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part of HID

Exo 400

High Temperature Application & Testing Guide

Tests conducted:

- Thermal soak
- Thermal cycling
- Extreme thermal shock
- Autoclave test

Guide to testing

The Exo 400 HT tag has been subjected to extreme testing to ensure performance across a much higher temperature than standard tags.

This document outlines the standard and specific testing performed to validate this tag. Although this is acceptable for many purposes, each customer has different requirements and therefore should perform testing to ensure functionality for their own use case. The purpose of this tag is to survive a period in high temperature environments without compromising the tags performance upon returning to its normal operating temperature range.

Standard thermal testing

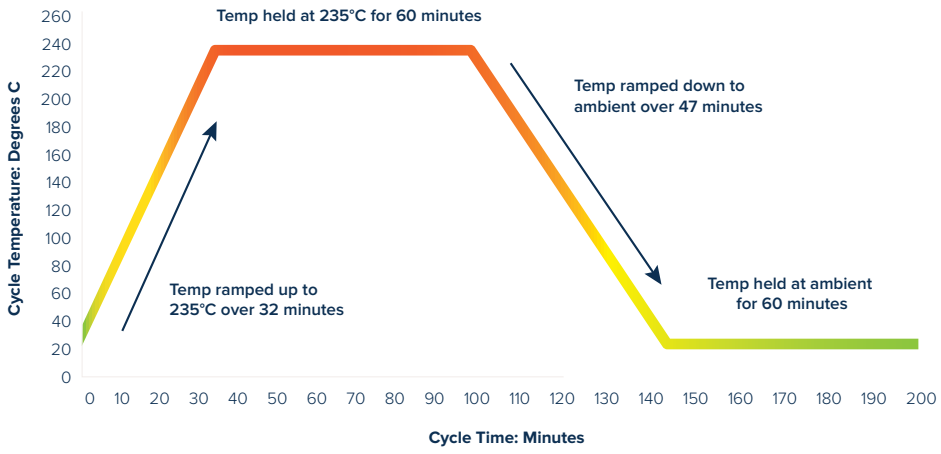
A sample of tags have been taken and subjected to two types of thermal testing; Thermal Soak and Thermal Shock. All thermal testing is performed in a calibrated thermal chamber to maintain accuracy.

Thermal soak

A sample of tags are placed in the thermal chamber at the minimum (-40°C) and maximum (235°C) temperatures for a prolonged period. The time intervals are 168, 336, 504 and 700 hours. The tags are tested for Frequency Shift, change in Read Range and IP68 compliance once the internal temperature has returned to below 85°C.

Thermal cycling

The thermal cycle test involves gradually increasing and then decreasing the temperature of the tag from ambient to a pre-determined maximum, in this case 235°C. The upper and lower temperature limits are maintained for a prolonged period to ensure the tag fully reaches the required temperature. This cycle is repeated over periods of 168 hours (51 cycles), 336 hours (101 cycles), 504 hours (152 cycles) or 700 hours (211 cycles) to simulate a worstcase tag lifecycle in a highly accelerated environment.



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Results

Testing Parameters	Duration	Quantity	Post-test performance	Post-test IP68 Result
Thermal Soak @235°C	168hrs	20	100% pass	100% pass
Thermal cycle amb-235°C	168hrs	20	100% pass	100% pass
Thermal Soak @235°C	336hrs	20	100% pass	100% pass
Thermal cycle amb-235°C	336hrs	20	100% pass	100% pass
Thermal Soak @235°C	504hrs	20	100% pass	100% pass
Thermal cycle amb-235°C	504hrs	20	100% pass	100% pass
Thermal Soak @235°C	700hrs	20	100% pass	100% pass
Thermal cycle amb-235°C	700hrs	20	100% pass	100% pass
Thermal soak @-40°C	700hrs	5	100% pass	100% pass

Extreme thermal testing

Extreme thermal shock

In addition to the standard tests, extreme shock testing was performed to ensure consistent performance from the tags after sudden and extreme temperature changes. The tags are placed in the thermal chamber for a defined period and then immediately transferred directly to either ambient conditions or a cold surface at 0°C for a further period and repeated for 100 cycles to simulate extreme thermal shock eliminating the gradual ramp up and ramp down in temperature.

The images on the right show the tags tested in ambient conditions and cooled to 0°C.

Thermal test	Duration	Quantity	Post-test frequency shift	Result
100 cycles (235°C to ambient)	40mins (20mins @ 235°C, 20mins @ ambient)	50	Shift less than 2MHz	100% pass
100 cycles (235°C to 0°C)	40mins (20mins @ 235°C, 20mins @ 0°C)	50	Shift less than 2MHz	100% pass

In addition to the standard tests, extreme shock testing was performed to ensure consistent performance from the tags after sudden and extreme temperature changes

Continue overleaf

Autoclave test

Another sample of tags is taken and placed in a Pulse Vacuum Sterilizer (pictured left) and subjected to repeated high temperature, high pressure cycles. This process also includes steam sterilization of the tags.

Thermal test	Pressure	Quantity	Post-test frequency shift	Result
50 Cycles (70° - 135°C)	2.0 – 2.3 bar	5	Shift less than 2MHz	100% pass

Conclusion

Following these tests, the tags are tested for any frequency shift or changes in read range as well as IP68 compliance. It is important to note that all RF checks are performed once the tag temperature has been returned to normal operating temperatures; they may not operate below -40°C or above 85°C. The testing performed has proven that the tags do operate at the specified operating temperatures and can survive at temperatures for a prolonged period of time.

The tests Omni-ID have performed are designed to simulate a broad spectrum of possible operating environments, however the tests do not cover every applications' thermal profile.

We strongly advise customers to perform their own testing to ensure the tags will operate effectively in their specific environment. It is important to note that 235°C is close to the maximum limit of the tag materials, therefore care should be taken to maintain operating temperatures at or lower than this to avoid undue tag failure.

Omni-ID is the leading supplier of passive, low-profile UHF RFID solutions. Through our patented technology, Omni-ID “cracked the code” to overcome the problems traditionally associated with RFID, enabling a broad range of new applications that improve accuracy and efficiency in asset tracking, supply chain management and work-in-process.

Our family of versatile RFID tags works reliably in the harshest environments, including on, off, and near metal and liquids and excels in solving tracking and identification challenges with unprecedented accuracy.

With offices in the USA, UK, Asia and India backed up by a purpose-built manufacturing facility in China, our mission is to drive the widespread adoption of RFID and wider IoT technologies as the optimal tracking and identification devices.

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