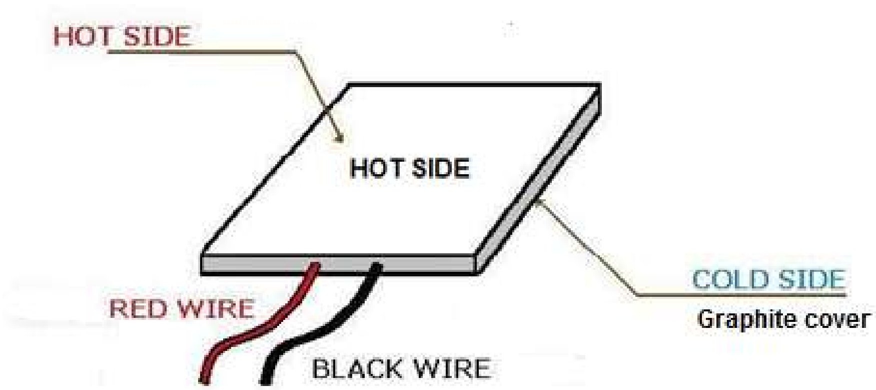
POWER MODULE INSTALLATION NOTES

TEG power modules have large thermal expansion characteristics while in operation! Especially, when they are being thermally cycled (ie. hot –cold –hot –cold). Therefore, proper compression and mounting is paramount for long life trouble free operation.

Hot side and Cold side Identification:

TEG modules only generate electricity when there is a temperature difference across the module! Therefore a hot side must be in excellent contact with a heat source the cold side must be thermally touching and compressed against a heat exchanger that can remove the heat effectively away from the cold side face of the module.

TEG1-PB series modules are capable of operating at 340°C up to 360°C. The temperature of the cold side is **ONLY RATED AT 190°C so it is imperative that the module be installed correctly with the hot side face attached to the heat generating device. Failure to do this procedure will result in the destruction of the module.**



NOTES:
1. *Look at the drawing to determine hot side of module and that orientation is the same in you application.*
2. *Assemblier must attach "HOT SIDE" to the heat source.*
3. *Attach cold side " COLD SIDE" to the cold side source ie. liquid sink, heat sink, or heatpipe.*
4. Hot side is covered Graphite no Thermal Grease
5. Thermal Grease should only be used on the cold side IF and ONLY if no Graphite is present.

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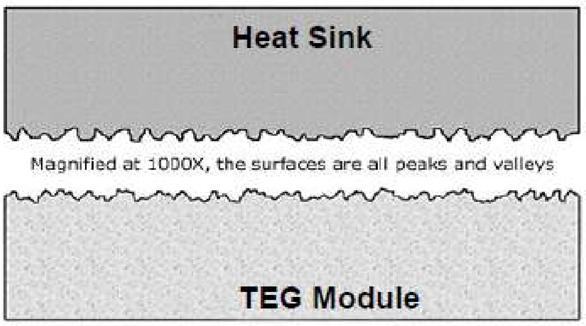
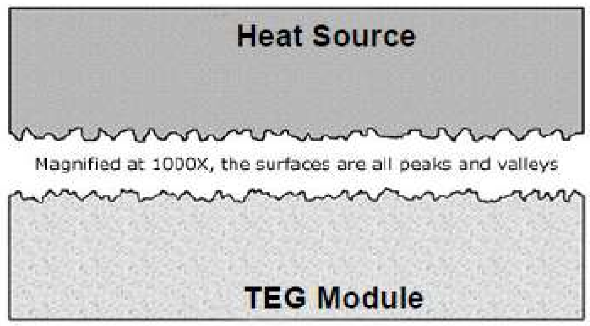
Thermal Interface:

Microscopic Look at Surfaces

Even when you have two “flat and smooth” surfaces, they are far from truly flat or smooth. The diagram below shows what’s really going on at a microscopic scale.

