

**Subject:** L1100162-v1, VRB question: acceptable to not vacuum bake the CP and ERM to ESD flex connector bond?

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LIGO-L1100162-v1

To the VRB,

Our question: Is it acceptable to not vacuum bake the Compensation Plates (CP) and End Reaction Masses (ERM) after the Electro-Static Drive (ESD) flex connector has been bonded to the barrel of the optic?

Background:

The current plan for providing the electrical connections to the Electro-Static Drive (ESD) on the Compensation Plates (CP) and End Reaction Masses (ERM) is to bond a flex connector, with wires embedded in it, to the optic's barrel using Pyralux adhesive. This provides strain relief for the wires that are soldered to the gold ESD pattern. [T1100320-v2](#) is the current ESD connector bonding/soldering procedure. The Pyralux adhesive is included in LIGO vacuum compatible materials list ([E960050-v10](#) on page 15, E13 and will be modified to note use in both the BOSEM and the ESD connector).

The flex connectors are layers of kapton and Pyralux with five wires sandwiched in between. They are cured at the vendor during lamination for 1.5 hrs at 182 degrees Celsius. Then at CIT these flex connector/wire assemblies are vacuum baked at 130C for 48 hrs and then RGA scanned. A set of five of these flex connector assemblies have passed their Class A RGA scan ([ICS bake-1800](#)) with < 3e-12 torr-liter/sec/cable hydrocarbon outgassing rate.

At CIT we then bond these cured connectors to the surface using an additional sheet of Pyralux in between the flex connector and the optic's barrel. The bonding is done at CIT for 2 hours at 200 degrees Celsius. If we require a subsequent vacuum bake and RGA scan to ensure that the flex connector to optic barrel bond is fully cured and outgassed, then we incur some additional risk:

1. Requires additional handling to get optic in and out of the oven
2. Any hydrocarbons that outgass during the vacuum bake will stick to the optical surfaces of the CP and ERM. It is not clear whether or not these hydrocarbons can be removed without damage to the gold ESD pattern.
3. We do currently have a good and safe way to mount the optics in the vacuum bake oven at 200C. Metal mounts should not be used due to their differential thermal expansion, glass mounts cannot be used because optics have been known to actually stick to glass mounts after baking. A Class-A cleaned teflon or PEEK mount (baked at 200C) might be an option, but we would then bake the ESD and optic assembly at a lower temperature to minimize the outgassing from the mount, say 170C.

The basic concern is whether the Pyralux adhesive has been fully cured and outgassed during bonding the connector to the optic. Note that:

1. The curing of the Pyralux bond is more rigorous at CIT than at the manufacturer (two hours of 200 degrees Celsius versus 1.5 hours of 182 degrees Celsius at vendor)
2. The RGA test of the flex connector assembly passed outgassing requirements after 130C for 48 hrs. We could perform a 130C outgassing bake in air, immediately after the initial cure cycle.

3. A flex connector was bonded onto a LASTI ERM and an FTIR was conducted on its surface before and after, no contaminants were found on surface or barrel right next to connector.

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