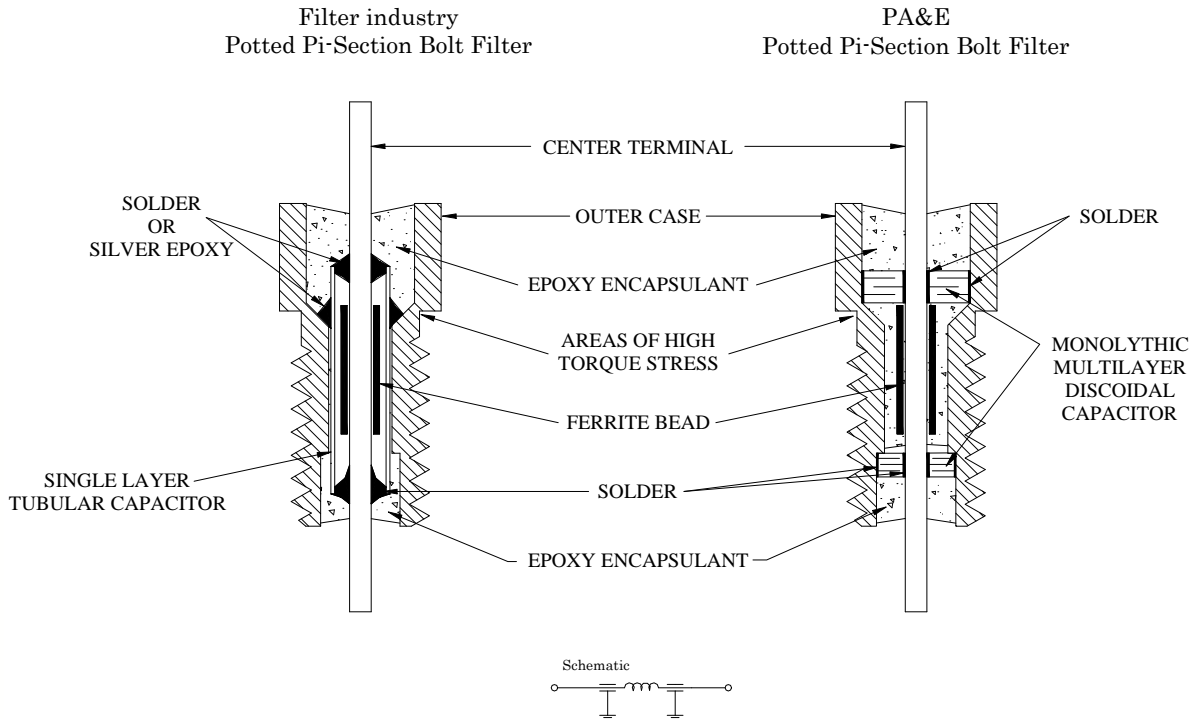


EMI FILTER CONSTRUCTION

DISCOIDAL CAPACITOR VERSUS TUBULAR CAPACITOR

The fundamental differences between PA&E's bolt style parts and filter industry similar devices, lies in the internal construction used.

Historically, device types similar to MIL-F-15733/44 & /61 have been fabricated with single layer tubular ceramic capacitors. In the π or L configuration, a ferrite bead is installed coaxially inside the tubular ceramic capacitor. The coaxial subassemblies (lead, ferrite bead, tubular capacitor) are soldered into a brass or steel threaded housing. See figure 1.



Potential failure modes on this device include microcracks in the single layer tubular ceramic capacitor induced by thermal shock during initial fabrication of the subassemblies or installation in the bolt housing. Subsequent thermal cycling will open these micro-cracks and allow metal migration between inner and outer electrodes. The result will be a progressive deterioration of IR with time and ultimately a short from the center terminal to ground.

In order to minimize thermal stress on the tubular ceramic, some manufacturers install the filter subassembly in the housing with silver filled epoxy.

