COMPANY BACKGROUND

HISTORY

TE Technology was founded in 1989 by Richard J. Buist, Sr. He began his thermoelectric career in 1959 working for industry pioneers including Battelle, Borg Warner, Marlow, Cool Power, and Thermal Ovonic/Tellurex. His education as a solid-state physicist led him to specialize in the testing of thermoelectric materials and applications. When TE Technology was founded in 1989 the original focus was to manufacture thermoelectric test equipment and cooling assemblies. Currently TE Technology specializes in the design and manufacture custom cooling assemblies, thermoelectric modules, temperature controllers and power supplies.

CERTIFICATIONS

TE Technology is ISO 9001 registered, ITAR registered, and our data systems meet the requirements of DFAR 252.204-7012 / NIST 800-171 for our customers in the defense industry. Our manufacturing specialists are trained and certified per IPC standards in soldering and inspection.

QUALITY POLICY

TE Technology is dedicated to providing quality products and services which meet or exceed our customer's expectations through a commitment to excellence and continuous improvement.

COMPANY BACKGROUND

RICHARD J. BUIST, JR.
PRESIDENT & CFO
M.S.A. MANAGEMENT INFORMATION SYSTEMS

Joined the company in 1998 focusing on sales and distribution of thermoelectric products.

PAUL LAU
VP, CHIEF ENGINEER
MECHANICAL ENGINEERING

Joined the company in 1993 as a mechanical engineer specializing in the heat transfer of thermoelectric cooling systems.

MIKE NAGY
VP, SALES & MARKETING
ELECTRICAL ENGINEERING

Joined the company in 1992 electrical engineer specializing in the design of thermoelectric temperature controllers and cooling assembly design.

COMPANY ORGANIZATION

TE Technology is a privately held company with equal ownership by the abovementioned principals. TE Technology employs approximately 35 people and has annual revenue of approximately 9 MM USD per year.

MISSION STATEMENT

Serve our customers through quality, cost-effective, on-time thermoelectric assembly production. Remain at the forefront of thermoelectric technology and development on a global basis, and use our thermoelectric expertise, materials and equipment to give our customers a competitive edge.

INDUSTRIES SERVED

LABORATORY INSTRUMENTS

Benefits from significantly smaller sizes compared to a compressor plus the ability to heat and cool.

SEMICONDUCTOR

Benefits from precise temperature control and high reliability.

MILITARY & AEROSPACE

Benefits from a wide operating temperature range and durability under high shock and vibration.

INDUSTRIAL

Benefits from the ability to operate under harsh operating conditions with IP rated systems.

MEDICAL

Benefits from coolers specifically designed to meet both the thermal and regulatory requirements of the application.

STANDARD PRODUCTS

PRE-ENGINEERED SOLUTIONS FOR YOUR PROJECT

STANDARD COOLING & HEATING ASSEMBLIES

TE Technology's standard products allow you to quickly and inexpensively evaluate thermoelectric components for your application. We stock a wide range to meet your cooling needs, so you can begin testing immediately. Standard products can also act as a starting point for future customization. No matter how you use them, you gain extensive savings on engineering and development costs and time.

- No engineering or design fees
- In stock and ready to ship
- Wide range of thermal capacities

AIR COOLERS

APPLICATIONS

Air coolers, sometimes called air-to-air heat exchangers, are the best choice for cooling electrical enclosures and refrigerated cabinets containing objects that can not be easily cooled by direct contact to a cold plate. There may be irregularly shaped components, parts that need freedom to move, or objects that do not have any one good surface from which to remove. Air coolers adapts to any and all shapes within the cabinet.

POSSIBILITIES

Models offering high efficiency (C.O.P.) at low temperature differences for electronics enclosures.

Outdoor (IP) rated models for telecom, military and industrial applications.

Models capable of cooling to refrigeration temperatures for biomedical and laboratory applications.