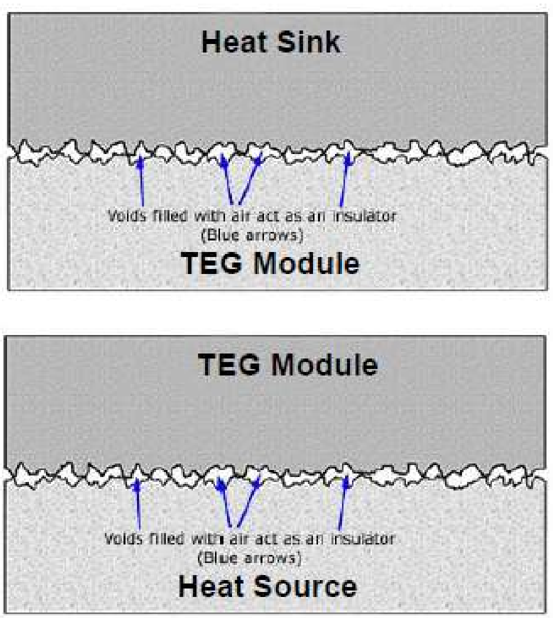


Flat and Smooth Surfaces?

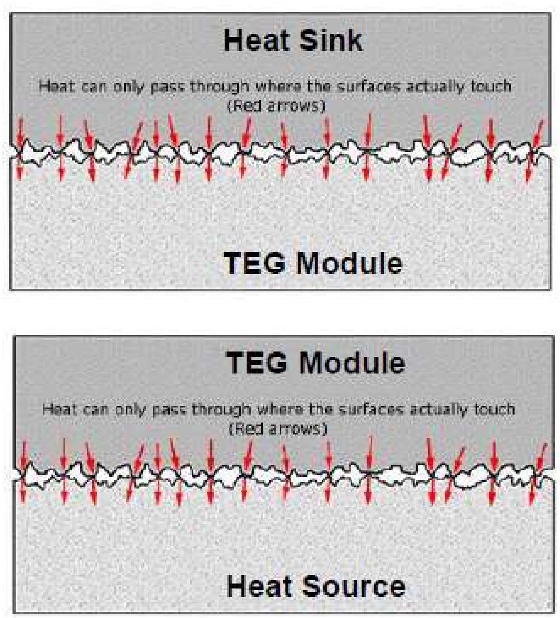


Flat and Smooth Surfaces?

As you can see, the two surfaces may look flat and smooth, but in reality, when examined under magnification, they consist of “hills”, “peaks”, and “valleys”. When these two surfaces are brought into contact with one another, only the peaks make contact. It has been calculated that the average amount of contact between any two smooth surfaces is in reality only 5%. The other 95% are voids!



Contact without any TIM



Contact without any TIM

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Power Module Installation Notes

The above image shows how the remaining valleys create voids through which heat energy can barely pass through, in effect creating an insulated area – not the ideal thermal interface.

