Climats
a schunk company

AEROSPACE

Expert in environmental simulation

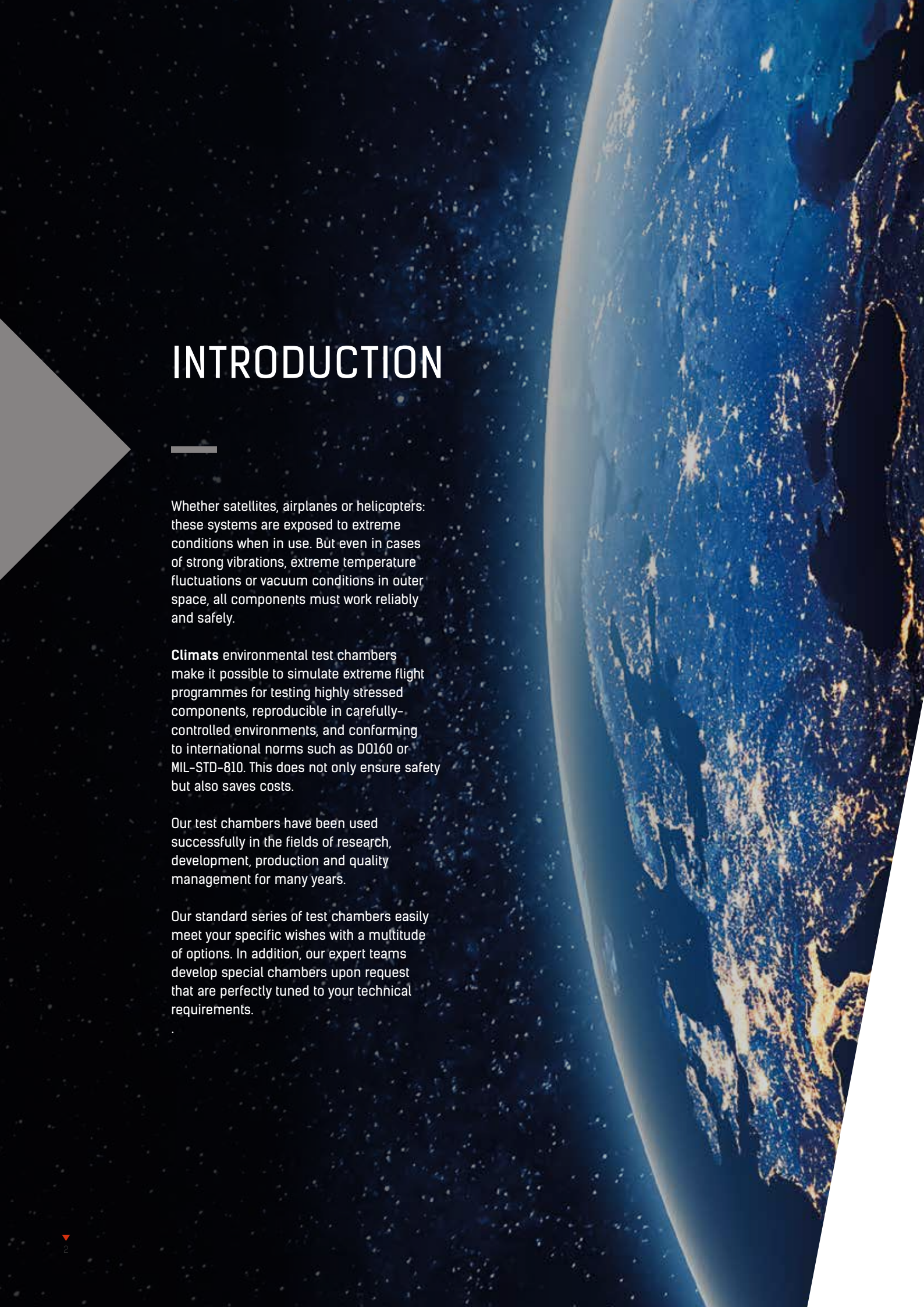
CREATOR OF EXTREME

SPATIAL

- THERMAL VACUUM CHAMBER / SPACE SIMULATOR / TVC
- LOW TEMPERATURE CHAMBER / LTC

AERONAUTIQUE

- ALTITUDE CHAMBER
- CLIMATE CHAMBER FOR THERMAL BATTERY TESTS
- ENVIRONMENTAL STRESS SCREENING (ESS) : SPEEDCAL
- ENVIRONMENTAL CHAMBER COMBINED WITH A VIBRATION SYSTEM : VIBCAL
- SIMULATION OF SOLAR RADIATION
- THERMAL SHOCK : SCAL



