Water Cooled Sensor

Corrosion Report

Symptoms and Recommendations

Through the last several years in the calibration lab, we have seen an increase in the number of sensors that are being processed that have excessive corrosion. This corrosion typically presents itself in the form of "pitting" in the internal chambers, and is frequently characterized by the presence of films and build up in the internal chambers. In Figure 1, you can see examples of the "pitting" typical in corroded sensors, and in Figure 2, you can see the build up in the internal channels.

Figure 1

Figure 2

In order to understand this concern further and to work towards resolution of this concern, we requested water samples from several customers. These water samples have been analyzed and have been found to contain high chloride levels, and a wide range of pH values. Our recommended range for pH values is above 4 and below 9, and we recommend that chloride levels are kept low to avoid corrosion.

In addition to the pH and chloride levels, there were a wide range of contaminants that were found in the water. This contamination was mostly metallic in nature, but there was some presence of organic compounds noted. Upon further investigation, we found that systems with very high rates of corrosion issues were using a closed-loop system which pumped the contaminated water back through the chambers of the sensors, causing further damage to the sensors. This resulted in receipt of a murky water sample from customers, with apparent rust and corrosion in the water itself. Based on this finding, we'd recommend that the water used in these systems is flushed every 6-12 months, and that a biocide is introduced to the sensor environment to prevent the buildup of bacteria and algae.

If corrosion is at play in your sensor, there are symptoms that can be identified that would trigger a return for servicing. Perhaps the most common symptom of corrosion in your sensor is that the housing of the sensor is leaking water. In these cases, corrosion has built up inside the sensor, forcing water to breach the o-ring barrier or to eat away at the channel holding the o-ring, and water will either spray or drip onto the absorber disc. Once the sensor has corrosion built up inside, there is also an increased risk that the o-rings have melted and the disc may be damaged. See Figure 3 for an example of an o-ring that has been melted by a sensor that has not cooled properly, and Figure 4 for an example of a channel that has been corroded to the point that the integrity of the channel has been compromised.

Figure 3

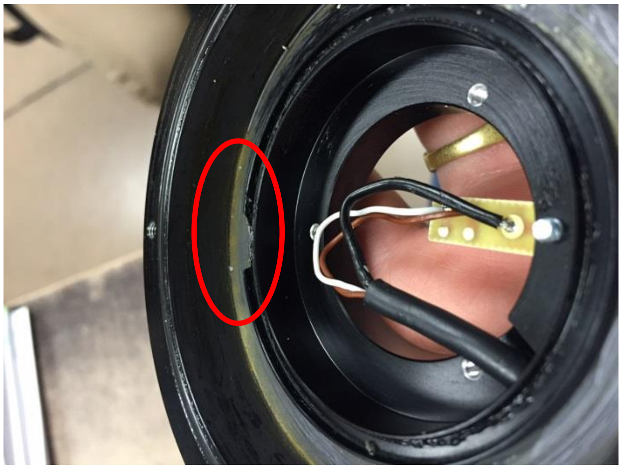

Figure 4

Internal blockages in the channels can be ascertained by the sensor failing to cool normally, as the water cannot flow through the channel unimpeded, and leading to extended cool-down periods and abnormally high power readings. When these symptoms are caught early-on in the process and the equipment is serviced, repair costs are lower and the effects of the corrosion can be mitigated.

In summary, there are several steps that can be taken to prevent and mitigate the effects of corrosion: ensure that the water is pH balanced, and that there are low chloride and metallic ions in the water. If your sensor exhibits behavior inconsistent with its normal use, i.e. through slowing of water through the sensor channels, abnormally high power readings, or longer cool-down times, we recommend returning the equipment for servicing. Additionally, we recommend taking care to blow out the sensor channels with clean, dry, compressed air when the sensor is put away to prevent water from sitting inside the channels and causing accelerated corrosion.