

ICING TEST CHAMBERS

Climate chambers provide flexible testing of critical equipment through environmental simulation

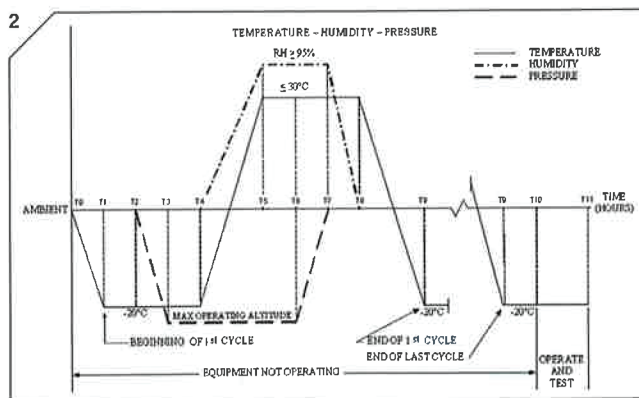
For obvious safety reasons, determining the effect of temperature, altitude and humidity on critical equipment is of utmost importance. To be certified, aircraft systems and equipment, depending on the nature of the application - civil or military, must undergo design and qualification tests as per DO-160 standard, Environmental Conditions and Test Procedures for Airborne Equipment, or the US military test method standard MIL-STD-810. These norms describe combined testing procedures that have to be strictly followed to ensure the proper functioning of the specimen in any environmental conditions it could potentially encounter during its lifetime. Simulating these conditions on earth requires special altitude chambers from Weiss Technik.

PRIMES, the Platform for Research on power Electronic Integration and Management of Energy and Storage devices, part of the ENIT engineering school in France, acquired such a chamber to perform severe CTAH (combined temperature, altitude, humidity) test cycles on electronic power components and assemblies.

The CTAH chamber was initially designed for the CEPIA project (Advanced Integration for Power Electronics Converter), an initiative to develop a comprehensive approach to the predictive reliability issue for power assemblies used in embedded applications. "Our industrial partners, among them Alstom Transport and Technofan, had to ensure and prove the reliability of their electronic components for the whole range of possible environments they might face when embedded in airplanes or trains" says Dr Paul-Etienne Vidal, researcher and lecturer at ENIT in France.

The chamber, integrated in a larger test bench, allowed testing and ageing of equipment such as power converters and avionic integrated systems.

1 // A Weiss Technik specialized climate chamber provides combinations of altitude, temperature and humidity for critical equipment



José Ferrao, PRIMES operations director, said, "Now that the CEPIA project is finished, and as the chamber is still fully operational, we are planning to make it available for industrial projects. We are even thinking about upgrading the chamber's performances to respond to the highest technical requirements of our customers," which may include a major European aircraft manufacturer to test innovative sensors they are developing.

The test cycle for power converters and avionic integrated systems starts by stabilizing equipment at -20°C. This temperature is maintained while chamber pressure is decreased to simulate the operating altitude for the standard flight conditions required for the specimen. Then, temperature is decreased while relative humidity is maintained above 95%.

2 // A sample of the cycle described in the DO-160 standard for testing beginning at -20°C, rising to 95% humidity (around 30°C) before falling again. The cycle is repeated 25 times before testing begins

This phase simulates conditions similar to those encountered when flying through warm, humid cumulonimbus clouds which instantly condense and freeze on cold equipment. Pressure and relative humidity levels are then brought back to room ambient, while temperature is maintained during a sufficient period of time to melt all frost. The cycle is repeated 25 times before finally starting specimen operation and testing.

Weiss Technik France's engineers solved several technical issues such as controlling temperatures at low pressures (91mbar, as per DO-160 standard) where convection is not optimally efficient due to the lack of air and using radiation panels would have significantly increased the chamber's cost.

The second challenge is producing high relative humidity at low pressure. This was solved with a specific mechanical design and required hours of tuning and testing PID controllers before commissioning. Customer training was also mandatory to ensure the longest service life of the chamber.

Weiss Technik supplies an extensive range of aerospace testing equipment covering many applications, from standard and icing altitude chambers, to kerosene conditioning units and space simulators. \



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