TUTCO HEATING SOLUTIONS GROUP

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DECEMBER · 2023

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Electrification and Decarbonization

Wood stove industry warms up to electric heat

The wood stove industry is undergoing a transformational shift, embracing the efficiency and convenience of electric heat to enhance home heating experiences, particularly in colder climates. Traditionally, homeowners in these regions have relied on expansive wood stoves, strategically positioned either at ground level or in basements, to generate warmth throughout their homes.

Typically, these wood stoves utilize blowers to circulate heated air, yet achieving and maintaining the desired temperature swiftly has posed a significant challenge. Recognizing this hurdle, TUTCO has collaborated with numerous customers to introduce an innovative solution—an ultra-efficient open coil electric heater add-on to complement traditional wood stoves.

This groundbreaking electric heater seamlessly integrates with the existing wood stove setup, offering a rapid heating solution while the wood stove itself is gradually reaching optimal temperature. The incorporation of an electric heater is a game-changer, allowing homeowners to enjoy the swift warmth they desire, even during the initial stages of wood stove operation.

Beyond expediting the heating process, the electric heater proves its versatility by effectively dispelling the chill on days when starting a fire in the wood stove may seem excessive. This dual functionality ensures that the home remains comfortably warm, irrespective of whether it's time to ignite the wood stove or simply take the edge off a mildly chilly day.

By providing a custom electric heat solution that mimics the effectiveness of conventional heating systems, TUTCO is at the forefront of this industry evolution. The synergy of wood stove charm and electric heat efficiency not only addresses the longstanding challenges associated with wood stove heating but also elevates the overall comfort and convenience for homeowners in colder climates. As the wood stove industry warms up to this innovative approach, the marriage of tradition and technology brings forth a new era of home heating.

To learn more about energy transition, click here.

All About Tolerances in Conductive Heaters

by Ian Renwick

There are normal variations in the dimensions and electrical properties of heaters we build, and it's good to know what they are so there are no surprises.

First, a few words about tolerances in general. Tolerances are deviations from nominal values, be they lengths or resistance values, in the case of our heaters, that are deemed acceptable. Tolerances exist because of variations in manufacturing processes. Nothing can be manufactured perfectly the same way every time. If you measure closely enough (to enough decimal places), you'll always find a difference between two manufactured parts. Some tolerances are present because of things that we do in the process, like swaging, and others are passed on to us from suppliers that we have to live with, like the resistance tolerance of a spool of resistance wire, measured in Ω/ft.

Varieties of Tolerances we'll cover in this article are: Length, Wattage, Resistance, Diameter, Width, Leadwire Lengths, Protection Lengths, and Camber.

Length: Starting off with Hi-Temp Cartridge Heater lengths, the tolerance of a swaged cartridge heater length is ±2% of its length or 1/8", whichever is larger. For example, the length tolerance of a 12" long heater is 12" x 0.02 = 0.24" or about 1/4". For a 3" long heater, it would be 3 x 0.02 = 0.06". Since 1/8" is larger than 0.06", the tolerance on that heater is 1/8". The reason for that tolerance being length-dependent is because of the swaging operation we perform on every heater. There's a small amount of uncertainty as to the exact length heaters will swage to due to there being so many variables in the components of what is being swaged. That variability results in heaters that, when built and assembled identically, result in slightly different final lengths. That tolerance of ±2% of the length accounts for that variability.

For Standard Cartridge Heaters (unswaged, loose fill heaters), it's a lot easier. The tolerance of the length of those heaters is ±1/16" regardless of the heater length. The reason for that is because we have a lot more control over the heater length. Since the heaters aren't swaged, there's no change in their length during our processing and no predictions of the final length are required. What you cut (to length) is what you get, and we can cut tubing to a precision of 1/16" over a heater of any length. The same applies to Ceramic Strip Heaters, Ultima Strip Heaters, and Permaheat Strip Heaters.

