

# **Thermoelectric Cooling Assembly (TCA) Instruction Manual**

**Drawing 4921-1 Rev. E, 3 September 2019**



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This Thermoelectric Cooling Assembly (TCA) Instruction Manual must be read and followed carefully before installation and operation.

! Follow all recommendations and suggestions, heed all warnings contained in this manual and use the product as intended. Failure to do so could result in hazards and loss or damage to the TCA and/or secondary equipment.

! Only qualified technicians should install and configure the TCA.

! Use of the TCA is restricted to operators capable of understanding one of the languages presented in this manual, as stated by agreement between TE Technology, Inc. and the Purchaser. The originating language of this manual is English.

! The TCA is intended to be operated in a light industrial environment only.

! Do not use in an explosive or potentially explosive environment.

! Do not use the TCA if damaged.

! Do not disassemble TCA. No user serviceable parts inside.

! Do not operate the TCA outside the specified operating temperature range.



Condensation could form on cooled sections of the TCA and on secondary equipment. This condensate and any subsequent drainage onto other secondary equipment could pose hazards and/or damage to the TCA and/or secondary equipment. If such hazards are present, devices should be added to prevent or remove the condensate such as dehumidifiers, dry gas purge systems, desiccants, etcetera. Alternatively, cooled sections of the TCA and secondary equipment should be restricted from being cooled below the dew-point temperature.



Portions of the TCA could exceed 60 °C during normal operating conditions resulting in a hazard. Use caution! Protect against contact with hot surfaces.

! When using a temperature controller, improper configuration of the temperature controller, improper installation of a temperature sensor, or the use of an incorrect temperature sensor can result in hazards or damage to the TCA or secondary equipment.

! Hazards, excessive hot or cold temperatures, and damage to the TCA or secondary equipment can occur from fault conditions or human errors such as:

1. Incorrect wiring of the TCA.
2. Failure or misuse of the TCA.
3. Failure or misuse of the control device used with the TCA.
4. Reduction in the flow of cooling air or liquid.

#### Special Liquid Heat Exchanger Warnings:



If the TCA has one or more liquid heat exchangers, mount the TCA in a position so that an unexpected liquid leak will be diverted away from electrical circuitry and sensitive equipment into a containment area where damage to the equipment and/or hazards will not result.

Do not allow the liquid in the liquid heat exchanger to freeze or overheat, whether in operation or in storage. Before use, purge all air from the liquid heat exchanger for proper operation and to prevent overheating.

! The liquid heat exchangers are designed for use with filtered, distilled water. Other fluids may be acceptable for use if and only if TE Technology has provided express written notice that they are compatible with the liquid exchanger. Do not use fluids which have not been approved by TE Technology. Otherwise, damage and/or hazards could result.

! Do not exceed the specified operating maximum liquid pressure as noted on the TCA specification sheet or 205 kPa if it is not otherwise specified.

#### Additional Operation Warnings:

! Proper operation of the TCA is dependent on sufficient air flow through the fans, heat sink fins, and/or the liquid heat exchanger if so equipped.

! Do not obstruct air flow or liquid flow to the TCA or use in areas where the heat sink is not well ventilated. The fan and cooling fins should be kept clear of dirt and dust. Clean by directing compressed air over the fins.



Do not operate the TCA if the heat-sink fan is not operational. This could cause damage and create hazards from the heat sink being greater than 60 °C. Do not operate the TCA if the heat-sink fan is operational but exhibits bearing noise or is otherwise not operating as normally expected.

! Frost/ice should not be allowed to form on the heat sink, fan(s), or cold sink (if so equipped) as this could obstruct air flow and decrease performance and/or cause damage to the TCA and secondary equipment. If frost/ice contacts the cold-sink or heat-sink fan, de-energize the TCA until the frost/ice has been removed.



Do not operate TCA without finger guards. This could result in a hazard.



Portions of the TCA (the heat sink, for example) will become warmer than the ambient temperature. They can become hotter than 60 °C even if control temperatures of greater than 60 °C are not desired. The operating temperature of the TCA depends on many factors: ambient temperature, input power, and heat pumping. If the TCA is to be used in conditions where a portion of the TCA could possibly exceed 60 °C (for example, if the TCA is operated in ambient temperatures greater than 35 °C) test the surface temperatures of the TCA under the worst-case operating conditions of maximum ambient temperature, highest heat pumping, and maximum input power. If any portion of the TCA exceeds 60 °C place adequate guards around the TCA to prevent contact with hot surfaces.

See “Electrical Connections” section for proper connection from controller/power supply.



Do not:

1. Install the TCA,
2. Attach anything to the TCA, or
3. Operate the TCA or attached equipment, in a manner that would create a voltage potential of 50 V or more on the TCA.

## Protective Devices:

! Use protective devices to prevent hazardous conditions and/or damage to the TCA and secondary equipment (refer to connection diagram). Protective devices should be placed at all points on the TCA and secondary equipment where a hazardous condition can be detected. NOTE: Unless noted in the product specifications, protective devices are not included.

Protective devices should de-energize the TCA and, as necessary, related secondary equipment. It is recommended that such devices require the user to remove and correct the root cause of a fault before allowing the TCA and related equipment to be re-energized.

! Protective devices must operate independently of the primary temperature control circuitry.

! Some TCA's include integral thermostatic protective devices. Always operate these devices within the electrical specifications as listed on the TCA data sheet. Do not use these protective devices as a means of temperature control; damage to the TCA or equipment may result.

! Some temperature controllers can detect under-temperature and over-temperature conditions and can be configured to deenergize the TCA when such a condition is detected. If a temperature controller is used to provide under-temperature and/or over-temperature detection, it is recommended to monitor the heat sink and, as necessary, the cold side (cold sink, cold plate, liquid heat exchanger) for under-temperature and over-temperature conditions. However, hazards and/or risk of loss or damage to the TCA and/or secondary equipment could still occur if the temperature controller and/or sensors were to malfunction. Therefore, independent, redundant protective devices are recommended in addition to the safeguards provided by the temperature controller. For the purposes of this manual temperature controllers are not considered protective devices.

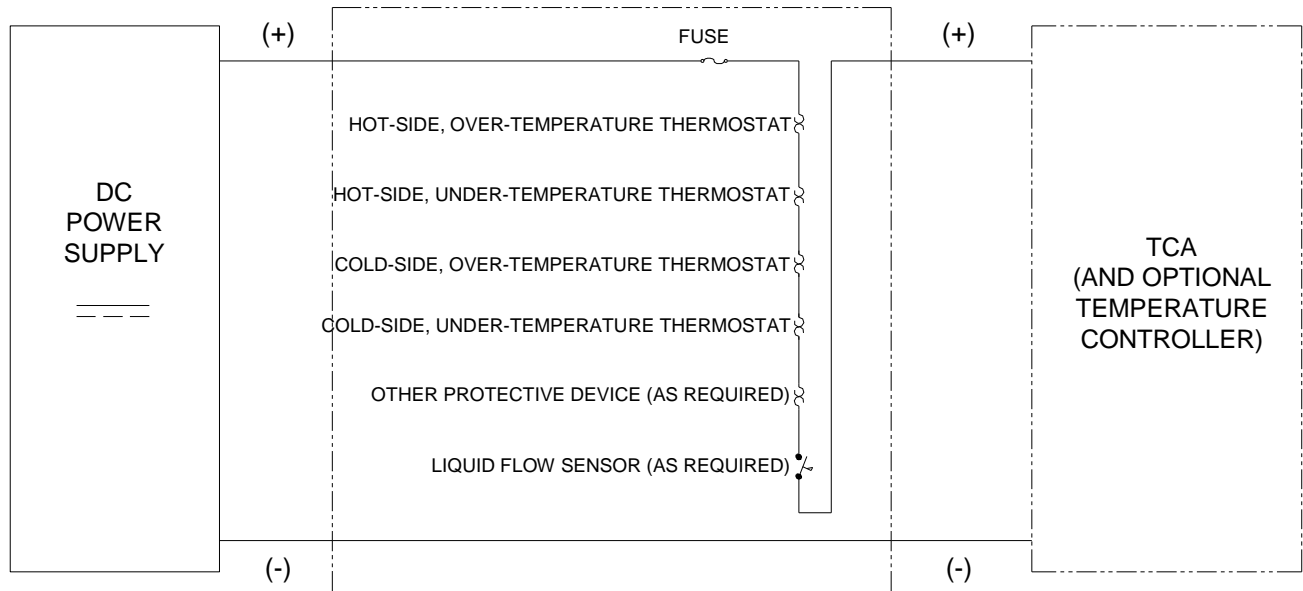
! TE Technology, Inc. shall not be liable, and Purchaser shall defend, hold harmless, and indemnify TE Technology, Inc. from and against, any losses, costs, expenses (including reasonable attorneys' fees), injuries, liabilities or damages of any kind or nature whatsoever, arising out of or from the omission or failure to use protective devices.

