SOLID SEALING TECHNOLOGY, INC.

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Current Performance for SST .154 Power Plug (FA18788)

Forward: It is of no surprise that an electrical current passing through a conductor will generate heat. This heat can be overlooked as it relates to an electrical connector or feedthrough, with more emphasis placed on a product's current rating. Unfortunately a rating cannot encompass all the outside variables that can influence the temperature (both in a positive and negative manner) of the critical areas in the product. Thankfully, in a vast majority of applications this current-induced heat rise, combined with the heat generated from other sources, is low enough that it never approaches the maximum temperature rating of the connector or feedthrough. In applications where current-induced heating or outside heat levels approach the temperature limits of the product, it becomes more important to understand how much heat the critical area of the product experiences.

Construction of SST power plug: The SST FA18788 power plug is a push/pull air side connector specifically designed to mate to the SST hermetic feedthrough FA17599. The power plug connector utilizes a pure copper, turned body that is over-molded with a silicone rubber boot. Internal to the copper body is a beryllium copper spring clip sized to fit the conductor on the feedthrough. The spring clip is composed of many individual spring 'fingers'. When the power plug is mated to the feedthrough a high voltage/high current connection is made by deflecting the fingers of the spring clip around the conductor. To keep the beryllium copper spring clip from losing an appreciable amount of its spring properties over time, SST recommends the power plug conductor temperature does not exceed 125°C.

Construction of SST power feedthrough: SST's FA17599 hermetic feedthrough uses a solid copper conductor (other materials are available) that is high temperature, vacuum brazed to an alumina insulator. The insulator is also high temperature, vacuum brazed to its weld flange. The feedthrough is rated at temperatures up to 450°C, allowing for high temperature bake outs and/or sustained high temperature exposure.

Considerations for maximum operating current: While SST suggests current-induced heat rise be considered for any of our products being installed to carry power, the FA18788 power plugs require particular attention, as they are designed to operate at high currents while mated to feedthroughs that are capable of sustaining much higher temperatures than the power plug can withstand.

Many variables can affect the overall temperature of the power plug-to-feedthrough interface: the ambient temperature, the temperature of the environment that the feedthrough is sealing, heat generated by equipment connected to the feedthrough conductor inside the sealed environment, and the cable length on the power plug to name a few. It is for this reason that SST has chosen not to give its power plugs a blanket current rating. Rather, SST has performed current-induced heat rise testing to give our customers an indication of how much heat is generated due to an applied electrical load through the interface. This gives our customers an indication of how much additional heat the power plug will tolerate before reaching its maximum operational temp (125°C) for a given operating current.

Heat rise testing: SST performed heat rise tests at DC currents ranging from 15 amps to 70 amps using a power plug with a cable length of 3 ft. The feedthrough was terminated to another 3ft section of cable via a barrel connector. The free ends of the cables were connected directly to a high current power supply. A thermocouple was set to measure the temperature of the copper body of the power plug directly over the area where the spring clip resides (see Figure 1). Tests were run at ambient room temperatures (≈ 22°C). The test current was applied long enough to allow the temperature to stabilize at each current level. Several tests were performed using increasing currents. The maximum heat rise from ambient room temp for each current tested was recorded. The heat rise for each current was then plotted. See Figure 2.