For some band heater and other strip heater dimensions, we have similar control as with Standard Cartridge Heaters. What you cut is what you get. For heaters with widths <=4", the tolerance of that width is ±1/16". For heaters over a 4" width, you're looking at a tolerance of ±1/8". That applies to HT Mica Bands, Better Bands, HT Mica Strip, and Better Strips. The ID tolerance on band heaters, in general, isn't as much of a concern, nor is it as easy to specify because there's spring-back when it comes to forming the ID of a band heater. If your heater clamps around your object properly and clamps tightly in place without the gap shrinking to 0", then you've got a good fit.

Wattage and Resistance: Now we move to an electric property of all heaters. When you purchase a heater at a certain wattage, say 1000 watts at 120 volts, there's a variance on that wattage of +5%/-10%, meaning the wattage could vary from 1050 watts down to 900 watts. The variance actually resides with the resistance where the resistance tolerance is +10%/-5%, which translates to the aforementioned wattage tolerance when a known voltage is applied. The reason for the overall variance is because of the variance in many of the materials we use, along with the processes performed to make your heaters. There's a tolerance of ±5% of the resistance (in Ω/ft) in the plain resistance wire we purchase. There's a variance in the winding process that puts wire around a ceramic core or piece of flat mica. There's a variance in the amount of resistance change when a heater is curved to shape or swaged to diameter. Variances stack up, so we end up with a final resistance range of 15% around the nominal value, whether you're talking about wattage or resistance. We really build resistance devices where we can tell you the wattage you'll get when a certain voltage is applied. We control the resistance as best we can, and knowing the voltage you'll be applying, we can determine the wattage you'll get out of the heater, along with the tolerance of that wattage. Why is the wattage tolerance +5/-10% instead of ±7.5% if the tolerance range is 15%? We do that to be on the safe side. We would rather have a heater operate with a lower wattage than one that's much too high.

(Continued on next page)

Ask Ian Continued

Can we do anything to make the tolerance smaller? Yes, but it's not inexpensive. Sometimes the only way we can do it is by sorting. Finished heaters that do not conform to the tighter tolerance are simply scrapped and built again. That drives up costs, which are then passed on to the end customer. We could also attack the problem further up the production stream by asking our suppliers to provide parts built to a tighter tolerance. Guess what happens? The costs go up. There's always a trade-off, and no such thing as a free lunch.

Diameter: Changing gears again, when it comes to cartridge heater diameters, we size our heaters to an ideal heater size that's slightly undersized to fit into a hole it's intended for, along with a tolerance. For example, a 1/2" diameter hi-temp cartridge heater is actually provided at a 0.495" diameter with a tolerance of 0.002". The heater is named after the hole it fits into, not its actual size. Due to tool availability, it's a lot easier for a machinist to drill a 0.500" diameter hole than a 0.505" diameter hole, which would be required if we provided a heater at 0.500" in diameter. And besides, "a 1/2" diameter heater" rolls off the tongue a lot more easily than "a 0.495" diameter heater.

Click here to see list of diameters for the two varieties of cartridge heaters and their tolerances.

The number in parentheses is the decimal equivalent of the imperial fractional diameter, and the number after the dash is the true size we furnish the heaters, followed by the tolerance. With little exception, we can control the swaged diameter of a hi-temp cartridge heater to ±0.002". For the standard cartridge heaters, we don't swage those heaters, so we're at the mercy of the tubing tolerance as we receive the tubing from the supplier. Those tolerances are typically a bit bigger.
Leadwire: Next is an easy one; Leadwire and Protection Length.

Across all product lines, leadwire lengths may vary as much as +1/-0". Leadwire Protection, like braid and armor, has the same tolerance. We typically provide 2 to 4" more leadwire than the protection length when a difference is not specified, and those tolerances may only become apparent when things get long (say over 3 feet) and stretch of the items (protection, not leadwires) becomes a factor.