! Protective devices should include, but are not limited to:

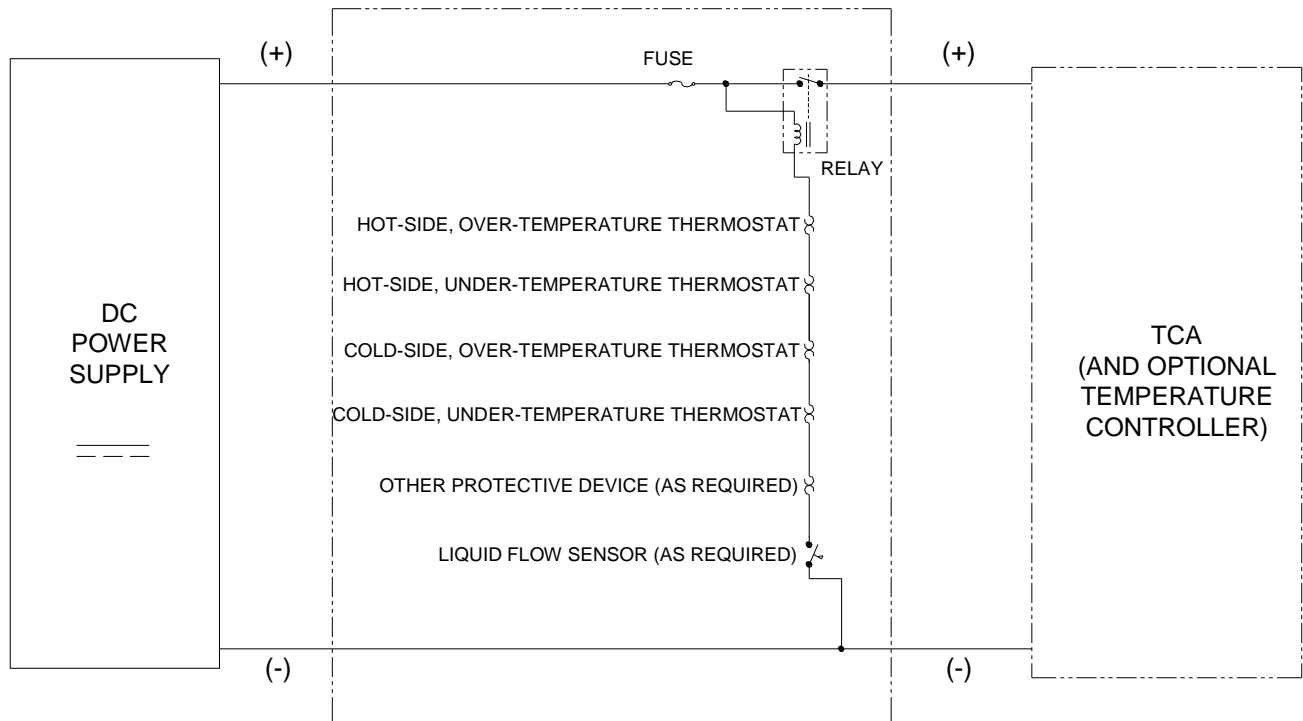
- Fuses to prevent against electrical overloads,
- Over/under temperature thermostats to prevent against hazardous and/or damaging temperatures,
- Liquid flow meters to prevent against damage due to loss of coolant flow

See “Protective Device Options” below for suggested options.