INTRODUCTION

Whether satellites, airplanes or helicopters: these systems are exposed to extreme conditions when in use. But even in cases of strong vibrations, extreme temperature fluctuations or vacuum conditions in outer space, all components must work reliably and safely.

Climats environmental test chambers make it possible to simulate extreme flight programmes for testing highly stressed components, reproducible in carefully-controlled environments, and conforming to international norms such as DO160 or MIL-STD-810. This does not only ensure safety but also saves costs.

Our test chambers have been used successfully in the fields of research, development, production and quality management for many years.

Our standard series of test chambers easily meet your specific wishes with a multitude of options. In addition, our expert teams develop special chambers upon request that are perfectly tuned to your technical requirements.

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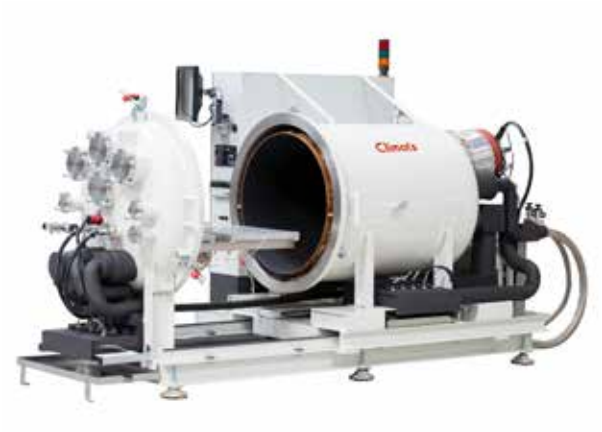
SPACE



TVC
Thermal Vacuum Chamber – Space simulator

Testing space flight equipment before the first flight into space is a prerequisite to be able to predict the behaviour of these valuable components, and is done by simulating space conditions. **Climats** Thermal Vacuum Chambers accurately reproduce outer space conditions and thus allow testing in a completely controlled environment. Our high-performance pump systems can achieve a vacuum of down to 10^{-7} mbar. Liquid nitrogen circulating in a Thermal Vacuum Chamber create low temperatures comparable to outer space of -185 °C to +165 °C. Specific features such as infra-red radiation or a spatial temperature gradient can be simulated to meet our customer requirements.

TVC-Vacuum Chamber Space Simulator*
- Testing room size: 20 m^3
- Temperature range: from -135 °C to +150 °C
- Pressure range: down to 10^{-7} mbar
- Infra-red radiation: 2 500 W/m^2

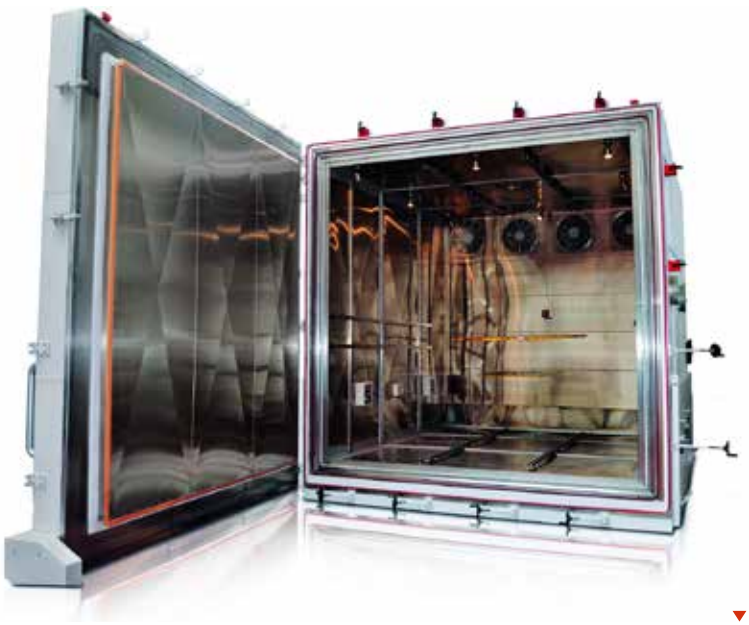
**Selected system – further information on other versions upon request, feel free to ask.*

