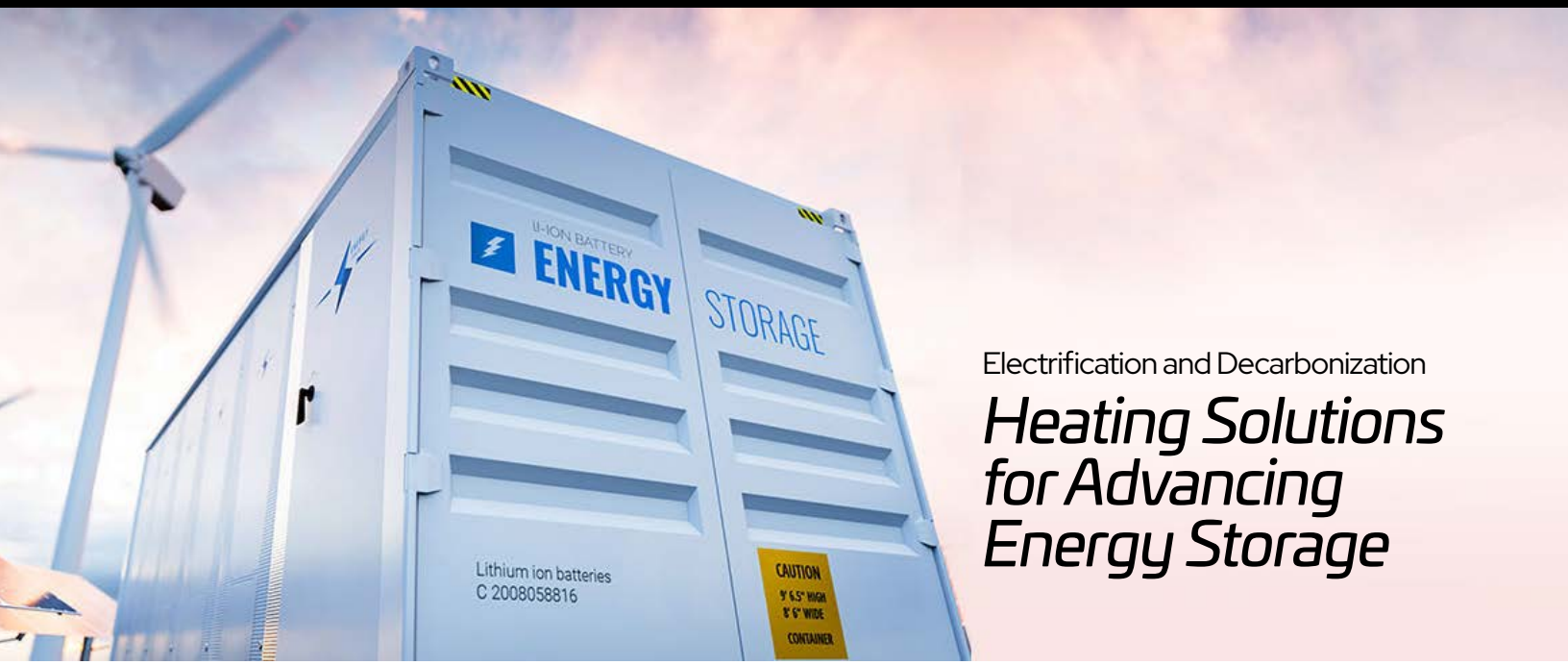
TUTCO HEATING SOLUTIONS GROUP

TUTCONNECT

TUTCO FARNAM | TUTCO SUREHEAT | TUTCO CONDUCTIVE | APRIL 2024



Electrification and Decarbonization

Heating Solutions for Advancing Energy Storage

In the pursuit of sustainable energy solutions, electric heat emerges as a crucial component, driving innovation in energy storage applications. The transition towards renewable energy emphasizes the necessity of advanced energy storage systems, pivotal in achieving carbon neutrality and sustainable decarbonization. TUTCO SureHeat offers cutting-edge heating solutions tailored to meet the evolving needs of industries embracing energy storage across various applications.

