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Energy

# A Test Rig for Linear Generator Bearings

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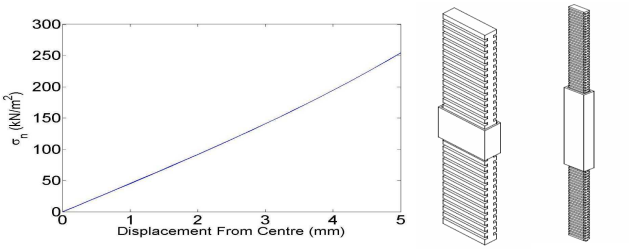
## Testing Aims

**To understand plain contact linear polymer bearings in operation**. This will provide valid information on whether they can be used as a "fail to safe" contact bearing in direct drive linear generators for the P.T.O in wave energy converters. The comparison between bearing needs in Iron –cored and more novel Air-cored types of generator investigated through loaded and unloaded tests.

### Generator Characteristics




Iron-cored generators with a variable stack length were compared. A 10% deflection over a 5mm air-gap is gives a steady load of **22.5kPa** throughout.[1]

For air-cored generators only the self weight of the translator is taken into account.

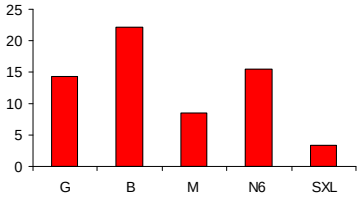
The effects of wave loading on the generator have not been taken into account in this study.

## Bearing Demands

➢**Limitations** to conventional rolling contact bearings include regular re-lubrication, sealing & shock load resilience.

➢A contact bearing system **maintains operation** in the event of the active bearings, such as magnetic or oil/ water fed hydrostatic bearings, losing power supply or control. This will prevent devices having to cease operation until maintenance arrives.

### Low Wear characteristics




Based on well lubricated operation [2] and the wear coefficient of SXL [3]

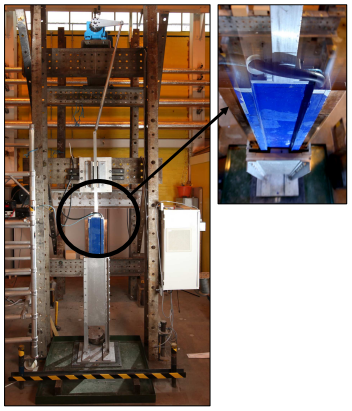
**G -** Graphite
**B -** Bronze
**M** -Molybedenum
**N** -Nylon 6

➢**Polymers** are low wear alternative bearing material. Benefits include greaseless operation, abrasion resistance and ability to run in salt water.

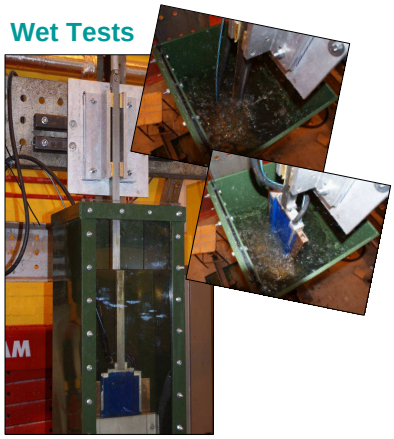
➢Maximum yearly WEC operation can be expect up to **11,000km** travel over nearly 100000 cycles based on a 7m stroke.

## Rig Development

**Dry Tests**



**Wet Tests**

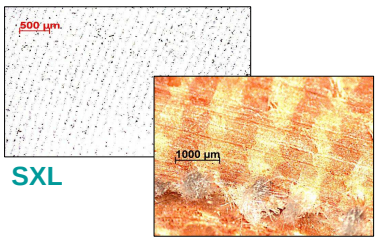


### Data Acquisition

| Sensors | Signal Conditioning | Output |
|---|---|---|
| LVDT<br>Strain Gauges<br>Thermocouples | Labview NI DAQ | Stroke Counter<br>Velocity profile<br>Strain<br>Temperature |

## Initial Results

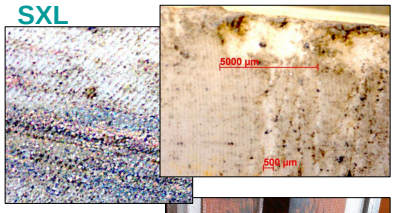
### Pre Test Surfaces



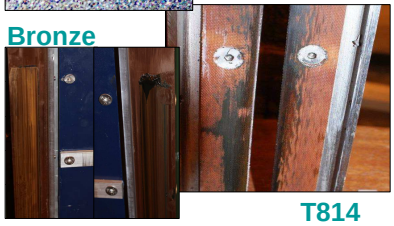

SXL

### Post Test Surfaces

SXL




Bronze



T814

The main requirement of the tests are to measure **bearing wear** over the test duration and **observe** the material response during wet and dry operation.

A conservative wear constant [3] for each material can then be deduced to use in **life predictions** for full scale generators.

$$W = PTk \qquad [\frac{mm}{yr}]$$

**Wet &dry** no-load tests on the SXL bearings, showed no significant wear. Prelim tests travelled 50km in 40hrs. Minor damage from heat occurred. Loaded tests on the T814 samples are underway.

### References

1.Caraher, Crozier, EWTEC 09
2. Collins, J.A, " *Failure of Materials in Mechanical Design*", 1993,
3. Hogg. C, Thordon Inc. Personal Correspondence.

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