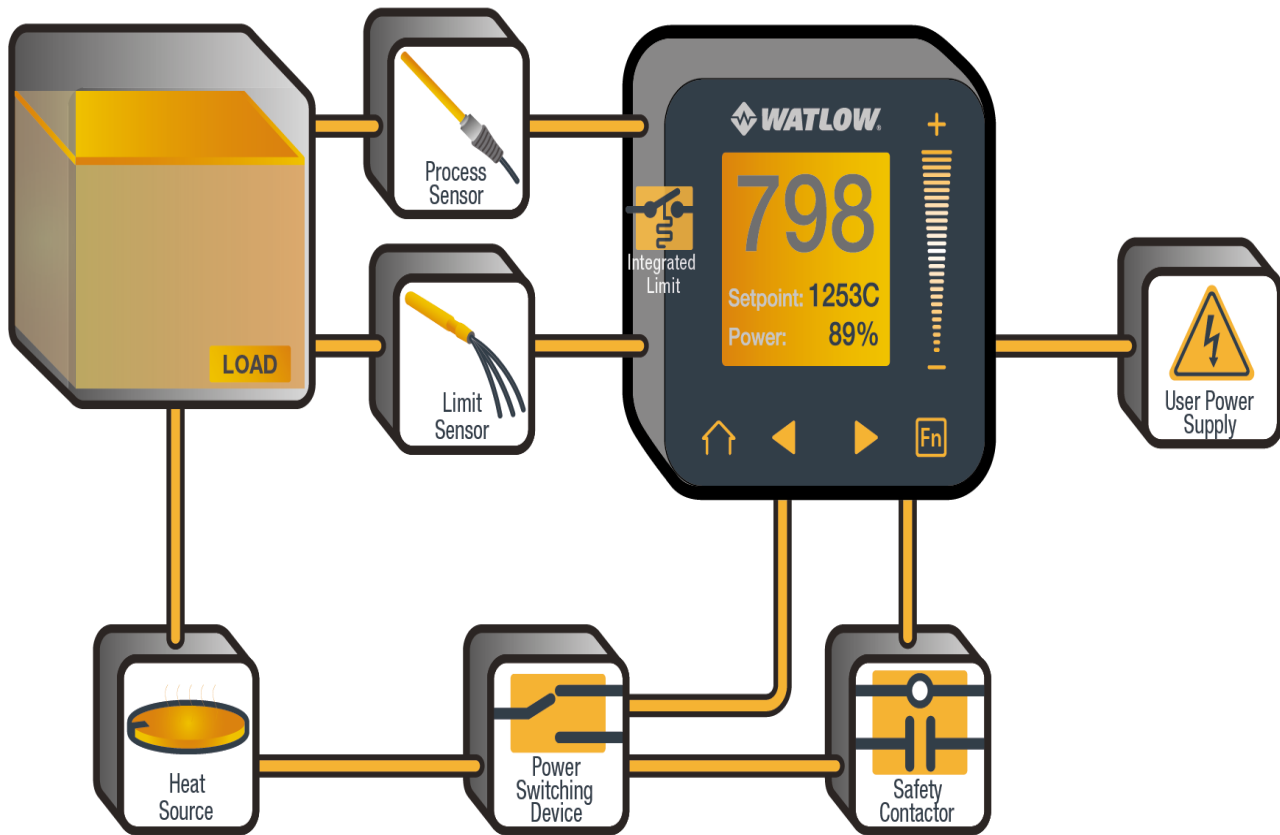


Best Safety Practices for High-Limit Sensors

By: - October 29, 2021

(/-/media/images/techtips/high-limit-sensors_mesa-de-trabajo-1.ashx?la=en&hash=7CEC1112AC9FBFEE65CE85098EE280BAF2CAD71C)



(/-/media/images/techtips/high-limit-sensors_mesa-de-trabajo-1.ashx?la=en&hash=7CEC1112AC9FBFEE65CE85098EE280BAF2CAD71C)

Heater systems have several safety controls built in to protect workers, devices and materials. High-limit sensors, or safety sensors, are one of these types of devices. Such sensors prevent runaway situations in which a switch does not turn off a heater and it continues heating after reaching the desired temperature. These can be dangerous situations that lead to damaged materials and devices or a fire that could injure employees and damage property.