COLD PLATE COOLERS

APPLICATIONS

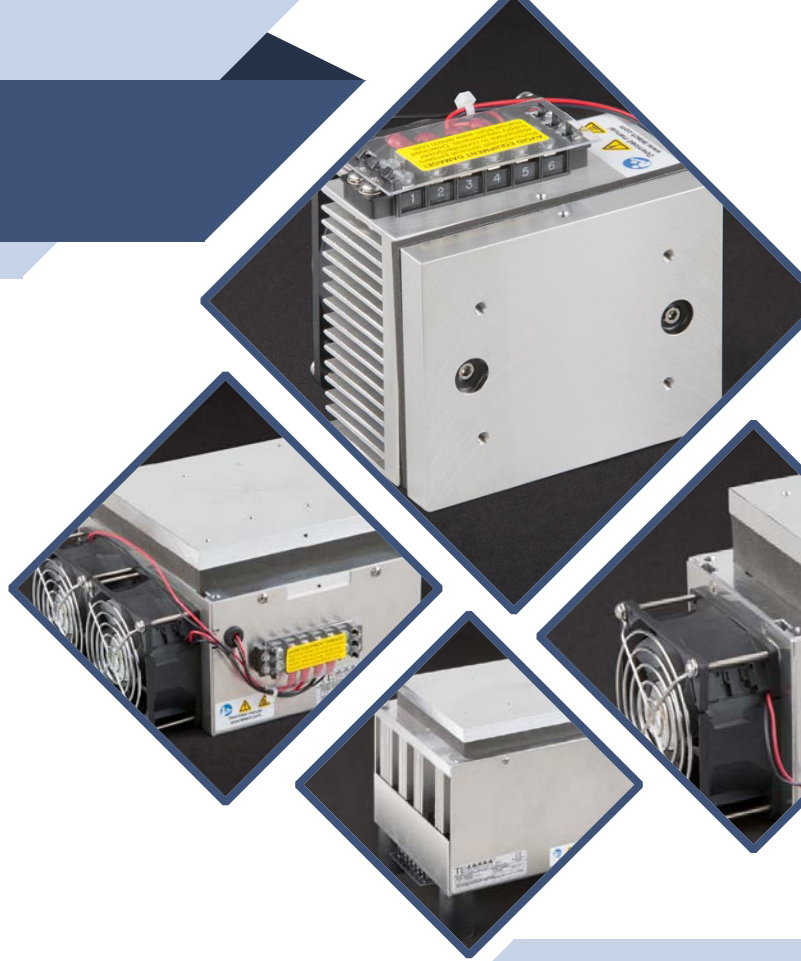
Direct contact cooling allows the heat to be efficiently conducted to the thermoelectric (Peltier) modules. This keeps the system operating as efficiently as possible, makes the cooler and power consumption as small as possible, and improves the stability and accuracy of temperature control.

POSSIBILITIES

Wide range of cooling surface sizes and capacities.

Cooling air can flow lengthwise through the fins or in the middle and out both ends depending on the model. This offers flexibility when integrating the coolers into instruments and enclosures.

Integral mounting points for attaching the cooled objects, the sensors, and for mounting in the cooler into the system.



LIQUID COOLERS

APPLICATIONS

Liquid coolers excel at delivering cooling to concentrated heat sources such as laser diodes and for delivering cooled fluid into remote or compact locations where the cooling assembly itself cannot be located.

POSSIBILITIES

Highly efficient multi-pass liquid loops.

The LC-SSX1 can be mounted to our cold plate coolers to make a liquid cooler with an all stainless-steel wetted surface.

Mixer Coils can be utilized.

Can also be used to dehumidify gas streams.