# Protective Device Options



or





# Terminology

TCA – Thermoelectric Cooling Assembly

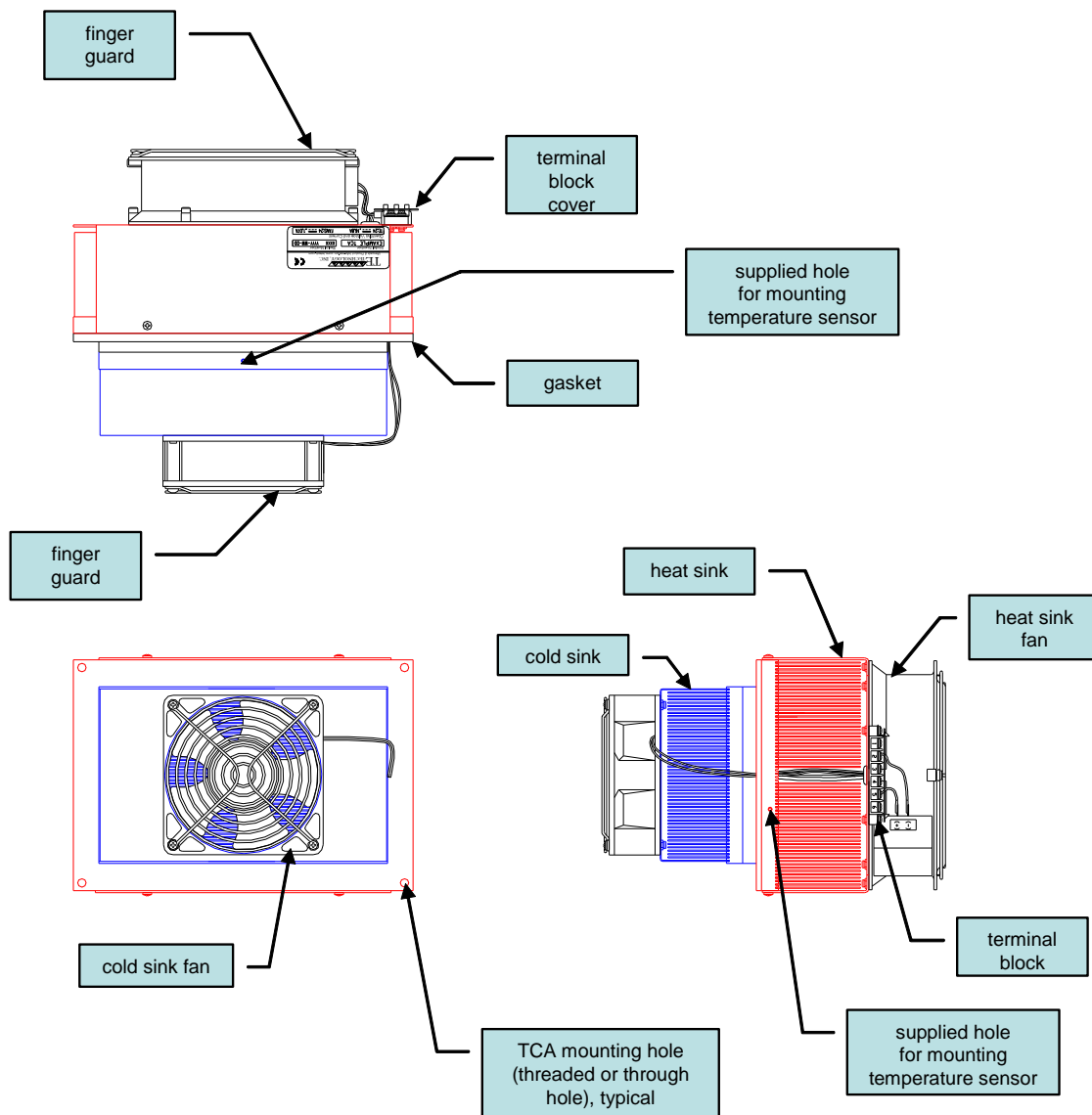
AC – Air Cooler

CP – Cold Plate

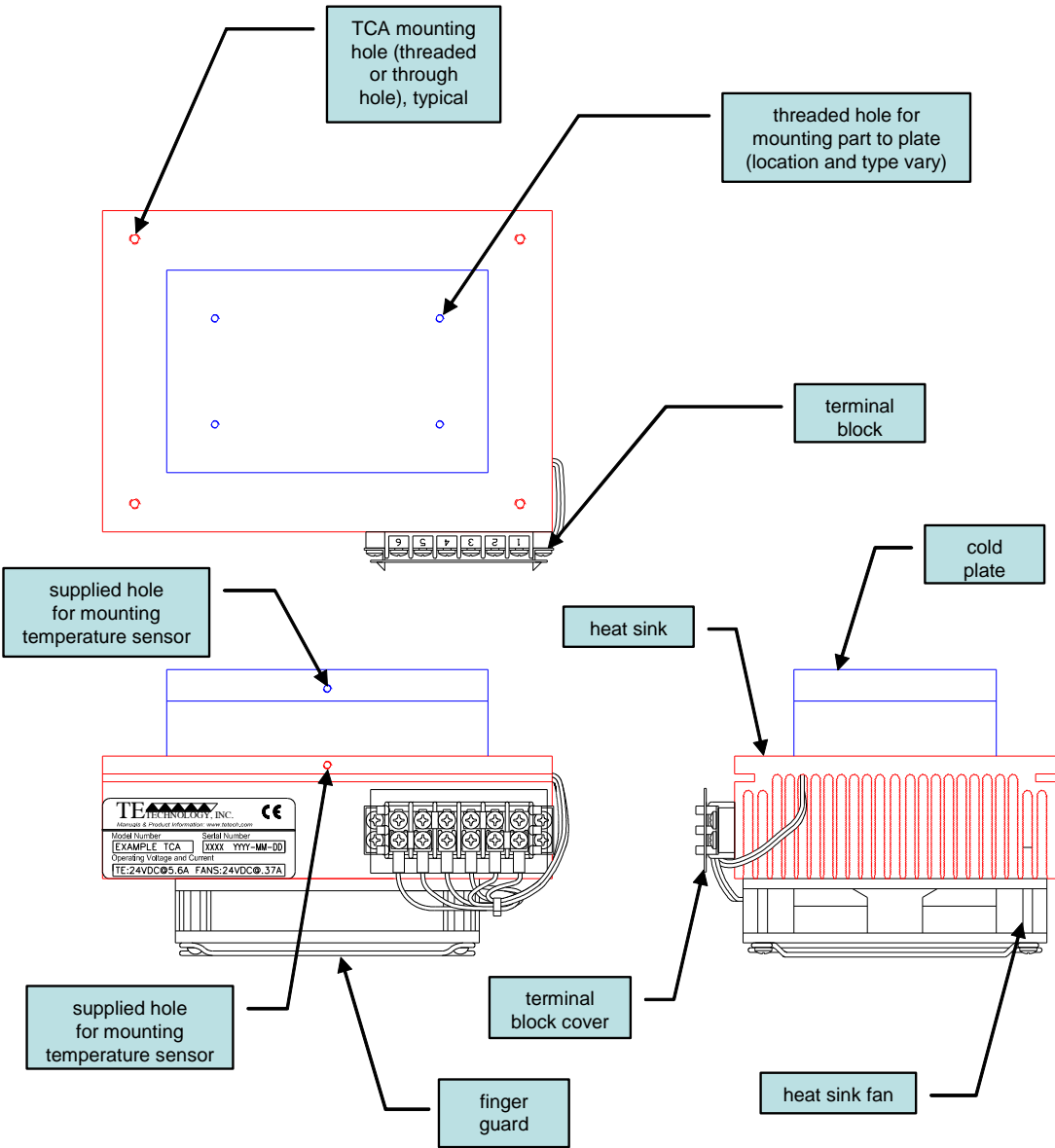
LC – Liquid Cooler

Note: drawings are for illustrative purposes only; consult TCA Specifications for complete details.

