

**Fast
Accurate
Reliable
Temperature
Testing**

THERMONICS Precision Temperature Forcing Systems



THERMONICS
A Test Enterprises Company

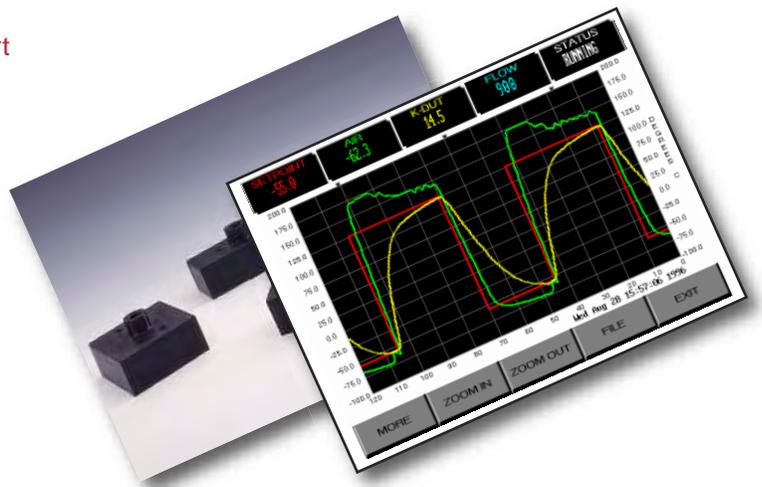
About Thermonics

Thermonics, located in Sunnyvale, California, was established in 1976. Our mission since inception has been to design and manufacture superior Precision Temperature Forcing Systems (PTFS) and ancillary products which facilitate testing of electronic devices at temperature. Thermonics is a Test Enterprises, Inc. company.

Many models are available that provide a variety of temperature ranges, cooling mechanisms and software sophistication. Applications in which tri-temperature automatic component handlers are either unavailable or inappropriate due to a low volume of test components are ideal candidates for these systems. Typical applications include research and development, device validation, product engineering, quality assurance, and production test.

Thousands of our systems are in use around the world, offering increased productivity and accuracy as well as maintenance savings for our customers. We proudly produce high-quality products with proven reliability. These product offerings are supported by:

- Product Warranty
- World-Wide Service and Support
- Product Training
- Thorough Documentation
- On-Line Support



Products and Services

Our main product offerings include:

Precision Temperature Forcing Systems: That use directed, temperature-controlled forced air to provide a controlled environment for temperature testing/cycling of devices. This enables you to perform tests in situ, at the specific location of the component: on a test socket, PCB or small assembly or to provide a more generalized temperature source for a thermal chamber, or your own custom application.

Optional Systems: Include a self-contained unit that requires no external air source, convenient bench-top systems and liquid-nitrogen assisted systems, with extreme low-temperature capability.

Custom Thermal Fixtures: Are uniquely designed thermal test enclosures that we develop to your requirements and integrate with the PTFS. Designs take into consideration the many complex aspects of electronic testing of microelectronic devices at temperature and represent many years of experience in this field.

Accessories: Include tools and material that work in conjunction with the PTFS to facilitate testing. Available items range from air ionizers and conductive thermal caps and materials, to equipment for calibration and maintenance of our systems.

Product Families

Various levels of software sophistication, user interface type and physical characteristics differentiate our product families. These product offerings provide a range of options within which you can easily find a system that will provide a solution to your specific temperature testing requirements.

The system designs are generally modular, allowing them to be configured with optional features to meet varying customer requirements. Systems can be configured for use in specific production applications by the addition of options to the standard units. Modifications can include different styles of arms, test fixtures, or enhancements to the temperature range or air flow rate.

Our various implementations of mechanical refrigeration are highly reliable, environmentally safe, and chlorofluorocarbon free (CFC-free). This approach eliminates the need for liquid nitrogen in most cases, which saves valuable floor space and reduces long-term costs. Thermonics is the acknowledged leader in providing Precision Temperature Forcing Systems using mechanical refrigeration as the primary cooling mechanism. CE certification is available.

The main product families are::

T-2500: Our premier product family, the T-2500 series of Precision Temperature Forcing Systems set a higher standard for performance and value than other available systems. Products in this group are obtainable with a variety of design and performance options to meet the needs of an assortment of test specifications. Variations in arm design coupled with different strategies in the heating and cooling mechanism, provide a wide variety of available systems. The core product in this family, the T-2500SE, has a temperature range of -90C to 225C and can transition air temperatures between +125C and -55C in as little as 4 seconds.

T-2600BV: Our portable product offering. Bench-top size packaging makes the units light, compact and easy to transport. The smaller size facilitates use in applications where traditional temperature forcing systems may be impractical due to weight and size constraints: such as a lab setting, or when the application has a low volume of devices to test. Systems in this category typically have a temperature range of -30C to +200C.

T-2800: Our mid-range product offering provides a balance between feature-sophistication and economy. Ideal for functional test stations, this series of products enables trouble-free testing of electronic components over a temperature range of -60C to +200C. The systems are easy to use and deliver fast and accurate test results. For facilities that do not have an air source, the T-2800 is fully self-contained, eliminating the need for installation of an external air compressor.

Model T-2820 provides trouble-free testing of electronic components over a temperature range of -80C to +225C. The system is easy to use and delivers fast and accurate test results. Both models make use a new arm design that enables easy manipulation and placement of the thermal test head.



T-2500 Product Family

The systems in this family are produced with a variety of options for the thermal head, arm and cooling mechanisms. The core product in this family, the T-2500SE, has a temperature range of -90C to 225C and can transition between +125C and -55C in as little as 4 seconds.

Variations in available arm designs range from fully-motorized to manual arms or even a basic output hose. While most systems use field-proven, single stage mechanical refrigeration as the sole cooling mechanism, LN₂ assisted systems are available for extreme low temperature testing. The model T-2500IX/M is a multi mode system, capable of using mechanical refrigeration and/or an LN₂ assist mechanism to achieve -130C. For high flow rates, model T-2500HFE provides continuous 1200 SCFM at -90C. A similar model is also available with a basic output hose - T-2500HFB. See the T-2500 Series Feature Table, for a summary of available models.

Features common to this family of products include:

Intelligent Touch-Screen Interface

An intelligently designed, multi-color touch-screen makes the system easy to set up and operate. On-screen graphics present the temperature setpoint, air temperature, DUT (device under test) temperature, airflow rate, and current system status. Menus enable the operator to change parameters by touching the desired selections. In addition, a password protection feature makes it possible for the test engineer to determine operator accessibility to essential software segments.

