

Temperature: The Element Of Difference

So often, it happens that we seem to forget the effect that temperature has on the measurement process. All too often there arises a disparity between the shop floor and those in the inspection lab. Also, between the supplier and the receiving inspection department of the customer. In many cases the reason for that disparity is measurements that were taken and recorded under different temperature environments.

Feature characteristics that are measured at the machine contain thermal memory from the machining process and the production environment. Then, the inspection department that is monitoring the process measures that product in a controlled environment and discovers a different set of numbers.

Why? The culprit is temperature due to the Coefficient of Expansion of a body over the range of temperature from 68 degrees F is defined as the ratio of the fractional change in temperature.

According to ANSI B89.6.2 Standard for "Temperature and Humidity Environment for Dimensional Measurement", a device used to perform a comparison of the part and a master called a comparator be utilized to quantify the amount of change that takes place due to thermal expansion and contraction.

Differential Expansion is defined as the difference between the expansion of the part and the expansion of the master from 68 degrees to their time-mean temperatures at the time of the measurement.

The "fix" for these type of temperature related difficulties can be addressed by adhering to an experiment called a "Drift Test". This test will provide data that may be used in correlating measurements to correct the differences associated with temperature. This test is described as a recommended procedure in section 20.3 of the Standard ANSI B89.6.2.

There are of course other methods that may be utilized to control the thermally induced measurement disparities such as by applying mathematical compensation or stating those differences as part of the "Measurement Uncertainty". Another way would be to take all measurements in a controlled environment of 68 degrees F after allowing the parts to normalize in that environment for a period of 24 hours under normal circumstances.

This obviously causes great difficulties in the production process. Response times are often more critical to machining process that require immediate responses. This becomes even more of an issue to those who are involved with real time SPC tracking. Therefore this requires a lot of investigation during the set-up phase of the operation. For some, this is an issue that will be addressed during a PPAP (Pre-Process Approval Plan) operation.

The main idea here is to become aware that temperature as it relates to the measurement process is an issue that needs to be addressed by all. Help is available from "The American Society of Mechanical Engineers" by providing the standard that deals with correcting the temperature issue through "ANSI B89.6.2"