THERMOELECTRIC MODULES

APPLICATIONS

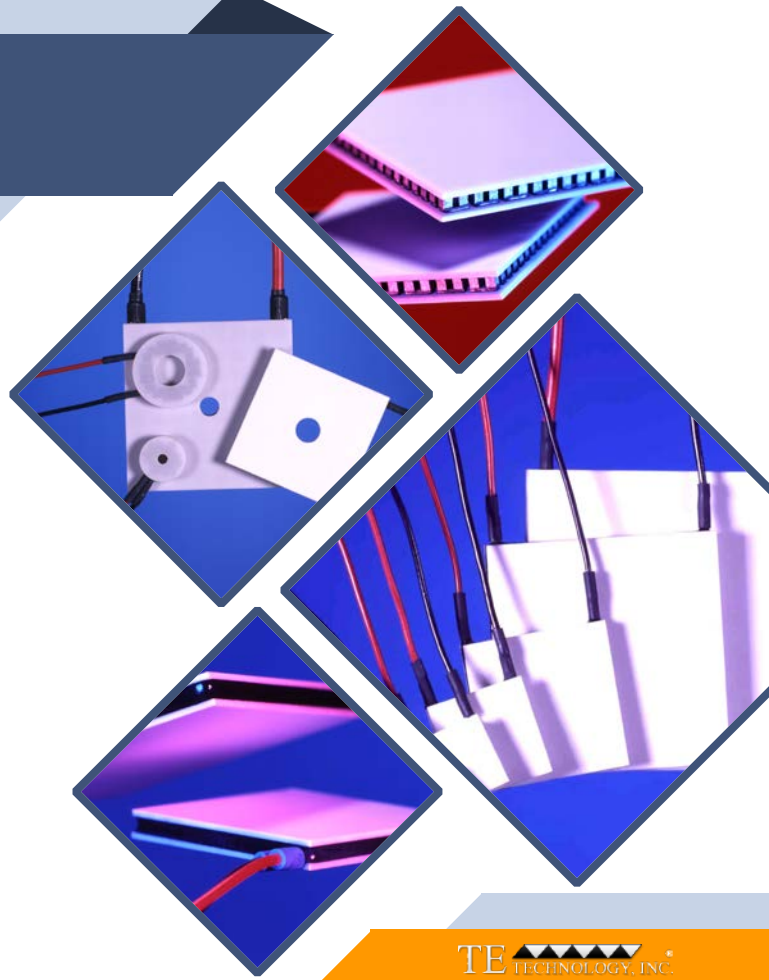
TE Technology's Thermoelectric (Peltier) Modules form the basis of any thermoelectric cooling assembly and are already integrated in our standard cooling assemblies. Available with a wide variety of physical sizes, thermal capacities and electrical properties. While typically used for cooling, they can also be used for heating by reversing the electric current flow and even power generation.

POSSIBILITIES

Variations offer high capacity, high temperature differences, high temperature operation, and small size.

Proprietary epoxy sealing available for moisture protection and increased mechanical strength.

Allow for very precise temperature regulation by simply varying and or reversing the current flow.



TEMPERATURE CONTROLERS

APPLICATIONS

TE Technology offers numerous highly adaptable temperature controllers for use with our standard and custom cooling assemblies. Our temperature controllers use fast pulse-width modulation to provide control that does not cause harmful thermal cycling of the thermoelectric (Peltier) device as can happen when using common on/off type controllers. OEM versions (with no display or enclosure) are also available for customers integrating the controllers into their equipment.

POSSIBILITIES

Can be used for stand-alone control or in conjunction with a host computer.

Easy to use Graphical User Interfaces (GUI) for graphing data and adjusting parameters.

USB, RS-232, and RS-485 communications options.

Options like fan speed control, ramp and soak programs, user-configurable alarms, etc. are available.

POWER SUPPLIES

APPLICATIONS

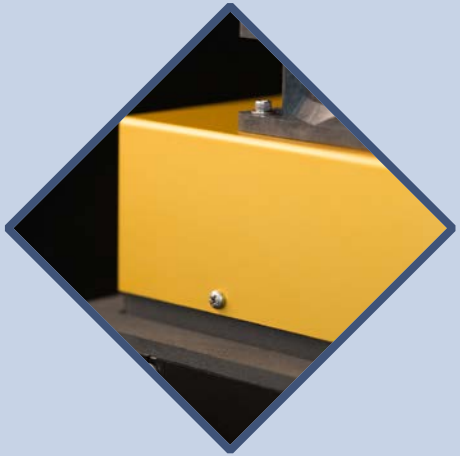
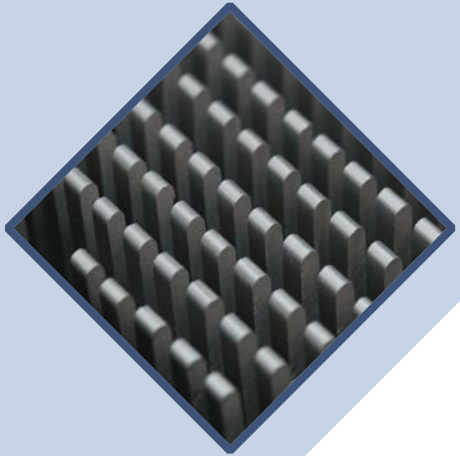
TE Technology offers a line of economical power supplies for use with our thermoelectric coolers and temperature controllers. These power supplies are all compact switch-mode designs with wide-ranging inputs for use in global applications.