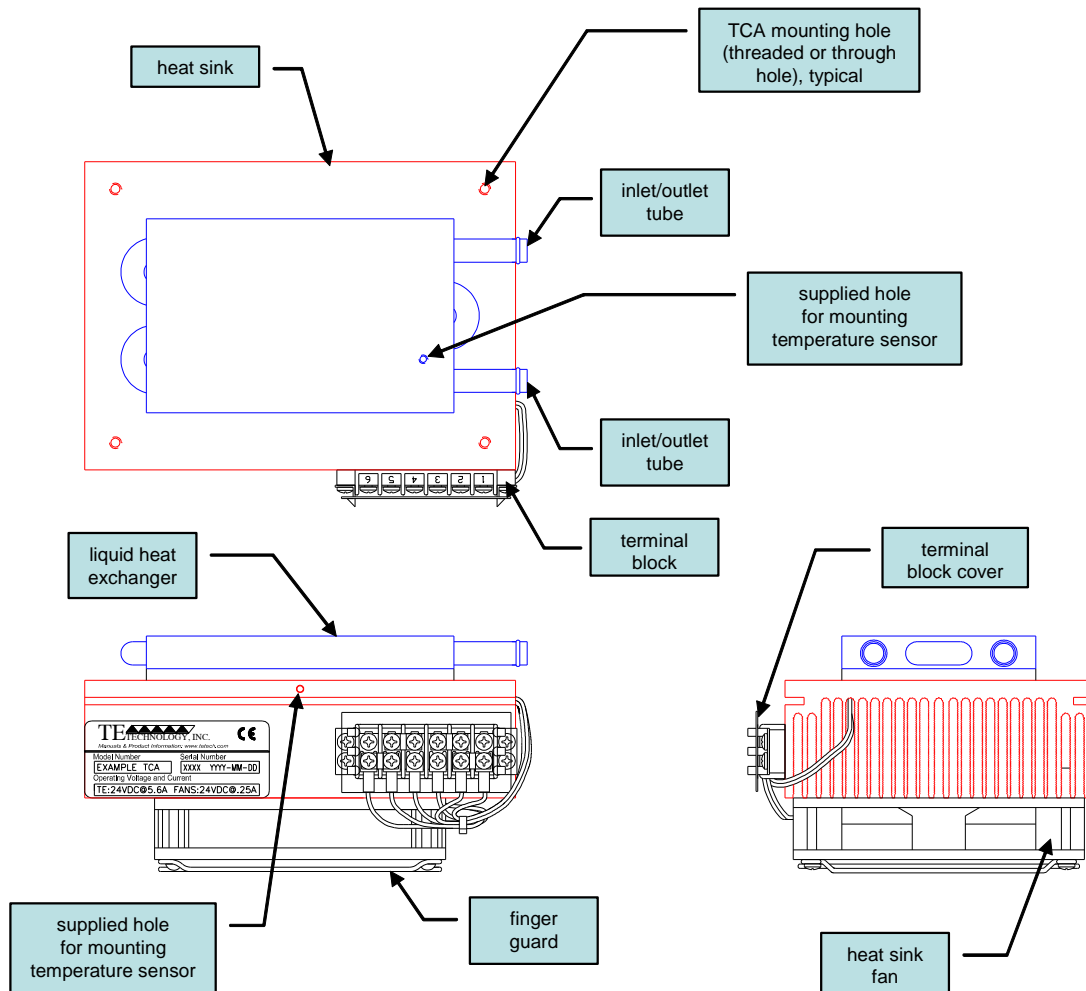
## AC-xxx TCA Terminology



# CP-xxx TCA Terminology



## LC-xxx TCA Terminology



# **Installation**

## **Mechanical Mounting:**

! Improper mounting or installation of the TCA could result in the unit falling, creating a hazard. Be certain that the structure supporting the TCA is of sufficient strength for its weight and that all fasteners are properly installed.

! The cold side of the TCA may form condensation. Mount the TCA in a location that is not affected by condensation, or use caution so that condensate does not contact areas where damage to the TCA or secondary equipment may result. Condensate should not be allowed to contact the TCA fan or wires or electrical connections.

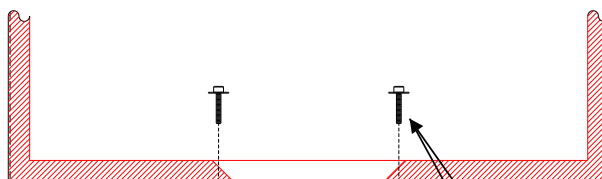
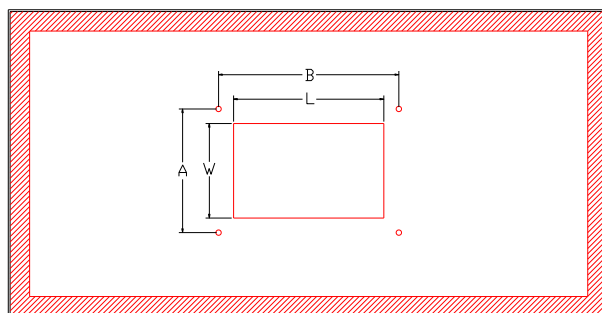
! For AC-xxx units, there is a gasket on the face of the heat sink for the purpose of sealing against the enclosure wall. The gasket must be compressed to a level that will ensure proper sealing. Proper compression is dependent upon the enclosure wall stiffness, the number and location of the mounting holes, the size of the cooler, etcetera. Generally, the gasket can be completely compressed. A suitable sealant (one that is weather resistant and provides good adhesion between the sealing surfaces, possibly, but not necessarily, RTV silicone rubber sealant, for example) should be applied to ensure proper sealing.

! To maintain a NEMA or IP rating or otherwise to prevent leaks of dust or liquids, use sealing washers on all screws and seal all openings, gasket surfaces, and mounting hardware with a suitable sealant.

Note: if the AC-xxx unit has been removed for service, the gasket should be inspected for its ability to maintain the seal integrity prior to re-installation. If the gasket is damaged or has lost resiliency, the gasket should be replaced.

! If an AC-xxx or other TCA has a NEMA or IP rating, the sole purpose of the rating is to state that when installed on an enclosure the TCA can maintain the seal integrity of the enclosure up to the stated NEMA or IP rating. However, the TCA must be installed and tested by a qualified technician to verify the seal integrity as there are a number of design variables which are outside the control of TE Technology.

## TCA Mounting Hole Dimensions



NOTE: Only AC-xxx units have gasket for sealing the opening. Use sealing washers and appropriate sealant on gasket surface and mounting hardware are to achieve rated sealing.

! Air Coolers with shrouds or terminal blocks/wires leading out of the cold-side may require additional length (L) or width (W) - adjust accordingly.

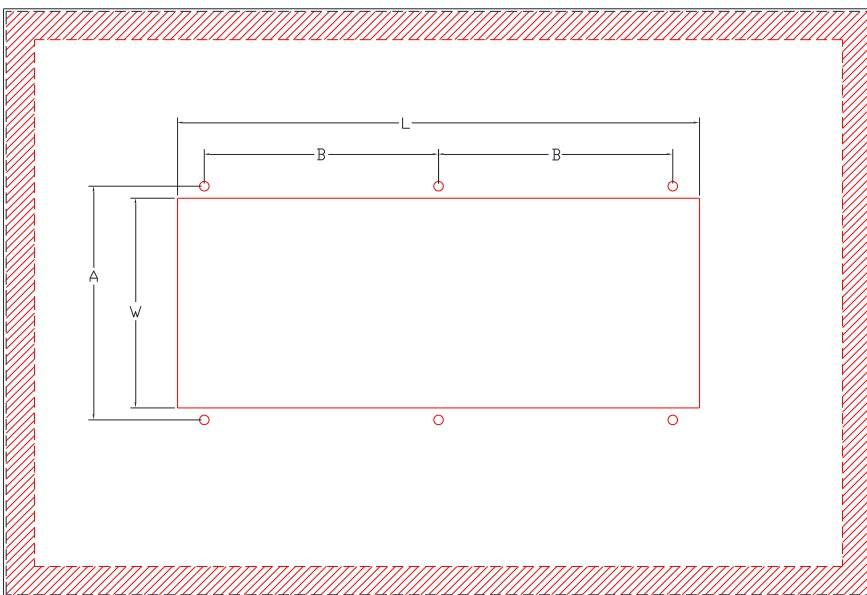
TCA	A (mm)	B (mm)	L (mm)	W (mm)
AC-027, CP-036, CP-036HT	104.6	127.0	106.6	85.0
CP-040HT	47.3	127.0	119.3	64.9
AC-046, CP-065	104.6	152.4	132.0	85.0
CP-061, CP-061HT, AC-053	88.9	139.7	132	85.0
AC-055	104.6	188.0	148.9	88.3
CP-121	172.2	139.7	157.4	157.4
AC-073, CP-110	114.3	190.5	157.4	97.0
CP-200, CP-200HT, CP-200TT, CP-200HTTT	161.0	241.3	220.9	157.4
AC-162	161.0	241.3	220.9	137.1
AC-140, AC-194	161.0	246.4	230.0	145.4
LC-035	104.6	127	167*	85
LC-061	104.6	152.4	192*	85
LC-200	161	241.3	281*	157

\* This length dimension is required to prevent interference with tubing. The heat sink face will not completely seal against the outside surface of the opening.

