



A glass-to-metal seal, properly manufactured, is an extremely rugged device.

What is frequently misunderstood is the level of detrimental stress, which can be imparted to a seal, simply by changing the temperature of the housing in which it is installed.

The vast majority of seal failures; are thermally induced and occur during subsequent manufacturing processes and testing. These failures are not typically an indicator of field reliability. In other words, these result from conditions far more severe than those occurring in service.

Can robust seals be designed to overcome such thermally induced failures? The answer is possibly, but likely this will be much more expensive than addressing the process conditions which caused the failure in the first place.

How are these undesirable stresses generated? These stresses are the result of unbalanced (non-radial) forces on the seal caused by thermal gradients in the area of the seal.

Factors contributing to the risk of such failures:

1. Low conductivity housing material
2. Large cross-sectional changes in area of the seal
3. Rapid application of heat or heat removal, particularly by conduction

General recommendations for avoiding thermal stress failures:

1. Validate heating and cooling rates used in processing to assure they are not destructive to seals. If destructive, slow them down or utilize pre-heating techniques.
2. Aluminum housings are far more forgiving than lower conductivity materials.
3. Avoid conductive heating/cooling processes such as hot plate heating or cold plate cooling. Utilize convective heating and cooling methods to minimize large thermal gradients wherever possible.
4. Radiant heat methods are acceptable for such things as curing of epoxies since it heats the module reasonably evenly and gradually.
5. Some gross leak tests are destructive to certain products under test relating to their cross-sectional geometry in the area of glass seals and material thermal conductivity. Potentially destructive methods are MIL-STD-883, Method 1014.10, Condition C, and MIL-STD-202, Method 112E, Test Condition A. Alternate tests to avoid the excessive thermal stresses are MIL-STD-883, Method 1014.10, Condition C<sub>3</sub> and MIL-STD-202, Method 112E, Test Condition B.
6. SHP will provide free application engineering services to evaluate your housing/seal designs to minimize potential failure modes up front and will assist its customers in troubleshooting problems encountered on the production line relative to seals.