POSSIBILITIES

Various size options selected to complement our standard cooler offerings.

They feature overload, over voltage and short circuit protection and are shipped ready to use with the AC power cord attached.

When ordered in conjunction TE Technology coolers and temperature controllers the interconnection cables are included free of charge.

CUSTOM PRODUCTS

DESIGNED AND BUILT TO YOUR SPECIFICATIONS

CUSTOM DESIGN & MANUFACTURING

More than thirty years of experience goes into every design. Performance, size, manufacturability, cost target - we optimize all of these and give you exactly what you need.

An exclusive line of heat sinks, modules, vapor seals, and special optimization ensures that your competition will not surpass you. A custom thermoelectric assembly gives the capacity and features needed without increased cost for anything extra.

- Optimized for your application
- Customized power consumption, size, and noise level
- Guaranteed reliability

CUSTOM PRODUCT DESIGN PROCESS: INFO GATHERING

Our design process begins with understanding the intended use of the product, the environmental conditions in which it will be used, and the parameters that need to be met.

THERMAL & ENVIRONMENTAL SPECIFICATIONS

Maximum ambient temperature

Maximum relative humidity

Desired internal temperature

Maximum allowable fan noise

Internal dimensions of the enclosure

ELECTRICAL SPECIFICATIONS

Desired operating voltage range

Maximum current draw

Maximum power input

USAGE & THERMAL CYCLING SPECIFICATIONS

How many times will the unit be turned on and off?

Describe any thermal cycling the product will be required to perform during typical usage.

What is the expected lifetime of the assembly?

CONSIDERATIONS FOR OPTIMIZATION

Cost

Lowest power consumption

Minimum overall size

Low fan noise

CUSTOM PRODUCT DESIGN PROCESS: FEASIBILITY

Using the information supplied, we utilize calculate the heat load requirements and our proprietary modeling software to determine the feasibility of achieving the desired level of cooling or heating within the design constraints.

THERMAL & ENVIRONMENTAL SPECIFICATIONS

Desired Cold Side Temperature 5°C

Heat load 30 Watts from electronic components plus insulation losses

Max Allowable Fan Noise 44 dBA

Ambient Temperature -10 to 55 °C

ELECTRICAL SPECIFICATIONS

Max Current Draw 4A

Desired Operating Voltage 24V

USAGE & THERMAL CYCLING SPECIFICATIONS

Typical Thermal Cycling 4 times per day

8 Years Expected Lifetime

CONSIDERATIONS FOR OPTIMIZATION

Minimize cost (#1)

Low power consumption (#2)

Minimize physical footprint (#3)

CUSTOM PRODUCT DESIGN PROCESS: ENGINEERING

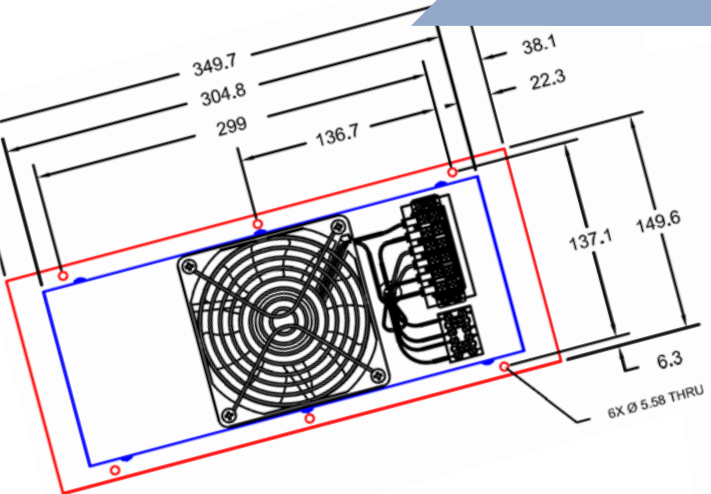
Components are then selected and fine tuned to meet the specific operating requirements of the application, and the physical design is recorded in a unique drawing package for each application.

