Envirotronics®

# Solar Technology


## ›Solar/Photovoltaic Module Testing

Environmental Test Chambers

# Environmental Testing *Solar Technology*

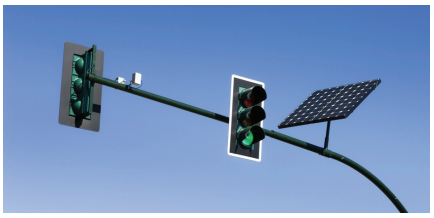
Solar energy is one of the viable options for a clean, renewable and sustainable energy source. Today, new companies are emerging that are engaged in the research, development and manufacturing of products to harness and use this abundant resource.

The role of environmental testing is to examine and prove the suitability, reliability and durability of these products through exposure to the environmental effects of temperature, humidity, light, etc. Specific test requirements have been developed for application in the research and development/ design approval phase as well as in the quality control/manufacturing process.

To assist in the process of bringing new solar technology products to market at the lowest possible cost, laboratory testing must provide accurate and reliable results in the shortest possible amount of time.

Acceleration of the environmental effects that these products will experience in nature is required. Reliability of the equipment to ensure the reproducibility of the test results is an absolute necessity.

Envirotronics provides the solution.



## The following standards apply to the testing of photovoltaic modules:

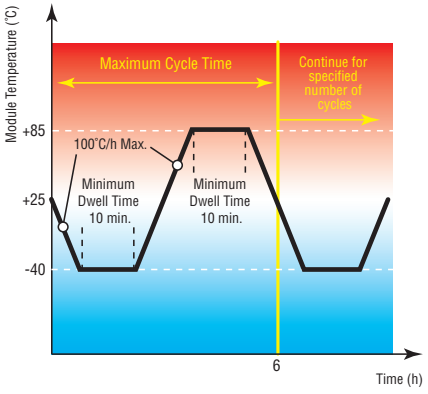
**IEC 61215**
Terrestrial crystalline silicon photovoltaic (PV) modules, type suitability and type approval

**IEC 61646**
Terrestrial thin-film photovoltaic (PV) modules, type suitability and type approval

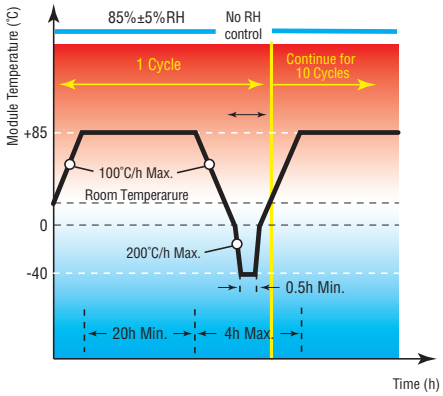
**ASTM E 1171**
Standard Test Method for Photovoltaic Modules in Cyclic Temperature and Humidity Environments.

*These standards comprise different processes for testing of the suitability of the design; however, they have identical temperature and humidity testing procedures.*

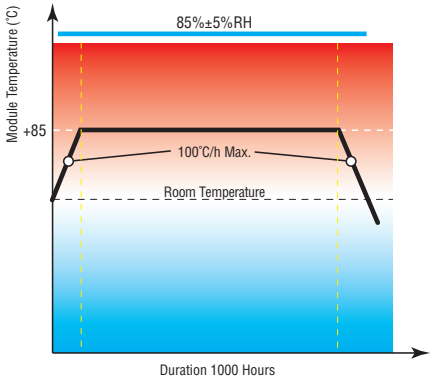
### Temperature Shock Cycling Test (10.11)



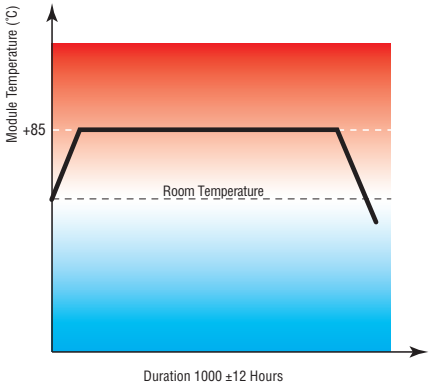

### Humidity Freezing Test (10.12)




### Damp Heat Test (10.13)

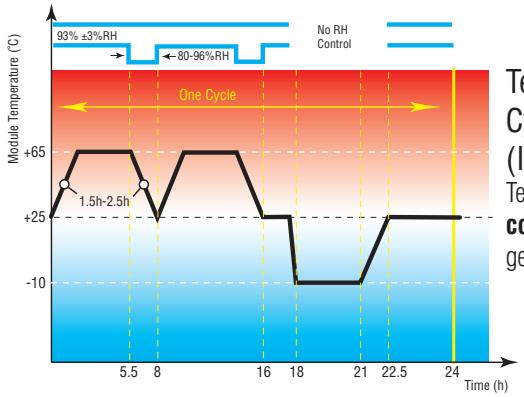



*Light testing with UV irradiation and solar simulation is also described in these standards.*