Sophisticated Temperature Cycling

Temperature profiles are easily set up on the touch screen. Profiles can be saved and recalled for use or export. Data entered can be as simple as two temperatures and soak times, or as intricate as a 99 step cycle - each with a unique temperature, soak time, or ramp rate. T-2500 products may be used for temperature cycling per MIL STD-883C for thermal stressing of semiconductor devices.

Easy PM and Calibration

Thermonics' Precision Temperature Forcing Systems are field proven for durability, performance and reliability. The system can be relied upon for use in around-the-clock production environments. Maximum up time is achieved with a modular design that promotes quick and easy implementation of preventive maintenance activities. Calibration of the system is facilitated by a series of software screens that guide you through the procedure in a systematic manner. In addition, diagnostics screens report system malfunctions in an easy to understand format that assists with servicing of the system.

ATE Compatibility

Remote operation of the system is accomplished with an IEEE-488.2 interface. A library of remote communication commands enable easy configuration, monitoring, and actuation of critical setup and operating parameters; such as temperature set points and soak times from any remote computer or terminal. A standard ATE interface providing start test, end of test, and class signals is provided to assure full ATE compatibility which includes the ability to communicate with all main ATE and Rack and Stack test systems.



T-2500SE Precision Temperature Forcing System

Efficient Air Dryer

To ensure the use of clean and dry air, a built-in air dryer removes water vapor and particles from the compressed air source. This heatless air dryer lowers the dew point of the source air to approximately -80C.

ESD Protection

Grounding of all surfaces and air pathways prevents the development of electro-static discharge (ESD) which can damage sensitive semiconductor components.

Optional Air Ionizer

ESD protection can be further enhanced by inclusion of the optional air ionizer. The ionizer provides an ion balance that prevents a charge from developing in the air stream and removes charges from non-conductive surfaces. Conductive silicone rubber thermal caps and insulation sheets are also available.

On-Screen Graphics

Numerical representations of the DUT, air and set-point temperatures continuously display. A screen that presents the data in graphical form similar to a chart recorder is provided at the touch of a key. Logged data can be stored. See examples at right.

CE Certification

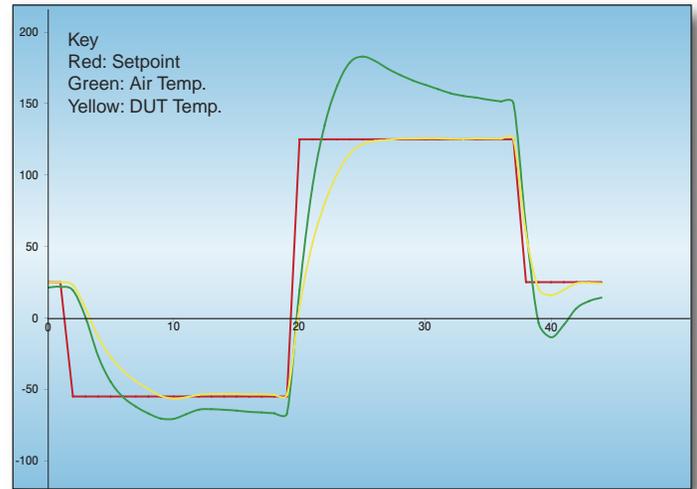
For use in Europe, CE certification is provided.

Precise Temperature Control

A patented, proprietary temperature control algorithm provides the most rapid and precise temperature control of any available temperature forcing system. Physical integration to the DUT is accomplished with the interface kit, which includes thermal caps and a shroud assembly. Coupled with the system's high airflow and cold boost feature, test temperatures are achieved efficiently and economically; making the T-2500 product series the optimal system for testing semiconductor packages, hybrids, modules, MCMs, PCBs, and small subassemblies. Examples of typical semiconductor packages that the system can accommodate include PLCC, DIP, LCC, PGA, SOP, QFP, and others. Custom thermal fixtures are available to provide a controlled temperature environment for testing larger modules.

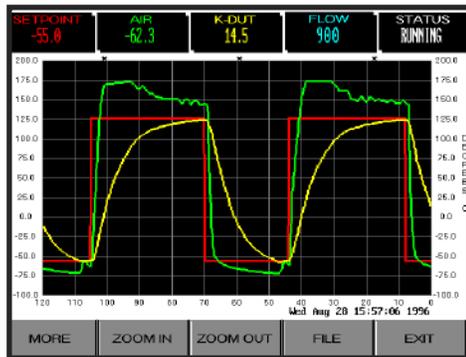
DUT Sensor

The case temperature of the DUT can be controlled with the use of the DUT sensor (K-type or T-type). This feature makes it possible to control the temperature of the DUT to within $\pm 1\text{C}$ of the desired temperature setpoint. In addition, an advanced temperature control algorithm assures the DUT is quickly stabilized at temperature.



+25C to -55C and -55C to +125C with 5 second soak time using DUT control with Cold Boost enabled.

Typical Device Temperature Response



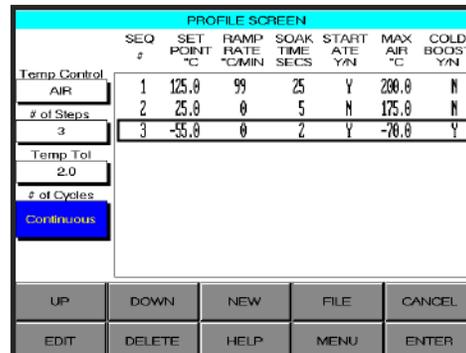
Scrolling Graph Screen



Numeric Keypad



Manual Control Screen



Profile Setup Screen

T-2500 Systems

Integrated Thermal Test Head and Motorized Arm

The standard system provides a strong support arm for adapting the thermal test head to the DUT. The positive action, quick adjust arm has several degrees of freedom that enable it to be positioned in a wide range of horizontal and vertical positions. The combination of electro-mechanical and pneumatic action of this assembly ensures precise, stable and repeatable placement of the thermal shroud over the DUT. Heated purge air is provided to keep the test interface free of frost or moisture when operating at cold temperatures.

Other arm options are available. The T-2500BE provides a basic out-pipe hose and the T-2500SEA provides a simplified mechanical arm.