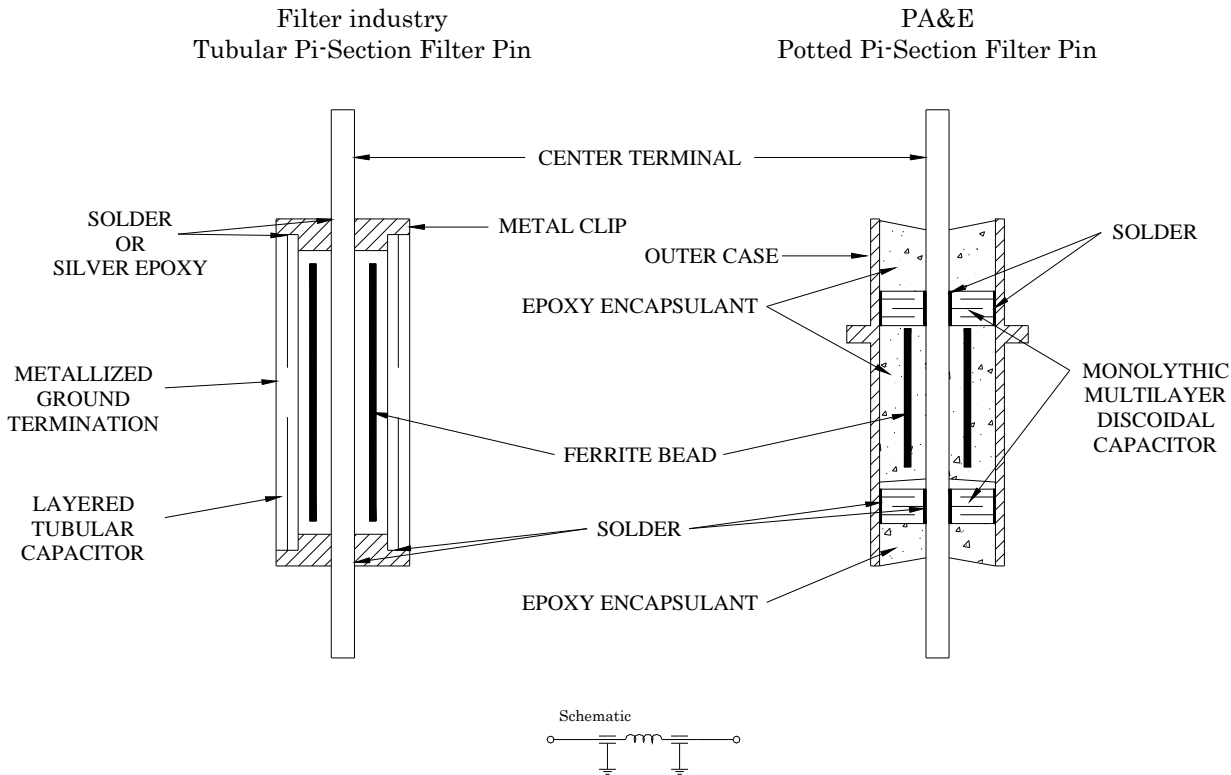
Most silver filled epoxy materials become resistive at frequencies greater than 500 MHz, which has the effect of introducing a resistance between the capacitor(s) and ground, thereby reducing the effectiveness of the filter.

In addition, in this type of construction, the torque stress applied to the bolt head during installation can be transmitted through the case to the OD of the ceramic tube with results that are anything from immediately catastrophic to long term latent defects such as described above under microcracks.

EMI FILTER CONSTRUCTION

DISCOIDAL CAPACITOR VERSUS TUBULAR CAPACITOR

Another typical example of differences between the design and internal construction of Pi solder-in filter pins as manufactured by PA&E and filter industry similar devices based on Mil-F-15733/33, /40, /62, etc., is shown below.



PA&E Filter Division construction utilizes two monolithic multilayer discoidal capacitors and a ferrite bead. Advantages of this type of construction are as follows:

1. The discoidal capacitor is inherently a mechanically stronger device than the thin walled single layer tubular capacitor.
2. Because of its increased volume and mass, the discoidal capacitor is not as susceptible to thermal stress cracking as the single layer tubular.
3. Since the discoidal capacitors in this type of construction are located away from regions of torque related stress, and are mechanically isolated from each other, the unit is better able to withstand installation torque stress.
4. In the discoidal configuration, the ferrite bead is secured within the case by epoxy potting, thereby precluding any possible damage to the bead from shock and vibration.