### Temperature Test (IEC 60068-2-2)

To evaluate the ability of the module for use/ storage under high temperature




### Temperature and Humidity Cyclic Test (IEC 60068-2-38)

Testing procedure of **power conditioner** for small PV power generating systems

### Solar Simulation on PV Modules

- Determination of the maximum output
- Determination of the temperature coefficients
- Measurement of the nominal operating cell temperature
- Performance under standard testing conditions
- Performance at nominal operating cell temperature
- Hot spot endurance test
- UV Test - Pre-treatment of the PV module with ultraviolet (UV) radiation before the thermal shock load and the humidity freezing testing.
  **Required source of radiation:**
- UV radiation source within the range of 280 to 385 nm and at max. 250 W/m$^2$
- Light Treatment (only under IEC 61646)
  **Required source of radiation:**
  Solar simulator with 800 to 1000 W/m$^2$

# ›FST & FSH Series
## Standard Design
## Temperature and Temperature/Humidity Test Chambers

Flexibility. The FST & FSH Series chambers provide flexibility through intelligent engineering, ergonomic design, broad temperature range, space-saving footprint, and lasting reliability at a competitive price.

The powerful Navigator+ Controller is integrated into the ergonomically designed Control Center which also features a large viewing portal. This portal offers an expansive view into the workspace with the touchscreen controller located comfortably at the operator's fingertips. The heated portal window eliminates the need for a wiper in humidity applications.

Your test profiles can be pre-programmed into the controller, so running your test can be as simple as pressing a button.

Advanced compressor technology enables the FST & FSH Series chambers to offer a temperature range of -40˚C to +180˚C employing an economical single-stage refrigeration system. For the range of -73˚C to +180˚C a high-efficiency flat plate cascade condenser is used, resulting in less cooling loss and more available machine compartment space.

In today's business environment, capital equipment must be easily transferable to virtually any manufacturing location worldwide. Envirotronics provides a multi-voltage transformer as standard equipment on each FST & FSH chamber. You can select between 480/3/60, 415/3/50, and 380/3/50. Your chamber will be ready to move when you are.

The FST & FSH Series chambers are available in 600, 1200, and 1800 liter sizes.

**Temperature Range:**

| | |
|---|---|
| Single Stage | -40˚C to +180˚C |
| Cascade | -73˚C to +180˚C |

Control Accuracy: 0.1 - 1.1˚C

**Humidity Range:**
10% to 98% ±1-3% relative humidity

*Conforms to* IEC 60068-2, GB/T2423, GJB/1032 *and* GJB/899.

## ›PVT & PVH Series

### High-Low Temperature and Temperature/Humidity Test Chambers for Photovoltaic Modules

These sturdy, single-unit construction reach-in-style test chambers are built-to-order and can offer a more aggressive testing than the FST/FSH Series. Our PVT Series chambers are temperature only test chambers while our PVH Series offers both temperature and humidity conditions. PVT and PVH chambers can be customized to meet your specific needs in terms of size, horsepower or performance.

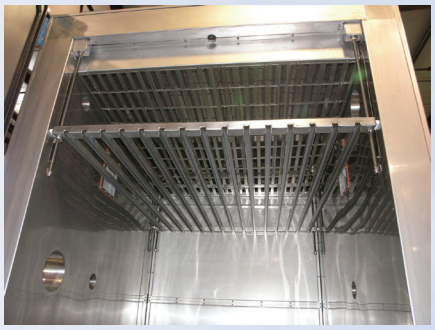
PVT and PVH chambers are loaded with standard features that ensure the durability and reliability of your test chamber for years to come and that enhance its ease-of-use. Your test profiles can be pre-programmed into the controller, so running your test can be as simple as pressing a button.

