



## Passive cooling and heat dissipation for high-powered lighting electrical enclosures using SRI's Self-Cooling Paint™

*Results of an independent field test*

### Risk of overheating of electrical systems for high powered lighting

Musco Sports Lighting, LLC approached SRI with an interest in exploring new solutions to increase the passive cooling of their outdoor lighting systems. Their high-powered LED lights are mounted on poles and controlled by electronics typically enclosed in gray coated aluminum cabinets. Even though this system is very efficient, significant heat energy is generated during operation. The proper functioning of the lights is important, as they provide visibility in a multitude of commercial venues such as stadiums, sports parks, and racetracks. There is a desire to increase the longevity and performance of these electronics where extreme heat is a possible limiting factor. Any exterior coating must also be sufficiently durable to withstand weather conditions.

#### SOLUTION

Self-Cooling Paint is a passive radiative cooling solution – without requiring any power or electricity, it can cool down any surface up to 5-8 °C (8-12°F) below ambient temperature\*, and 15-30 °C (20-50 °F) below ambient on an uncoated surface based on internal tests on a metallic substrate\*\*. Achieving sub-ambient temperature is significant and has been accomplished by engineering this coating that combines high solar reflectance with high infrared emittance in the sky transparency window.

#### APPROACH

The objectives of this field test were to verify the cooling performance of the Self-Cooling Paint, and to note comparative temperature differences of the interiors of three enclosures, in both power-off and power-on conditions, for three coating options – a commercial gray paint, a commercial white paint, and SRI's Self-Cooling Paint.

#### APPLICATION

Prior to painting, stickers and adhesive were removed from the aluminum cabinets, surfaces were scuffed with a DA sander using 3M 120+ abrasive, and surfaces were wiped clean with a wax and grease remover.

Per SRI's instruction, the Self-Cooling Paint was applied using a spray gun using a 1.3mm nozzle, at a wet film thickness between 0.028" and 0.035" (0.7mm - 0.9mm). The coating cured at ~24°C for 48+ hours.

*"I think the cooling results are great. They definitely make a difference. We'll continue to test but I think there could be a place for this coating with our product."*

TH, R&D Engineer  
Musco Sports Lighting

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## DATA MANAGEMENT

Temperature data was collected in real-time by a data acquisition system. K-Type thermocouples were used. Weather conditions such as humidity and cloud coverage were noted. Data was collected for more than 1 week both with internal electronics turned on (between 5:30 PM – 10:00 PM) and with internal electronics turned off for the rest of the period, when no light is needed.

## RESULTS

Each enclosure is approximately 9"x14"x52". The cabinets were mounted nearly 30ft above ground on a pole. They have vent holes on the bottom surface that are open to ambient air. Each cabinet had simulated electric/thermal loads depending on the test.

Overall, the aesthetic appearance of the dry paint surface was pleasing. Some slight surface cracking was observed. Other than that, the surface was smooth and matte.

The field-test temperature measurements were conducted at a Musco site in South Central IA starting in September 2025.

## COOLING PERFORMANCE

1. The ceiling temperature of three different painted enclosures are reported against the ambient air temperature, as shown in the plot below (Internal top surface temperature). Under no internal electrical/thermal load, the gray enclosure reaches maximum temperature every day during peak solar hours, while the SRI painted enclosures demonstrated the lowest temperature during those peak solar hours. Maximum temperature differentials of around 10°C – 18°C were observed between these two extreme temperatures. A thermal load reduction of 3°C - 5°C on the ceiling was noted with SRI's Self-Cooling Paint vs. the powder coated bright white paint. Note that there was no insulation in the enclosures, no control of convection, and the surface area facing the sky was <1/10th that of the vertical surfaces.

2. Similar observations were found for internal air temperature, as shown in the plot above. The internal air temperature without any additional internal electrical/thermal load followed the ceiling temperature behavior in all the enclosures.

3. In the subsequent week, the effect of the internal thermal load was observed on the internal temperature and temperature of electronic boxes, mounted inside the enclosures. The plot above (right) for a single day data represents typical behavior. During solar peak hours, no light is expected from MUSCO's system. Hence the test with power off demonstrates the temperature of two electronic boxes during peak solar hours. When lights were on, the electronic boxes generated internal heat. To our surprise, electronic boxes in SRI's painted enclosures were at a lower temperature than the gray and bright white painted enclosures – which were almost at the same temperatures. The maximum temperature differential of 5°C was observed.