SCREW AND WASHER ONLY FOR: AC-027, AC-046, AC-053, AC-055, CP-036, CP-040HT, CP-061, CP-065, CP-121, LC-035, LC-061

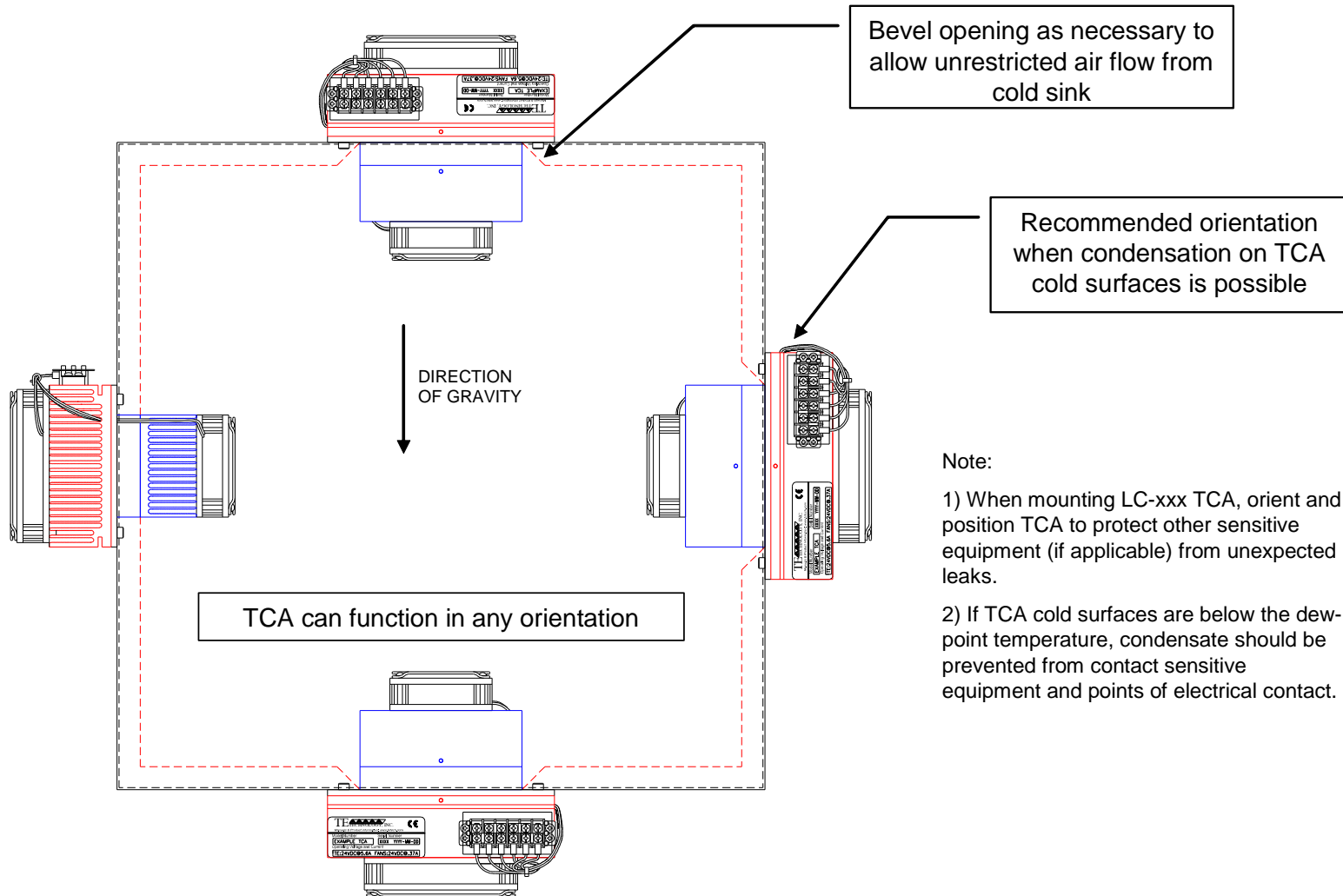
BOLT, NUT, AND WASHER FOR: AC-073, AC-162, AC-140, AC-194, AC-220, CP-110, CP-200, LC-200