Camber: The last item to mention that has a tolerance is something called camber. It pertains only to hi-temp cartridge heaters and is the measurement that the heater is away from being perfectly straight. It's the bow in the heater length that is imparted during the swaging process. If present, it starts becoming noticeable in heaters that are at least about 2 feet long. If you were to roll the heater along a perfectly smooth surface, like a granite surface plate table, you might see a point along the rotation where the gap between the center of the heater length and the table is at a maximum. That gap is the camber and can be measured with a feeler gauge. It should not exceed 0.020" per foot of heater length. There is no need to worry about installing a heater with a slight amount of camber as the heater will flex and straighten as it is inserted into its hole.

As you can see, there are several tolerances to consider when specifying and sizing conductive heating elements. Manufacturing tolerances should be considered to ensure parts fit together properly and behave as expected. If you ever have questions about how heaters will fit into your application properly and if any of the tolerances mentioned here will have an adverse effect on heater performance or life, please contact one of the members of engineering at TUTCO, and we'll get you the information that you need.

MORE FROM ASK IAN

Home brewer sees the proof in TUTCO solution

TUTCO received an interesting request from a customer seeking a heating solution for their home brew moonshine steel kettle to optimize the distilling process. The customer required a band heater that could effectively add heat to the kettle while operating on a standard 120V wall outlet. It was crucial for the heater to be protected from moisture or any potential leakage to ensure safe and efficient operation.

To meet the customer's specific needs, TUTCO proposed the implementation of an HT Mica Band Heater, specially designed for this application. This band heater was equipped with a cord and a standard 120V Male Plug, allowing seamless compatibility with a standard wall outlet. With this setup, the heater would operate safely below the 15A limit of the standard wall plug, guaranteeing optimal performance and safety during the distilling process.

The HT Mica Band Heater boasts high-quality construction and advanced heating technology, making it a perfect fit for the home brewing setup. The mica insulation provides excellent thermal efficiency, ensuring uniform heat distribution throughout the steel kettle. Its robust design ensures long-lasting performance, even under demanding conditions, providing reliable and consistent heating for the distilling process.

MORE THINKING OUTSIDE THE BOX

TUTCO

Closed-Loop Control Panels

FEATURES	
Volts	120V, 208V, 240V, 277V, 400V, 480V
AMPS	30 to 60 AMP options
Phase	Single and Three Phase
Temperature Controller	Eurotherm
Communication	LAN Connection
Emergency Stop	E-stop button

To enhance the efficiency and reliability of TUTCO electric air heaters, we highly recommend the use of our closed-loop control panels. Specifically designed for industrial facilities and OEM solutions, these controllers comply with all necessary industry safety standards and integrate the latest advancements in heater controls and safety features, including LAN connectivity for effective communications, to provide users with a robust and versatile solution for their temperature control needs.

TUTCO's closed-loop heater control panels incorporate power controllers, a temperature controller, and thermocouples, providing continuous monitoring to sustain constant output voltages despite fluctuations in airflow. This ensures the heater's stability, upholding processes and safeguarding its functionality. Our temperature controllers not only conveniently display air temperature but also allow on-site adjustments based on your application's requirements.

Electric air heaters are integral components of a well-balanced and durable system. Without the proper control setup, electric coil heaters may experience premature failures due to overshoot from voltage control issues. Not all thermal designed systems are created equal. The most effective way to ensure your heater element performs as expected is by purchasing a TUTCO closed-loop control panel to use with your heater.

For industrial processes and other critical applications, the TUTCO Control Panel exemplifies our commitment to cutting-edge technology, providing users with precise control and consistent performance in managing their thermal processes.

LEARN MORE

Feature Video

TUTCO Farnam's Cool Touch™ Heaters

TUTCO Farnam's highly efficient Cool Touch™ family of heaters minimize the temperature on the exterior skin of the heater creating safer working conditions for personnel and limiting the impact of high heat on nearby equipment. Based on our Flow Torch heaters, the Cool Touch triple-pass design is very efficient in reducing heat loss. With its large thermal storage capacity, the Cool Touch™ is particularly useful for applications requiring intermittent use and rapid response times. The Cool Touch™ is available in three model sizes, 050, 150, and 200. We provide pressure testing for any of our Cool Touch™ products as an add-on service.

WATCH THE VIDEO

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