T-2500BE with basic output hose



T-2500SE Fully-Motorized Arm



T-2500SEA Simplified Arm

T-2500 Series Feature Table

Product	Temperature Range	Key Features	Benefits/Application
T-2500BE	-80C to 200C	Single heater in chassis. 1.5 meter basic output hose.	Appropriate for use with custom thermal fixtures.
T-2500E	-80C to 225C	Single heater thermal head with motorized up/down boom. Manual in/out arm.	Full-featured system that is economically priced.
T-2500EA	-80C to 225C	Single heater thermal head with simplified manual arm.	Enables closer proximity of the tester to the PTFS.
T-2500HFB	-90C to 200C	1.5 meter basic output hose. High air flow capability (20 CFM)	For high-flow test requirements. Provides 1200 SCFH (20 CFM) at -90C.
T-2500HFE	-90C to 225C	High air flow capability (20 CFM)	For high-flow test requirements. Provides 1200 SCFH (20 CFM) at -90C.
T-2500IX	-100C to 225C	Single heater thermal head optimized for colder output.	Extends the cold output to -100C without using LN2.
T-2500IX/M	-90C to 225C LN2: -130C	Dual mode system capable of using LN2 for enhanced cold operation.	Useful for large or high-power dissipating devices. Provides continuous -130C using LN2.
T-2500SE	-90C to 225C	Dual heater thermal head with fully motorized arm and boom assembly.	Full-featured system. Provides the most sophisticated temperature testing capability available.
T-2500SEA	-90C to 225C	Dual heater thermal head with simplified manual arm.	Enables closer proximity of the tester to the PTFS.

For additional information call a Thermonics Sales Representative today! **(408) 542-5900**

T-2500 Series Product Specifications

The model T-2500 product family is designed to comply with the following specifications. The systems have been factory tested to verify conformance.*

FEATURES

- Fast temperature response time
- Environmentally safe
- Fully grounded
- Small footprint
- Fast DUT temperature stabilization time
- Color LCD display with touch-screen
- Flexible ATE communications
- Sophisticated system self diagnostics
- $\pm 1\text{C}$ accuracy with 0.1C readout
- High air flow rate
- Frost free operation
- Graphical display of temperature response

GENERAL DESCRIPTION

Method of Cooling: Forced air with single-stage mechanical refrigeration and multi-stage self-cooling heat exchanger. Non-CFC based refrigerants are used - environmentally safe.

Method of Heating: Forced air with in-line air heaters.

Operator Interface: Color LCD display, menu-driven touch-screen with software menu selections. Software contains system self diagnostics. Uses graphical software to select system menus such as operating mode, and to set system parameters such as temperature setpoint or flow rate.

Data Communications: Interfaces to ATE systems. Contains IEEE-488.2, RS-232C, Standard Tester Interface, and Printer port. Software communication parameters are configurable to accommodate varying systems.

SYSTEM FEATURES

Temperature sensor: Device Under Test (DUT), K-type and T-Type thermocouples. Also, K-type thermocouple for air temperature. P-N junction for V_f temperature control.

Controller: Pentium®-based PC motherboard.

Fail safes: Snap-disc thermostats, air flow sensors and thermocouples. Over-temperature limit of 245C .

TEMPERATURE PERFORMANCE

	Range (°C)	Accuracy (°C)	Stability (°C)	Displayed Resolution (°C)	Transition** Time (sec)
T-2500BE	-80–200	± 1.0	± 0.3	0.1	120
T-2500E	-80–225	± 1.0	± 0.3	0.1	10
T-2500EA	-80–225	± 1.0	± 0.3	0.1	10
T-2500HFB	-90–200	± 1.0	± 0.3	0.1	120
T-2500HFE	-90–225	± 1.0	± 0.3	0.1	4
T-2500IX	-100–225	± 1.0	± 0.3	0.1	4
T-2500IX/M	-130–225	± 1.0	± 0.3	0.1	10
T-2500SE	-90–225	± 1.0	± 0.3	0.1	4
T-2500SEA	-90–225	± 1.0	± 0.3	0.1	4

Maximum cold specifications are for room ambient temperature of 77°F (25°C), or lower, using 60Hz power. Cold temperature specifications are degraded 5°C for 50Hz operation. **Transition time is between $+125^\circ\text{C}$ and -55°C ; air temperature measured at air output nozzle. Measured in temperature cycle mode after system stabilization with a 10-second soak time, or less, at each temperature.

ENVIRONMENTAL REQUIREMENTS

Ambient Temperature Range: 15°C to 26°C

Relative Humidity: 20 - 65%

POWER REQUIREMENTS

Volts	Hertz	Phases	Amps
200–230	50/60	1 \emptyset	20 (30 amps for T-2500HFE)

AIR INPUT REQUIREMENTS

Pressure: 80-110 PSIG (5.7 - 7.8 Kg/Cm²)

Flow Rate: 18 SCFM (8.6 liters/sec) (30 SCFM for T-2500HFE)

Dew Point: Less than 10C at 80 PSIG (5.7 Kg/Cm²)

Quality: Clean air; free of oil, moisture and particles

OUTPUT AIR FLOW

200 to 900 SCFH (1.6 to 7.08 liters/sec.). Flow is under software control.

1200 SCFH for T-2500HFE (9.4 liters/sec.)

PHYSICAL CHARACTERISTICS

Height (in/cm)	Width (in/cm)	Depth (in/cm)	Weight (lbs/kgm)
55/139	25/63	28/71	350/160



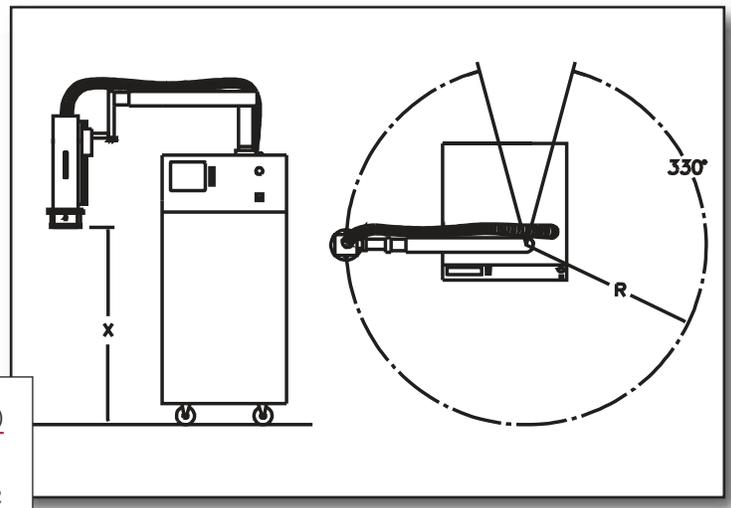
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	Min (in/cm)	Max (in/cm)
X	27/69	44/112
R	34/86	48/122



T-2600 Product Family

The products in this family are light, compact and portable enabling their use in applications where transportability of the temperature-controlled air source is key. These very capable and efficient test systems are the smallest units Thermonics manufactures, and may in fact, be the smallest available PTFSSs. These units can be used for hot and cold testing of semiconductor, hybrid and other small components and provide an economical alternative to larger systems.

