



There are basically two types of soldering systems currently being utilized to install glass-to-metal seals.

The most common is the soft soldering systems, which utilize soft Pb/Sn or Sn based solders primarily and sometimes, various indium based solders.

The second is the hard soldering system, sometimes referred to as a braze, which utilizes gold based solders including; Au/Sn, Au/Ge and Au/Si.

It is important to understand the benefits and limitations of each of these systems when selecting one for a hermetic package. The reliability of a package will be more the result of the design than any other element and the design will be the most expensive to change once in production.

The solder system consists of the chosen seal, the solder and the metallic media surrounding the seal, which contributes to the local stress and strain of the system.

The soft solder system depends on the ability of the solder to absorb essentially all of the strain developed in the system due to the various CTEs of the constituents.

With this system the solder will yield under stress over time and therefore, produce both compressive and radial stresses on the seal over the life of the product. The magnitude of the stress at any time is limited to the yield stress of the solder typically between 1,000 and 3,000 PSI for common soft solders and possibly less for some indium solders.

A properly designed soft solder seal system will limit the solder strain per thermal cycle and therefore, insure the long cyclic life of the solder joint. Such a system is effective with essentially all common combinations of seal and housing materials except that the seal CTE should not exceed the housing CTE.

On the other hand, the hard solder system can develop very high stress levels in the solder and surrounding materials driven by the CTE differentials and particularly the high yield stress of the hard solders. While this can be very effective in insuring radial compressive stresses on the seal over the life of the product with some housing/seal material combinations, it can produce high negative stresses in others.

The stresses generated in some material combinations can be so close to the yield of both the solder and the housing material (in the case of aluminum) that any stress modifier resulting from the design geometry and temperature fluctuations or produced from external sources may trigger a hermeticity failure of either the glass or the solder.

Another particularly high-risk situation exists when soldering conventional F-15 (Kovar) feedthrus into F-15 housings. Extremely high radial stresses are imposed on the glass seal placing the glass and its glass/metal interface in high radial tension for the life of the product, a situation not conducive to long term seal reliability.

While this seal may survive initial assembly, it is extremely vulnerable to externally generated stress as produced for example, by laser welding or seam sealing the lid.