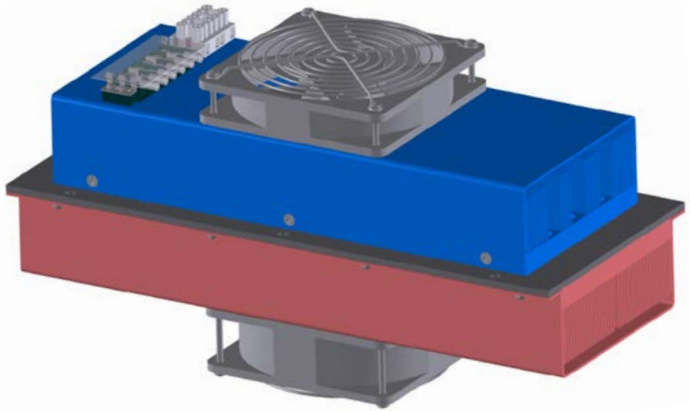
PRELIMINARY THERMAL DESIGN

2D DRAWINGS AND PROCESS ROUTERS

SOLID MODEL

CUSTOMER INTERFACE DRAWINGS





Model Number:
AC-3920

THERMOELECTRIC MODULES

CUSTOMIZATION

Semiconductor Element Geometry
Operating Voltage
Qmax for the Highest Efficiency
Physical Footprint
Wire Entries
Internal Solder Types
Nickel Diffusion Barriers
Sealing (Potting) Options

Optimize physical geometry for most efficient heat transfer

Target specific operating voltages and currents by wiring modules in combinations of series and parallel and adjusting semiconductor element geometry and number of couples.

ENGINEERING CONSIDERATIONS

Cooling Capacity: Optimize thermal capacity versus quantity/footprint of modules and total cost.

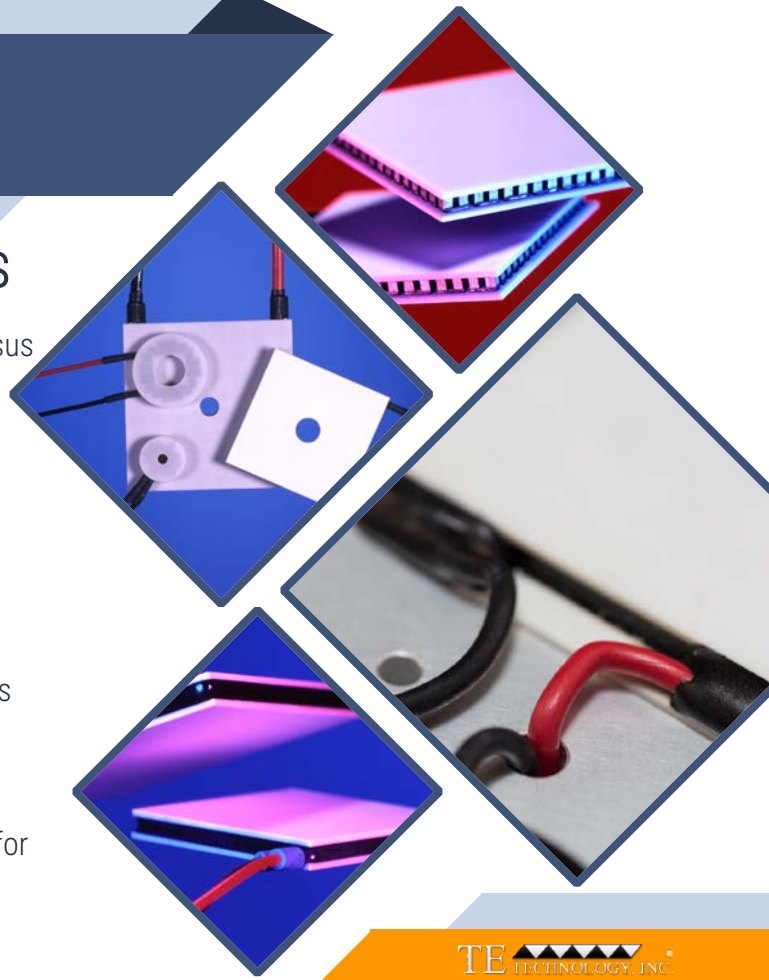
Moisture Protection: Perimeter sealing (Potting) options.