Members of this family include the T-2600, T-2610, and T-2650 all of which are desk-top sized units that are differentiated by their size, temperature performance and air output options. The T-2610 and T-2650 have a mechanical arm and thermal head assembly, while the T-2610 makes use of a Basic Output Hose (BOH).

T-2600BV with Vortex Thermal Head

Provides easy positioning and precise placement of the air source over the device under test. Various physical setups, such as direct testing of socketed device on an ATE system, can be easily accommodated. The head can be raised and lowered by pressing a button on its side, stepping on a foot pedal switch, or by sending a remote command through the IEEE-488 interface. The temperature range is -30C to +225C.

T-2610BV with Basic Output Hose

Provides the lowest cost solution for placement of the temperature controlled air on the test device. Heating or cooling of the device is achieved by directing this stream of air directly on the device. This PTFSS is also useful for providing temperature controlled air for an enclosed environmental chamber such as one of Thermonics' custom designed thermal test fixtures. The temperature range is -20C to +200C.

Vortex Technology

Vortex technology provides the cold air source via either a vortex thermal head or a basic output hose. This unique mechanism for delivering temperature-controlled air is very reliable and safe with the added benefit of not using any refrigeration. Silicone rubber thermal caps provide an inner chamber that enhances the fast and accurate temperature control. A variety of sizes and shapes of thermal caps, which can enhance the integration of the air source with a variety of test devices, are included with the systems.

Control and Interface Panels

Features common to this product family are the control and interface panels. The primary features are a four-line, eighty character display, a data entry keypad and three preset keys for storing pre-programmed temperatures. The display presents status information, menus and end-user prompts to assist in easy setup and operation of the system. The interface panels contain the IEEE-488 remote interface.

Menu-Driven Software

Menu-driven software offers flexibility in configuring these systems for a variety of applications. Specific items you can configure include: test temperature, temperature control mode (air or DUT), soak time, temperature ramp rate and interface type. The systems also let you set up and store sets of test sequences with various temperature set points and soak times for use in automated temperature cycling. Programmable preset keys enable the operator to store and recall commonly used application parameters, which can be re-invoked at the touch of a button. All setup parameters are stored in non-volatile memory.



T-2600BV with Vortex Thermal Head and

- Temperature range of -30C to +225C
- Small footprint
- Easy to adjust support arm and thermal test head
- DUT temperature control



T-2610BV with Basic Output Hose

- Temperature range of -20C to +200C
- Highly portable
- Convenient "mail-in" servicing and calibration

For additional information call a Thermonics Sales Representative today! **(408) 542-5900**

T-2650BV

The T-2650BV Precision Temperature Forcing System (PTFS) provides a unique and cost-effective approach to testing devices over a wide (-60C to 200C) temperature range. This compact system is ideal for “benchtop” applications and includes an integrated thermal test head and support arm.

This advanced PTFS is also energy efficient. Compared to full size roll-around systems, the T-2650BV dissipates 50% less power for most applications. For modest temperature range applications (-10C to 150C) only 7 SCFM (198 liters/min.) of compressed air flow is required.

A full array of operational features is provided within the software of the T-2650BV. These include IEEE-488.2 (GPIB) remote control, temperature ramping, temperature cycling and device under test (DUT) temperature sense capability with an external K or T type thermocouple. Temperature resolution is 0.1C and accuracy is +/- 1.0C

The T-2650BV fulfills the need for an effective PTFS in a setting where floor space is limited or portability is required. The system is a true bench-top sized unit that retains many of the salient features of our full-sized units.

Common applications for use of the system include research and development, product engineering, quality assurance, or production test. The optimum test candidates for this system are single parts or passive devices if parallel testing is implemented.

Integrated Support Arm and Thermal Test Head

Provides easy positioning and precise, repeatable placement of the thermal test head over the device under test (DUT). Assures superior integration of the DUT with the air stream for effective temperature control.

Small Footprint

Perfect for tight work spaces. Easily portable relative to a standard unit. Unit measures 21 inches by 20.75 inches. (53.3 cm X 52.7 cm)

System Options

System options designed specifically for this unit include the T-ADF air dryer and the T-CART/BV customized cart - shown in the above photo.

T-ADF Compressed Air Dryer and Filter

This heatless regenerative air dryer removes excess moisture and particles from your compressed air and lowers the dewpoint to -70C. The unit can be used to condition the air for the T-2650 or as a standalone unit for other applications. The air dryer arrives fully assembled and ready for use. Easily integrated into the roll-around cart.



T-2650BV PTFS installed in cart with air dryer

- Temperature range of -60C to +200C
- Vortex and Mechanical Refrigeration
- Small Footprint
- Compact and Portable
- Easy to Operate
- Lower Power Consumption

T-CART/BV Customized Cart

The cart provides a stable and convenient platform upon which to mount the T-2650 PTFS. Additionally, the cart supports localized mounting of the T-ADF air dryer for further ease of use. Large, four-inch, locking casters enable smooth movement and uncomplicated steering and positioning of the unit.

Whether your requirement is for convenience in an R&D facility or the test floor, the T-CART/BV is an option that will augment easy transport of the system within your facility.

T-2600 Series Product Specifications

The model T-2600 product family is designed to comply with the following specifications. The systems have been factory tested to verify conformance.*

FEATURES

- **Light, Compact, Portable**
- **Small Footprint**
- **Vortex Cooling**
- **Easy to Operate**
- **Lower Power Consumption**

GENERAL DESCRIPTION

Method of Cooling: Forced air with integrated vortex tube. No CFC based refrigerants are used.

Method of Heating: Forced air with in-line air heaters.

Operator Interface: Four-line, 80-character fluorescent display panel. Numeric keypad for data entry. Preset keys for setup data storage and retrieval.

Data Communications: Interfaces to ATE systems. Contains IEEE-488.2, RS-232C, and Standard Tester Interface. Software communication parameters are configurable to accommodate varying systems.