## TCA Mounting Hole Dimensions

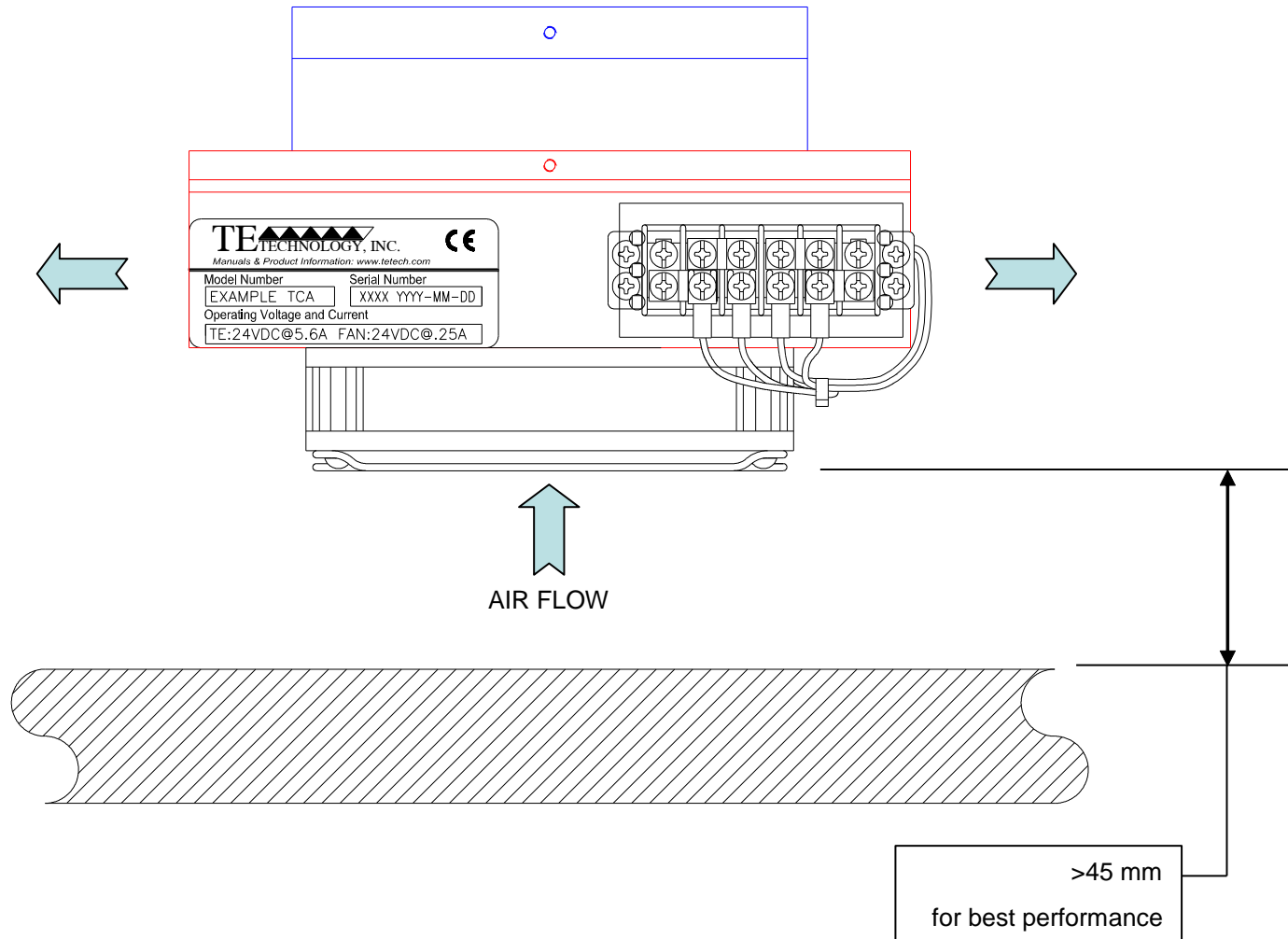


TCA	A (mm)	B (mm)	L (mm)	W (mm)
AC-220	136.9	136.8	309.8	127.8

## TCA Orientation

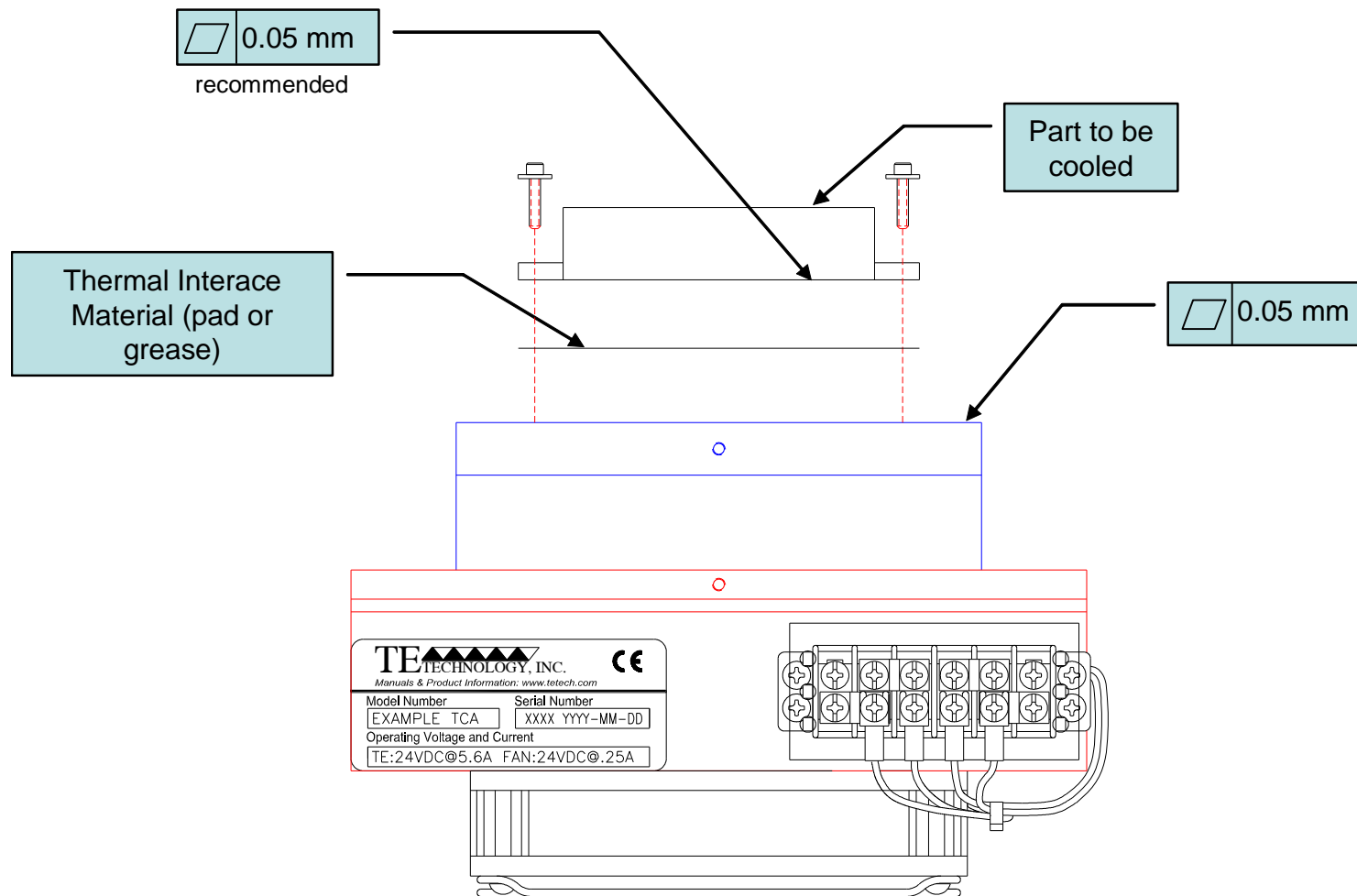


## Minimum Distance between Fan and Obstruction

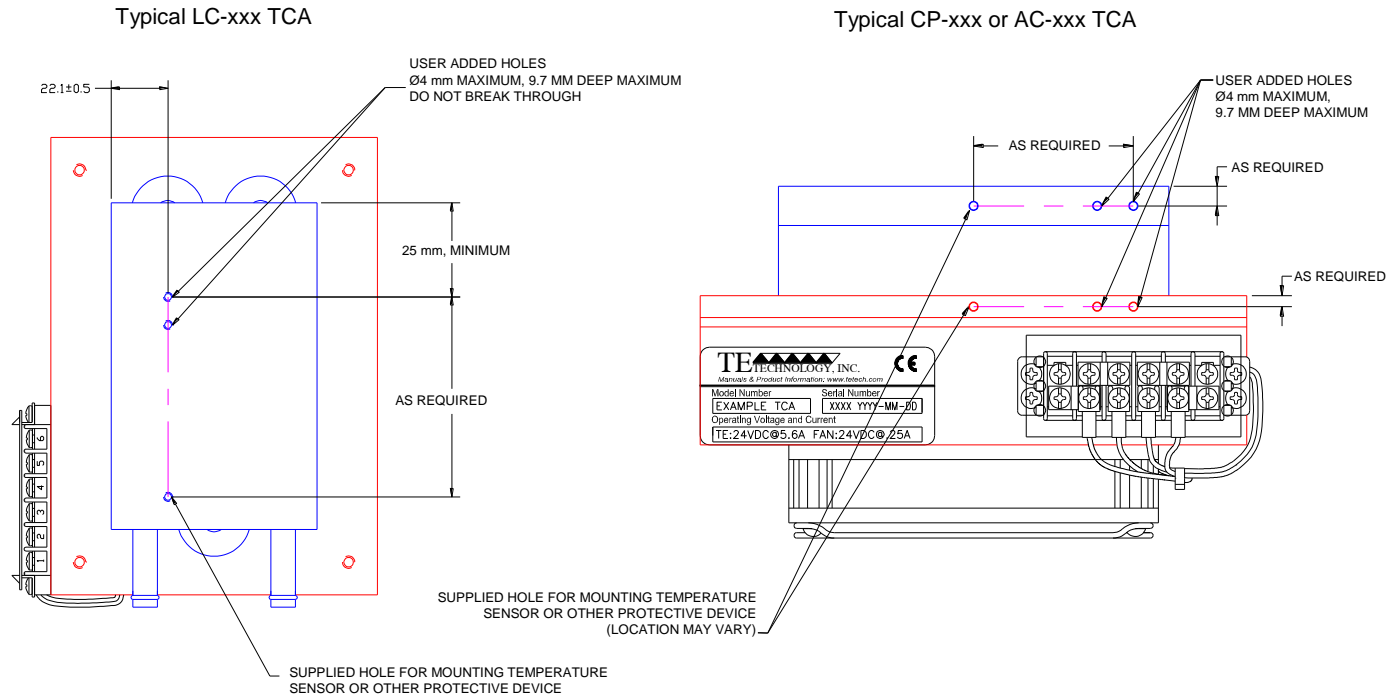




## Attaching Part to CP-xxx TCA



## Allowable Locations for Adding Holes for Mounting Protective Devices



- Notes:
1. All dimensions in millimeters.
  2. Clamp directly to base of heat sink when adding holes to heat sink; clamp directly to cold side (base of cold sink, cold plate, or liquid heat exchanger) when adding holes to cold side. Do not apply compressive force from the heat sink to the cold side.
  3. Locations for protective devices other than those shown here may be acceptable. Contact TE Technology. for assistance with locating a protective device elsewhere on the TCA.