Our heating solutions enable the utilization of thermal energy storage (TES) systems, employing heat as a medium to store and release energy efficiently. These systems, utilizing molten salt or phase change materials (PCMs), provide a flexible and sustainable alternative to traditional storage technologies. Molten salt systems, for instance, utilize thermal heat to melt and store salts during periods of surplus energy production, subsequently generating electricity during peak demand. This approach enhances grid stability and facilitates the integration of renewable energy sources, mitigating intermittency issues associated with solar and wind power.

Furthermore, our heating solutions cater to sensible energy storage applications, where heat is stored in materials with noticeable temperature changes. From regulating temperature variations in water tanks to industrial processes, TUTCO SureHeat products offer sustainable solutions for enhancing energy efficiency and promoting environmental sustainability.

Innovative approaches like latent energy storage are also within our expertise. By aiding in the storage and retrieval of thermal energy during phase changes, our heating solutions contribute to efficient energy storage in materials with high latent heat capacities. This method, utilizing materials like water/ice and salt hydrates, ensures reliable and versatile energy storage solutions for diverse applications.

Thermochemical energy storage represents another frontier in sustainable energy solutions. TUTCO SureHeat provides heating solutions for thermochemical systems, which absorb or release heat during chemical transformations. Leveraging materials with reversible reactions, such as metal oxides or salts, these systems offer extended storage durations, addressing the intermittency challenges of renewable energy sources.

As the demand for sustainable energy solutions continues to rise, TUTCO SureHeat remains committed to providing reliable heating solutions for energy storage applications. With our track record of performance and reliability, we empower companies to embrace emerging technologies and drive the transition towards a sustainable energy future.

READ MORE ON ELECTRIFICATION

Why Do Our Heaters Have an Upper Temperature Limit?

by Ian Renwick

One of our readers recently wrote in to ask why heaters have an upper temperature limit. Great question. While there are many factors that determine a heaters upper temperature limit, understanding temperature limitations in a heater is essential for maximizing heater performance and ensuring safety.

Electric heaters are limited in temperature by the properties of the materials they're built from. Materials' properties change with temperature, and they can only take so much abuse (heat) before their properties are not able to behave in the manner intended. There are two types of changes in temperature that happen to materials in the way of degradation: excessive oxidation or dielectric breakdown.

Very quickly put, the metallic parts of a heater fail due to oxidation. That's when materials either break, as in snap or separate, or allow a path for electricity to get from the heating circuit to a component that should be electrically insulated, like the heater sheath. Dielectric breakdown occurs when an insulating material does not insulate as it once did, resulting in a short from the circuit to the sheath or between live components.

A lot of the design of a heater has to do with preventing electricity from flowing where it shouldn't, like from the circuit to ground. That's one definition of heater failure. It's one thing to burn yourself from touching an energized heater (silly person), but it's another altogether if you were to get electrocuted. That's why there are safeties in place in our homes and businesses to protect us, mostly as ground-fault circuit interrupters (GFCI) or Residual Current Device (RCD).

The dielectric strength of an insulating material, which is its ability to prevent electricity from flowing through it, decreases with temperature. That's just the nature of the beast and there's nothing we can do about it. We're talking about ceramic materials, magnesium oxide powder which is used as an electrical insulator in cartridge heaters, and mica or aluminum oxide used in band heaters. Insulating materials don't become full-on conductors when they get too hot but they can allow too much current to flow through them, resulting in a short, usually to ground. That leakage current can initially be as small as a few milliamps, but it is still dangerous. That decrease in dielectric strength at higher temperatures is something that limits the upper temperature of a heater. The change in the insulating properties of a material depends on the material itself, often expressed in volts/mil, and its temperature.

