

FAQ 02-12: What are sensor cooling requirements ?

There are two temperature issues to consider for QCM sensors:

1) ambient temperature, and 2) temperature changes.

1. Ambient Temperature: Standard Sigma QCM sensors are constructed of vacuum compatible materials, and can be baked out or operated at temperatures up to 175°C. This bakeout limitation is due to the Teflon coated InVac cable. UHV bakeable sensors allow bakeout to 300C by replacing the InVac cable with a conductor and insulators enclosed in a SS tube. For shuttered sensors, the actuator limits operating temperature to 150°C.

2. Temperature changes: A QCM measures film thickness by measuring the change in frequency of oscillation of a crystal, due to a change in deposited material thickness. If the temperature of the crystal changes during the measurement, it also causes frequency to change. A QCM instrument cannot distinguish whether a frequency change was caused by a change in thickness, or temperature, or both. Crystals are designed to minimize temperature effects in the range of 25 to 70C, but you can also help.

To reduce the effect of temperature changes, QCM sensors are provided with water cooling lines. Water cooling helps keep crystal temperature constant, which contributes to better rate/thickness measurements. A source of clean water is required, capable of flowing 1 to 2 liter/min (~0.2 to 0.5 gal/min) at 2 to 3 bars (30-40 psig) inlet pressure.

The water should be at approximately room temperature ~20°C (to a high of ~30°C). Water cooling does not appreciably lower the ambient temperature of the sensor, but is intended to help maintain a constant crystal temperature. For that reason, a water supply at a reasonably constant temperature is more important than the specific water temperature.