

To: Hogan Nguyen and John Krider

10/23/01

From: Cary Kendziora

Subject: R&D of the vacuum seal of the Straw Brass Inserts.

The seal between the brass inserts that get inserted into both ends of a straw is the weakest component of the vacuum system design. Much care must be given to this seal or the end result could be catastrophic failure of the vacuum system or chronic progressive leaks over time.

The bonding between the brass inserts and the end of the straw has two purposes. The first being an electrical ground connection of the straw and the brass insert, the second is a vacuum seal between the gas inside the straw and the vacuum chamber.

Tricon conductive epoxy BA-2902 is used to produce a good electrical connection. This epoxy is approximately 50% silver by volume. The significant amount of silver found in this epoxy dilutes the epoxy and significantly reduces its strength. The Tricon epoxy makes a very good electrical connection but is very susceptible to peel. The Tricon epoxy by itself could likely experience peel between the brass insert and the inner straw surface due to the creep of the straw over time. The end result could be a leak or a separation of the electrical connection. This peel can be avoided by using Devcon 5 minute epoxy on the inner and outer areas of the brass insert (see attached illustration).

Much effort went into trying to find a better alternative for the Devcon 5 minute epoxy, but it turns out that the Devcon 5 minute had superior results over all the other epoxies and adhesives tested (see attached list). Close examinations of bonded inserts were tested under a microscope by peeling away the straw from the brass insert. Close attention was paid to how strong the bonding was between the insert and the straw. Only the Devcon 5 minute epoxy had a bond so strong that the inner copper layer would separate from outer Kapton layer of the straw, thus the copper remained bonded to the insert. The straw was easily peeled away from all the other epoxies and adhesives tested, the silver type epoxies exhibited the weakest bond.

In conclusion the best possible recipe based on the test performed at the PAB for bonding the straws to the brass inserts as well as producing a good electrical connection is, to use a layer of Tricon conductive epoxy BA-2902 between 2 layers of Devcon 5 minute epoxy. The straw inserts should be redesigned (for the final design) to accommodate an expanded surface of .10 inch for each layer of epoxy.

List of Adhesives Tested for bonding Brass Inserts to Straws:

Epoxies:

Devcon 5 Minute
Tricon *conductive epoxy* BA-2902
3M 2216
Epon 815
American Chemical FE7004
Duro 120 Minute
Loctite 90 Minute
ACE 18611
PC Products 15 Minute

Loctite anaerobic adhesives:

380
401
406
420
493

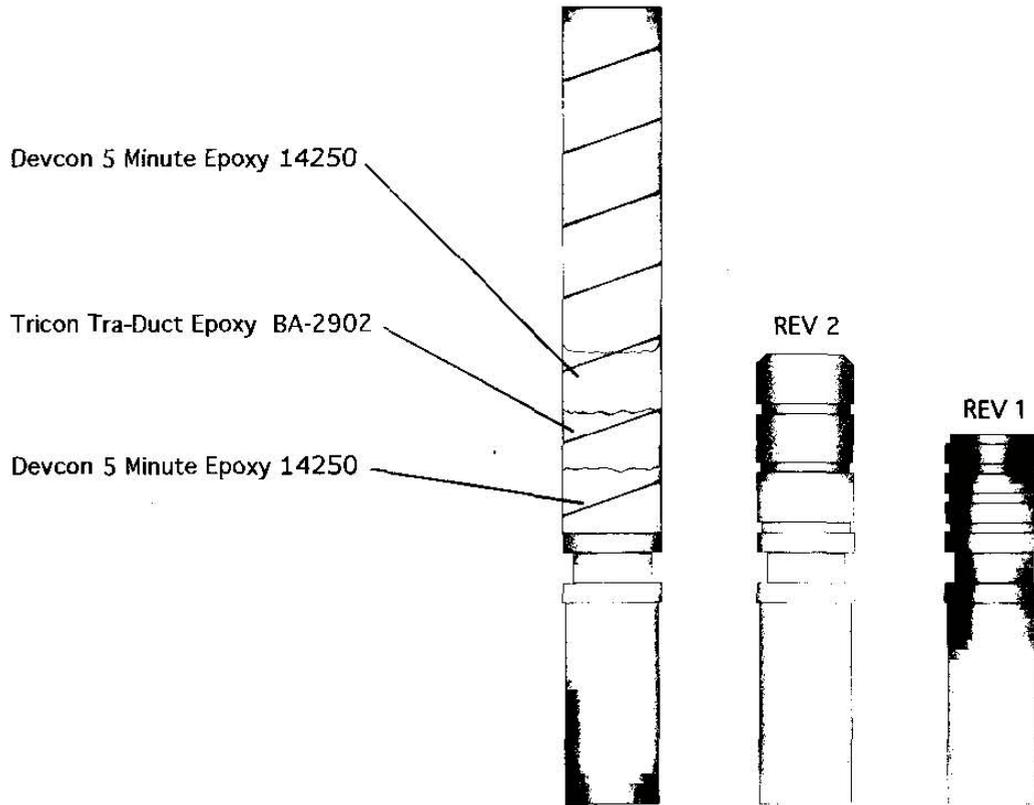
Pacer PT -19 anaerobic adhesive

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BB - 2114

Best result

Straw End Epoxy Seal



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