A Reliability and Quality Engineering student from Kharagpur, India had the following questions about product testing:

1. What is environmental testing?
2. Why is it required?
3. What other testing is performed on various electronic and electrical systems and components?
4. What are the various standards required for maintenance testing of various electronic and electrical systems and components?

Mr. Worsham answered his questions below:

1. Environmental testing involves testing the product or component under the same or similar environmental conditions in which the product is expected to operate. A degree of reasonableness certainly applies here, but most product designers would want their product tested under slightly harsher conditions than they would expect most users to subject the product or component to. For example, if it would be reasonable to expect some users to operate the product or component in frigid Siberia, then it would be prudent for the product designer or tester to try to duplicate these frigid conditions in the laboratory and test the product under those conditions. If the same product is going to be operated in hot dry climates as well as dusty, dirty, moist environments then the product tester would want to duplicate and test the product or component under these conditions as well. Sometimes it is very difficult to determine the conditions under which the product will be used, but to avoid costly product liability lawsuits the designer has an obligation to try.

2. Environmental testing is necessary for several reasons, the most important of which is to prevent people from being injured or killed using the product. Another reason for environmental testing is to ensure the production of a safe quality product. Still another reason is to produce a product that is competitive in the market place. If we don't environmentally test our product or component, others are certainly going to test theirs. Because of this they will produce a better product and eventually drive us out of the marketplace. Finally, environmental testing is necessary to prevent or minimize costly product liability lawsuits.

3. There are many different types of product or component tests for electrical or electronic components. The most common environmental test for electronic components is the temperature/humidity test. This test developed by Western Electric in the 1960's is referred to as an 85/85 temperature and humidity stress test. In this test, electronic devices are exposed to warm (85°C) unsaturated moisture (85%RH) under static electrical bias for 1000 to 2000 hours. They are then analyzed for corrosion of the internal die or metallic wire bonds. Another test is the pressurized humidity test. This is like testing electronic devices in a pressure cooker or autoclave. Finally, IC (integrated circuit) devices are tested in HAST (Highly Accelerated Stress Test) and Dual HAST systems. Both of these tests are improved versions of the pressure cooker/temperature/humidity/bias test method that is very effective in identifying failure modes in electronic devices very quickly.

4. Standards for electronic devices are not universal. In the United States, Underwriter’s Laboratory (UL) and other testing agencies continually test all types of components and electronic devices. Their primary
reason for performing the tests in safety. As a result of their testing however they do develop certain minimal standards for quality and safety. Compliance with these standards by manufacturers is strictly voluntary, but there is a strong incentive for manufacturers to comply with these standards. First, testing agencies give a **seal of approval** to products that have been tested by them and meet their standards, which really helps sell the product. Second, in the event of a product liability dispute and it was found that the product in question did not meet the minimal standards, product liability awards are likely to be much higher. Finally, sophisticated customers like NASA and the U.S. Military for example, require higher standards than those used by UL and other testing agencies. In these instances the customer dictates the standard and is willing to pay the additional cost for a product that meets that standard.

William (Bill) C. Worsham was a Senior Consultant for Reliability Center, Inc. Mr. Worsham had over 30 years experience in the field of Maintenance and Reliability program management. He had participated in and led teams in the development, design and implementation of three separate maintenance management systems. He had also participated in the design and implementation of specialized reliability inspection programs such as lubrication scheduling, vibration monitoring, instrument inspection and preventive maintenance. Mr. Worsham was a practitioner of root cause analysis in the field with his clientele as well as an educator. Our friend and colleague has passed away since writing this article. If you would like to make an inquiry on this topic please contact us at 804/458-0645 or info@reliability.com.