

THERMOTRON[®]

Selection Guide for Solar Photovoltaic Test Equipment



Good Things Come in Threes

Whether you're testing solar panels, grid-tied photovoltaic inverters, or photovoltaic cells and modules, Thermotron has the experience necessary to provide a solar test system right for you. Our three-pronged approach allows you to find everything you need for your testing demands: a variety of test chambers, specially designed fixtures, and integrated product control & datalogging.



Chambers for Solar Panel Testing



SE-3000 Chamber

Designed and manufactured specifically for solar panel testing, the SE-3000 combines the performance of our SE-Series chambers with an extra deep workspace for a solar panel testing solution. With an internal workspace measuring 48" wide x 72" deep x 52" high, the SE-3000 provides ample space for testing long length solar panels. Two circulation fans and an optimized airflow system provide conditioning throughout the entire workspace for consistently repeatable test results. The SE-3000 environmental test chamber is capable of meeting the specifications found in IEC 61215, 61646, 62108 and 61730 as well as UL1703.

Other Features & Benefits:

- Optional Universal Port
- 8800 12-inch Touch Screen Programmer Controller
- Data Acquisition capabilities
- Ethernet compatibility to network-wide accessibility
- USB Connections for fast and convenient data storage and transfer
- Optimized Air Flow
- Range of compressor sizes



SE-1415 Chamber

Ideal for customers in need of a chamber capable of testing tall, vertical oriented products such as solar panels, the SE-1415 features an interior work space measuring 40" wide x 39.25" deep x 55" high. Depending on panel thickness and dimension, the SE-1415 can test up to 20 solar panels simultaneously. An enhanced airflow system provides better gradients and improved product temperature change rates.

Other Features & Benefits:

- Optional Universal Port
- Large, heated window permits product viewing while under test
- 8800 12-inch Touch Screen Programmer Controller
- Data Acquisition capabilities
- Ethernet compatibility to network-wide accessibility
- USB Connections for fast and convenient data storage and transfer
- Optimized Air Flow





F-113 Chamber

With a volume of 113 cubic feet (2,662 liters), Thermotron's F-113 provides a large workspace for testing a multitude of solar panels simultaneously. Built with a solid construction insulated floor, the chamber is able to withstand a load of up to 900 pounds (408 kg). The chamber's temperature and humidity performance can be customized per customer requirements or based on ASTM E1171 and IEC 61646 test specifications for solar panel testing.



Other Features & Benefits:

- 2 4-inch diameter ports located on each side of chamber
- Cable port optional
- High output humidity system
- 8800 12-inch Touch Screen Programmer Controller
- Ethernet compatibility to network-wide accessibility
- USB Connections for fast and convenient data storage and transfer
- Optimized Air Flow

Walk-In Chambers

Capable of testing large products, Thermotron's Walk-In chambers are able to simulate a wide range of temperature and humidity environments. Each of Thermotron's Walk-in chambers consists of a self-contained conditioning module and a room constructed from interlocking panels or welded, insulated solid walls. Walk-in Chambers are capable of meeting the most demanding specifications requiring humidity control during temperature transitions. Our Walk-In chambers are large enough to support testing racks filled with solar panels and are available as a panel or solid-construction chamber.



Panel Construction

Panel Construction:

- Utilizes easy to use prefabricated panels for ease of customization
- Options include bi-parting doors and reinforced floors
- Available in standard sizes ranging from 286 to 1,422 cubic feet (8100 to 40,271 liters)
- Temperature range from -68°C to +85°C
- Humidity range of 20 to 95% RH; Low humidity package available



Solid-Construction

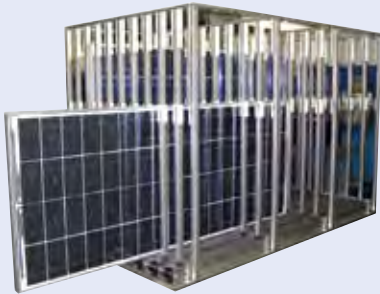
Solid-Construction:

- Designed for customer specific testing applications
- Features welded and insulated walls are able to withstand extended temperature and humidity ranges
- Chamber workspace can be customized to almost any test requirements
- Temperature range from -77°C to +177°C
- Humidity range of 20 to 95% RH; Ultra-low humidity package available



