Assembly Tips

The techniques used in the assembly of a thermoelectric system can be as important as the selection of the thermoelectric module (TEM). It is imperative to keep in mind the purpose of the assembly – namely to transfer heat. Generally a TEM, in cooling mode, moves heat from an object to ambient environment. All of the mechanical interfaces between the device to be cooled and ambient are also thermal interfaces. Similarly all thermal interfaces tend to inhibit the transfer of heat or add thermal resistance to system, which lowers COP. Again, when considering assembly techniques every reasonable effort should be made to minimize the thermal resistance between hot and cold surfaces.

Mechanical tolerances for heat exchanger surfaces should not exceed .025 mm/mm with a maximum of .076 mm total Indicated Reading. If it is necessary to use multiple TEMs in an array between common plates, then the height variation between modules should not exceed 0.025 mm (request tolerance lapped modules when placing order). Most thermoelectric assemblies (TEAs) utilize thermal interface materials, such as grease. The grease thickness should be kept to 0.025 ± .013 mm to minimize thermal resistance. A printer's ink roller and screen works well for maintaining grease thickness. When these types of tolerances are to be held, a certain level of cleanliness must be maintained to minimize contaminants.

Once the TEMs have been assembled between the heat exchangers, some form of insulation should be used between the exchangers surrounding the modules. Since the area within the module, (i.e. the element matrix), is an open DC circuit and a temperature gradient is present, air flow should be minimized to prevent condensation. Typically, a TEM is about 5.0 mm thick, so any insulation that can be provided will minimize heat loss between hot and cold side heat exchangers. The presence of the insulation/seal also offers protection from outside contaminants.

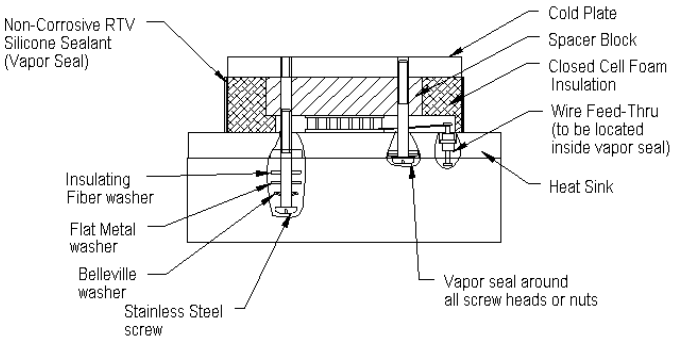
The insulation/seal is often most easily provided by inserting a die cut closed cell polyurethane foam around the cavity and sealing with either an RTV type substance or, for more physical integrity, an epoxy coat. Whatever form is used, it should provide the protection outlined above. It is often desirable to provide strain relief for the input lead wires to TEM, not only to protect the leads themselves, but to help maintain the integrity of the seal about the modules.

We have included an Assembly Tips drawing (Fig. 6). This drawing shows the details of the recommended construction of a typical assembly. The use of a "spacer block" yields maximum heat transfer, while separating the hottest and coldest parts of the system, by the maximum amount of insulation. The "spacer blocks" are used on the cold side of the system due to the lower heat flux density. In addition, the details of a feed thru and vapor sealing system that can be used for maximum protection from the environment are shown.

If you follow the recommendations shown in these drawings than you will see a significant improvement in performance. When testing an assembly of this type it is important to monitor temperature. Measuring temperature of the cooling fluids, inlet and outlet temperatures as well as flow rates is necessary. This is true if either gas or liquid fluids are used. Knowing input power to the TEM, both voltage and current, will also help in determining the cause of a potential problem.

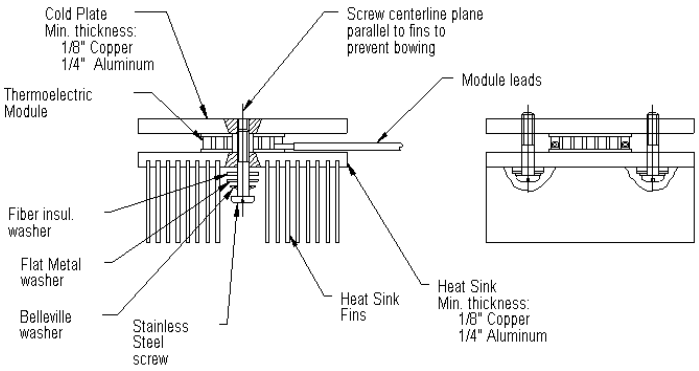
In addition we have enclosed step-by-step procedure for assembling Laird Technologies modules, Solderable or Lapped modules to heat-exchangers.

Figure 6: Assembly Tips Drawing



If you should require any further assistance, please contact one of our engineers. Our many years of experience in working with customers ensuring reliable and efficient application of our products has proven to be essential to product success.

Figure 7: Assembly Procedures Drawing



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