

How to Reduce Warranty Costs Attributed to Temperature Sensors

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Temperature sensors undergo a thermal shock test as part of life testing. In this test, the sensors are transferred between 203 and 33°F (95 and 1°C) baths every minute until sensor failure occurs. Because thermal shock is one of the primary sources of sensor failure in refrigeration environments, this kind of testing is crucial to finding and correcting potential points of failure in a sensor design before it moves to production.

If you are involved with temperature sensors for the refrigeration industry – designing, sourcing, qualifying or replacing – you likely know the challenges that come with finding a robust, reliable, cost-effective sensor. Warranty costs attributed to temperature sensors often can be in the top five of all components

within a refrigeration system. Sensors that were designed into systems years ago may have worked back then, but they are now failing at an unacceptable rate, in part because of the ever-changing refrigeration landscape.

As the push is made for more energy-efficient equipment, the sensor is exposed to a much harsher operating environment.

While necessary for an efficient system, rapid defrost cycles expose the sensors to thermal cycling from -22 to 212°F (-30 to 100°C), which can thermally shock the sensors and soak them in water, causing premature failure. The end result is incorrect information being interpreted by the control system, requiring a technician to make a service call or causing

the products to be ruined. Sadly, a \$5 temperature sensor can be responsible for hundreds of thousands of dollars lost.

Fortunately, three key components to reducing temperature-sensor-related warranty costs have been identified:

1. Investigate new sensor designs and assembly methods.
2. Qualify your potential supplier to validate the claims of the temperature sensors and ensure product quality in your application.
3. Mediate among engineering, quality assurance and procurement within an organization to identify the best temperature sensor solution.

A closer look at these three components helps identify ways to reduce temperature-sensor-related warranty costs.

Investigate Sensor Designs and Assembly Methods

New materials and processes are being developed frequently, and what was once thought to be impossible is now reality. Just as the refrigeration market grows and breaks ground to meet new requirements, the temperature sensor market is doing the same.

Temperature sensor manufacturers are designing new and improved sensors targeted directly at the challenging applications of the refrigeration market. Materials, process technologies and quality control methods that were not available previously are now driving change



Two temperature sensors are installed in a refrigeration environment. The rapid defrost cycles found in refrigeration environments are hard on sensors, and the sudden temperature changes and moisture created from rapid defrosting often cause premature sensor failure. Both sensors shown are suited to withstand the demands that rapid defrosting places on sensors.

within the industry. While some temperature sensor manufacturers may stick with the cliché, “We do it this way because that’s the way we’ve always done it,” others are focused on designing products and processes to meet the temperature-sensing demands of challenging refrigeration applications. In fact,

the recent recession has been a benefit to companies because it has helped narrow their focus and allowed them to address specific needs within a market.

Some manufacturers have adopted specifications like IP68 as a qualification, which mandates that a sensor is watertight when

TEMPERATURE SENSORS



Thermistor chips are created at one facility before being assembled into sensors for major OEMs. Sensor buyers should tour prospective suppliers' facilities to gain a better understanding of how the sensors will be created.

submerged in water. Additionally, some manufacturers have specified a minimum number of freeze/thaw cycles that a sensor design must survive being subjected to without failure. Qualities like water resistance, long-term reliability and thermal response time are items that temperature sensor manufacturers are addressing with new designs.

Those specifying, qualifying or sourcing temperature sensors must be open to new parts, even if it means slight changes to components within the system. Remember, the overall objective is the reduction of warranty costs for the benefit of the company.

Qualify Prospective Suppliers to Validate Sensor Performance and Product Quality

Many companies sell temperature sensors throughout the world. A quick web search will show there are a large number of temperature sensors targeted at the refrigeration market, and no two designs are identical.

At the same time, there are few companies actually manufacturing the sensor elements, assembling them into the final package and selling the completed sensor. It is critical to know who you are dealing with and understand the impact of dealing with any potential supplier. Ask qualifying questions such as:

- Where are the parts manufactured?
- Are the qualification samples produced in the United States? If yes, are production

quantities produced in the United States as well, or will production quantities be transferred overseas?

- What type of quality control system is in place?
- Do you understand and have systems in place for life testing and highly aggressive life testing (HALT)?

Be willing to spend the time and money to have your quality assurance department perform an on-site audit. Manufacturers should be willing to have you tour their facilities, show you where your sensors will be manufactured, and walk you through the process as much as possible without divulging any proprietary information.

Encourage Your Teams to Work Together to Identify the Best Sensor

Different teams within your company such as engineering, quality assurance and procurement should work together to identify the best temperature sensor solution. Often, one department is “sold” on a new sensor design but the other departments are not ready to sign off on the supplier, the design or the price. Depending on the company, this can mean that because the decision is not unanimous, the choice is made to just continue with the current temperature sensors until a perfect solution comes along.

However, if a perfect solution has not yet come along, it is possible that it never will. Engineering, quality assurance and procurement teams must be willing to compromise. For example, if a new sensor has been identified, qualified and proven to eliminate failures, but it costs a few cents more than the existing

temperature sensor, the whole project could be doomed to failure. Generally, procurement is evaluated on cost-reduction across all respective components. Adding 10 cents per unit when 100,000 of these sensors are used each year results in a \$10,000 increase attributed to the buyer responsible for sensors. Unless all parties come together and put the unit cost in perspective with the yearly costs of warranty issues, the company may be stuck in the same rut.

Why Sensor Reliability Matters

Warranty costs for temperature sensors can add up in a hurry. While these costs directly impact the bottom line, they also affect relationships with existing and potential customers.

New temperature sensor solutions on the market are aimed specifically at the challenging, high-cost-of-failure applications in refrigeration. Be open to these new

designs and evaluate the quality of these products. Put in the necessary time to verify whatever test results are considered critical to your application.

When the design process has proceeded to the point where it makes sense to do so, send the appropriate quality team out for an on-site audit, where face-to-face meetings and detailed process review can greatly increase your confidence level in the supplier.

Above all, ensure that all departments are willing and able to work together to accomplish the goal of reducing temperature sensor failures. Do not let corporate dynamics override the common sense aspect of potentially spending slightly more on a temperature sensor if it means over a 70 percent reduction in warranty costs. **PC**

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