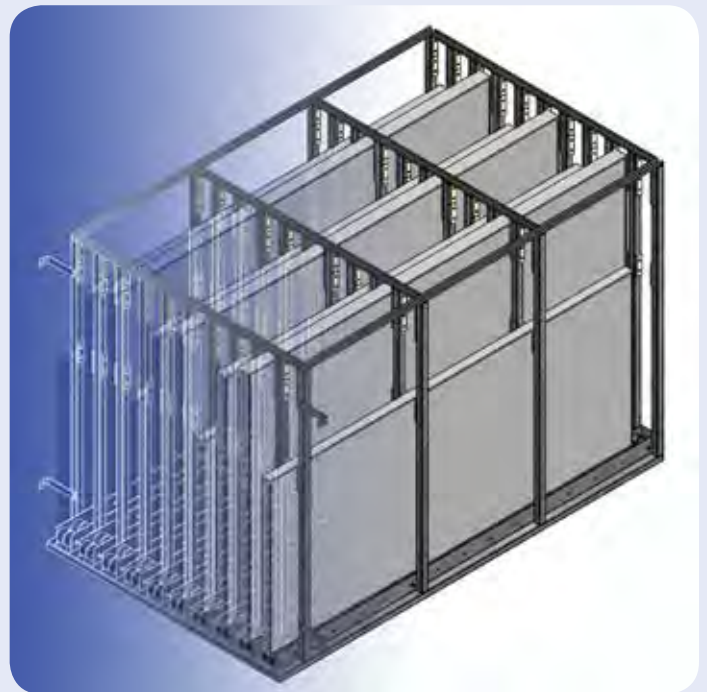
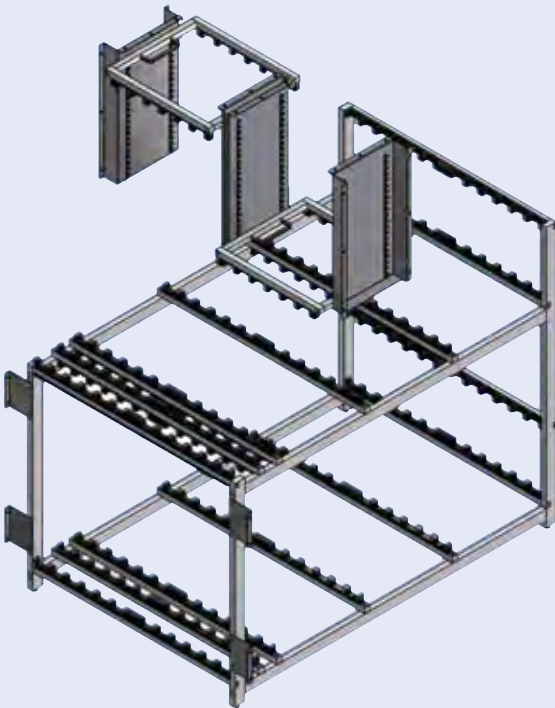
Product Fixturing for Solar Panels

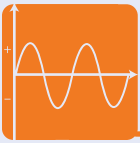
Thermotron's test fixtures are specifically designed and manufactured to maximize airflow and even temperature distribution around each solar panel under test. Able to hold multiple panels, these fixtures are made from long lasting, durable materials. Fixtures serve to protect the edges of the panels during loading and unloading as well as allowing for routing of wiring harnesses providing power and sensing to each product.



Other Features & Benefits:

- Long-lasting, durable construction and materials to withstand the rigors of the testing environments
- Adjustability for variable panel sizes
- Safe and easy roll-in loading and unloading
- Standard fixture configurations to accommodate 10, 20, 48 or 60 thin film or framed solar panels
- Easily customized for special solar panel sizes or loads.





Test, Measurement & Data Acquisition

The 8800 controller found on all of Thermotron's solar panel test systems has built in data acquisition capabilities.

It is important to functionally test and continuously monitor the solar equipment as environmental stresses are applied. Thermotron can provide a turn-key test solution based on a user's unique set of test requirements. With over 25 years experience, Thermotron's Product Test Solutions group is capable of meeting a variety of test equipment needs.



8800 Data Acquisition:

Available in several configurations for power supply control and recording, the 8800 data acquisition equipment is a completely designed and programmed custom test system for data collection and control tasks.

In addition, all data collected from the 8800 DAQ can be viewed right on the 8800 display. The DAQ offers simple setup of the desired channels. Setup wizards allow for configuring units, resolution, average factors, high and low limits, as well as notes with simple, step-by-step instructions. Digital readouts show the status of active channel conditions.

- Available options include analog input channels, analog output channels, and user-configurable digital input/output channels.
- Digital outputs allow manual or programmed profiles that activate product inputs or relays, turning solar panels on and off based on interval, chamber data, or status information.
- The analog outputs can be used to activate a programmable power supply or product inputs, or they can retransmit temperature/humidity readings to a chart recorder.

Solar Panel Temperature Datalogging:

8 to 16 Thermocouple inputs can be monitored and recorded simultaneously. For customers in need of even more data acquisition capabilities, from increased channel counts to faster data collection, Thermotron's Product Test Solutions group can design and build a custom solution.

Software Solutions:

Thermotron has also developed software that will allow you to monitor multiple values on up to ten chambers from a single computer and store the data in a custom database format. Thermotron software solutions communicate with chamber controllers and record time & date, test profile name, humidity, air and product temperatures, and other test information at customer-defined intervals. The software also allows remote monitoring of the tests.

