enclosures. The test is run with the internal electronics on, in an environmentally controlled room, and three sides of the enclosure are illuminated uniformly with controlled banks of lights to a measured surface radiant value of 70 watts/ft^2. The temperature rise inside the enclosure above ambient is added to 115°F. This temperature total must not exceed the lowest rated component within the enclosure.

Surrounding Location

Reflection of solar energy from the foreground and surrounding surfaces can impact the total amount of radiant exposure by as much as 30%.



The results of the test show the enclosure with top and side shields to have approximately a 46% reduction in temperature compared to the unshielded enclosure. Hoffman offers top shields as an accessory for Hoffman COMLINE® Wallmount enclosures. The reduction in temperature is approximately 25% with the solar shield top only.

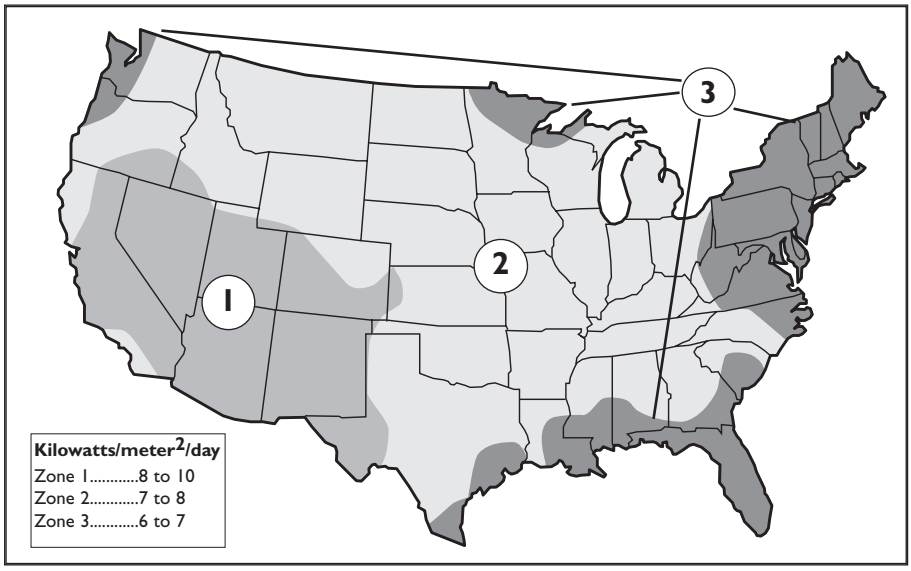
The Benefits of Shielding Enclosures

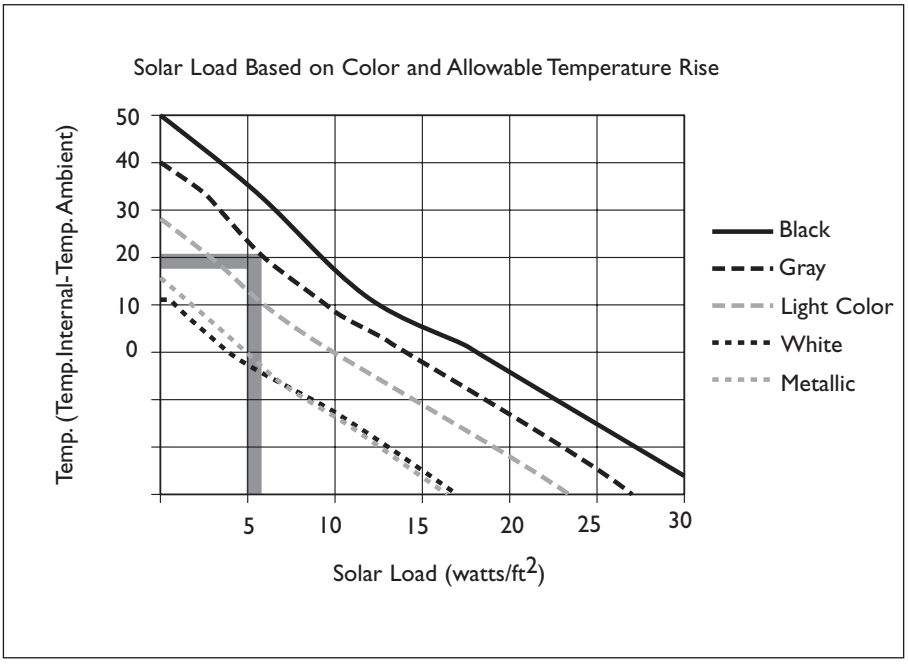
At Hoffman we have researched the thermal affects of solar radiation on our products. In our continuing research, we have found that shielding is an effective, low cost method of reducing solar heat gain in outdoor electrical/electronics applications. Right now we offer a top solar shielding product that is made for use with COMLINE® wall mount products.

We tested enclosures with and without top-shielding and the results showed a 25% reduction in temperature when a top shield was employed.

Unshielded vs. Shielded
Air Temp. = 100.2
Enclosure color is lt. gray (RAL 7035)

Enclosure Type	Temperature	% Temp. Reduction
Unshielded	118.6	---
Top shield only	114.0	25%
Top and side shields	110.1	46%





Exposure to Solar Radiation

Over much of the United States, the approximate peak values of solar radiation striking the Earth's surface is 97 watts/ft^2 and a maximum outdoor air temperature of 104°F. Altitude, humidity, and air pollution have an impact on these values, even more so than latitude. In the high dry climates of the southwest, extreme solar values of 111 watts/ft^2 and maximum temperatures greater than 104°F can be reached. The extreme conditions the enclosure will be exposed to should be identified. If the internal enclosure temperature is greater than the outdoor temperature, wind will have a cooling affect. But, because the cooling affect of the wind is not guaranteed, it is usually not taken into account when establishing a worst case evaluation.

Evaluation of Solar Heat Gain

To evaluate the specific heat load on an enclosure, you must take into account the following:

- Total surface area of the enclosure
- Color of enclosure
- Internal heat load that needs to be dissipated
- Maximum allowable internal temperature
- Solar load
- Benefits of shielding or insulating

Example:

What amount of heat energy must be removed from a solar loaded gray enclosure with 38 ft^2 surface area, internal gear dissipating 300 watts of heat and an allowable internal temperature of 124°F?

Use 104°F for ambient temperature. The allowable temperature rise is 20° (124-104).

The solar load from the graph at the left where 20° intersects the gray color curve and shows 6 watts/ft^2, which is then applied over the entire surface of the enclosure. Total solar load is 38 ft^2 x 6 watts/ft^2 or 228 watts.

Total active cooling load required (solar load + internal heat load) to ensure the internal enclosure temperature will not exceed the maximum of 124°F allowed is 228 + 300 = 558 watts.

So the minimum capacity of the active cooling system (either heat exchanger or air conditioner) must be able to remove 558 watts.