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Enclosure Heaters: "Life Insurance" for Electronics

By Gary Steiger, STEGO, Inc.

Today's continuous miniaturization of components results in high packing densities within enclosures. These ever-increasing densities lead to higher temperatures with the enclosure - figures that will increase as ambient temperatures rise. In response to this thermal problem, cooling systems have become standard in many applications. However, just as critical and widely underestimated, are failures caused by the formation of moisture. Under certain climatic circumstances, moisture can build up not only in outdoor or poorly insulated enclosures, but also in highly protected and well-sealed enclosures.

Moisture - An Overlooked Cause of Failure

Moisture, especially when combined with aggressive gases and dust, causes atmospheric corrosion and can result in the failure of components such as circuit breakers, busbars, relays, integrated circuit boards and transformers. The greatest danger lurks in conditions where electronic equipment is exposed to relatively high air humidity or extreme variations in temperature, such as day-and-night operation or outdoor installation. Failure of components in such cases is usually caused by changing contact resistances, flashovers, creepage currents or reduced insulation properties.

Up to a relative air humidity of 60 percent, moisture and corrosion remain low. Above 65 percent, however, they increase significantly. These problems can be reduced substantially by keeping the environment inside an enclosure at a temperature as little as 5°C higher than that of the ambient air. Relative air humidity is the ratio between the actual amount of water vapor present and

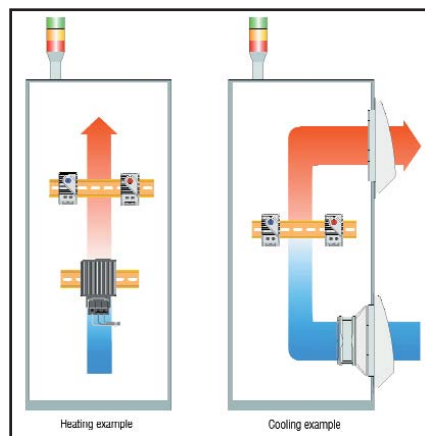


Illustration 1

the maximum amount which can be held by the air at the prevailing air temperature (stated as a percentage). This key measurement must be determined to prevent damaging condensation within enclosures.

The higher the air temperature, the more invisible water vapor it can absorb. Even if the amount of water vapor remains the same, the air will become saturated as the temperature drops. When the air can no longer hold the water vapor it contains, it has reached the "dew point."

Observers will note fine drops of water forming on surfaces. In everyday life, droplets form on window panes, eye glass lenses and drinking glasses. Unfortunately, the simple physics of condensation can be very destructive inside electronic enclosures.

Outdoor equipment is particularly at risk since condensation occurs with the shift between warm daytime and cooler nighttime temperatures. Greater damage can be brought about by condensation caused by seasonal climatic changes or by the sudden temperature drops during summer thunderstorms. Even indoor systems are imperiled by the formation of condensation through temperature variations, for example, when components in an enclosure heat up during operation and then cool down after being turned off.

Constant temperatures are a necessity for guaranteeing optimal operating conditions. Continuous temperature changes not only create condensation but they thereby reduce the life expectancy of electronic components significantly. Electronic components can be protected by cooling in the day and heating at night.

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Enclosure Heaters: The Other Thermal Management Solution

Modern enclosure heaters have been designed especially to afford protection against condensation. They heat the air inside enclosures so that water vapor cannot condense on components. Modern heaters provide the greatest possible air circulation at very low energy consumption. This efficient performance is obtained through special designs, i.e. chimney-like shapes, which favor ideal heat distribution. Intended for tall, narrow cabinets, these heaters function best when mounted near the bottom of the enclosure, with a temperature controller such as a thermostat, located near the top (See Illustration 1).

Heating element technology has also improved, providing longer operating life and greater energy efficiencies. Coil, tubular, cartridge and mica-insulated heaters are still available and are frequently used, but a growing trend towards a new technology has emerged. Positive Temperature Coefficient (PTC) heaters are becoming more prevalent due to their solid-state ceramic element construction, rapid heating, and safety features. The main advantage of PTC-heating is the unique temperature-resistance characteristic of the PTC-element, which reduces the danger of overheating.

However, special designs and better technology are not always sufficient, especially for higher wattage heaters. As the power output of a heater increases, the heat sink used to disperse the heat away from the heating element must also increase to prevent the unit from overheating. After a certain point, the size of the heat sink becomes large and impractical, and an axial fan attached to the heater becomes a more suitable solu-

tion. Fan heaters can also be used in cases where higher temperatures or greater air circulation are required, especially in the case of outdoor applications with extreme temperatures or in designs with very high packing densities.



The CR027 heater from Stego features a PTC element, axial fan and an adjustable thermostat

Another factor to take into consideration is installation. Well-designed heaters offer quick wiring options and easier mounting, such as on 35 mm DIN rail, and can thus reduce installation time and expense. For these reasons, flat radiators, ceramic resistors and even light bulbs, which have been used in the past, are not as suitable since they were originally designed for other purposes.

Finally, thermostats, hygrometers or a combination of the two are recommended with all heaters for optimum temperature and humidity control in enclosures. These regulators provide effective and efficient control, and offer the best solution for moisture problems, especially in situations

where radical temperature variations exist or where high air humidity is a constant.

Enclosure heaters offer safe and effective protection against the problems caused by temperature variations and resulting condensation. When dealing with sensitive electronic equipment, the economic impact of failure and repairs makes the purchase, installation and operating costs of enclosure heaters the far wiser alternative.

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Since 1980 STEGO has developed, produced and marketed high quality products for controlling climate inside of control cabinets and enclosures. The products are sold throughout the world under various well-known trade names.

A safe heater for your outdoor enclosure!



Concerned about heater safety? The CR 027 Fan Heater comes standard with an adjustable integrated thermostat and additional safety thermostat. UL recognized.

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