PVT and PVH Series chambers are available with either Horizontal or Vertical airflow and can be equipped with an adjustable rack for holding your test specimens.

**Temperature Range:**
-73˚C to +180˚C
Control Accuracy: 0.1 - 1.1˚C

**Humidity Range:**
20% to 95% ±1-3% relative humidity.

Extended ranges available.



*The PVH chamber pictured above features a Vertical Airflow system and Envirotronics' adjustable specimen rack.*

# ›Designed-Built to Your Specifications

## Solid Construction Walk-In Rooms

Envirotronics' walk-in test chambers can be designed and manufactured to meet your specific requirements in terms of dimension and performance.

The welded construction of our walk-in test chambers provides superior strength and durability. The integral, welded floors provide proper drainage of water/fluids. The unit's one- piece custom construction makes the chamber very easy to install. Larger units can be constructed on site.

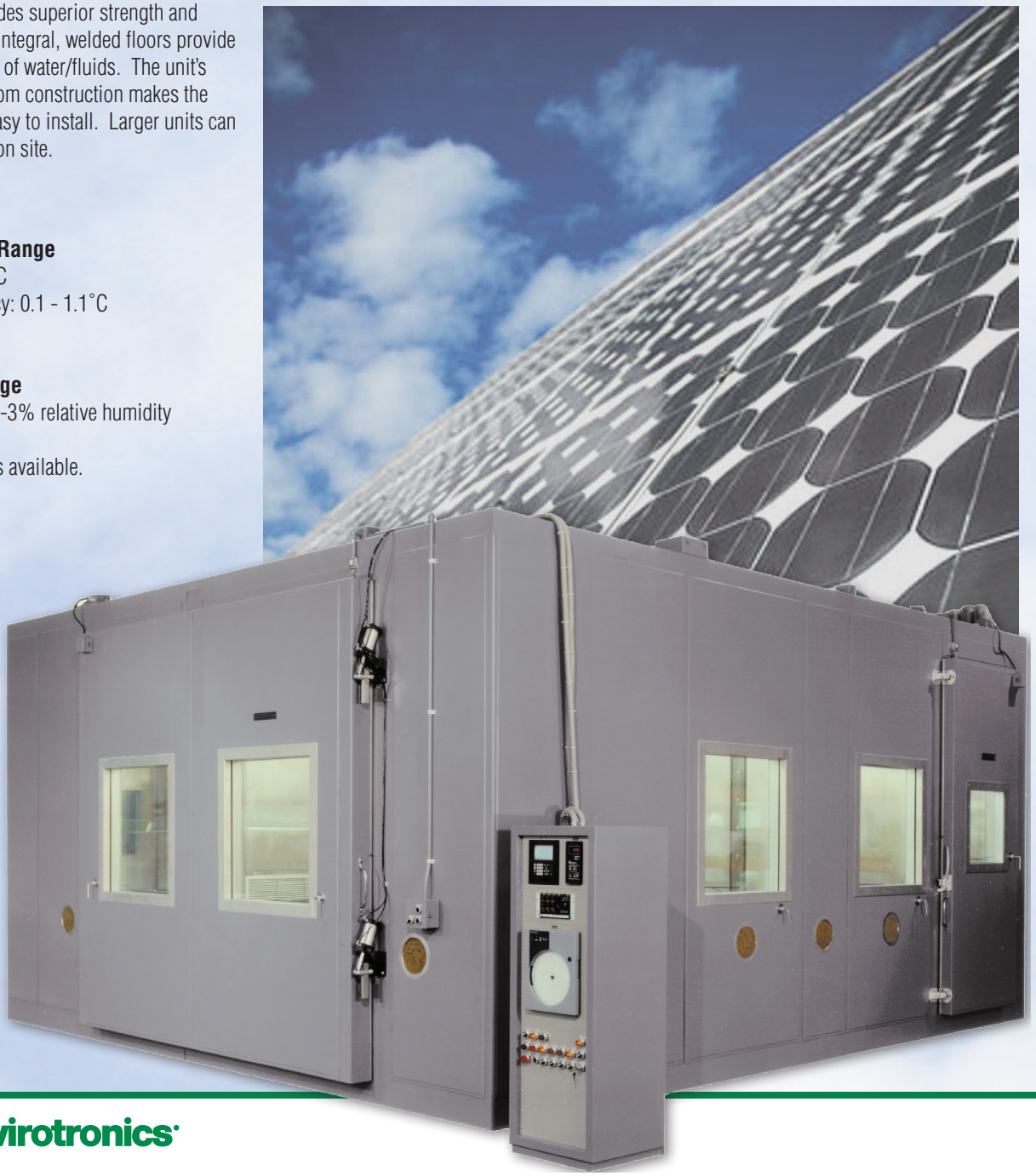
**Temperature Range**
-73˚C to +180˚C
Control Accuracy: 0.1 - 1.1˚C

**Humidity Range**
20% to 95% ±1-3% relative humidity

Extended ranges available.

