# Heat Loss Factors

*By:* - October 05, 2020

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Understanding the factors that influence heat loss allows you to better calculate the insulation and power needed to heat your product. By troubleshooting any inefficiencies and reducing heat loss you can make your heating system more efficient. In this article we explore the factors related to heat loss and provide graphs to assist in calculating your current or projected heat loss.

## Factors that affect heat loss

Heat loss is the intentional or unintentional movement of heat from one material to another. This can happen through conduction, convection and radiation. Conduction often occurs when an insulated or uninsulated component is in direct contact with another component. Convection occurs when your pipe, electric heater or other component has an air barrier around it. Radiation occurs when there is no contact and heat moves as waves.

At Watlow, we make sure you select the power and temperature controllers that best fit your heating situation. One way to do this is to account for common heat loss factors. While every situation may have different factors that affect heat loss and heat transfer, here are some common areas of heat loss that design engineers need to account for with their heating products:

- Uninsulated surfaces
- Vertical or horizontal insulated surfaces
- Water surfaces

- Oil or paraffin surfaces
- Wind velocity effects

These effects are cumulative, so an uninsulated pipe running partially through oil and partially through exposed outdoor air needs to include all three of these heat loss elements when making a calculation. Heat loss is an inefficiency. Adjusting the temperature of your heater or protecting it from one or more of these heat loss factors can reduce the wattage usage of your system. This can save your facility a considerable amount in daily operating expenses.

Factors that influence heat loss can change when you relocate a process or make changes to your assembly line. Targeting the heat loss factors and making necessary adjustments with your controlling equipment or insulation strategies keeps your application operating at the same quality and consistency as it was before the change.

Calculating the heat loss of a system also helps you identify the correct product for a new line. Before you use our product selector (https://www.watlow.com/en/app-guide), calculate the expected heat loss based on the location, insulation type and material being heated. These are crucial factors that may affect the size and type of heating unit used in your industrial process.

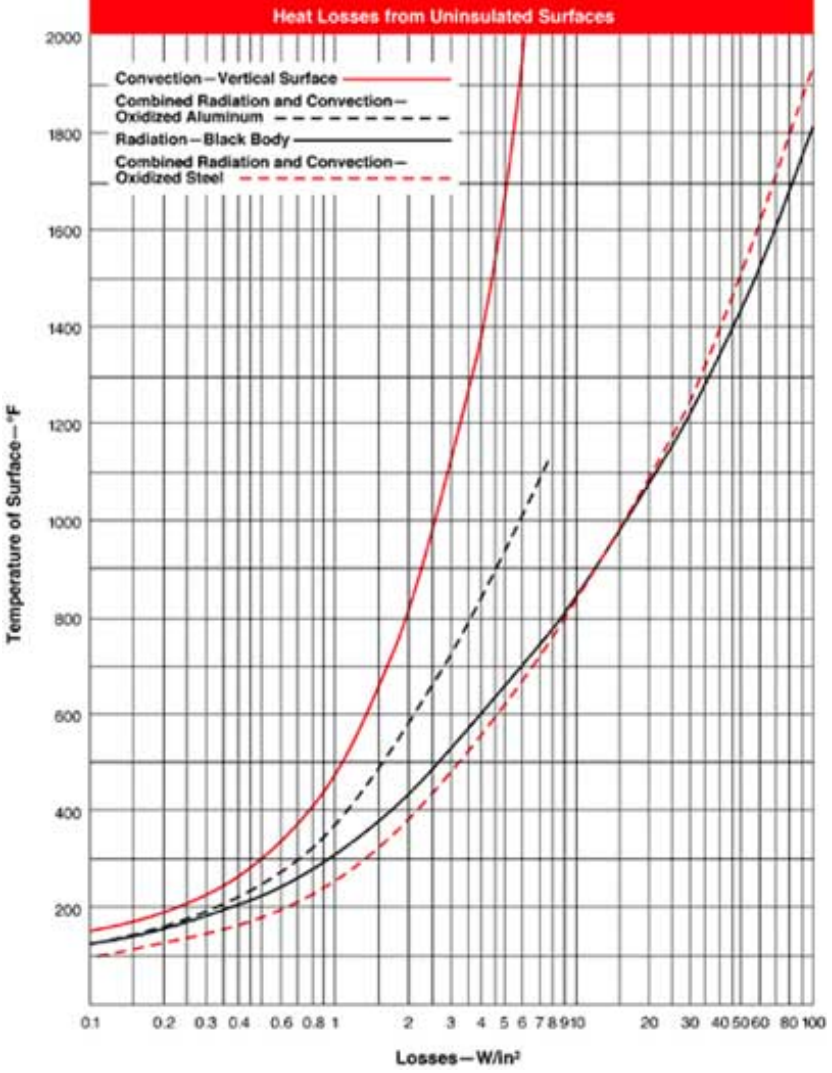
## How emissivity affects heat loss

Emissivity is defined as the ability of a particular object or material to emit infrared energy. The emissivity of your heater, thermocouple and insulation can, therefore, affect the heat loss by radiation.

This is another piece of the puzzle when determining how much heat you need (https://www.watlow.com/blog/posts/how-much-heat-do-you-need) for your specific application. Explore the emissivity of the material in your heating process. Be sure to include whether the material is a polished surface or has medium or heavy oxide. Even non-metals have emissivity, so check on the specific heat of insulation materials to see how they can affect your overall heat loss.

## How to calculate heat loss factors

At Watlow, we offer a number of heat loss graphs (https://www.watlow.com/resources-and-support/engineering-tools/reference-data/heat-loss-factors-and-graphs) to assist you with calculating the changes in temperature in your specific application. Multiply the convection curve value by a factor of 1.29 for horizontal heating products. Vertical pipes should use the direct value of the curve. For bottom surfaces, multiple the curve by 0.63.

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This calculation does not take into account the many heat loss factors that may affect your product. OEMs need a more accurate way to measure heat loss for their specific product, so alterations need to be made, called emissivity values.

Using this graph is helpful at high temperatures, but as the temperature reaches ambient, or 70 degrees Fahrenheit, it can be difficult to read. There are two general rules that can help you arrive at a more precise temperature reading:

1. Calculate losses from an uninsulated surface with close to 1.0 emissivity by dividing the temperature rise above ambient by 200.
2. Calculate losses from an insulated surface with an approximate thickness of one inch and K- value of 0.5 BT-in/hr-ft2-℉ by dividing the rise above ambient temperature by 950.

These calculations need to be adjusted based on emissivity and insulation rating of your product, but they can assist you in using the above graph more effectively.

## How heat loss affects your industrial process

Heat loss factors not only help you adjust your power and temperature controllers, but also find the ideal heater for your process. Browse our heating products (https://www.watlow.com/en/products/heaters) to compare wattages, materials and other factors. Whether you are shopping for a new PID controller (/en/products/controllers/temperature-and-process-controllers), heater or simply looking to improve the efficiency of your process, Watlow has the products and technical guides to help you understand and manage heat loss factors.


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