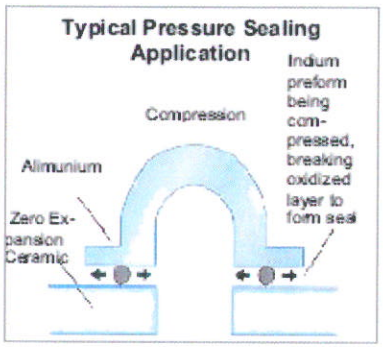
Sealing with Indium

Indium can be used to seal conventionally non-wettable surfaces in cryogenic applications, vacuum pumps and in heat-sensitive areas.

When indium is used as the sealant, a mechanical and chemical bond is formed between this silvery, semi-precious metal and the surfaces to be mated. Gaskets made from other materials only form a barrier to the medium being contained.



Indium seals are far less sensitive to mechanical shock, vibration and the effect of low temperature than other types of seals.

A characteristic of indium is that it forms an oxide its surface. In order to present clean indium metal to a substrate, this film must be broken by plastic deformation. Only by breaking the oxide film is it possible to obtain a chemical bond between indium and another surface without soldering. This process is easy to accomplish since indium readily flows under pressure, even at cryogenic temperatures.

The Quality of an Indium Seal Depends On:

1. **The purity and the cleanliness of the indium used.**

- 4Ns is the preferred purity.
- Pretreatment of the seal is not usually necessary, but heavy contamination with organic compounds should be removed by degreasing. Surface oxide can be etched off by using 50% hydrochloric acid (a 2-4 second dip) followed by rinsing in deionized water.

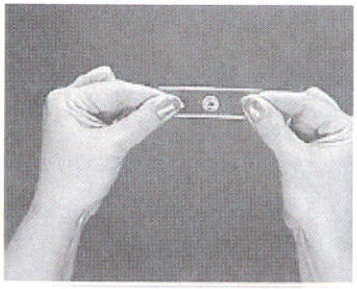
2. **Proper preparation of the surfaces to be sealed.**

- All surfaces must be clean and dry.
- Glass and ceramic surfaces must be cleaned with an effective glass cleaner. Drying can be done in an oven or by passing through a gas flame. In super-clean applications, cleaning is done by bombarding with ultra-violet light or with electrical plasma.
- Metal surfaces can be bare, pre-tinned with indium or plated with indium or silver. Bare surfaces can be polished using very fine abrasive powders or can have a fine, machined finish. Fine machine finishes should not be "improved" using abrasive powders, cloths, etc.

3. **Thickness and shape of the indium.**

- While some flat seals can be as thin as a few thousandths of an inch (<0.2mm), other applications call for thick material (1-2 mm). Required indium seal thickness depends upon the area of the mating surfaces and the compressive force on the seal.
- If the seal is placed in an "O" ring groove, the seal should be sized so that when it is compressed it overfills the groove by 5-15%.
- In some applications, overlapping segments of indium can perform as well as a continuous washer.
- Correctly formed seals have leak rates of less than 2×10^{-7} torr liter/sec^{-1}.

Cookson Electronics supplies indium preforms in various shapes including flat washers, "O" rings, square windows, discs, rectangles, etc. Foil and wire are available for custom seal fabrications.



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