

# PTC Heating

## Introduction

Heating applications are often unique, requiring a specific solution matched to the industry and process being utilized. Heating the interior of a delivery vehicle requires a different solution than the interior space of a warehouse or an outdoor charging unit.

As a result, the heating industry is often segmented according to the technology being used and the application with which that technology will be paired. This can make it harder for design engineers to find the ideal solution to match the needs of their newest project - especially if there are exceptionally tight tolerances that need to be met by an existing system.

To help you select and match the right solution to your specific needs, this guide has been developed, showcasing different heating options and the situations in which solutions like positive temperature coefficient heating will meet those diverse, specific needs in ways traditional heating systems cannot.

You will also find links to additional information that can be accessed on the [PelonisTechnologies.com](http://PelonisTechnologies.com) website, including specific product information related to the very precise needs you may have for your applications.

# Heating Applications

Heating systems vary depending on a number of factors, most notably the size and cost of the system for which it is being selected. A medical device that requires near-exact, pin-point temperature control requires a safe, energy efficient system that will provide precise temperature management often coupled with a cooling system to ensure minimal variations.

That's why there are so many options in the heating industry. To show the range of heating solutions currently available, here is a select list of applications and how heating systems must be customized to fit their very specific needs.

**Household Heating** Household heating refers to water heating, boiler or furnace heating, and any other heating system utilized in a home to maintain comfort levels for all occupants. Because household heating relies on the thermal conduction of the home, as well as a number of other limiting factors, it can use larger, less precise systems that have energy saving solutions built into them.

This includes heating systems such as forced air heating, radiant heating, geothermal heating, and solar water heating that all use imprecise energy sources and a thermostat to create comfortable environments.

**Heating in Transportation** In transportation applications, heating has traditionally relied on electric, fixed resistance heating elements and thermostats for control. This allows the system to utilize the built-in power source for the vehicle while providing steady heating for the interior space. The cost of maintaining these systems is manageable on a small scale, though for large scale operation - such as a fleet of delivery trucks, airplanes, trains, or taxi-cabs - it can get quite costly.

Especially in an open air environment, such as a mail truck or golf cart, heating can greatly increase energy consumption for the vehicle, resulting in a higher than acceptable cost to operate. It's for this reason that a number of such vehicles to date do not have heating systems installed.



**Portable and Electronic Devices** While most portable devices produce plenty of their own heat and only require a cooling system, there are some portable, electronic, and medical devices that require careful temperature modulation. Whether it's an electric blanket in a hospital, a device that must be kept above room temperature, or a life assist module that requires a certain degree of heating, there are a number of different options that will make it almost vital that a more precise heating system is used.

Traditional electric heating elements are too imprecise, costly, and potentially dangerous for these types of systems, which is why newer technologies like positive temperature coefficient (PTC) heating are becoming a viable solution.

**Outdoor Applications** Until very recently, technology was not sufficient to provide efficient heating in outdoor spaces. The energy loss associated with a heating system that radiated heat and constantly consumed energy was too high for heating outdoor work sites, back yards, or other open spaces.

Recent technologies have advanced to the point that this is quickly becoming a viable option. Infrared heating technology allows targeted heating of a specific area in an outdoor setting, reducing the cost from energy consumption and increasing comfort level. At the same time, embeddable PTC heating elements are nearly as effective, offering self-regulating heating solutions in targeting areas.

**Diverse Applications Have Diverse Needs** Because each of the applications listed above is different and has a very different need, there are numerous solutions for each. The next section will discuss how to select a system based on certain criteria as they relate to these specific applications.

In addition, there are certain factors and new technologies that make it possible to select custom heating solutions for diverse applications that may not match any of those listed above. In such situations it is important to have a clear understanding of what your options are and, more importantly, how the right selection process can help you choose something that will fit those needs precisely.

# Selection Criteria for Small Scale Heating Systems

While every system has different requirements, there are a number of selection criteria that must be considered in every design. These factors can have a direct impact on the cost, efficiency, size, and usability of a finished product, all of which make it necessary for careful analysis of the best possible solutions for your needs.

Specific criteria you may consider when choosing a heating system include:

**Energy Efficiency** Energy efficiency is a vital component in any heating system. Traditional heating has long consumed more energy than is necessary. Combustion heating, and electrical heating using a heating element are both highly inefficient because of the lack of precision in the heating system. Energy is poured into the system until a secondary system, either a thermostat or a human user, determines it is sufficient and shuts down the heating system. This can be extremely costly in large applications or when multiple systems need to be heated regularly, such as a fleet of delivery trucks, trains, or airplanes.

**Safety in Overheating** Because most heating systems rely on a secondary limiting device like a thermostat, there is a risk of failure. If a thermostat stops working or if other limiting devices or systems become inoperative, the system can overheat, continuing to pour energy into the heating elements until it reaches an unsafe level. In many systems, such as a water heater or household heating system, this is at worst damaging and costly. But in certain applications, such as in transportation, or when there is a high cost of maintenance, it can be a huge issue that leads to extremely costly repairs or possibly dangerous conditions.



**Size and Scalability** Because of how traditional heating systems are constructed they are often limited in size. Projects must take into consideration the sizes available for the heating systems that match the application. Custom solutions in traditional heating elements are even more costly and can prove a cumbersome design issue in the long term. Certain systems are more flexible, including PTC heating technology that can be embedded in smaller spaces and with more customizable space considerations than the average heating system.

