TUTCONNECT

INSIDE THIS ISSUE

Unmatched Expertise in Electric Heat

TUTCO continues to lead the way in the transition to electric heat

TUTCO is at the forefront of electric heating technologies, leading the industry with unmatched expertise and a global footprint that spans continents. Holding over 80% of the world's patents in electric heating, TUTCO is the name that industries trust for innovative and reliable solutions.

TUTCO's engineering expertise covers a wide array of applications, including process air heating, conductive heating elements, duct and HVAC heating, and high-temperature process solutions. Whether it's heating air or inert gases, designing for applications that require conductive or flexible heaters, or creating custom solutions for large industrial processes, TUTCO's solutions are tailored to enhance performance and efficiency.

What sets TUTCO apart is the ability to innovate with highly customized solutions. The company's engineers work hand-in-hand with clients to deliver heaters and control products that meet their unique applications. From low-volume production to large-scale manufacturing, TUTCO ensures seamless delivery while maintaining the highest standards of quality.

A Global Network of Expertise

TUTCO's global presence ensures localized support for customers no matter where they are. With engineering and R&D centers in Cookeville, Tennessee; Arden, North Carolina; Exeter, New Hampshire; and Montreal, Canada, each location offers comprehensive support, including customer service and sales.

Beyond North America, TUTCO's facilities in Mexico and China expand its reach, enabling the company to strategically manufacture and ship products globally. This global footprint allows TUTCO to address customer needs quickly and efficiently, even for last-minute, high-priority orders. All told TUTCO's vast manufacturing capabilities include more than 300,000 square feet of space across the globe dedicated to R&D, production,

warehousing, service, and support. This infrastructure ensures TUTCO is always ready to meet the most demanding production schedules.

TUTCO's commitment to quality is further bolstered by strong relationships with raw material providers worldwide. These partnerships guarantee TUTCO priority access to the highest-quality materials, ensuring reliable and consistent results for every product.

Customer-Focused Innovation

At the heart of TUTCO's mission is a dedication to helping customers succeed. By offering localized engineering support and tailored solutions, TUTCO makes it easy for businesses to implement cutting-edge heating technologies. The company's focus on decarbonization initiatives ensures that clients are equipped with sustainable, forward-thinking solutions that align with global energy goals.

TUTCO isn't just a leader in electric heating solutions—it's a company committed to driving in-novation and supporting a cleaner, more sustainable future. With a foundation built on exper-tise, a global footprint, and a customer-first approach, TUTCO continues to redefine what's pos-sible in the world of electric heat.

Learn About Our Custom Solutions Process

Applying Voltage to a Heater Other Than What It's Rated For

by Ian Renwick

If you want to apply a different voltage to a heater than what it was designed for, there are a few things to keep in mind. Safety should be of utmost importance when considering something like this, so always keep it in mind.

It's always, always, always OK to apply a lower voltage to a heater than what it was designed for. You may not get the results you expect, but it's always safe to do so and won't be detrimental to the heater. It's also always OK to apply any voltage frequency you want to a heater as long as there's no additional circuitry involved. Resistive electric heaters don't have frequency ratings, like AC 60 Hz, AC 50 Hz or DC. You can apply a voltage source with any of those ratings (and any other) and be perfectly fine. Electric heaters don't react differently to different voltage frequencies. Technically that's not true, but the inductance that's created is so staggeringly small it can be ignored.

Care should be taken when applying a higher voltage to a heater than what it's rated for. Can you apply 115V to a heater designed for 110V? Very probably. How about 120V. That's the same answer. The difference becomes more evident when a large jump in voltage is being considered. Can you apply 240V to a heater designed to accept 120V? That's a definite 'maybe' and quite likely a 'no'. When you apply a different voltage to a heater you're causing it to generate a different amount of wattage than is marked on the heater.

If you look closely at the small print on a power brick for a laptop you'll see that it can accept anywhere from 100V to 240V AC. That's a huge range for the allowable input voltage. That brick contains circuitry that takes that input AC voltage and converts it to 19V DC that powers your laptop (or something like that). Heating elements are nothing like that. They have a fixed resistance and there is no fancy circuitry in them that will alter the incoming voltage as just described. Think of a heating element as a glorified light bulb (the old fashion incandescent kind) consisting of the element and that's it. When applying a different voltage it follows a square law as to how much power you'll get out of the heater. Double the input voltage and you'll quadruple the power output. Quadruple in the input voltage (think of 480V applied to a 120V heater) and you'll get 16 times the power output. 16 times!!