- Heavy duty floors slope to common center drains
- Nominal 6-inch (15.2cm) high temperature non-settling fiberglass insulation
- Vapor-proof interior lights with external switches

Walk-in test chambers can be equipped with special facilities for solar simulation testing.

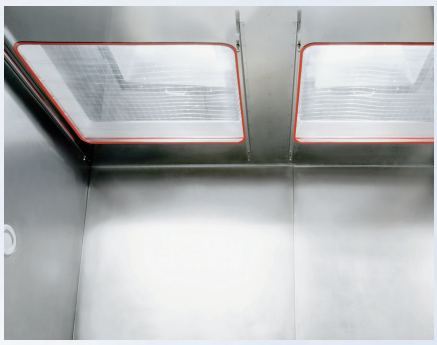


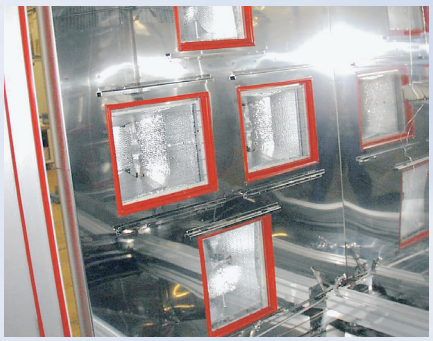
# ›SC Series

## Solar SimulatorTest Cabinets

### Example: SC 2000 MHG

- Workspace volume 3.4m³
- Workspace dimensions WxDxH 2000 x 1150 x 1510mm
- Irradiation unit Type of irradiation 2 x 4 kW Metal halide global lamps
- Irradiation intensity 800 to 1200 W/m2 with reference to the test area, steplessly adjustable
- Uniformity ±5% with reference to the test area
- Test area 1700 x 800 mm, at a distance of at least 600 mm below the ceiling glazing
- Spectral radiation distribution Global radiation 280 to 3000 nm, recommended for aging tests
- Basis CIE Pub. No. 85 Tab 4
- Parts DIN 75220 Tab. 1 Column 2/4
- Radiation modulation <1%
- Output stability ±1%






Envirotronics

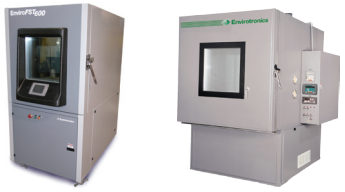
# We'll find you a *Solution*

Our slogan, "we'll find you a Solution" says it all about what we do here at Envirotronics.

We find solutions for our customers' environmental test chamber requirements through innovative and intelligent design, quality customer service, and our commitment to excellence.

The images shown here represent a sample of the equipment solutions we provide for our customers. We would be delighted to to discuss your test chamber requirements and how Envirotronics can provide a successful solution for you.

Let Envirotronics find a solution for you!



Temperature and Temperature/Humidity Test Chambers

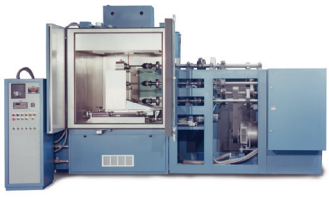
Environmental Stress Screen Test Chambers

Altitude and Altitude/Humidity Test Chambers

Solid Construction and Modular Panel Construction Walk-In and Drive-In Test Chambers

Salt Spray and Corrosion Test Chambers

Mini- and Benchtop Temperature and Temperature/Humidity Test Chambers



Custom Designed and Manufactured Test Chambers

Solar Panel and Photovoltaic Module Test Chambers

Thermal Shock Test Chambers

Pharmaceutical Stability Chambers

Sand and Dust Test Chambers

Hydraulic Cement and Concrete Moist Cabinet Curing Chamber

AGREE-Style Test Chambers

Pneumatic Vibration Tables

Complete HALT/HASS Test Systems

ENV 1108 PV

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