



High quality glass to metal seals can only be achieved by following precise steps. These are:

- Use of precision parts
- Proper cleaning
- Metal out-gassing
- Optimized metal oxide preparation
- Precise fixturing
- Precise temperature firing
- Etching (as required)
- Re-fire for glass polish
- Verifying conformance by performing inspections at each stage of manufacture

Too frequently, short cuts are taken to reduce seal cost at the expense of quality. These include:

- Combining the oxidation and firing steps (ie: single pass)
- Combining unlike parts in a single furnace setting, thereby compromising the optimum firing condition
- Eliminating the etching process and accompanying re-fire process, or including the etching process but eliminating the re-fire process
- Inadequate in-process quality verification
- Use of fixtures beyond normal life

Each of these eliminated or deviated steps saves significant labor cost and might look very attractive from a price viewpoint. However, the compromise of quality and reliability can have significant impact, particularly in a hermetic microwave application. These risks are not worth taking. They will lead to subsequent failures in the ultimate product when failure cost impact is most significant.

History in the hermetics field is filled with poor results with improperly manufactured glass to metal seals being a significant cause. Typical negative results include:

- Glass to pin separation
- Glass to ferrule separation
- Cracked glass
- High meniscus
- Gas bubbles in glass

While not all seal failures can be attributed solely to inferior seal manufacturing, good results cannot be consistently attained without proper seal manufacturing practices.

The user of hermetic seals is at high cost risk if he acquires seals solely on a price basis without verification that the necessary process steps are utilized to ensure a high quality product.