

WHITE PAPER:

Cooling Electrical Panels in Waste Water Treatment Applications:

Over the past few decades, the use of sophisticated electronics for automation and process controls as well as transformers, VFDs and PLCs have become commonplace in NEMA enclosures. The thermal management and related costs of these electronic enclosures has become very important considerations in managing these valuable assets.

NEMA cabinets are used for protection from the harsh environments encountered in many industries, both indoors and out. Without some form of cooling, problems will occur with heat sensitive electronics in these enclosures. Most electronics can handle temperatures between 40c and 50c, some more, some less. It is always a good idea to check the manufacturer's specifications regarding the maximum allowable operating temperature of the devices being used; this is key in making the correct thermal decision for your applications.

Also, for outdoor installations, factor in the correct solar heat load, an often overlooked source of heat related failures. As always, the best solution is prevention via some sort of overhang or cover but if this is not possible, an accurate solar load calculation is a must.

The following are the most popular enclosure cooling choices in the marketplace, along with some general cost considerations and assumptions needed to make a good decision.

First and simplest is to purchase a cabinet large enough that it can take full advantage of natural convection to remove waste heat via the cabinet's un-insulated metal walls. However, you might not have the real estate for this option, and it could potentially cost more money than cooling due to the cost of a larger metal cabinet, especially if it is made of stainless steel.

Second would be a filtered fan cooling system. This option is the most economical of all but is not preferred in dirty or humid environments. A filter which is fine enough to block contaminants adequately usually becomes easily clogged and requires frequent preventive maintenance to prevent overheating, and no filter can block humid air entering the panel. The extra maintenance needed to clean the electronics within the cabinet defeats the cost savings of this approach and puts expensive electronics at risk of contamination.

Third is the thermoelectric device. This solid state air conditioner provides effective cooling but requires one watt of power to remove one watt of heat. They are typically used only in very small cabinets and are not very cost effective.

Next are the compressed air coolers. They use plant air to create a 'cyclone' effect that cools the inside of the cabinet. The high cost of your compressed air supply should be considered as well as whether that air is dry and oil-free. Like the fan and filter method, short term gains are often offset by long term maintenance issues and hidden costs.

Air conditioners are the most frequently used cooling method. When electronics first made their way into the plant, air conditioners had to be used because the low thermal thresholds of early electronics required that the devices inside be 'refrigerated' to below ambient conditions. But in today's world, components are made to withstand much more heat without harm or performance de-rating; they do not require 'refrigeration'. Since air conditioning units cost more to install and maintain and use far more energy than most other options and they are being replaced by alternative cooling solutions where possible.

Two of the most cost effective, reliable and energy efficient alternative cooling methods are the air-to-air and air-to-water heat exchanger. Where appropriate, the heat exchanger delivers the best value and ROI due to its low initial cost, negligible power consumption and long life. These designs have become increasingly popular both in new panel installations and retrofit of older panels.

The water industry has a unique advantage with its ability to employ easily available sources of water (typically under 2 GPM) for use in air to water panel coolers. These devices cost pennies on the dollar per BTU/hr compared to all other methods, and are the most 'green' and environmentally friendly solutions as well. Also, this clean but heated water can often be reused in some other process, taking advantage of the heat energy it carries with it.

Whatever your requirements, look at the long term energy and maintenance costs as well as initial purchase price in evaluating your panel cooling alternatives. The initial cost is known, but you should probably assume that operating and energy costs will only continue to climb. Therefore, give them serious consideration in making your decision.

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