Here's the rule for calculating what you'll get when you don't apply the expected voltage.
Actual Output Power = (Rated Power) x (Applied Voltage)^2 / (Rated Voltage)^2
The 'Rated' power and voltage are what a heater is expected to produce (rated power) at the expected (rated) voltage.

Here are a few examples:

Take a heater designed to produce 500 watts when 115 volts is applied.

If 110 volts were applied , you would get 500 x 110^2/115^2 = 457.5 watts. That's not bad. It's a little less than what you want but you can probably live with it.

If 120 volts were applied , you would get 500 x 120^2/115^2 = 544.4 watts. That's also not bad. It's a little more than what you want but you can probably live with it too.

If 208 volts were applied , you would get 500 x 208^2/115^2 = 1635.7 watts! Things are getting toasty, and this is most probably NOT a good idea. You're over three times the rated power output. If you've exceeded the watt density limit of the product line, do not proceed.

If 480 volts were applied , you would get 500 x 480^2/115^2 = 8710.8 watts! This is a huge no. No need to explain this one. Don't do it. Don't even think about it.

If 575 volts were applied , you would get 500 x 575^2/115^2 = 12500.0 watts! This is also a huge no, but even bigger.

If 24 volts were applied , you would get 500 x 24^2/115^2 = 21.8 watts! Is it even worth it? Would you even be able to tell if the heater were turned on?

In these instances of excessively high-power output, they might be OK if there's enough surface area of the heater to be able to get the heat away from the heater. All different types of heating elements have a watt density rating which is the wattage output per square inch (or square whatever) of surface area. They all have a limit and if you exceed that limit, you're asking for trouble.

Here's a case in point. Let's say you have a 3/4" OD, 24" long cartridge heater, designed to produce 100 watts at 120 volts. Its purpose is to sit inside an ATM to make sure that the paper bills don't stick to each other when it's bitterly cold outside. That heater has a low watt density of only about 2 W/in^2. At that watt density you can almost hold the energized heater in your hands (please notice the word 'almost'). What would happen if you applied 480 volts to that heater? It would produce 1600 watts of power, giving you a watt density of about 32 W/in^2. That's perfectly fine for a heater of that variety and wouldn't cause any problems at all, for the heater. What about the application

though? Could those paper bills handle a hot heater sitting a few inches away from them? I don't know but I don't want to find out. You've got to consider the effect on the heater but also how it will affect the application.

A 3/4" diameter heater was used in that example because I didn't want to introduce another variable that needs to be considered, and that's the voltage itself. If you're going to increase the voltage to a heater you've got to make sure it can handle that increased voltage from an insulation point of view. A 3/4" heater can take 480V without batting an eye. A 1/4" diameter heater? Not at all. A 1/4" diameter heater would fail when a higher voltage is applied not because of the higher temperature it would experience but the higher voltage it has to be insulated against. That applied voltage is constantly trying to jump from the heater circuit the sheath and that insulation strength is less when there's less distance between life and grounded components and decreases with temperature. When applying a higher voltage to a heater, make sure the heater itself can take the higher voltage.

In that example earlier of a 3/4" OD x 24" long cartridge heater designed to produce 100 watts at 120 volts, let's compare it to a heater with the same dimensions producing 1600 watts at 480 volts. Their internal construction would be absolutely identical; same components, same resistance wire, same winding pitch, same everything. With the exception of the marking on outside of the heaters, they would otherwise be indistinguishable from each other. Heaters don't 'know' if they're going to be connected to 120 volts or 480 volts, just that their resistance is fixed so the wattage produced will be determined by the voltage applied. Just something to think about.

We've discussed a lot about applying a higher voltage to a heater than it's rated for. The general rule in that situation is to simply not do it. Don't try to reason yourself into it and that it'll be fine. There are liability issues that need to be considered as well as the safety issues mentioned earlier. Even if you're SURE that everything will be fine, it's best just not to do it. Speaking of liability, there's also the issue of applying a higher voltage to a heater than what's marked on it. Can you explain that satisfactorily to your customers? Think carefully about it and the consequences. Applying a lower voltage? Have a good time. That's perfectly safe as long as there's no other circuitry that might be affected.

To summarise

- Always consider the safety of what you're doing. This is key not only with the heaters involved, but the application in which they will be used.

