

Bearings for Direct Drive Linear Generators in submerged W.E.C s

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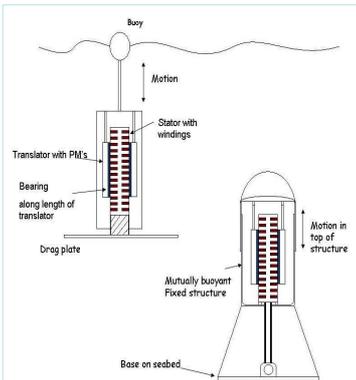
The Challenge

Developing a reliable bearing to operate over the 5000hrs of operation a year that wave excedence charts indicate in the harsh, unpredictable and corrosive environment of a submerged WEC generator provides many design challenges.

The design will be based on survivability and low maintenance, ideally once a year or less. Identifying materials and adapting generator construction to suit the environment without compromising efficiency involves fully integrating the bearing into the machine structure and minimising highly loaded contact.

The Conditions

Operation in submerged WEC

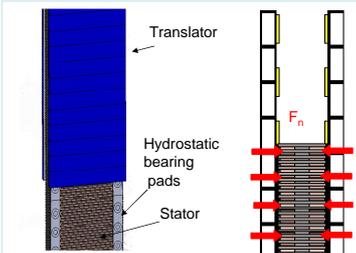


Heave loads from waves of high frequency seas, 1.5Hz, exert up to 177kN on the submerged structure.

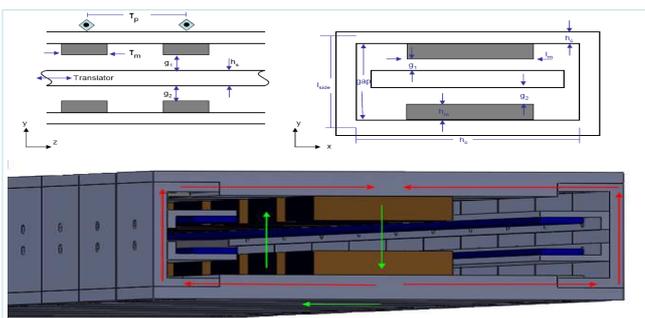
In an iron cored machine F_n can range from 0.2MN to 0.42 MN with air gap of 0.5 to 2.9mm.

Double sides balance out the forces, bearings should keep this imbalance to a minimum.

Fluid film bearings provide non-contact operation. This reduces wear.



Air Cored C-Core Machine – flux paths, air gaps & dimensions [2]



Testing the Materials

Testing of novel bearing options is to be undertaken this year.

•The vertical rig consists of the prototype C-C generator.

•The modular design has changeable bearing pads to test both Thordon SXL [3] and TENMAT T814 [4] water lubricated bearings.

•Adjustable pads have the ability to run off centre to exert forces on the bearings.

•Stainless & nickel plated steel used to resist corrosion. Bearing runner is bronze.

•To increase the loading on the bearings the coils can be replaced with iron to replicate a iron cored machine.

•Speed range 0.5 to 0.75 m/s to match sea states of frequency 0.1 to 1.5Hz

•Hydrodynamic effects will be studied

Expected Wear Rates

Bearings to be tested claim 1 mm wear per year if lubricated whereas Contact bearings can have minimum abrasive wear rates of 0.04mm per day when not lubricated.

Highlighting the main areas of wear to determine the best bearing solution is the aim of the testing. Hybrid solutions using fluid film effects are to be tried also.

References

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- Thordon Bearings Inc, (2008) [cited 05/05/2008] www.thordon.com/brochures.
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