

Poster # THPTEV012

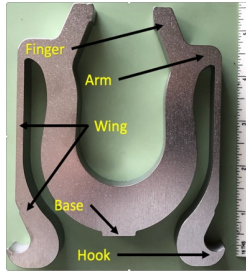
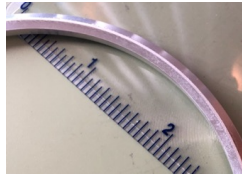
SUBSTITUTION OF SPRING CLAMPS FOR BOLTS ON SRF FLANGES TO MINIMIZE PARTICLE GENERATION* †

Abstract

Hyperboloid LLC developed and successfully tested a System of High Force Spring Clamps to substitute, one for one, for bolts on the flanges of SRF Cavities. The Clamps are like exceptionally forceful binder clips. The System, that includes the Hydraulic Openers that apply the clamps, minimizes generation of particulates when sealing cavity flanges. Hyperboloid LLC used ANSYS to design the titanium clamps that generate the force to seal the hexagonal cross section, relatively hard aluminium gasket developed for TESLA and used at JLab and other accelerators. The System is developed to be suitable for use in SRF Clean Rooms. Results of particle counter readings during bolt and clamp installation and superfluid helium challenges to the sealed flanges are discussed. Results of a half-size clamp that could seal a soft aluminium gasket and the attempt to seal a gasket made of niobium are also discussed.

CLAMP MODEL 1

- Titanium 6Al4V Clamp Material
- Uses Hard Aluminum Tesla & US SRF Gasket



Results:

- Sealed a Research SRF Cavity[§],
- Two sealing cycles (new gaskets for each)
- Challenged by superfluid helium, at 2 K
- Helium Leak Tight
- Fewer Particles detected during Assembly



George H. Biallas[‡]

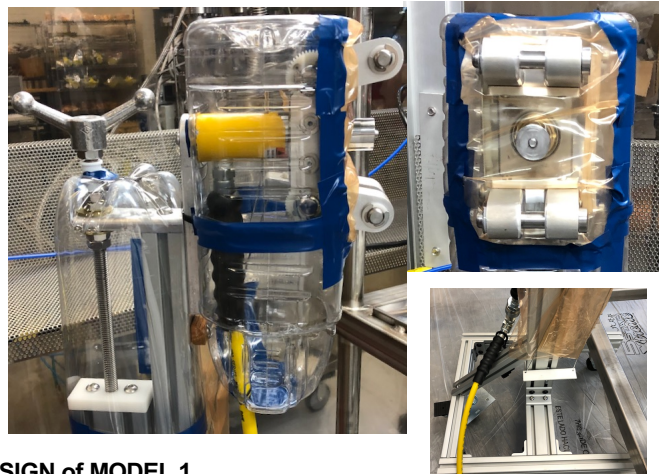
Hyperboloid LLC

104 Loon Court

Yorktown VA 23692-2998

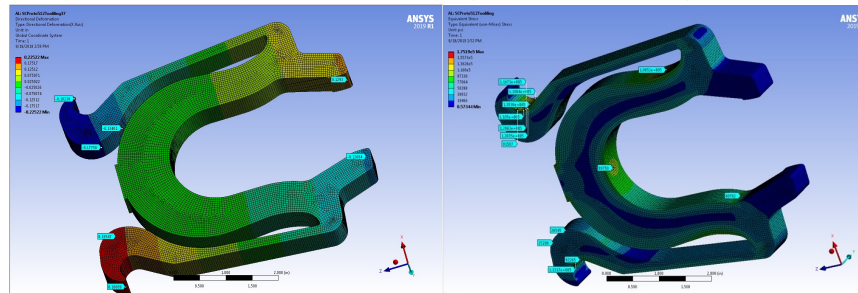
THE CLAMP OPENER SYSTEM

- Mechanism of Opener System within a Shroud
 - No particles to Clean Room Environment
- Uses Enerpac hydraulics
- Only Stirrup Rods and Piston touch Clamp
- Pedal Activates Stirrups



DESIGN of MODEL 1

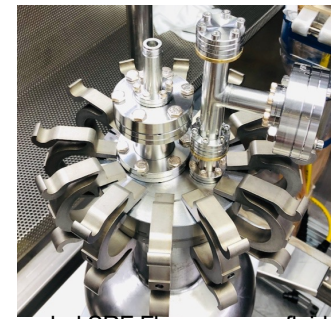
- Used ANSYS
- Clamp opens about 1/4 inch with 10,000 lb. push at the Base
- Max Body Stress is 99,000 psi (120,000 Yield Stress)



See the Clamp Installation Movie at <https://www.hyperboloid.online>

HALF-SIZE, HALF FORCE CLAMP (MODEL 2) DEVELOPED – BETTER FIT IN CRYOSTAT

- Uses the same Opener
- Niobium Gasket leaked
 - Cause by machining tears
- Softer Aluminum Gasket needs validation using new funds.



CONCLUSIONS

- High Force Spring Clamps sealed SRF Flanges superfluid helium leak tight
 - Used Standard Hard Aluminium Gasket
 - System generates fewer particles than when using Bolts.
- Clamp concept a better match for future of SRF
 - Lower particle generation
 - Hydraulics replace physical labor
 - Potential for automation
- Model 2, with Softer Gaskets
 - Acceptable footprint to Cryostat Designers
 - Needs additional funds to be qualified

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†(Patent US 9756715[1]) he patent held by Jefferson Science Associates (TJNAF).

‡ georgebiallas@gmail.com

§ TJNAF CRADA #JSA 2019S003