- Using a lower voltage than a heater is rated for is always safe. Make sure all precautions used for the rated voltage are also followed when using lower voltage.

- Using a higher voltage should be done cautiously. A small increase in the applied voltage (like applying 120V to a 110V heater) is probably fine, but you should always check. Something like doubling the voltage is generally not a good idea, but possible if certain criteria are met. Be sure the heater can withstand the higher voltage. Be sure the heater can withstand the higher watt density and temperature. Be sure the application can withstand the higher temperature.

- The power output of a heater changes by a square law. Double the voltage and you'll get four times the power. Halve the voltage and you'll be a quarter of the power.

To close, as stated several times, keep it safe. Check your work. If you're unsure of the results of your actions, just don't do it.

Read More Ask Ians

More Than Just a Supplier!

Continuing with the theme from the past couple of months, let's start with inspiration from a fast-food restaurant slogan. A rapidly growing chain, rooted in the heart of the South, has built its reputation on exceptional customer service and is known for responding to every request with the phrase, "My Pleasure." For this company, it's not just a phrase—it's a guiding philosophy. When you walk into their restaurants, you feel welcome, valued, and part of the family, which has been a key to their success.

Here at TUTCO Heating Solutions Group, we take a similar approach. We don't just want to be another vendor or supplier; we want to be your partner and an extension of your team. Since our founding, TUTCO has built a reputation for working with customers in ways that many other companies won't. When you work with us, you're not just dealing with customer service or a sales team. Our engineers and other technical experts are here to collaborate with you whenever needed.

We want you to see our expertise in electric heat as your resource. Often, we provide value not just in the high-quality products we supply but also through the insight and support we offer to ensure your project's success. With over 80 years of experience as a leader in electric heating solutions, we're here to share that knowledge and put it to work for you.

In closing, our goal is simple: we want to be your partner and part of your extended family. When you succeed, we succeed. Let us show you how our experience, extensive product portfolio, and commitment to customization and added value can help make your next project a success. It would truly be our pleasure to partner with you today!

More Thinking Outside the Box

FEATURE PRODUCT

SureHeat Specialty Flanged Inline Heaters

TUTCO SureHeat's Specialty Flanged Inline (SFI) heaters are setting new performance standards for high temperature and high-pressure capability. As industry demand grows for more efficient turbofan engines, reduced emissions, renewable energy, and carbon free heat, SFI's are increasingly playing a critical role. In addition to air, SFI's are designed for use with hydrogen, ammonia, CO2, steam, and various syn gases, for safe and efficient operation.

At the heart of the SFI Heater's success is TUTCO's proprietary Serpentine™ technology, which allows for a compact, lightweight design that significantly reduces the heater's size versus conventional immersion heaters, making it an ideal choice where space is limited. Additionally, the rapid heat-up and cool-down times help reduce operational costs and improve overall efficiency. Whether used on a research test stand, a factory production line, or as part of a thermal energy storage system, SFI Heaters deliver precise and reliable results.

From combustion research and aerospace testing to emissions control and green steel production, SFI Heaters are delivering performance across vital industries worldwide. With their compact design, energy efficiency, and precise controls, they are helping businesses innovate and adapt to a rapidly changing technological landscape.

Some SFI Heater Applications

Aerospace Valve and Component Testing
OEMs and MRO FAA repair stations rely on SFI's reliable and repeatable performance for tests of pneumatic (bleed) valves and other components to ensure they meet exacting FAA and EASA specifications.

Aerospace Turbofan R&D
TUTCO's SFI deliver the most stable and reliable conditions valued by the world's leading turbofan OEMs conducting critical R&D for improving fuel efficiency and lowering emissions.

