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# Humidity testing of electronics and mechanics

How to select the right test method

Anders B. Kentved, DELTA November 2008

SPM's sekretariat  
DELTA Dansk Elektronik,  
Lys & Akustik  
Venlighedsvej 4  
2970 Hørsholm  
Telefon: 72 19 40 00  
Fax: 72 19 40 01  
[www.spm-erfa.dk](http://www.spm-erfa.dk)

## **SPM**

### **Society for Reliability and Environmental Testing**

SPM is an independent organisation consisting of about 70 company members in Scandinavia.

SPM initiates and finances unprejudiced investigations of common interest for its members – mainly in the field of reliability and testing of electronic components and materials.

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## Abstract

The result of a given humidity test depends not only on the test method but also on the failure mechanisms applying to the equipment being tested. This often complicates the task of selecting the right test method(s).

This report describes a number of typical humidity related failure mechanisms for electronics and mechanics. These are then used to characterise a number of internationally recognised humidity test methods.

The report is a result of gathering information from a number of sources, including engineers with many years of experience in humidity testing of electronics and mechanics. The information and experiences gathered have been compiled to give the reader an adequate mixture of theory and practical experience.

A number of tests were carried out in the project. The purpose of the tests was to show practical examples of leak rates observed in typical enclosures for electronics and mechanics. The tests indicate that optimum conditions for water accumulation, through the so-called “humidity pumping” effect, are often present in equipment enclosures with a high IP-classification.

The report can, for instance, be used by designers of electronics and mechanics, to get a quick overview of commonly used humidity test methods and how to select the right one(s) for their equipment.

## Preface

### Background

The work presented in this report has been initiated and financed by SPM “Society for Reliability and Environmental Testing”.

SPM members have asked for a detailed survey of existing standardised humidity test methods and characterisation of their severities. This has now been compiled in the present report, where a number of internationally recognised humidity test methods have been characterised with respect to their relative ability to produce four different failure mechanisms.

Since the effects of temperature and humidity are the results of plain physics, humidity test methods have not changed significantly during the last 30 years. As a result, one of the most versatile and well designed test methods, still used widely for testing of electronics and mechanics today, was made in Leningrad two years before the author of the present report was born!

Inspiration for this report has mainly been obtained from:

- The author’s 10 years of practical experience from DELTA with humidity testing of various customer equipment and problem solving of humidity related failures.
- The excellent reports of: Kjell Spång/Bengt Bergkvist [11], Thomas Trost [6], Kim Zachariassen [5], Povl K. Birch [3] and Kjartan Gudmonsson [10].
- Feedback from the SPM members in the project group and technical discussions with Fred Andersson (former DeLaval International AB) and Axel Laursen (former DELTA).

Special thanks to Kim A. Schmidt (DELTA) and Lise Korfitzen (DELTA) for guidance and motivation throughout the project.

### Readers

The report is intended for the non-specialist. Those already familiar with humidity related failure mechanisms and testing can proceed directly to the test survey in chapter 4 and characterisations in chapter 5.

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