Operating temperatures: Nickel diffusion barriers and high-temperature solders.

Wire Entries: Standard configuration, connections on “porches”, solder points protruding from substrates.

Thermal cycle reliability: Add elastomeric layers for stress relief.

Tolerance Against Shock & Vibration



HEAT SINKS & SHROUDS

CUSTOMIZATION

High-Density Extrusions
Bonded Fins
Pin Fins
Folded Fins
Custom Shrouds
Protective Covers
Conversion Coatings
Anodizing
Vertical or Parallel Fan Orientation

ENGINEERING CONSIDERATIONS

Geometry: Optimize the size and density of the fins to find the optimal balance of surface area and air flow.

Orientation: Direct air through the middle of the fins and out both ends for optimal efficiency or push air parallel to the fins for easy ducting.

Fans: Maximize air flow and heat transfer while minimizing noise.

Shrouds: Protect fins against physical damage and aid in routing air flow.

Coatings & Anodizing: Protect against corrosion and degradation in harsh environments.

FANS & AIR MOVERS

CUSTOMIZATION

Tubaxial Fans
Squirrel Cage Blowers
Operating Voltages
Speed Control
Tachometer Outputs
Wide Operating Temperature Ranges
Super-High MTBF Options

ENGINEERING CONSIDERATIONS

Air Flow: Maximize air flow for the fin geometry.

Power Consumption: Balance power consumption and heat generated within the enclosure against net exchanger performance.

Speed: Balance noise and power levels

Size: Minimizing thickness and footprint, reduce protrusion in enclosures, minimize heat sink width

Noise Level: Balance performance against noise and size.

Vibration: Isolate fans through vibration mounts or decoupling from the exchanger

