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portable evaporative cooling units

Preventing Heat Stress On the Job to Ensure Worker Safety and Productivity

white paper

Many industries face challenges when it comes to providing a cool working environment, particularly in heat-susceptible areas such as industrial plants, warehouses, manufacturing facilities and outdoor jobsites. These extreme-heat situations can impact worker safety and productivity, and certainly, the company's bottom-line. Without adequate cooling, workers are put in danger while equipment and manufactured products are at an increased risk for failure.

According to the Occupational Safety and Health Association (OSHA), thousands of workers become sick from occupational heat exposure each year. However, heat-related illnesses are preventable. "The best way to prevent heat-related illness is to make the work environment cooler," OSHA states. The dilemma becomes how to effectively and economically cool large, open areas where high-ambient outdoor temperatures and heat-generating machinery are factors.

Weighing the drawbacks of typical cooling methods

Traditionally, air conditioning (A/C) is a go-to cooling method. However, in large open spaces, the first impediment is the inability to close the space off and contain the inside air to achieve maximum cooling. Areas where outside doors will be open, such as in a warehouse, allow air to escape and render A/C an impractical solution. Another drawback is that air conditioners require compressors and a place to ventilate the heat generated from the compressor. This limits the mobility of an A/C unit given the fixed-ductwork and adds another point of heat generation. Harsh refrigerants and energy consumption are other downfalls. Refrigerants are an integral part of air conditioning systems to emit cool air, and A/C can pull a great deal of energy that translates to more energy expense.

Fans – both oscillating and ceiling options – seem like a quick, inexpensive fix to cooling workers and machinery. However, fans simply circulate stagnate air throughout the space. The air is not chilled in any capacity and cannot reach all areas of the large space to be cooled. In fact, industrial ceiling fans seem to be particularly more effective in the winter to improve heating operations by giving airflow to warm air.

An energy-efficient and cost-effective approach

OSHA provides clear guidelines for heat-related illness prevention, listing cooling fans as one of the top "engineering controls" for reducing workers' exposure to heat. Evaporative cooling products are essentially cooling fans that use the naturally occurring process of evaporation to cool warm air and drop temperatures. Evaporative cooling is, quite simply, cooling with water. By evaporating water, the temperature of the air in contact with the liquid water will lower as an endothermic reaction takes place. During this reaction, the liquid water changes to a gas and the temperature of the air lowers. In short, by pulling air across water, the temperature of the air will lower. A control system within the evaporative cooler operates the pump to assist in creating this effect and the fan distributes the cool air. A good example of evaporative cooling at work is the cooling sensation felt when climbing out of a swimming pool, when your body sweats or even when a breeze blows across a lake. That cooling sensation you feel when getting out of the pool is actually the theoretical limit and is known as the wet-bulb temperature. For your given ambient conditions you can find this theoretical limit from a psychrometric chart.

Submitted by Scott Jacobs, PE, Director of Engineering at Port-A-Cool, LLC

An evaporative cooler actually works best with a supply of outside ambient air to deliver a temperature reduction by as much as 30 degrees Fahrenheit. While evaporative coolers achieve significant temperature drops in more

arid climates and drier spaces, they provide relief from the heat in any climate. For example, in regions where relative humidity reaches 70% at midday with temperatures over 90 degrees Fahrenheit, evaporative coolers have been shown to offer noteworthy relief. Given that relative humidity is lowest in the afternoon when the temperature is at its highest, an effective evaporative cooling scenario is achievable.

Example: Evaporative coolers have been proven to deliver a temperature reduction from 8 to 10 degrees in the morning in the highest humidity regions (Miami, New Orleans, or Boston), and up to 12 to 15 degrees later in the day when the relative humidity goes down as the temperature goes up.

The technology at the center of an evaporative cooling system is the cellulose pad that collects water. Air passes through the pads and is cooled as the water evaporates. The cellulose pad material is specially treated to prevent deterioration as well as ensure a long service life. A special water distribution system spreads water over the surface of the pad within the cooling unit to ensure a uniform water supply. This keeps the entire air-contact surface of the pad thoroughly wet. A control system operates the water pump and distributes the cool air.

Today's evaporative coolers are not yester year's swamp coolers

While evaporative coolers use the same general principles as antiquated swamp coolers, the technology of modern-day evaporative coolers has evolved to become much more energy efficient and effective. It can be said that an evaporative cooler's operation hinges squarely on the pad technology. A quality pad, manufactured in a trustworthy facility by expertly trained technicians, is an important element to selecting a long-lasting evaporative cooler. The best pads have been treated during their curing process to maximize the interaction between air and water for superior cooling. Additionally, with improved design efficiency, today's evaporative coolers are among the most energy-efficient cooling methods available. Many require the same amount of electricity used to run standard household appliances and operate for pennies an hour.

Selecting the right evaporative cooler for the space

Size. Evaporative coolers are available in a variety of sizes, making it simple to customize cooling for both indoor and outdoor spaces. Units are typically available to accommodate areas ranging from 500 to 4,000 square feet. To cool even larger areas, two or more evaporative coolers can be used together to create a comfortable environment.

Portability and easy control functions. Portability is an enormous benefit of evaporative coolers. With heavy-duty casters, evaporative cooling units can be easily moved from smooth to rough terrain by one person. Water hose connections also enhance mobility, as there is no need to stay near a faucet in order to refill the water reservoir. Manufacturer. When researching and selecting the best evaporative cooler for your needs, a great place to begin is with the manufacturer. Choose a company that manufacturers their own parts in reputable facilities. Be certain to understand the kinds of pads and cooling technology that is utilized in the evaporative cooler you select. This extra research upfront will provide peace-of-mind in ensuring product longevity.

It is true that most heat-related health problems can be prevented, or at least the risk of developing them can be reduced. Take a proactive approach and begin carefully weighing cooling options. By benefiting the comfort of employees, you are effectively benefiting the company's bottom dollar.

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Scott is a Registered Professional Engineer in Mechanical Engineering with degrees from Kansas State University (BSME), University of Illinois Urbana-Champaign (MSME), and Bradley University (MSEE).

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