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Technical information sheet

Absolute humidity control

WHY	WHAT	HOW
Inaccuracies in the control of relative humidity in connection with cyclical temperature change in standard test procedures.	Optimisation of the control accuracy and the transient response of the relative humidity.	Adjustment of the control mode to control the absolute water content in the test space.

WHY – The challenge.

In the electronics and automotive industries, there are many established test procedures for ensuring the functionality of components at high relative humidity. The alternating climate tests according to DIN EN 60068-2-30 and DIN EN 60068-2-38 are frequently used.

The test according to DIN EN 60068-2-30 is used to assess the suitability of electronic products for both operation and storage at high relative humidity in conjunction with cyclical temperature changes. This requires a temperature cycle to be maintained at high relative humidity over a period of 24 hours. As an example, *Figure 1* shows an excerpt of the standard with requirements for air temperature in [°C] and relative humidity in [% RH].

Areas in the test cycle that are particularly critical for humidity are the temperature ramps, marked in *Figure* 1 with a) and b). These two transitions will be examined in more detail later on.

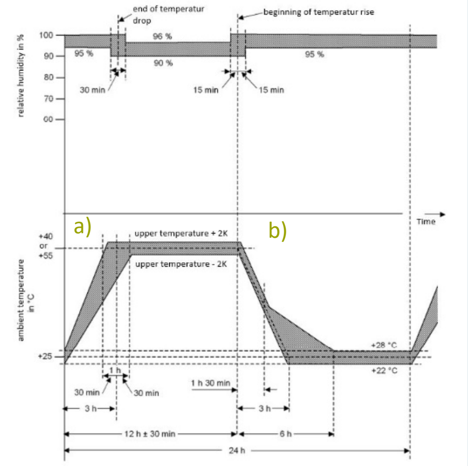

Figure 1 Extract from standard DIN EN 60068 - 2 -30.

WHAT – Status Quo.

In *Figure 2* you can see an extract of a test run in accordance with DIN EN 60068-2-30. If we look at the two control-critical ranges a) and b) in the test cycle, a transient response of the relative humidity towards the target value can be seen.

This transient response is due to the physics of humid air based on relative humidity control. In order to control the relative humidity, the test chamber initially reacts to the change of the dew point. The controlled variable "humidity" is therefore a component of the controlled variable "temperature". In point a) the temperature starts to rise, the dew point remains unchanged and the relative humidity decreases. As a result, the test chamber reacts with humidification. As the temperature continues to rise and humidification is initiated, the relative humidity increases. As a result, the test chamber now reacts with dehumidification. An iterative process is established, which is significantly dependent on the rate of change of the temperature. The same applies to point b), in reverse.

Despite compliance with the permitted deviations in accordance with the standard, *Figure 2* shows that the relative humidity settles down to the target value.

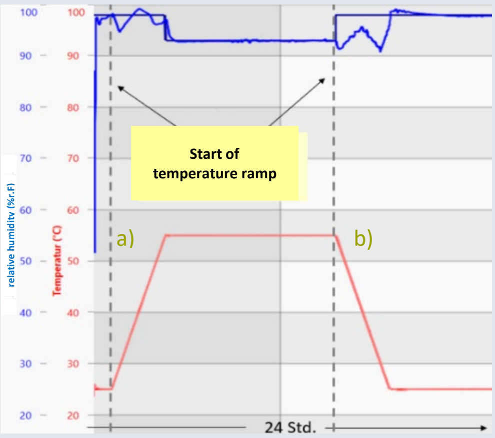

Figure 2 Evaluation of a cycle test according to DIN EN 60068 - 2 - 30.

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info@weiss-technik.com
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HOW – The innovation.

The aim is to adapt the humidity control of the climatic test chambers from **weiss**technik in such a way that a qualitative improvement in humidity accuracy and transient response is achieved. Theoretically, both temperature and relative humidity can be used as control variables. The idea: control via the absolute water content in the test space.

At different points in the test space, the temperature and relative humidity may differ slightly for physical reasons. However, there is only one absolute water content in the test space (see *Figure 3*). This absolute water content is also a fixed value for changing climates. This is illustrated in *Figure* . It can be seen here that the absolute water content in the test space decreases although the relative humidity increases. The test chamber would initially be humidified, but the actual amount of water in the test chamber decreases. The correct control measure is therefore to initiate dehumidification.

This is where the new absolute humidity control comes into play. By using the absolute water quantity for control, the relative humidity is no longer dependent on the temperature control. In this way, a control loop with two variables becomes a control loop with one variable.

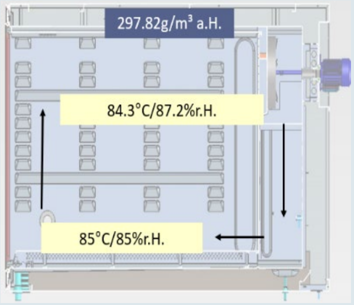

Figure 3 Example of relative and absolute humidity values in a test space.

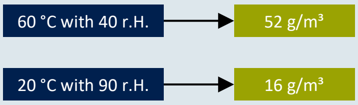

Figure 4 Absolute water content of two climate values.

In *Figure 5* you can see a direct comparison of the two types of control. With absolute humidity control, the control accuracy is significantly increased and the transient amplitudes are almost completely eliminated. In future, this innovation will ensure even more accurate and reproducible test results with the climatic test chambers from **weiss**technik.

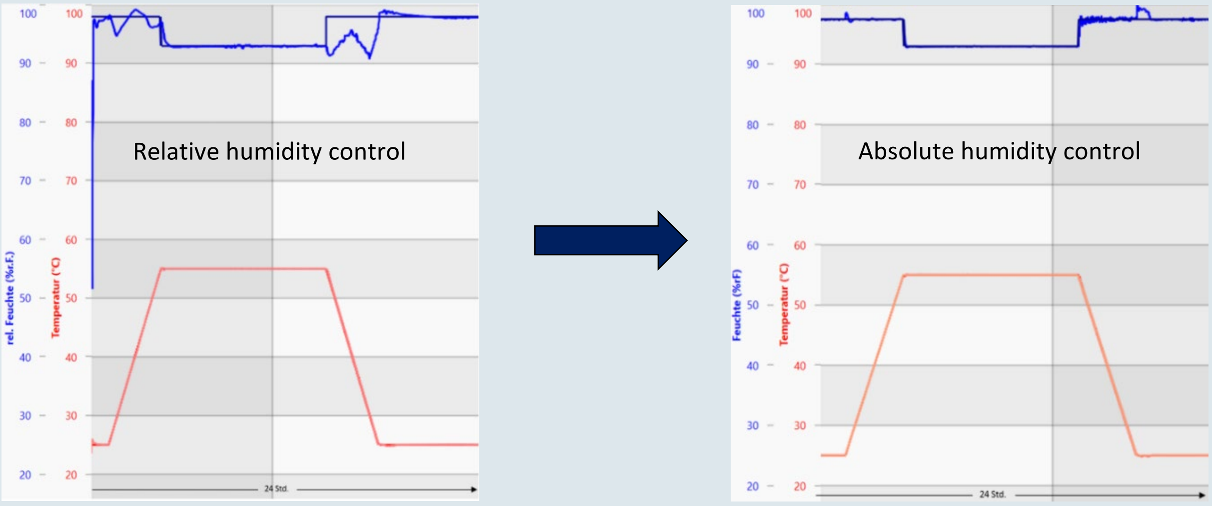

Figure3 Comparison of the evaluation of a cycle test according to DIN EN 60068 - 2 - 30 between relative humidity control and absolute humidity control.