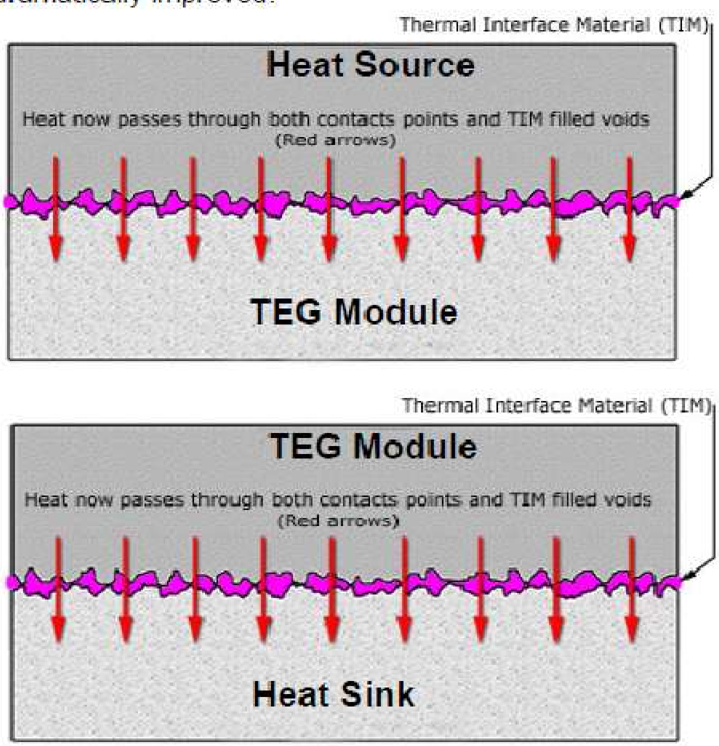
Surface Finish and Preparation

As a minimum, any surface intended to be part of a thermal interface should be flat to +/- 0.001 inches over the entire interface surface and smooth to a surface finish of 32 micro inches or better.

The interface surface must be thoroughly cleaned.Once all machining and polishing is completed. Do not touch the surface with bare hands (skin oils) or allow any contact with other materials. It is better to complete this final cleaning stage just before assembly so as to minimize any dust or contamination.

Thermal Interface Materials (TIM)

A “third party” interface material is needed since it is all but impossible to achieve ideal flat and smooth surfaces. The purpose of the TIM is to fill the valleys and gaps with a compressible material that has a much higher thermal conductivity (ability to transfer heat) than the air gaps it replaces. This essentially makes the entire interface transfer heat instead of just where the peaks were contacting. The following image shows how the situation has been dramatically improved.



Contact Using a TIM

Applying the TIM

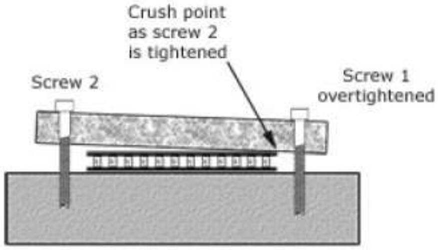
Here we prefer to use the high thermal conductive graphite sheet which has high thermal conductivity

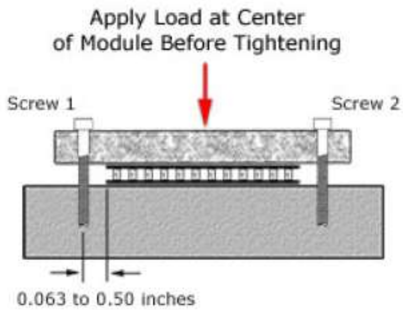
TM

Power Module Installation Notes

Screw Position:

Locate bolt holes in your assembly such that they are at opposite sides of the center of the TEG between 1.0 mm to 12.7 mm (0.04 to 0.5 inches) from the sides of the TEG. [See first image below] The bolt holes should be in the same plane line as the fins to minimize any heat sink bowing (bending) that might occur.





Clamping Procedure:

Before tightening the screws, apply a light load/force in line with the center of the TEG by using a clamp or weights. Make sure the clamp or weights apply the force evenly and at the center. Bolt carefully, by applying torque (tightening the screws) in small increments, and alternating between screws. It is of the utmost importance that the screws are tightened evenly in small increments back and forth. If one screw is over tightened, then the tightening of the second screw may crush the TEG. [See 2nd image above] Use a torque limiting screwdriver for best accuracy.

Clamping Forces:

The Following table lists the clamping force required for optimum thermal contact

Part Number	Size in mm	Clamping Force	Screw Diameter/Number of Screws/ Torque Per Screw.
TEG1-SnTe-07004-5.0	40mm x 40mm	230Kgs/500 Pounds	4mm/2/0.128Kg x m
TEG1-PB-12611-6.0	56mm x 56mm	430Kgs/920 Pounds	5mm/2/0.3 Kg x m

Pessure = 1275KPa (185psi)
Total Force per TEG = 209kg(460lbs)

To calculate the required spring scale pull force,
use this formula:
F = T / D
F = Force (lbs)
T = Torque (inch-lbs)
D = Distance (inches)
Example: What is the spring scale pull force required at the end of a 3.75 inch long L-shaped hex wrench to produce a 24 in-lbs screw torque setting?
F = 24 in-lbs / 3.75 in = 6.4 lbs pull force