SYSTEM FEATURES

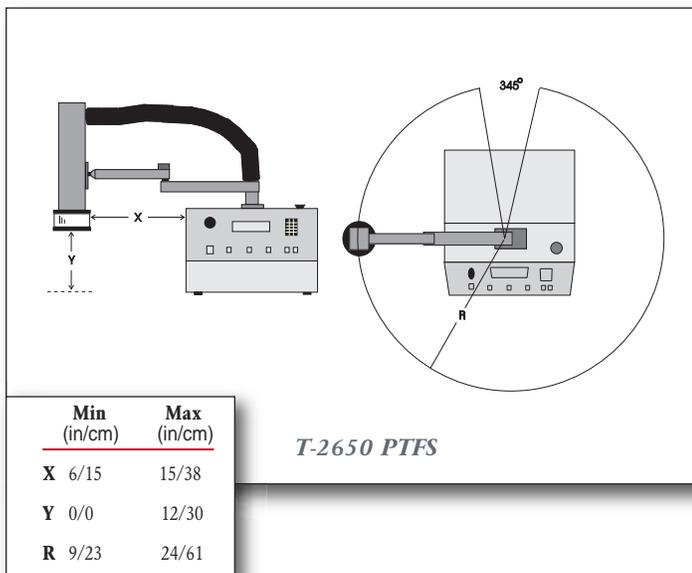
Temperature sensor: Device Under Test (DUT), K-type and T-Type thermocouples. Also, K-type thermocouple for air temperature.

Controller: Microprocessor-based PID (Proportional Integral Differential).

Fail safes: Snap-disc thermostats, air flow sensors and thermocouples.

PHYSICAL CHARACTERISTICS

	Height (in/cm)	Width (in/cm)	Depth (in/cm)	Weight (lbs/kgm)
T-2600	8/20	18/46	22/56	50/23
T-2610	10.5/27	16/41	8/20	30/14
T-2650	11/28	21/53	23/58	110/50



TEMPERATURE PERFORMANCE

	Range (°C)	Accuracy (°C)	Stability (°C)	Displayed Resolution (°C)	Transition** Time (sec)
T-2600	-30—225	±1.0	±0.3	0.1	15
T-2610	-20—200	±1.0	±0.3	0.1	40
T-2650	-60—200	±1.0	±0.3	0.1	40

**Transition time measured after system stabilization in cycle mode. Temperature set-points of +100C to -5C.

Maximum cold specifications are for room ambient temperature of 77°F (25°C), or lower, using 60Hz power. Cold temperature specifications are degraded 5°C for 50Hz operation. *Transition time is between +100°C and -40°C; air temperature measured at air output nozzle. Measured in temperature cycle mode after system stabilization with a 10-second soak time, or less, at each temperature.

ENVIRONMENTAL REQUIREMENTS

Ambient Temperature Range: 15°C to 26°C

Relative Humidity: 20 - 65%

POWER REQUIREMENTS

	Volts**	Hertz	Phases	Amps
T-2600	110—120	50/60	1Ø	20
T-2610	110—120	50/60	1Ø	20
T-2650	208—230	50/60	1Ø	15

**Note: All systems available in 100V to 240V models.

AIR INPUT REQUIREMENTS

Pressure: 80-110 PSIG (6.4 - 8.5 Kg/Cm²)

Flow Rate: 15 SCFM (7.15 liters/sec)

Dew Point: Less than -40C at 90 PSIG (6.4 Kg/Cm²)*
-70C for model T-2650

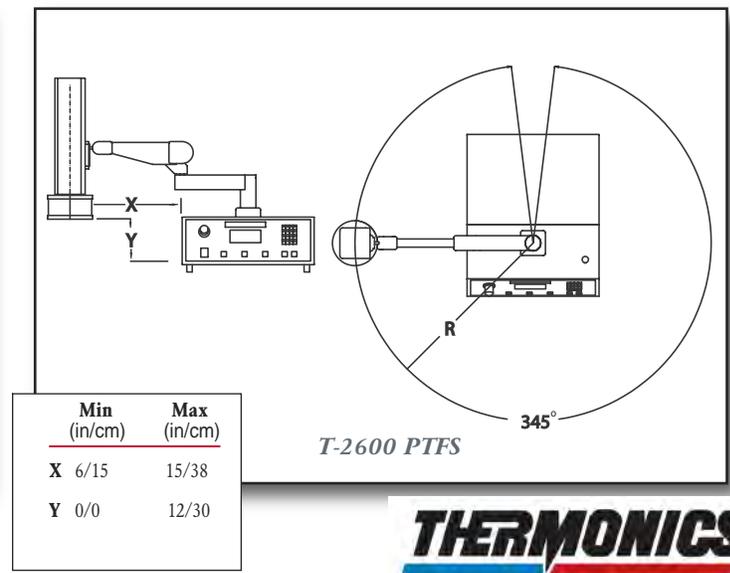
*This can be achieved using Thermonics T-ADF/BV air dryer.

AIR FLOW

T-2600 300 to 900SCFH (2.4 - 7.08 liters/sec) hot operation. 300SCFH cold.

T-2610 300 to 900SCFH (2.4 - 7.08 liters/sec) hot operation. 300SCFH cold.

T-2650 150 to 600 SCFH (1.18 - 4.7 liters/sec) hot operation. 300 SCFH cold.



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T-2800 Product Family

Members of this product family include the T-2800, T-2820 and T-2820SX. These systems provide economical and easy to operate test alternatives with unique characteristics including self-contained units, easy-adjust arms, and a variety of temperature ranges.

T-2800

Representing a conceptual breakthrough, this uniquely designed Precision Temperature Forcing System (PTFS) requires no external air source! By providing its own compressed air, you can simply connect the power cord to begin using the system. This integrated air source eliminates the costs associated with installing and maintaining a facilities air source and makes the system useable in a wider variety of locations. The system provides an airflow rate of 300 SCFH and a temperature range of -60C to 200C.

T-2820 and T-2820SX

The T-2820 Precision Temperature Forcing System provides trouble-free testing of electronic components over a temperature range of -80C to +225 C. Designed with economy and practicability as its primary design features, the system is affordable, easy to use and delivers fast and accurate test results. Typically used for hot and cold testing of semiconductor, hybrids and other small components, the T-2820 is ideal for use in production environment. A variation of this model with a lower cold temperature capability, the T-2820SX, can achieve -90C.

Features common to this product family are:

Menu-Driven Control Software

Provides flexibility in setting up the system for specific test applications. Configurable items include the test temperature, temperature control mode (air or DUT), soak time, temperature ramping rate and temperature cycling. The temperature cycling feature enables the system to perform a sequence of tests in an automated fashion. Up to 99 separate test temperatures with varying test criteria may be programmed and stored into the system. Individual presets can also be stored to non-volatile memory and recalled at the touch of a button.