## **Configuration**

### **Electrical Connections:**

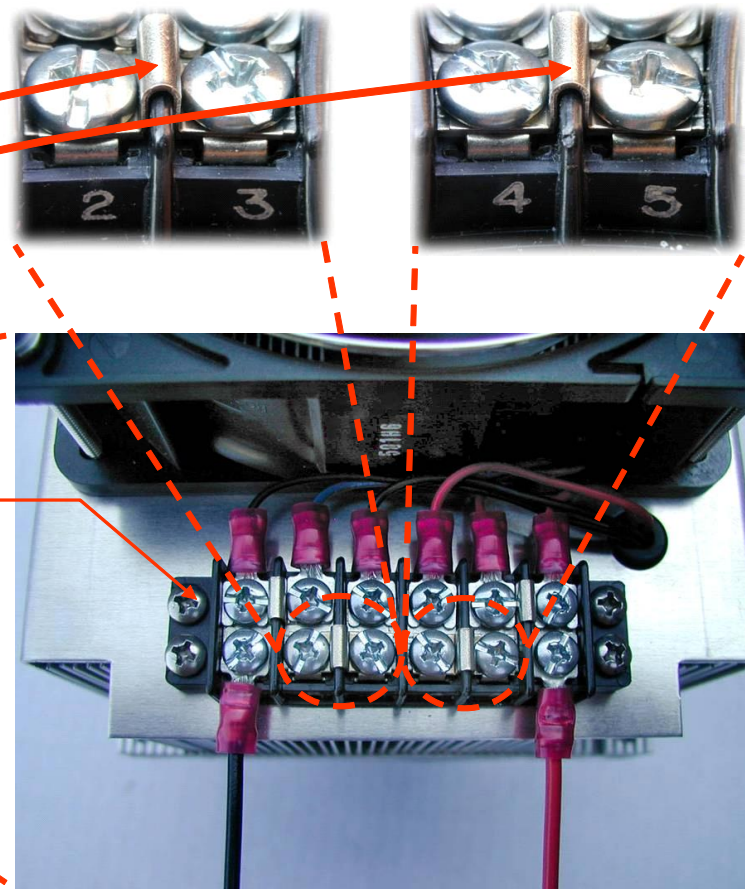
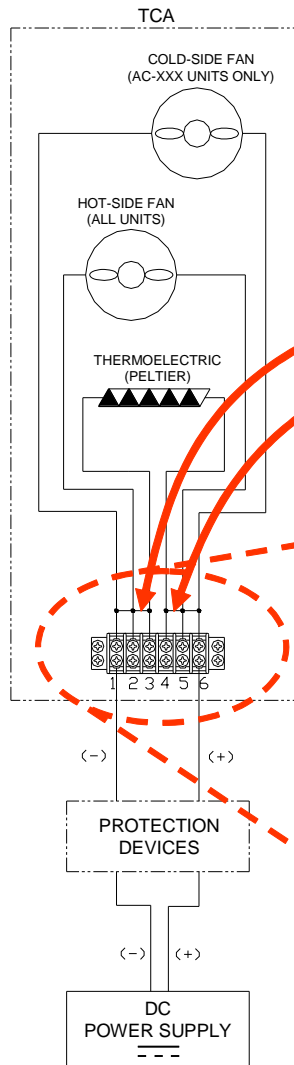
- ! Only use wires, electrical cables, and connectors that have proper electrical insulation for the operating voltages and sufficient capacity for the electrical current required.
- ! Be certain that all electrical components are in good condition. Do not pinch or damage any wires when installing or operating the TCA. Operate only with the terminal block cover in place to prevent accidental contact with equipment carrying hazardous voltages.
- ! The electrical input to the TCA must be fused appropriately to prevent injury in the event of an electrical malfunction.
- ! Use wire leads which are short in length to reduce the risk of electromagnetic interference. Use electrical shielding and ferrite beads as necessary.
- ! The application of incorrect voltage to the TCA can result in a hazard or damage to the TCA and/or secondary equipment.
- ! The electrical connections and wires of the TCA and secondary equipment should be restricted from being cooled below the dew point.
- ! Do not exceed the specified electrical ratings of the TCA.

### **Temperature Controller and Power Supply Connections:**

- ! For all electrical connection types shown below, the fans should be operated at their nominally rated voltage. Consult TE Technology, Inc. for operating fans above or below nominally rated voltage.
- “Single Power Supply, Constant Voltage Connection” may be used for cooling applications only.
  - “Two Power Supplies, Variable Heating/Cooling Connection” may be used with two separate power supplies: one constant voltage power supply for the fans and one variable or constant voltage power supply for the thermoelectric (Peltier) modules. It may be used for heating or cooling.
  - “Temperature Controller Connection” may be used with one power supply and one temperature controller (unless otherwise specified by the controller manual). Power supply powers the fans directly and supplies power to the controller, which then modulates power to the TCA thermoelectric (Peltier) modules to maintain a set temperature. It may be used for heating or cooling.

### Single Power Supply, Constant Voltage Connection

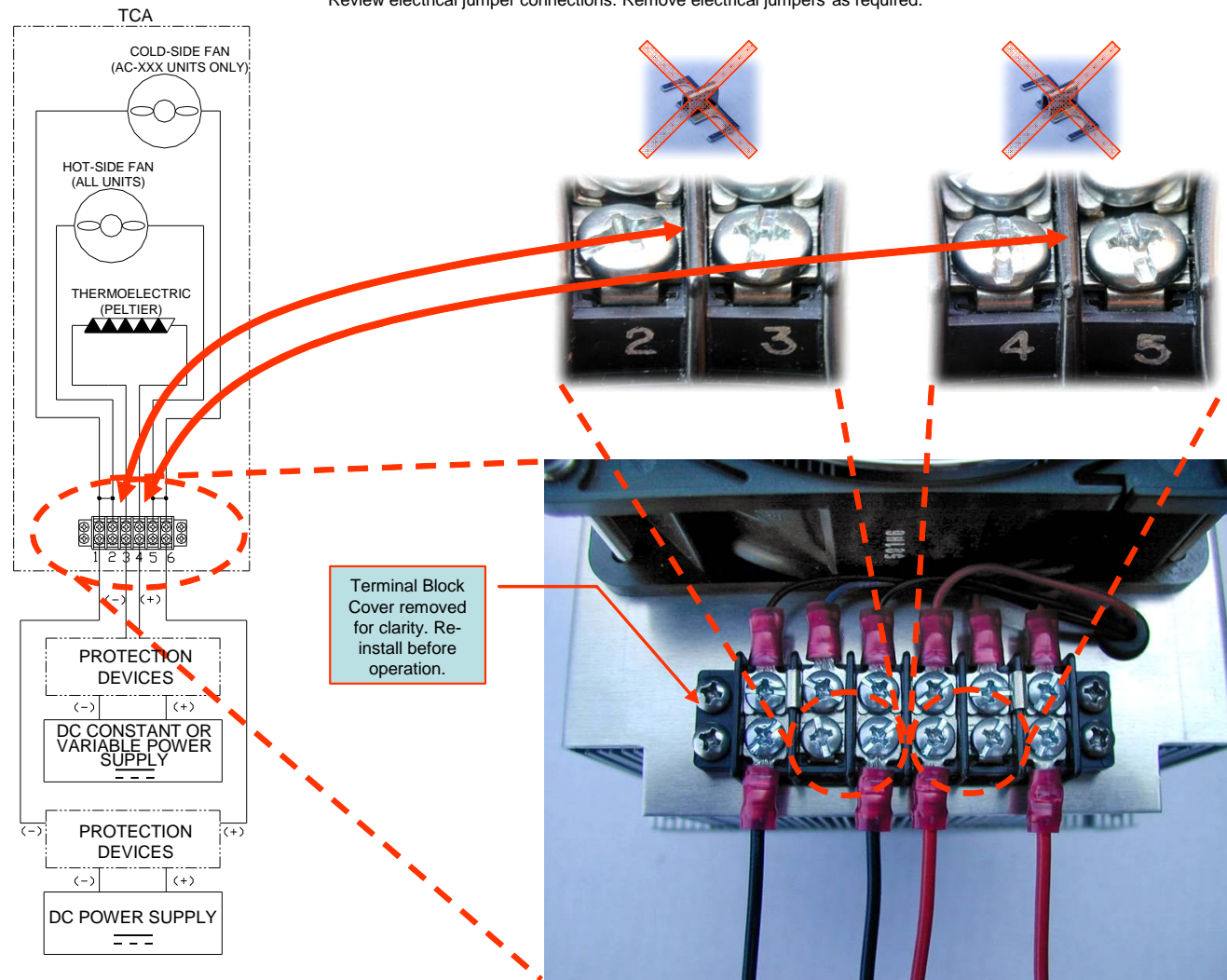
Review electrical jumper connections. Install electrical jumpers as required.