Three enclosures for comparison:  
Self-Cooling Paint (L)  
Powder coated standard white paint (C)  
Powder coated gray paint (R).



Self-Cooling Paint coated enclosure, mounted.



Before applying Self-Cooling Paint



After applying Self-Cooling Paint



Final finish of Self-Cooling Paint after 48 hours



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## TEMPERATURE MEASUREMENT

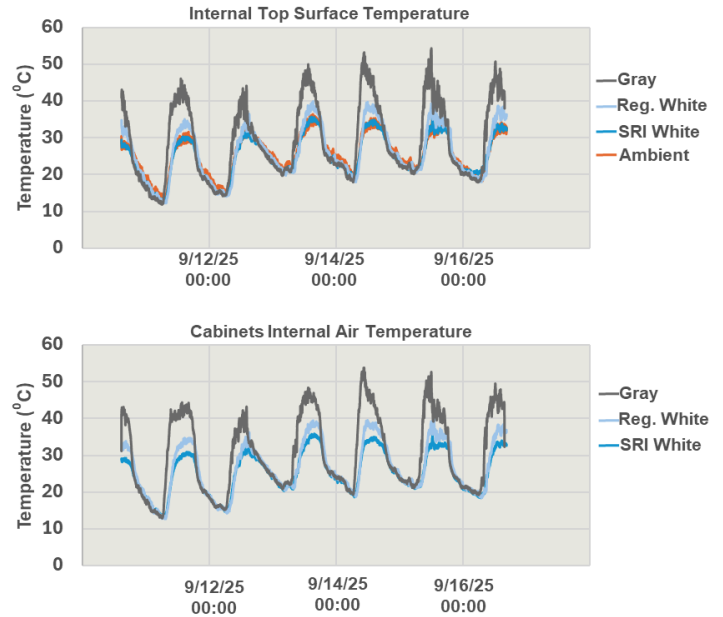
Each enclosure contained four of MUSCO's proprietary electronic devices – two at mid height and two nearer the top of the units. For temperature sensing, each enclosure contained:

- Three sensors suspended in air – top, middle, low
- Sensors in thermal contact with proprietary electronic boxes (EB) mounted – top and bottom.
- One sensor in thermal contact with the top internal surface (ceiling) of the enclosure

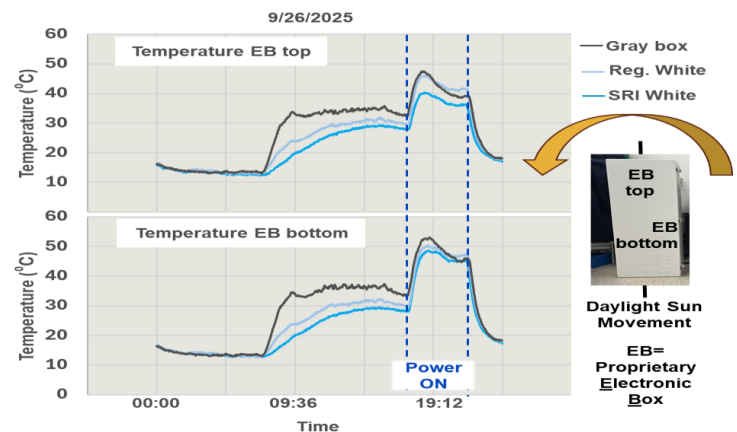
In addition, a sensor was placed beneath the enclosures (in the shade) to measure external ambient air temperature.

## CONCLUSION

Self-Cooling Paint consistently maintained the lowest surface temperature among all the painted enclosures, and compared to local ambient temperature, throughout the testing duration. To our surprise, the internal air temperature inside the electronic enclosure was also colder than other painted containers – both when internal electronics were turned on (i.e., generating internal heat) and turned off.



Ceiling Surface temperature in different painted containers vs ambient temperature; and internal temperature in different containers from one of the thermal sensors.



Temperature of two electronic box mounted inside the painted enclosures measured both during Power Off and Power On.

## About SRI

SRI is an independent nonprofit research institute, headquartered in Menlo Park, California., with a rich history of supporting government and industry. We create and deliver world-changing solutions for a safer, healthier, and more sustainable future. For more than 75 years, we have collaborated across technical and scientific disciplines to discover and develop groundbreaking products and technologies and bring innovations and ideas to the marketplace. Learn more at [www.sri.com](http://www.sri.com).

## Contact

Contact SRI to inquire about partnership or licensing of the paint.

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