Implementing the right high-limit sensor in the right location for your system is not something that should be overlooked. Watlow's experts are prepared to walk you through these best practices to ensure your safety sensor is the best solution for your unique situation.

What is a High-Limit Sensor?

A high-limit sensor is a redundant sensor designed to monitor the temperature of a heater or the material it is heating. The safety sensor is connected to a high-limit controller, likely a mechanical contactor. In the event that a primary sensor or switch fails to turn off the heater after reaching the desired temperature and the heater continues to function, the high-limit controller disables the heater when the sensor reads a predetermined unsafe temperature. This redundant system activates any time there is a fault in the thermal loop of a system.

For example, a hot tub has a high-limit sensor to prevent the water from getting too hot. If the primary sensor fails, the heater will continue to heat the water. When the water temperature reaches a certain level, between 110 and 120 degrees Fahrenheit, the high-limit sensor will disable the heater.

To provide additional safety, when the high-limit sensor trips the system, users are “latched out” until the system is inspected and reset by an operator, system designer or manufacturing engineer. Once the primary sensor is replaced and the system is reset, it can begin to operate as designed. In the spa example, the high-limit sensor will likely disable the pump in addition to the heater. A technician would need to inspect the hot tub and replace the primary sensor – and other defective parts, if necessary – before resetting the system.

What is the Best Location for a High-Limit Sensor?

Typically, high-limit sensors are included in the design of a heater and the designer of the device selects the location for the safety sensor. The majority of safety sensors on heaters are located near the top of the device as close to the heating element as possible. The thermal energy created by the heater is going to rise, so the top of the heater will experience the highest temperatures.

Multiple high-limit sensors are used on big heaters. A very large circulation heater may have several safety sensors to help identify failures in different sections of the heater. This approach allows operators to identify a potential issue before it becomes a bigger problem.

What Type of Sensor is Best Suited for High-Limit Applications?

There are three types of temperature sensors: Thermocouples, RTDs and thermistors. (Click this link for more details on the types of sensors.) For high-limit sensors, thermocouples are typically the best choice for safety shutdown systems. Thermocouples are relatively simple to create, sturdy and durable and capable of withstanding temperatures as high as 4200 degrees Fahrenheit.

Thermocouples are created by connecting two wires made of dissimilar metals. When the temperature changes, the metals produce a small voltage, which determines the temperature at the sensor’s junction. For high-limit sensors, heavier metals in the wire are used to handle the high-temperature

potential.

How Often Should High-Limit Sensors be Replaced?

Sensors can last 20-25 years depending on the type of sensor, if it is used within its temperature rating and other environmental factors. For example, a sensor exposed to temperatures greater than its rating will experience a shorter lifespan. Likewise, a sensor will degrade over time if it is exposed to harsh air or liquid flow rates, extreme temperature changes or routinely bumped.

For high-limit sensors, some manufacturers proactively replace high-limit sensors every one to two years. For facilities running production lines that create, for example, \$100,000 in parts every hour, the expected downtime of a sensor failure can add up quickly. If it takes four hours to find and fix the sensor, that is \$400,000 lost. Operations utilizing this proactive method will have replacement sensors, heaters, switching devices and controllers in stock to keep the equipment up and running.

Can High-Limit Sensors Trigger Other Safety Mechanisms?

High-limit sensors are not limited to shutting down heaters. They could activate a fire extinguisher system or shut down only the power to certain electronic devices that generate additional heat.

Some systems involve a chemical reaction. Even after the heater is turned off, the chemical reaction may continue. If it becomes exothermic and continues to produce heat, merely shutting down the heaters will not stop the temperature from continuing to rise. In this example, the safety sensor would activate a halon system or fire suppression system.

In other systems, such as a burn-in chamber, which is an environmental oven designed to test the reliability of semiconductors, the electronics that power the system give off heat. The heat produced by the electronic devices is considered part of the energy source in the system. In this type of system, the high-limit sensor would withdraw power to the heater and the electronics.

Contact Watlow to Find a High-Limit Sensor for Your System

High-limit sensors are a critical part of the safety of systems using heaters. By using the proper safety sensor and following best practices, your system will have the best opportunity to prevent catastrophic failure. But you do not have to go at it alone. Take a look at Watlow sensors (<https://www.watlow.com/products/sensors>) and contact the Watlow team of experts (<https://www.watlow.com/contact-us>) to walk you through how best to incorporate high-limit sensors into your system.