LTC
Low Temperature Chamber

Thermal stress induced by extreme space temperatures is so important that temperature tests of aerospace equipment are often performed even before the vacuum test. Our liquid nitrogen cooling system allows a very precise temperature adjustment over a large range, from -185 °C to +200 °C. **Climats** Low Temperature Chambers achieve rapid temperature changes and great homogeneity, in small volumes as well as in large walk-in chambers.

Low Temperature Chamber*
- Testing room size: 31 m^3
- Temperature range: from -185 °C to +200 °C

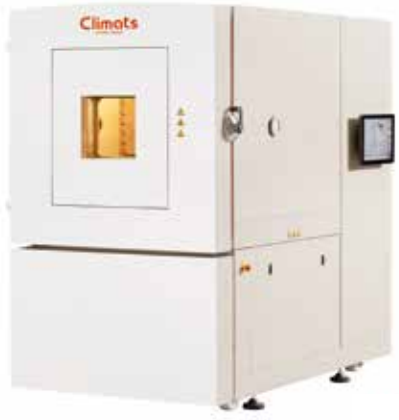
**Selected system – further information on other versions upon request, feel free to ask.*



AERONAUTICS

Altitude Chamber

During flight, airplanes are exposed to extreme pressure and climate conditions. Such parameters greatly impact the function of individual components and must be inspected and measured for safety reasons. **Climats** test chambers facilitate the testing of aerospace components in an environment that allows control of the parameters pressure, temperature and/or humidity. It is possible to simulate heights of 100 000 feet (30 000 m).



Standard Altitude Chamber

The standard altitude test chamber FCV/FCVH will allow you to simulate harsh environmental conditions and to study their impact on properties, function and life span of your products.

The FCV/FCVH range allows you to make most of the tests required by aeronautical standards RTCA DO-160G and MILSTD-810G.

This climatic chamber is able of to simulate the altitude range between 30,000 and 45,000 ft, but also to precisely control the corresponding temperature drop to 150 mbar at 45,000 ft.

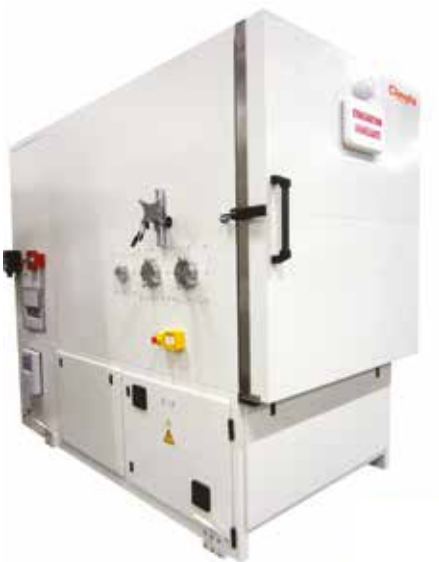
FCV/FCVH chambers are available for **volumes of 220, 500, 1000 and 1500 liters.**

Specific Altitude Chamber

Upon request, and in addition to standard characteristics from our "FCV/FCVH" model, combined icing tests cat B "Icing tests" can also be performed according to the norms RTCA DO-160 and MIL-STD-810.