FLUID LOOPS

CUSTOMIZATION

Traditional in-line liquid cooling

Compressed CO2 liquification

Dehumidification of instrument air

Single-piece tubes swaged into base plates

Captive tubes with cover plates

Machined fluid passages with cover plates

Bonded U-tubes and inlets in extruded base plates

Fluid headers with welded end caps

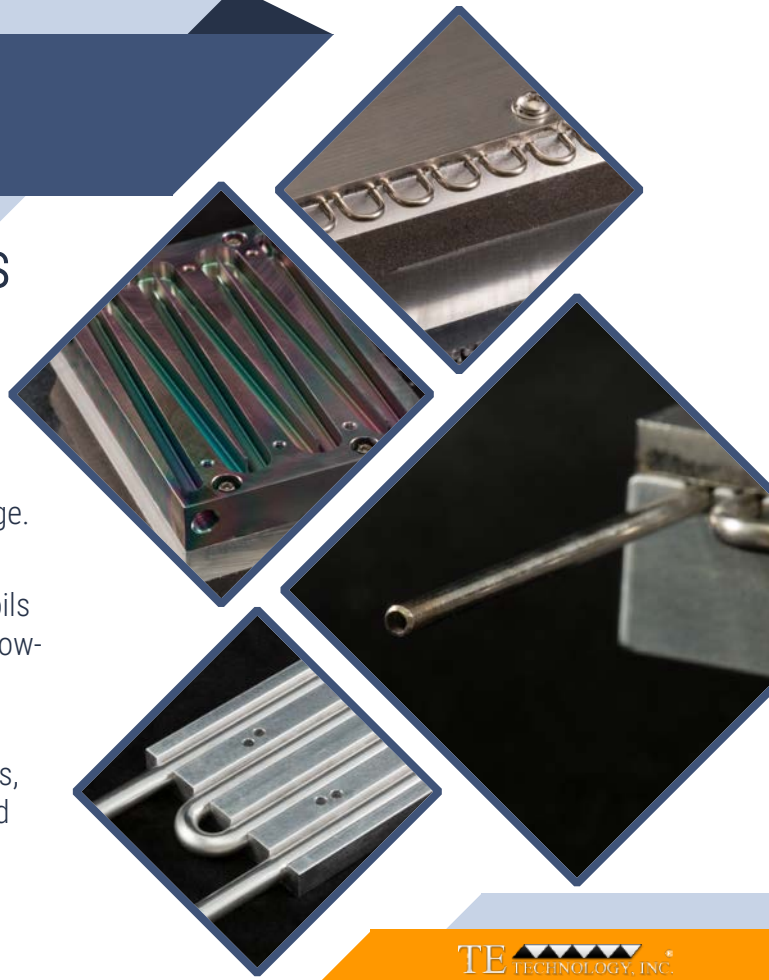
ENGINEERING CONSIDERATIONS

Tube Material: Stainless Steel and Copper Tubes

Tube Size and Length: Optimized diameter and length for high heat transfer and low pressure restriction across the operating temperature range.

Static Mixers: Static mixers and spring mixing coils improve fluid mixing to improve heat transfer in low-flow-rate applications.

Special Fittings: Compression fittings, tube beads, or threaded fitting holes to interface with the fluid path.



CUSTOM WIRING & CONNECTIONS

DESIGN OPTIONS

- Connectors
- Terminal Blocks
- Flying Leads
- Wire Lengths & Colors
- Insulation and Cable Jacketing
- Wire Labels
- Panel Labels
- Fuses
- Integral Thermostats
- Sensor Holes
- Thermistors, Thermocouples, RTD's, and Semiconductor-Based Temperature Sensors

WHY WE STAND OUT

MANUFACTURING EQUIPMENT

Machining Capabilities:

- Two CNC Vertical Mills
- Extrusion Chop Saw
- Fin Shear
- In House Machining for Quick Prototypes & Low Volumes;
- Outside Options for High Volume Cost Effectiveness

Specialized Processes:

- Robotic Epoxy Despenser
- Bake & Curing Ovens
- Torque Calibration Meters & Precision Torque Drivers
- Wire Cut & Strip
- Crimp Presses with Force Monitors
- Hipot Safety Testers
- Thermoelectric/Peltier Testers

Quality Assurance:

- XRF Analyzer
- AC Resistance Testers
- Pressure vs Flow Meters
- Crimp Pull Force Testers
- Surface Roughness Testers
- Coating Thickness Tester
- CMM

Test/Engineering:

- Environmental Test Chamber
- Thermoelectric Cycle Test Stand
- IR Camera
- Liquid & Air Flow Meters
- Thermal Data Acquisition Equipment
- Thermal Load Simulators
- 3D Printing Capabilities

TESTING

UNIQUE THERMOELECTRIC TESTING CAPABILITIES

TE Technology has designed and manufactured a wide range of specialized test equipment which is *not commercially available*. Our customers leverage this equipment—no need to dedicate precious engineering resources to reinvent test equipment and procedures! This unique equipment provides complete characterization of materials, modules and systems at only seconds per test. TE Technology's exclusive series of tests assures that all assemblies are top performers and allows for low-cost testing on every cooling assembly we make.

TE Technology verifies the thermoelectric module performance before modules are placed in an assembly:

- Semiconductor Figure of Merit
- Semiconductor Thermal Conductivity
- Semiconductor Electrical Resistivity
- AC Resistance of module

We verify the thermoelectric assembly characteristics after the assembly is completed:

- AC Resistance (ensuring modules are not damaged during assembly)
- Thermal Junction Quality (ensuring modules are making good thermal contact to heat exchangers in the assembly)

WHY WE STAND OUT

UNIQUE TESTING CAPABILITIES

Thermoelectric Semiconductor Material Test Capabilities:

- Figure of Merit
- Electrical Resistivity
- Thermal Conductivity
- Seebeck Coefficient

Thermoelectric Module Testing Capabilities:

- Figure of Merit
- AC Resistance
- Thermal Conductivity
- Seebeck Coefficient
- Effects of exposure to elevated temperatures
- Thermal Cycle Life (programmable upper and lower limits; in-situ data collection)
- Moisture Resistance

Thermoelectric Assembly Testing Capabilities:

- AC Resistance
- Thermal Junction Quality to heat exchangers
- Thermal Cycle Life
- Moisture Resistance
- Hipot Testing
- Thermal Capacity (large environmental chamber)

1590 Keane Drive
Traverse City, MI 49696

www.tetech.com | 231-929-3966 | cool@tetech.com