Integrated Support Arm

A new support arm design is implemented that provides easier manipulation and placement of the thermal test head over the DUT. The arm provides a reach of up to 48 inches and has 345 degrees of rotation about the main pivot point. Up/down and in/out adjustments are manual. A counterbalanced design ensures easy movement and adjustment of the arm. Head up/down is pneumatic.

Remote Communication Interfaces

All of these systems can be interfaced with remotely via the GPIB (IEEE-488.2) communication protocols, enabling easy monitoring and re-configuring from a remote computer. Relevant operating parameters such as temperature setpoints, actual sensed temperature, soak times and ramp rates, are easily statused, modified and controlled.



T-2800 Fully Self-Contained PTFS

- Self-contained air source
- Temperature Range of -60C to +200C
- Airflow rate of 300 SCFH
- Easy to adjust support arm and thermal test head
- DUT temperature control



T-2820 PTFS

- Temperature range of -80C to +225C
- Quick response time: +125C to -55C in 15 seconds
- Easy to adjust support arm and thermal test head
- Programmable temperature cycling
- Sophisticated system self-diagnostics



CONTROL PANEL

The control panel contains a four-line, 80-character display, a data entry keypad and three preset keys. The panel presents status information, menus and operator prompts that provide for easy setup and operation of the system. The programmable preset keys enable the user to store commonly used application parameters for easy recall and reuse.

T-2800 Series Product Specifications

The model T-2800 product family is designed to comply with the following specifications. The systems have been factory tested to verify conformance.*

GENERAL DESCRIPTION

Method of Cooling: Forced air with single-stage mechanical refrigeration and multi-stage self-cooling heat exchanger. Non-CFC based refrigerants are used - environmentally safe. T-2800 uses cascade refrigeration.

Method of Heating: Forced air with in-line air heaters.

Operator Interface: Four-line, 80-character fluorescent display panel. Numeric keypad for data entry. Preset keys for setup data storage and retrieval.

Data Communications: Interfaces to ATE systems. Contains IEEE-488.2, RS-232C, and Standard Tester Interface. Software communication parameters are configurable to accommodate varying systems.

SYSTEM FEATURES

Temperature sensor: Device Under Test (DUT), K-type and T-Type thermocouples. Also, K-type thermocouple for air temperature.

Controller: Microprocessor-based PID (Proportional Integral Differential).

Fail safes: Snap-disc thermostats, air flow sensors and thermocouples.

POWER REQUIREMENTS

	Volts	Hertz	Phases	Amps
T-2800	200-230	50/60	1Ø	30
T-2820	200-230	50/60	1Ø	20
T-2820SX	200-230	50/60	1Ø	20

Note: Built-in power transformer is provided to adjust actual voltage to nominal system requirement of 208 VAC, 60 Hz.

AIR INPUT REQUIREMENTS

Pressure: 80-110 PSIG (5.7 - 7.8 Kg/Cm²) (Note: T-2800 requires no air input)

Flow Rate: 18 SCFM (8.5 liters/sec) (Not applicable for T-2800)

Dew Point: Less than 10C at 80 PSIG (5.7 Kg/Cm²)

ENVIRONMENTAL REQUIREMENTS

Ambient Temperature Range: 15°C to 26°C

Relative Humidity: 20 - 65%

*Specifications subject to change without notice.
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TEMPERATURE PERFORMANCE

	Range (°C)	Accuracy (°C)	Stability (°C)	Displayed Resolution (°C)	Transition" Time (sec)
T-2800	-60-225	±1.0	±0.3	0.1	20
T-2820	-80-225	±1.0	±0.3	0.1	15
T-2820SX	-90-225	±1.0	±0.3	0.1	15

"For model T-2820(SX) transition time is between +125°C and -55°C; air temperature measured at air output nozzle. For model T-2800 transition time is +125°C and -40°C. Measured in temperature cycle mode after system stabilization.

OUTPUT AIR FLOW

T-2800 300SCFH (2.4 liters/sec).

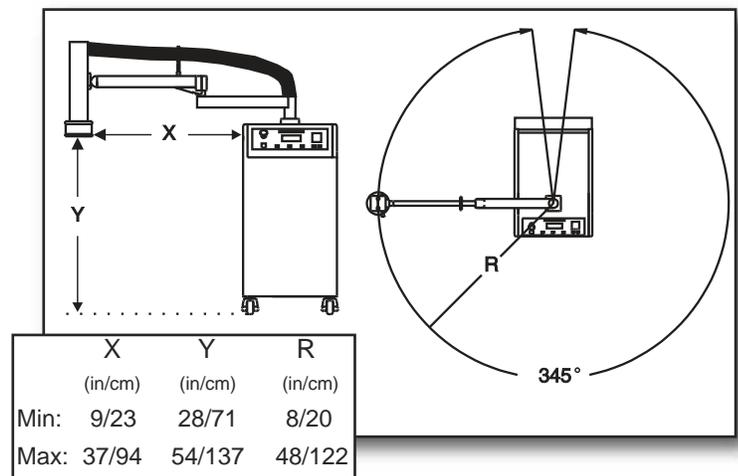
T-2820 300 to 900SCFH (2.4 - 7.08 liters/sec).

T-282SX 300 to 900SCFH (2.4 - 7.08 liters/sec).

PHYSICAL CHARACTERISTICS

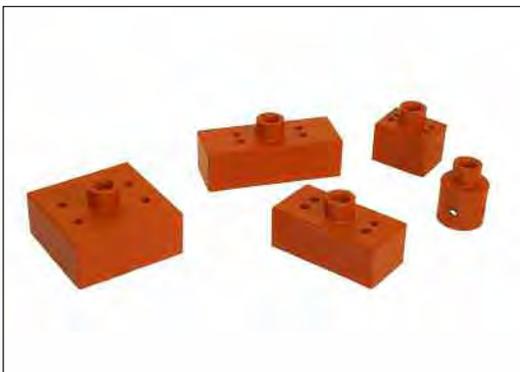
	Height (in/cm)	Width (in/cm)	Depth (in/cm)	Weight (lbs/kgm)
T-2800	43/109	21/53	34/85	450/204
T-2820	43/109	21/53	34/81	300/136
T-2820SX	43/109	21/53	34/81	300/136

Note: Weights are approximate.



Accessories

The usefulness of these accessories ranges from adapting systems to unique test environments to facilitating general repair, maintenance or calibration of the systems. Our sales staff is available to advise you on the use of any of these products in your particular environment.