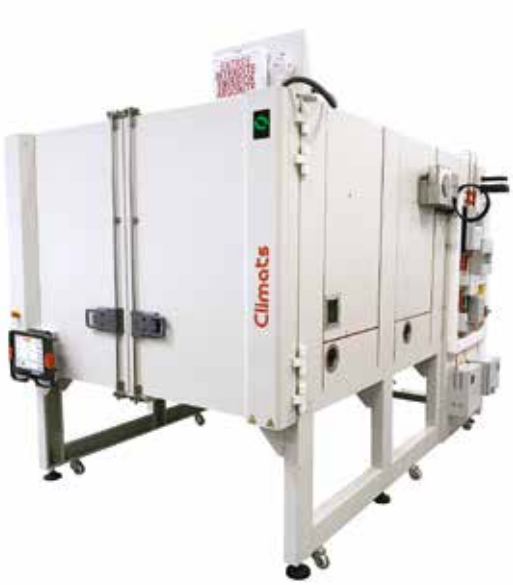
Climatic Altitude Chamber*
- Testing room size: 1 m^3
- Temperature range: from -70 °C to +180 °C
- Humidity range: from 10 % to 98 % RH
- Pressure range: 1 mbar

**Selected system – further information on other versions upon request, feel free to ask.*



Climate chamber for thermal battery tests

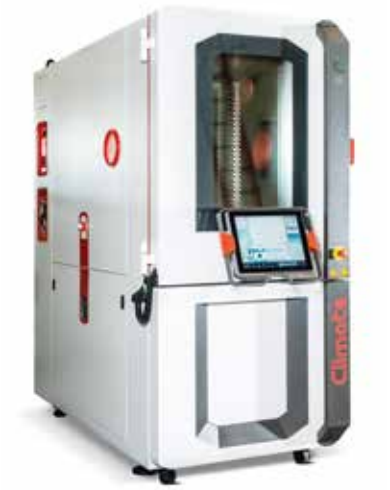
Energy storage units are important components in aerospace, which also must stand up to extreme conditions. With the **Climats** Testing Cabinets, you can perform tests like altitude, temperature, climate, vibration, and temperature shock tests, which can be supplemented by additional safety components corresponding to EUCAR "hazard levels".



- Temperature range* : standard mode : -70 °C to +180 °C
  safety mode : -60°C to +85°C
- Speed variation: less than 1°C/min
- Volumes upon request
- Secure chamber : each security system is independent and meets customer specifications. Safeties are generally central fire alarm with flame detections, smoke detections, as well as an audible and visual alarm. Possibility of securing also with inserting systems (nitrogen for example)

SPIRALE Vision as standard

**Selected system – further information on other versions upon request, feel free to ask.*

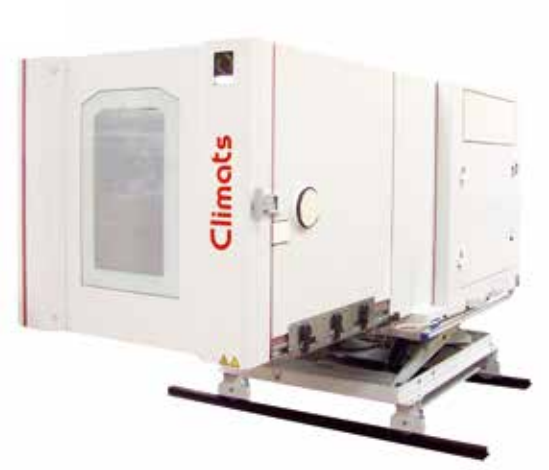


Environmental stress screening (ess): speedcal

High product reliability is a basic requirement for today's competitive market and very often is the only difference between different manufacturers. During the ESS test (Environmental Stress Screening), the products are subjected to precisely-prescribed stress in order to recognize defects in components and circuit boards timely in the production plant. Unreliable systems are scrapped before reaching the customer.

- Temperature range: from -90°C to +250°C
- Humidity range: 5% to 98% (for temperatures from + 10°C to + 90°C) with a minimum dew point of -5°C
- Speed of variation: up to 30°C/min
- Volumes: depending on needs

SPIRALE Vision as standard



Environmental chamber combined with a vibration system: VIBCAL

Airplane engines, rotor blades and space craft experience intense vibrations during take-off and landing. At the same time, these components experience rapid temperature changes in different types of climate. VIBCAL series (vertical environmental chamber vibration, VibA and horizontal environmental chamber vibration, VibT) permit the simulation of such dynamic processes in order to plumb the stress limits and thus allow for safe flight operation.