**Lifetime Maintenance** One of the major benefits of lighter weight heating systems such as PTC heating is that the lifetime maintenance costs are lower. Because it is self-limiting and uses less energy, it is far less likely to overheat or short out in the long term, whereas a more traditional heating system can experience conditions like this multiple times, to the point of costly damages and repairs being needed on a regular basis.

**Integration with Cooling Systems** In certain applications, heating systems need to be more flexible, working in tandem with cooling systems to maintain a very precise temperature for operation. Whether it's a medical device, electronic system, or vehicle, it's important that the technology being used can be carefully integrated with that of a cooling system that matches it in terms of efficiency and power consumption.

**Cost of Operation** In addition to the amount of energy consumed, there are other factors to consider, such as the risk of repairs being needed and the overall maintenance requirements of a heating system. Most heating systems are rated for a certain lifespan, but to maintain that, a certain degree of maintenance is expected and must be fulfilled to keep the system operating properly. The type of system you choose will impact how big a factor this becomes for you over the lifetime of the system.

Each of these factors has a direct impact on how effective a given heating solution will be for your application and should be considered as such when choosing the right option for your next system design.

# The Diverse Applications of PTC Heating

While there are a number of situations in which traditional element-based heating systems will work perfectly, there are many others in which safety, efficiency, and pinpoint control are important enough that something better is needed. That's where positive temperature coefficient (PTC) heating can be a viable alternative.

PTC technology is unique in many ways, allowing it to more effectively self-regulate temperature and reduce the potential risk of overheating in sensitive applications. PTC works as a semiconductor sensitive to temperature change. Made from polycrystalline ceramic with a basis of barium titanate, the PTC heating system can have a defined maximum temperature for which resistance increases sharply in the thermistors as the temperature is approached.

This self-regulating property makes a PTC heating element a safe alternative for situations in which overheating could be incredibly dangerous or costly. Not only does the system self-regulate - it manages power-input to match the specific heat output requested by the user. This reduces energy consumption and results in a system that is not only more efficient but safer in how it uses that energy, all without requiring a secondary limiting system.



# How PTC Heating Elements Are Constructed

A PTC element is metallized on the heating surface, allowing lead wires to be soldered directly to the PTC-pellet. The pellet and lead wire contact are then embedded in silicone that has a naturally high heat transfer rate combined with high insulation capacity. The insulation used for the system will depend almost entirely on the application, size of the PTC heating element, and a number of other design-related factors, both in stock PTC heaters and custom designed systems for unique applications.

The reason PTC heating is such an effective solution for so many very specific applications, is that it can be customized so effectively to the layout, size, shape, and point-of-heating required by the design engineer. The resulting system can be heated to match the direct needs of the customer, whether it's a multi-stage heating system or a highly sensitive system that can fluctuate to match the heating requirements of the device actively, as the system is used.

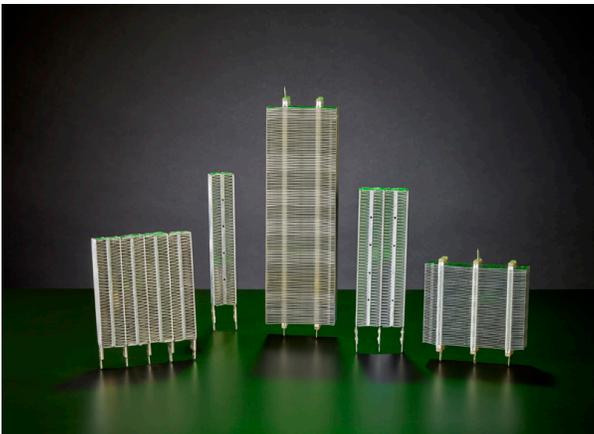


# Choosing the Right PTC Heating Solution

When the time comes to choose a heating solution for your application, there will undoubtedly be a number of factors to consider. Whether it's a very precise heating system that must work in tandem with your cooling system to maintain a specific temperature at all times or you are interested in something that will cut the cost of heating for an entire line of products or fleet of vehicles, it's important that you choose something that fits your needs.

PTC heating is a good solution in many situations - offering the sort of pin-point control that you won't find in other systems. But to know for certain whether it is the right solution for your needs, you need a professional who can help you customize your system and choose the right option to fit the very specific needs of that application.

If you are at this point and need to discuss your heating needs and the factors that will go into the development of your next product, contact the experts of Pelonis Technologies. We offer a full range of PTC heating systems, as well as customizable solutions to fit the very specific needs of your system.



# About Pelonis

Pelonis Technologies, Inc. (“PTI”) is a leading manufacturer of axial AC and brushless DC fans and motors specializing in high technology and Original Equipment Manufacturing solutions. Our unique competitive advantage in Flexible Manufacturing Efficiency enables us to produce high quality innovative products at lower costs and has made us a preferred vendor within our industry.

We manufacture and test our products based on the highest standards of quality and reliability. Our ISO-certified production facilities employ flexible manufacturing techniques that enable us to respond quickly and efficiently to large- and small-scale production requirements.

With over 25 years of product development and manufacturing experience, Pelonis Technologies’ management team and engineers are committed to providing exceptional quality, product innovation, and service at competitive pricing. Our company’s passion is to improve existing products and to develop new applications that benefit our customers and their constantly changing needs. This dedication has enabled Pelonis Technologies to build long-term partnerships with our global customers. Valued PTI customers come from a variety of sectors, including medical equipment, aerospace & defense, heating & air-conditioning, automotive, and appliances.