Oxidation occurs when oxygen in the atmosphere combines with metal components altering the material. A shiny new nail that's been exposed to the elements over many years becomes an old rusty nail. That rust is the oxidation the nail has been subjected to where the iron in the nail turned into iron oxide, giving it that characteristic dark orange rust color. Iron oxide is not iron and it doesn't have the same properties as iron. If you were to hammer an iron nail and a stainless steel nail into a fencepost and leave them alone for several years you would return to find that the iron nail had rusted and was darker in color and that the stainless steel nail was as shiny and new looking as the day it was placed there. That's great. Stainless steel doesn't rust. Or does it? At room temperature stainless steel doesn't rust. Get it hot enough though, and it will indeed oxidize and degrade. Oxidation occurs faster at higher temperatures, even with materials that are designed to resist oxidation, making things challenging for electric heating elements. There are other, even higher oxidation-resistant materials like Incoloy and Inconel that oxidize too, but it takes a few more hundred degrees (°F) to get them to oxidize. That shady straw color that appears on a heater even if it's only reached 500 or 600°F is a thin oxide layer. At that level, things aren't too bad. It's when you get to the 1100°F or 1200°F range (and above) that things start to get a bit dicey. Oxidation on resistance wire can cause it to break. Oxidation on resistance wire and the inside of a heater sheath can create a conductive path between the two. The first failure mode occurs when the oxidation degrades the integrity of the resistance wire, allowing it to break. The second failure mode occurs when the oxide layer gets so thick, both growing inward from the sheath and outward from the resistance wire, that the two surfaces get close enough to each other to allow electricity to flow. That's a failure to ground.

Continue on next page

ASK IAN CONTINUED...

Oxidation is not always bad. It does provide an airtight seal over the material that was originally oxidizing, thereby preventing it from oxidizing any further. The oxide actually becomes an airtight protective layer. If a heater is left on and held at a fairly constant temperature it's a lot better than cycling it between hot and cold many times. With cycling, that oxide layer can crack, exposing the inside unoxidized material to air, meaning it will oxidize further when it next gets to a high temperature.

There are many varieties of resistance wire alloys, and many of them are developed for resistance to the formation of oxides. Chromium and aluminum are common alloying agents that create tough oxide layers that are less prone to cracking from thermal cycling.

The best thing to do in order to lessen the occurrence of these types of failures, be it from dielectric breakdown or oxidation, is to not operate a heater as hot as it can. A heater in a large heatsink in a tight fitting hole or clamped tightly around a large mass (and retightened once at temperature to take up the slack from thermal expansion) will help pull heat away from the heater quickly, getting it to where it needs to go away from the heater and putting less stress on it. As counterintuitive as this may sound, one of the worst things for a heater is heat. Operating a heater as coolly as possible will prevent early heater failures as discussed here and prolong heater life.

READ MORE ASK IANS

Engineering Insight

TUTCO Farnam Insulation Blankets

TUTCO Farnam is creating efficiencies to reduce the consumption of fossil fuel energy

TUTCO Farnam high-temperature insulation blankets, specifically tailored for our Flow Torch™ family of heaters, offer a multitude of benefits for your heating applications. These practical and cost-effective solutions drive efficiency improvements, enhancing the performance and safety of our heaters through reduced surface temperatures, improved safety measures, and significant cost savings.

Efficiency from Installation to Operation

The installation process of our insulation blankets is designed for maximum efficiency. With a quick and straightforward setup, the blankets can be effortlessly wrapped around the outside diameter of the Flow Torch® and secured in place using integral straps and D-rings. In just seconds, your heater is fully insulated and primed for operation, minimizing downtime and maximizing productivity.

Crafted for Durability and Heat Resistance

Our insulation blankets are meticulously crafted from high-quality materials, ensuring durability and resilience in the face of extreme temperatures. The interior face, constructed of Vextra high-temperature textile, can withstand continuous use at temperatures of up to 1000°F. Filled with a needled non-woven fiberglass mat, also rated for continuous temperatures of 1000°F (with excursions up to 1200°F), and coated with flame-retardant silicone rubber on the exterior surface, our blankets offer enhanced resistance to abrasion, tears, and punctures, ensuring longevity and reliability in demanding environments.

