



There is a frequent misconception that matched seals are superior to compression seals. Speaking from a hermetic reliability standpoint, this is not necessarily true.

The seal stress must be considered under the soldered-in stress conditions, which are quite different for a soft, low strength soldered seal than for a hard, high strength soldered seal.

In the case of the hard soldered conventional seal in a high expansion material such as aluminum, a compression seal will result due to the high compression forces generated upon cool down. Therefore, a matched seal becomes a compression seal after installation and remains for the life of the product.

This system has a number of geometric limitations. The stresses developed in the solder and surrounding aluminum are extremely high (35,000-40,000 PSI). Therefore, this system is highly sensitive to stress modifiers resulting from geometric/thermal considerations or externally applied forces.

Hard soldering of conventional matched seals in low expansion material such as Kovar should be avoided since high radial tensile stress is developed in the seal on cool down leading to high risk for glass/metal separation and also solder failure.

With soft soldered seals in high expansion material such as aluminum, the seal will be under radial compression upon initial cool down. The stress level in the glass and housing is limited by the yield stress of the solder.

Over time at constant temperature the solder will creep and approach some limiting stress level on the order of 1,000 psi to 2,000 psi.

When the temperature of the assembly is then raised, the stress will reverse and become tensile at some temperature and continue to rise with temperature until reaching the yield stress of the solder.

The above phenomenon is repeated over the life of the product with rising and falling temperatures.

With the soft solder system, solder joint life is critically dependent on controlling the degree of strain within the solder. This strain is effectively limited on relatively small devices by assuring a thick solder joint as with the SHP "Aluminum Compatible" feedthru. With this system the seal will be subjected periodically to negative stress equal to or less than the yield stress of the solder.

It therefore, should be obvious that a seal that has pre-compression at time of manufacture will see less net negative stress in service. Therefore, the compression seal can be significantly more reliable or robust in a soft solder system.

Now, assuming the compression seal is manufactured with the same glass/metal adhesion qualities as the matched (Kovar) seal, it will provide a more robust sealing system than the matched seal.

As for soft soldering of seals in low expansion material such as Kovar, compression seals must be avoided as they create excessive negative radial strain on the solder during cool down due to their relatively high CTE. Matched seals are necessary in this case.