Thermal Caps and Adapters (Standard or Conductive)

Using an appropriately-sized thermal cap enhances the effectiveness and temperature transition time of a PTFS by ensuring superior integration of the DUT with the air stream. The caps install easily by pushing onto the socket in the thermal test head. An adapter is available for units with a basic output hose. Use conductive thermal caps in environments where ESD is a concern. Conductive caps provide volume resistivity of 5 ohm-cm. Each Thermal Cap Kit contains a selection of five thermal caps in a variety of shapes and sizes.

Item #	Description	Products
T-CAP	Standard Thermal Caps	All PTFS
T-CAPC	Conductive e Rubber Caps	All PTFS
T-LCAP	Large Thermal Caps*	ALL PTFS
T-LCAPC	Large Conductive Thermal Caps*	ALL PTFS

* Largest cap requires SH-ADD5 optional large shroud.



Silicone Rubber Sheets (Standard or Conductive)

Use sheets of silicone rubber to provide insulation between the thermal test head and the test site. The sheets are easily cut and shaped for custom applications such as insulating a DUT load board from frost or moisture, or as an insulating gasket for a custom thermal fixture. Electrically conductive silicone sheets are available for applications in which ESD is a concern. The conductive sheets provide surface resistivity of 20K ohms/sq. One side is conductive.

Item #	Description	Products
T-SRS	Standard Silicone Rubber Sheet	All PTFS
T-SRSC	Conductive Silicone Rubber Sheet	All PTFS



Foot Switch

This optional control device is available for any of our Precision Temperature Forcing Systems that incorporate the pneumatic head lift feature. The foot pedal provides hands-free operation by enabling the user to toggle the up/down position of the thermal test head, relative to the DUT, by stepping on the pedal. The unit installs easily to a dedicated port located on the system's rear panel. Operators can position the pedal in any convenient location.

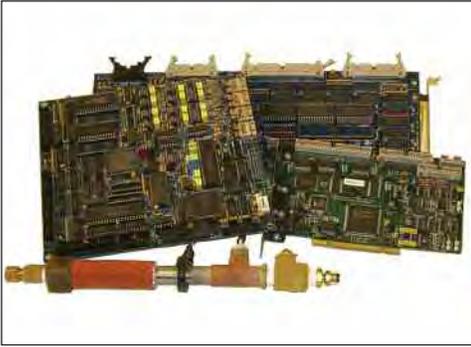
Item #	Description	Products
T-FSW	Foot Switch	All PTFS



Alternative Shrouds

Shrouds are used to create an environment to integrate the temperature-controlled air from a thermal head to the device under test. Alternative shroud designs can enhance performance of the system in some test circumstances. Two sizes are available: 3.28" (8.33cm) and 5.41" (13.74cm). Alternative shrouds can be purchased in lieu of the standard shroud, or as an additional component of the system.

Item #	Description	Products
SH-ADD3/25	Small Shroud	T-2500E/SE
SH-ADD5/25	Large Shroud	T-2500E/SE
SH-ADD3/28	Small Shroud	T-2800/20 (SX)
SH-ADD5/28	Large Shroud	T-2800/20 (SX)



Remote Spare Parts Kits

Remote spare parts kits are available for all systems. The kits contain a selection of standard replacement components; such as: PCBs, switches, heaters, and o-rings, used to ensure maximum uptime of the system. The kits are geared to systems that are used in remote locations and cover approximately 80% of critical parts.

Item #	Description	Products
T-RS2500E	Remote Spare Parts Kit	T-2500E
T-RS2500SE	Remote Spare Parts Kit	T-2500SE
T-RS2800	Remote Spare Parts Kit	T-2800
T-RS2820	Remote Spare Parts Kit	T-2820



Nozzle Extender

Extends the test head nozzle to facilitate testing of devices mounted on PC boards. The nozzle contains a muffler to reduce output noise. The extender measures 5.5" (14cm) in length and is compatible with a modified version of our various thermal caps. A purge air extension line is included to ensure frost-free operation.

Item #	Description	Products
T-NE/25	Nozzle Extender	T-2500E/SE
T-NE/26	Nozzle Extender	T-2600BV
T-NE/28	Nozzle Extender	T-2800/T-2820



Output Extension Hose

A flexible, insulated extension hose used for channeling air from the thermal test head to a thermal boot or custom test fixture. Hose measures two feet in length and attaches to the thermal fixture. Uses a 1/4-inch male NPT fitting.

Item #	Description	Products
T-EXTN/25	Extension Hose	T-2500E/SE
T-EXTN/28	Extension Hose	T-2800/T-2820



Compressed Air Dryer/Filter

Heatless Regenerative Air Dryers remove excess moisture, oil and particles from the source air and lower the dew point to -40C. They can be used in any application for which dry air is required. Use an air dryer to condition the source air for the T-2600BV or T-2610BV PTFs. The air dryer arrives completely assembled and ready for use. All that is required is to connect the air, and attach the output hose to your equipment's air input fitting.

Item #	Description	Products
T-ADF/BV	Compressed Air Dryer and Filter	T-2600BV/T-2610BV



Accessory Kits

The T-ACC Accessory Kit comprises a set of tools that facilitate temperature and air-flow calibration of the PTFs. The tools include an air flow meter, a hand-held thermocouple meter, and a set of Hex wrenches (Metric and English).

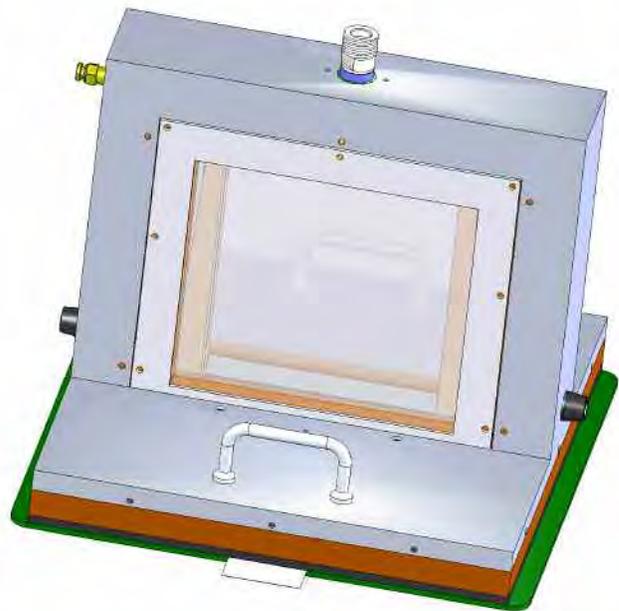
Item #	Description	Products
T-ACC	Accessory Kit	All PTFs

Custom Thermal Fixtures

To meet the needs of non-standard thermal test requirements, Thermonics is able to develop; design and manufacture customized thermal test fixtures. These innovative test fixture designs are useful for providing test solutions for a wide range of devices in an application-specific context. Our test fixtures are always designed to meet your specific needs and are fabricated to high-quality standards.