Terminal Block  
Cover removed  
for clarity. Re-  
install before  
operation.

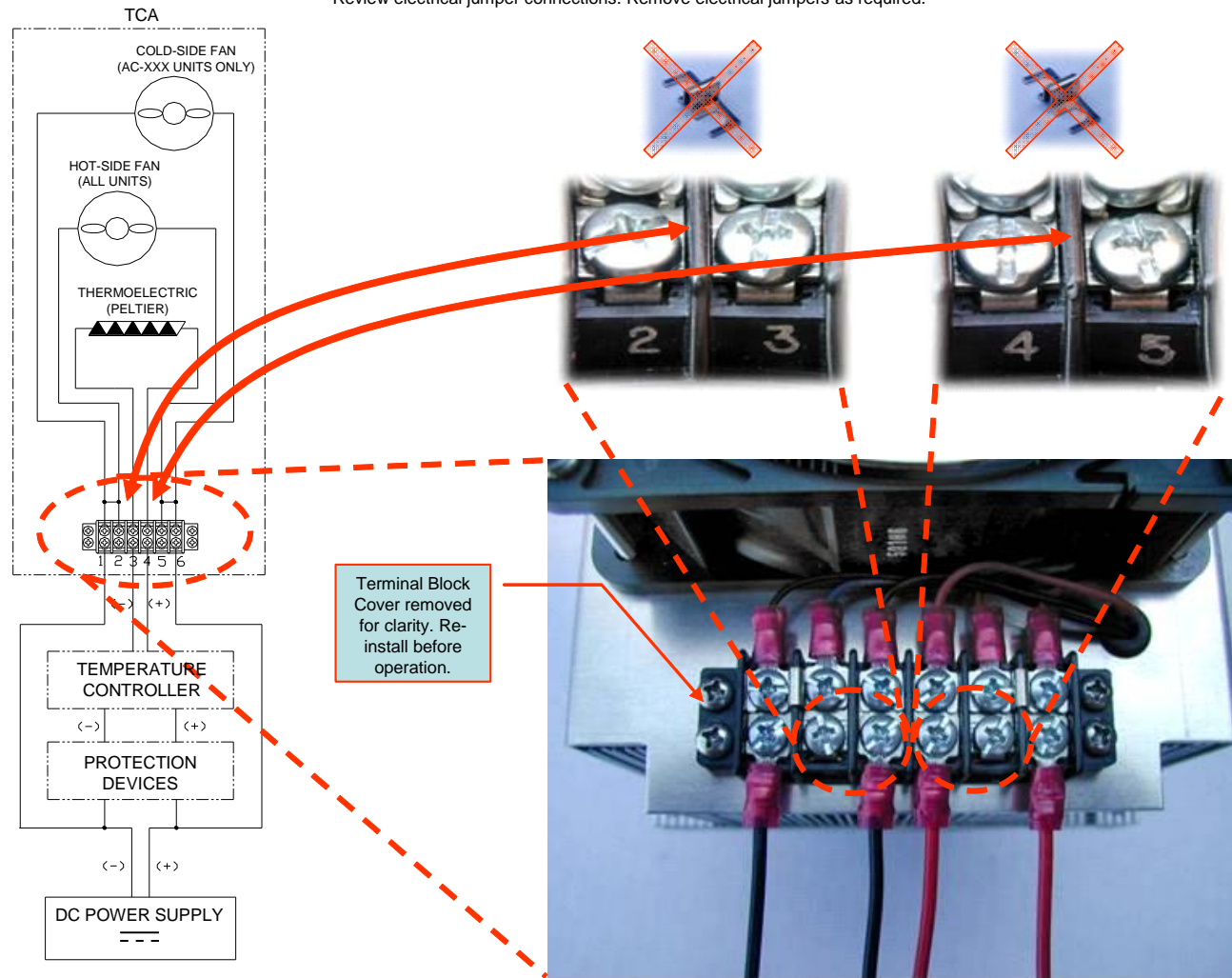
## Two Power Supplies, Variable Heating/Cooling Connection

Review electrical jumper connections. Remove electrical jumpers as required.



## Temperature Controller Connection

Review electrical jumper connections. Remove electrical jumpers as required.



The preceding temperature controller and power supply connections are generally applicable to our standard products. Custom products, of course, might not necessarily follow the same conventions or connection type. However, the same principles generally apply. That is, if you are using a temperature controller with the TCA, the temperature controller should be modulating power to the thermoelectric modules only. The temperature controller should NOT be used to modulate power directly to the fans.



## Operation

Review the TCA product specification sheet and verify that the input voltage to the TCA is appropriate. Verify that the power supply used with the TCA can provide sufficient current. Use direct current only; do not use alternating current unless otherwise specified by the TCA.

Be sure to follow the instruction manuals for the power supply and any temperature controller used with the TCA.

Check for proper electrical connections. If you notice discoloration or abnormally high operating temperatures on the wires and/or connectors, de-energize the TCA and rectify the fault before re-energizing the TCA.

If using a temperature controller that provides pulse-width modulated output to the thermoelectric (Peltier) modules, the pulse-width modulation frequency should be between 300 Hz and 3,000 Hz.

Use analog output to power the TCA fans; do not use pulse-width modulated output unless otherwise specified by the TCA specification sheet.

TCA thermal performance specifications are based on fans operating at full speed and nominal input voltage to the TCA.

The actual TCA performance may vary by +/-10% from that shown in the TCA specification sheet. Furthermore, specifications are based on the assumption of unrestricted airflow to the fans and from the heat sink and cold sink (as applicable to the TCA). It is further assumed that the TCA operates in standard air and barometric pressure (101 kPa). Consult TE Technology, Inc. if the TCA is to operate with some known airflow restriction and/or the TCA is to operate in a non-standard gas and/or pressure.

! Lowering the operating speed of a fan on the TCA, either through speed control function or by lowering the input voltage, will reduce thermal performance, and may result in the heat sink or cold sink exceeding the specified operating temperatures. Configure speed controls so that the heat sink and cold sink operating temperatures are not exceeded under worst-case combinations of maximum ambient operating temperature and heat pumping.



While in operation, look for any non-operating fans or unexpected changes in fan speed. If non-operating fans or unexpected fan speed changes are found, de-energize the TCA and inspect for improper electrical connections, failed or failing fans, or unexpected air restrictions. Do not re-energize the TCA until the fault has been rectified.

If you are using a custom TCA where fan(s) are not provided as part of the assembly, be sure that the method you have chosen for dissipating waste heat is adequate and operating correctly.

Review the frequently asked questions (FAQ & Technical information) and other related documents posted at <https://totech.com>.

Consult TE Technology if additional clarifications are needed.