Enhanced Safety Measures

A significant benefit of utilizing insulation blankets is the enhancement of safety measures in your workplace. By effectively reducing surface temperatures, these blankets eliminate the risk of accidental burns. For instance, with our insulation blankets installed, the maximum outside surface temperature of the Flow Torch heater is dramatically reduced to only 110°F, even when exhaust temperatures soar to 500°F. This substantial decrease in temperature ensures a safer working environment for operators, mitigating potential hazards and promoting peace of mind.

Cost Savings through Efficiency

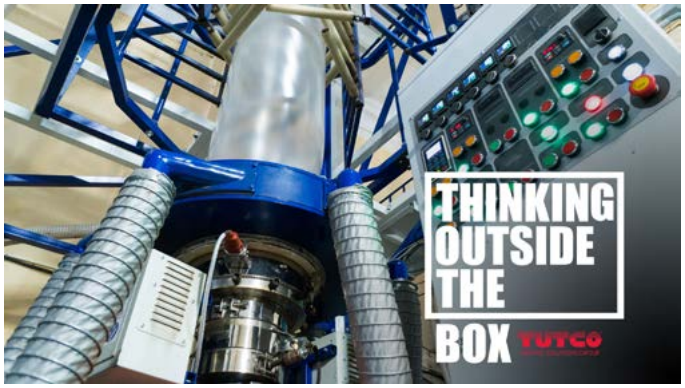
In addition to bolstering safety measures, insulation blankets deliver notable cost-saving advantages by minimizing heat loss and optimizing energy efficiency. Through meticulous calculations, we have determined that the utilization of insulation blankets can lead to significant savings in heat loss, resulting in substantial cost reductions over time. By efficiently retaining heat and minimizing energy waste, our insulation blankets offer a practical and economical solution for optimizing operational costs while maximizing performance.

Experience the Efficiency Advantage

Experience the advantages of TUTCO Farnam insulation blankets and discover why incorporating them into your heating applications makes perfect sense. From streamlined installation processes to enhanced safety measures and substantial cost savings, our insulation blankets are engineered to drive efficiency improvements and deliver exceptional performance for your heating needs.

READ MORE

The Perfect Heater for a Blown Film Application



A blown film manufacturer approached TUTCO with a unique requirement for special machined heater assemblies to be used in a specific process that did not have common off-the-shelf options. The challenge was to find heaters that could fit within a very limited space, ruling out the possibility of using cast heaters due to their space-consuming casting process. Additionally, the heaters needed to deliver high temperatures and a substantial heater output to meet the application's demands.

To address the customer's specific needs, TUTCO designed a special tubular heater assembly that offered versatility and customizability. This innovative assembly could be manufactured in various sizes to suit the specific requirements of the application. The tubular element was expertly positioned within a precision-machined part, and a cover was securely welded in place over the element, creating a fully enclosed heater assembly.

The unique design of the tubular heater assembly allowed it to fit perfectly within the limited envelope available, providing an efficient and compact heating solution. The machined part and the enclosure offered excellent thermal insulation, ensuring that the generated heat was directed to the desired location, optimizing the heating process. By providing a tailored solution with the special tubular heater assembly, TUTCO enabled the blown film manufacturer to overcome the challenges posed by space constraints and demanding heating specifications.

MORE THINKING OUTSIDE THE BOX

Feature Video

TUTCO Farnam's Mica Surface Heaters

In this month's feature video, National Sales Manager, AJ Nidek provides an overview of the features and benefits of TUTCO Farnam's Mica Surface Heaters

TUTCO Farnam's mica surface heaters offer unparalleled durability in a sleek, flat design. Capable of reaching temperatures up to 1200°F, these heaters provide rapid heating and cooling cycles while ensuring uniform heat distribution across surfaces. Built to withstand rugged conditions, mica surface heaters can be tailored to suit a wide range of applications.
In this month's featured video, explore the versatility and efficiency of these adaptable heater solutions, commonly employed in hot plates, sealing bars, and heat presses. Cost-effective and reliable, mica surface heaters enhance product performance and longevity. With a low watt density, they extend the lifespan of the heater while reducing power consumption. Their ribbon wound design outperforms etched foil in applications requiring flexibility, making them the ideal choice for dynamic heating requirements.

WATCH THE VIDEO