- Temperature range: from -70°C to +200°C
- Humidity range: from 10% to 98% (for temperatures from +10°C to + 90°C) with a minimum dew point of -5°C
- Speed of variation: up to 20°C/min
- Volumes: on request
- 2 types of chamber: vertical vibration (VibA) vertical & horizontal vibration (VibT)

SPIRALE Vision as standard

Simulation of solar radiation

Surfaces and materials can react to long-term sunlight irradiation. Our test chambers let you test your products for any quality deficiencies with reference to solar radiation. In addition, it is possible to check the irreproachable quality of your products and their resistance to various radiations.

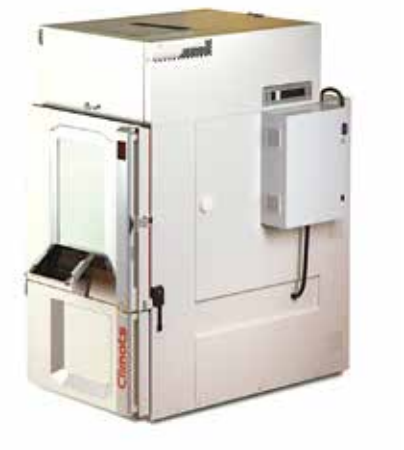
- Temperature range:
  -20°C to + 100°C with radiation
  -40°C to + 120°C without radiation

- Humidity performance:
  with radiation: 10% RH / 80% RH in the range +15°C to +80°C
  without radiation: 10% RH / 90% RH in the range +10°C to +90°C

- Test volume: 1000 litres

It is also possible to produce simulation of solar radiation for UV test radiation depending on needs.

SPIRALE Vision as standard

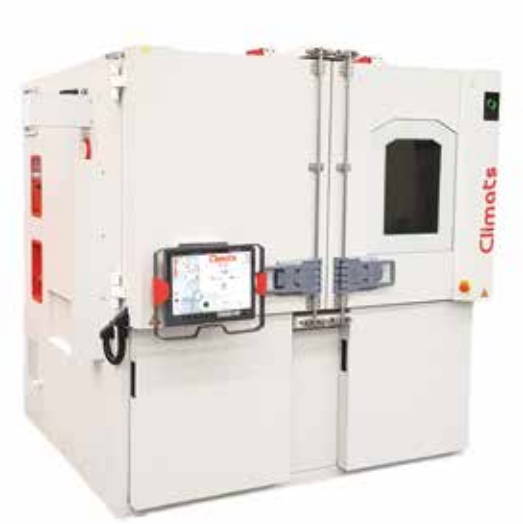


Thermal shock: SCAL

During flight, aircraft equipment often passes through several temperature zones in a brief period of time. Rapid temperature changes can impact the function and safety of individual components.

- Temperature range: from -90°C to +220°C
- Transfer time between both zones: less than 10 seconds
- ESS mode possible in cold cabinet with a maximum load of 100 kg (e.g. for SCAL CTH2)
- Volumes: from 70 litres to 1500 litres
- 7 configurations available: vertical or horizontal shock
- 2 or 3 test tanks

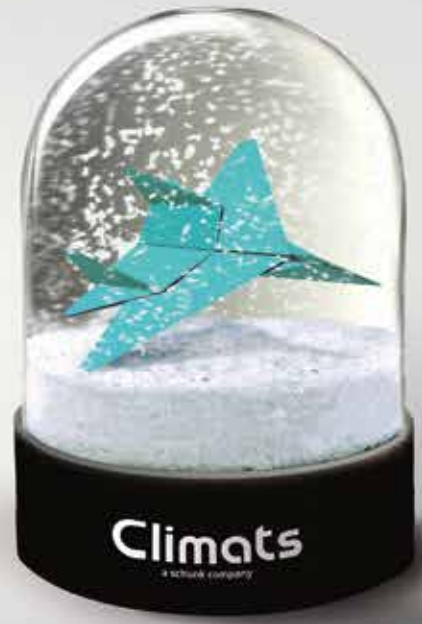
SPIRALE Vision as standard



Europe
Asia
America
Africa

An international presence

At the heart of Climats' development strategy,
we export through an intercontinental network of distributors.
Trained in our technologies and committed to lasting relationships,
our partners handle sales and technical support for our
environmental equipment around the world.



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