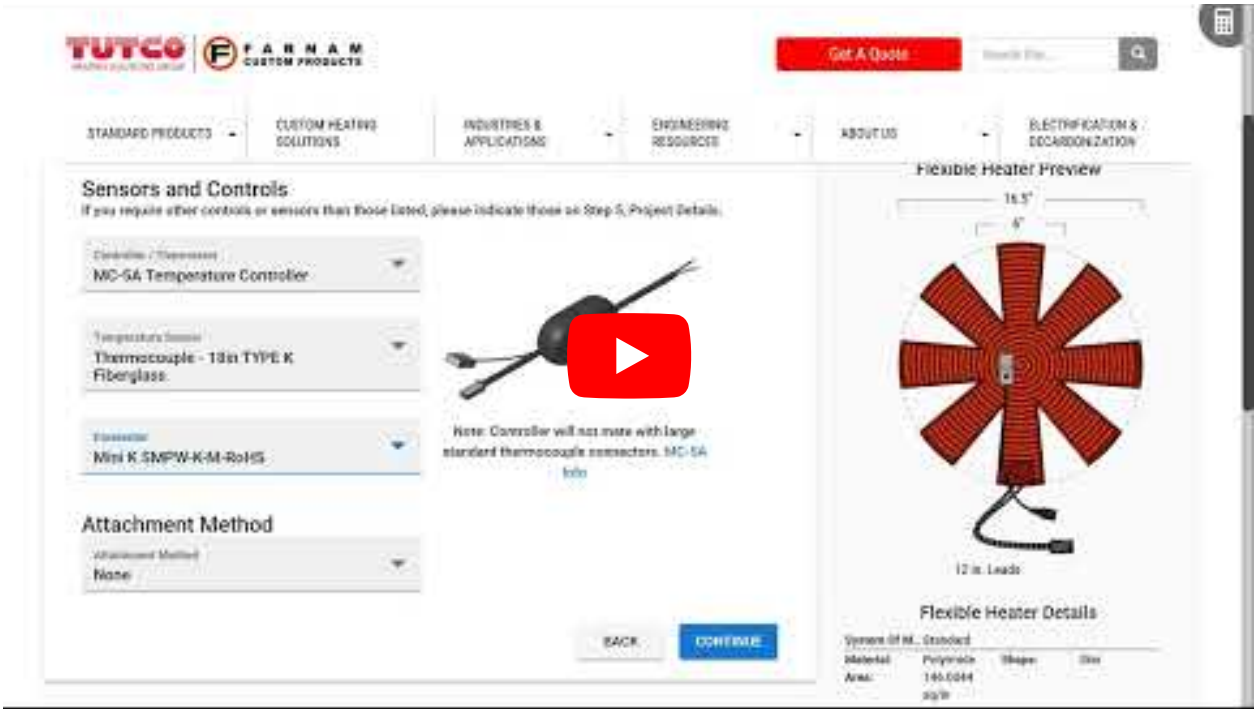
Wind Tunnel Research
SFI heaters ramp to high setpoint temperatures and stabilize in mere seconds which is ideal for testing relying on only minutes of stored capacity of high-pressure air / gas.

Solid Oxide Electrolysis Cells (SOEC)
SFI's are ideal for SOEC's producing hydrogen fuel by delivering high-temperature gases to the cathode and anodes with minimal pressure drop.

Thermal Energy Storage
Our heating solutions enable the utilization of thermal energy storage (TES) systems, employing heat as a medium to store and release energy efficiently.

Emission and Pollution Control
As industries increasingly transition to electrification and strive to minimize their environmental footprint, TUTCO SureHeat heaters are essential for efficient and eco-friendly pollution control.

More on SFI Heaters



FEATURE VIDEO

Flex Spec Online Configuration Tool

Whether you're an OEM, engineer, or designer working to incorporate heat into your products or processes, this video will show you how to easily configure and quote your custom heater using this intuitive tool. The Flex Spec tool simplifies the process of selecting the right flexible heater for your needs, including silicone rubber, polyimide, and mica heaters. The video demonstrates how to input key specifications such as heater type, power requirements (volts and watts), size, and more. It also covers the selection of essential components like sensors, controls, attachment methods, and connectors.

Once your heater is configured to your exact needs, you can save your build or submit it directly for a quote. The tool is designed to streamline the process, helping you get the perfect heating solution for your application, whether it's for adverse conditions or irregularly shaped surfaces. TUTCO Farnam heaters offer a range of customizable solutions for diverse applications. Polyimide (Kapton) heaters are thin, flexible, and precise, providing rapid heat transfer and customizable shapes and sizes. Silicone rubber heaters are durable, flexible, and perfect for applications like freeze protection, process heating, and composite bonding. Mica surface heaters are cost-effective and highly durable, capable of reaching temperatures up to 1200° F for a variety of applications.

Check out the video today to learn more about how TUTCO Farnam's heaters can improve the performance and reliability of your products. With our customizable OEM solutions and expert engineering support, we're here to help you meet your unique heating requirements.

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