During the design process, Thermonics' engineers take into consideration the various critical aspects of electronic testing of microelectronic devices at temperature. This includes a variety of factors: size, power dissipation, and temperature range and accuracy requirements of the device.

Additionally, during the design phase, great care is taken to provide protection against electrostatic discharge (ESD) problems as well as frost and moisture. Other important development factors include the interface of the fixture to the user's ATE system and the ergonomic and accessibility requirements of the end-user. Fixture designs for a production environment can vary significantly from those intended for low-volume engineering uses such as R&D or quality assurance.



Thermal Fixture with Probe-Through Windows

Thermonics offers application specific PCB thermal fixture designs that can include "punch-through" windows for probing component leads or PCB traces for failure analysis of PCBs at temperature. Fixtures have been made for operation at -40C to 125C with PCB sizes as large as 8" x 10" (20.32 cm x 25.4 cm). The punch through windows are thin translucent plastic sheets that are easily replaced. Heated purge air is forced over the exterior of the windows to minimize moisture condensation on the windows at cold temperatures.

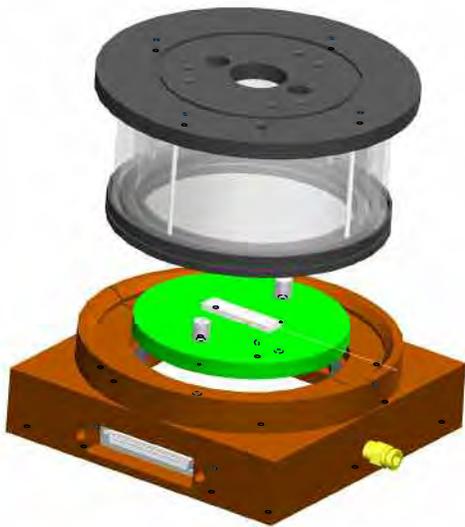
Applications

- **Integrated Circuits**
- **Hybrid Devices**
- **Microwave Devices**
- **Printed Circuit Boards**
- **Modules**
- **Optical Devices**

Features

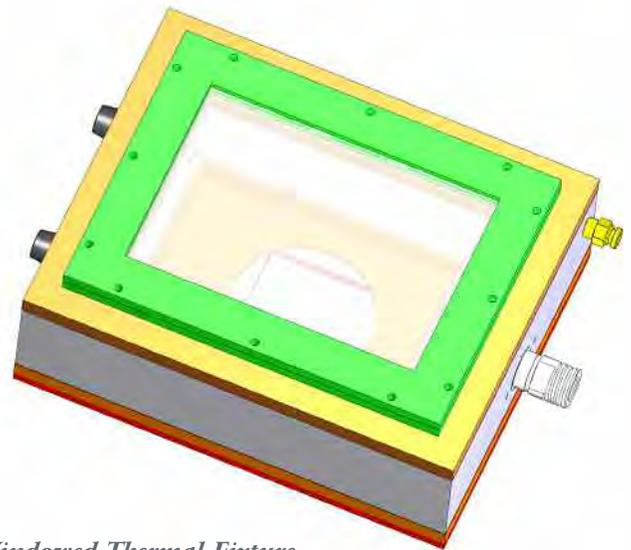
- **Temperature Range of -80C to 200C**
- **Accuracy of $\pm 1C$**
- **Frost-Free Operation**
- **Power Dissipation to 50 Watts**
- **ESD Protected**
- **Quiet Operation**





Large Shroud

The standard shroud provided with the Thermonics Precision Temperature Forcing System has an I.D. of 4.6" (11.6 cm). An optional shroud (SH-ADD5/25) has an ID of 5.4" (13.7 cm). In addition, custom shrouds can be made with an I.D. of up to 10" (25.4 cm). These shrouds are good for operation over the temperature range of -100C to 225C. For better distribution of the air flow to the DUT, an optional air dispersion (shower head) is available in place of the standard nozzle.



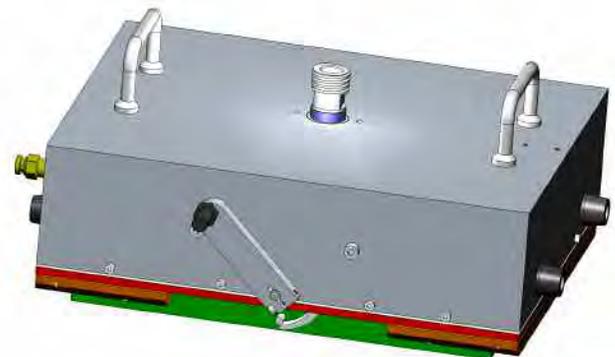
Windowed Thermal Fixture

Thermal fixtures with windows can be designed for applications that require external optical access to the DUT during test. This style of design incorporates a dual pane window with heated purge air forced over the outside window to minimize frost and moisture from forming on the window during test at low temperatures. In addition, air distribution plenums and exhaust ports are incorporated to maintain uniform air flow over the optical DUT. Ports can be provided for power and signal cables or fiber optics. An external extension hose (T-EXTN/25) is used to connect the thermal fixture to the thermal test fixture.



Rectangular Shroud

For applications that require the testing of multiple devices or small PCBs, rectangular shrouds can be designed. Temperature ranges between -80C to 125C can be accommodated. The shroud design consists of an insulated dual wall structure with an air plenum for uniform distribution of thermal air over the DUT or test PCB. Exhaust ports are provided to insure good air flow. Heated purge air is mixed with the exhaust air to eliminate frost build-up on the exhaust ports when testing at extreme low temperatures. The rectangular shroud connects to the thermal test head in place of the standard shroud.



Rectangular Shroud with Securing Clamp

Useful for applications that require a rectangular thermal test fixture that is too large to be attached directly to the thermal test head. The rectangular fixture can be designed with clamps to secure the fixture in place. This is particularly appropriate when the fixture is in a vertical position. This type of thermal fixture may be used for testing small PCBs or multiple socketed DUTs. Fixtures of this type can be made for temperature ranges between -80C to 125C. Air dispersion plenums and air exhaust ports are provided to permit uniform application of air flow to the DUT. The air exhaust is mixed with heated purge air to eliminate the build-up of frost at the exhaust port when operating at low temperatures.

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