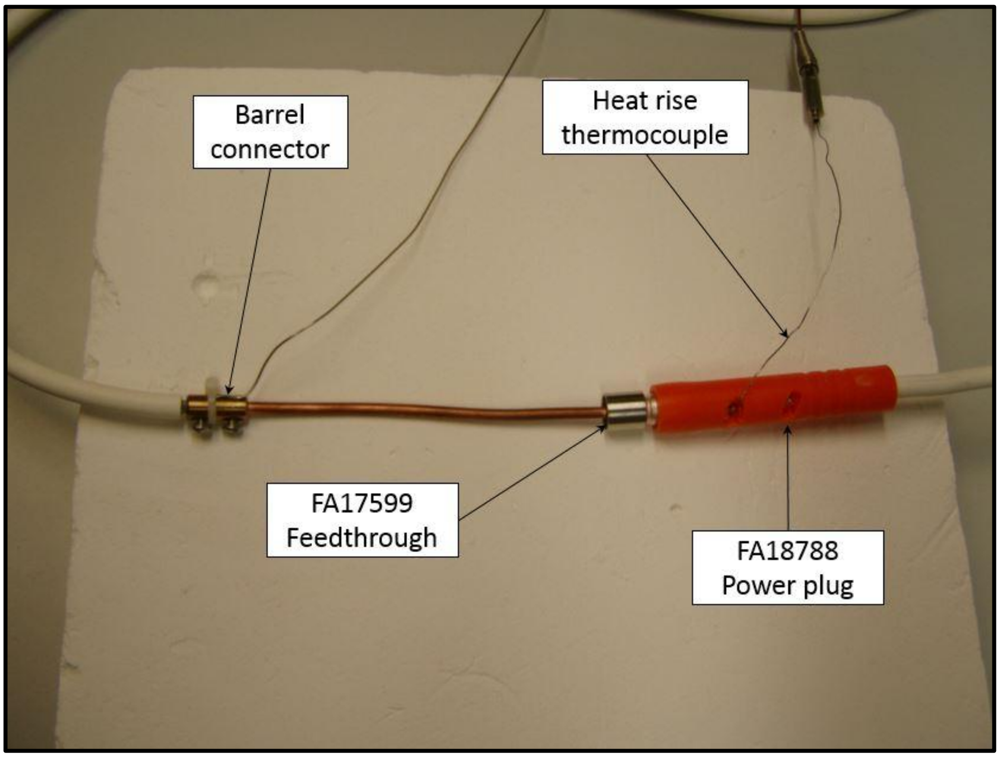

Figure 1

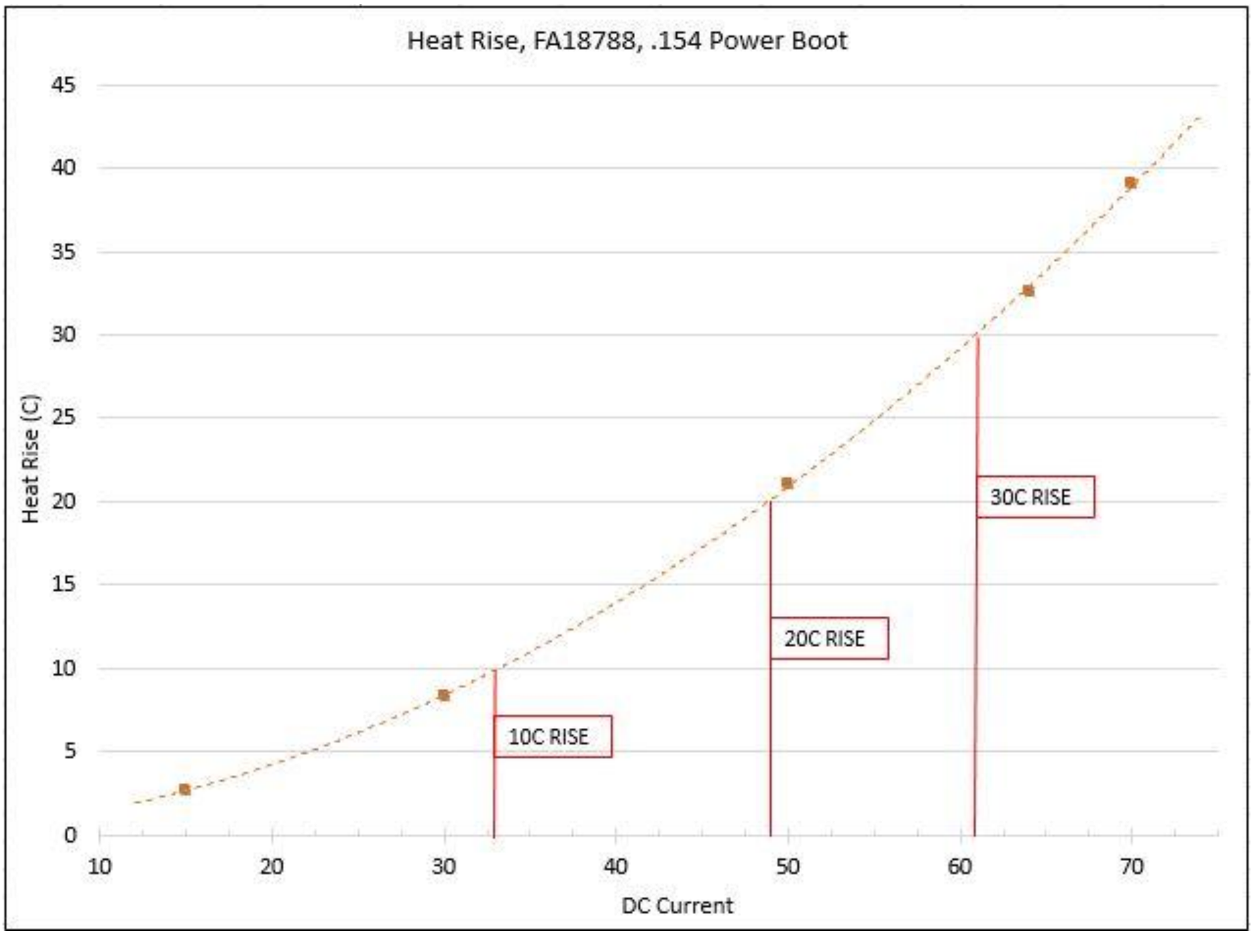

Figure 2

<u>Conclusion:</u> The heat rise graph gives a designer the ability to make reasonable estimates of the total heat on the conductor in the system for a given operating current. It should be noted, particularly for critical applications, heat measurements should be taken with the product installed in the actual system to ensure the overall system heat generation is influencing the plug as expected.