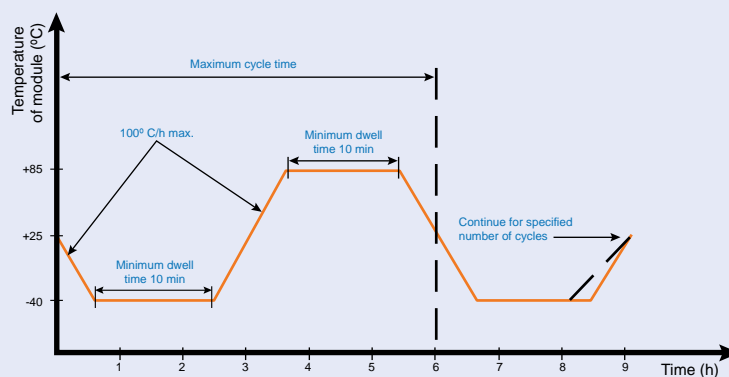




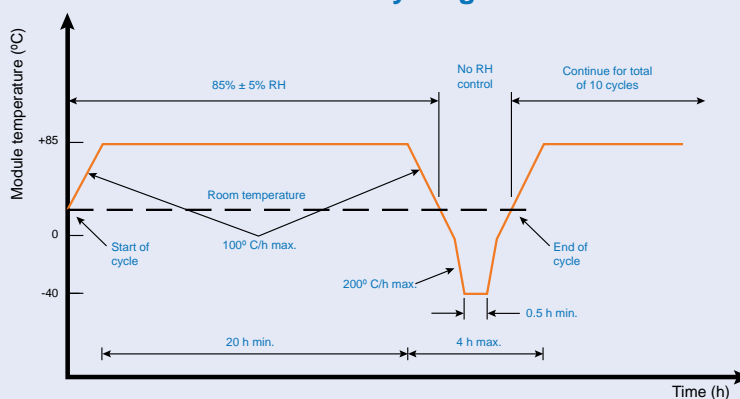
Solar Test Specifications

International Electrotechnical Commission (IEC)

Test Specification	Test Name	Test Specification Description
IEC 60068-2-78	Environmental Testing - Part 2-78: Tests - Test 2-78: Body Cab: Damp Heat, Steady State	Establishes a test method for determining the suitability of electrotechnical products, components or equipment for use under conditions of high humidity by observing the effect of high humidity at constant temperature without condensation on the product over a prescribed period of time.
IEC 61215	Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval	Provides requirements for design qualifications and type approval for crystalline silicon terrestrial photovoltaic modules for long-term use in general open-air climates. Includes Thermal Cycling, Humidity Freeze and Damp Heat tests.
IEC 61646	Thin-film terrestrial photovoltaic (PV) modules - Design qualification and type approval	Sets requirements for the design qualification and type approval of terrestrial thin-film photovoltaic modules suitable for long-term operation in open-air climates. Includes Thermal Cycling, Humidity Freeze and Damp Heat Tests.
IEC 62108	Concentrator Photovoltaic (CPV) Modules and Assemblies - Design Qualification and Type Approval	Specifies the minimum requirements for the design qualification and type approval of concentrator photovoltaic modules and assemblies suitable for long-term operation in general open-air climates. Includes Thermal Cycling, Damp Heat and Humidity Freeze Tests.
IEC 61730	Photovoltaic (PV) module safety qualification	Describes the testing requirements for photovoltaic (PV) modules in order to provide safe electrical and mechanical operation during their expected lifetime. Tests include polymeric materials, internal wiring, connections and bonding and grounding testing.



Thermal Cycling Test



Humidity Freeze Cycle



Institute of Electrical and Electronics Engineers (IEEE)

Test Specification	Test Name	Test Specification Description
IEEE 1513	IEEE Recommended Practice for Qualification of Concentrator Photovoltaic (PV) Receiver Sections and Modules	Provides qualification tests for the evaluation of concentrator photovoltaic (PV) receiver sections and modules design performance, reliability, safety, and susceptibility to known failure mechanisms. Includes testing of potential degradation of receiver section and module performance resulting from environmental weathering, mechanical loading, or corrosion

Underwriters Laboratories (UL)

Test Specification	Test Name	Test Specification Description
UL 1703	Standard for Safety for Flat-Plate Photovoltaic Modules and Panels	Provides safety requirements for flat-plate photovoltaic modules and panels intended for installation on or integral with buildings, or to be freestanding (that is, not attached to buildings), in accordance with the National Electrical Code, NFPA 70, and Model Building Codes, modules and panels intended for use in systems with a maximum system voltage of 1000 V or less or components intended to provide electrical connection to and mounting facilities for flat-plate photovoltaic modules and panels. Includes Temperature Cycling and Humidity testing.

ASTM International

Test Specification	Test Name	Test Specification Description
ASTM E1171	Standard Test Methods for Photovoltaic Modules in Cyclic Temperature and Humidity Environments	Provides procedures for performing accelerated stressing of photovoltaic modules and simulating the aging of module materials in simulated temperature and humidity environments. Includes Thermal Cycling.



Comprehensive Service & Support

When you work with Thermotron, you will be supported by the largest, best equipped, and most highly trained service force in the test equipment business. A network of highly qualified, direct sales representatives, field service and application engineers provide support before and after the sale. From preventive maintenance and customer service seminars to our responsive parts department, our worldwide service centers and technical support staff provide expert assistance throughout the life of your equipment.

The Choice Is Clear.





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