Design Aspects and Testing of Superconducting Flywheels

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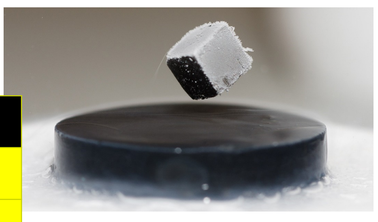
BILFINGER Babcock Noell GmbH

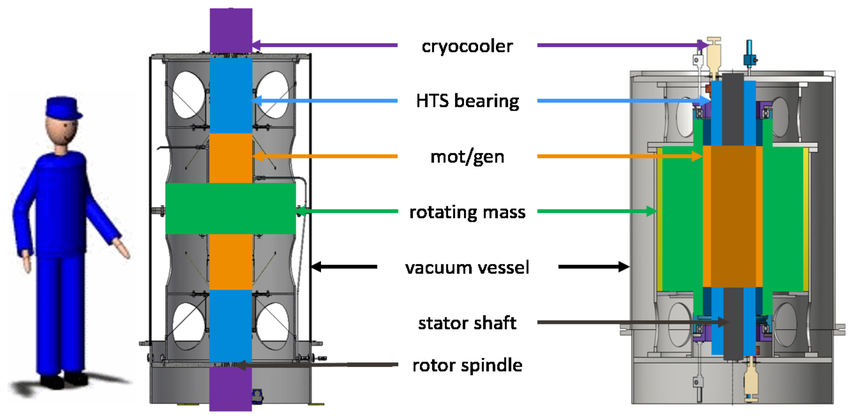
There will be an increasing need for energy storage due to the transformational changes envisioned for a modernized electrical grid with de-centralized generation and management. Flywheels present an interesting storage solution at a very high repetition rate and attractive power density. Therefore, flywheels with superconducting bearings are being developed at Babcock Noell GmbH. Superconductor material has been qualified by measurement of bearing forces as a function of the temperature and magnetic gap. In a second step, testing equipment has been developed and qualified for superconductor series quality measurements. A bearing test stand at full system dimensions has been set-up allowing bearing qualification in terms of orthogonal force measurement and high-speed spinning. This test stand allowed characterizing the bearings before integration into prototype flywheels. At present, full flywheel systems of both, internal rotor and external rotor type are being assembled and tested.

uninterruptible power supply

volatile generation

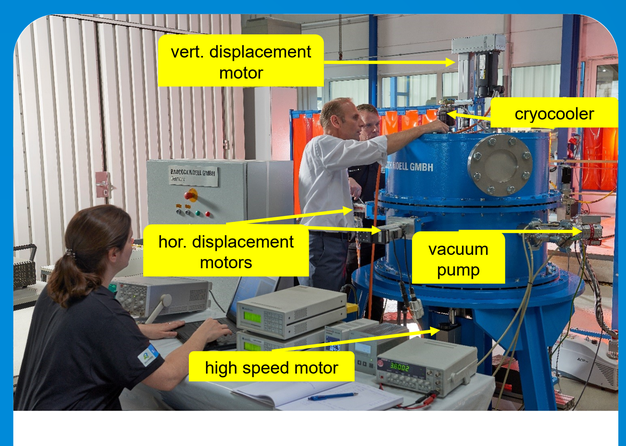
Parameter	UPS	Grid
Power	250 kVA	500 kVA
Capacity	2.5 kWh	5 kWh
Weight	1.5 to	2 to
Diameter	1.2 m	1.2 m
Height	2 m	2 m
Load cycles	5%	50% - 100%
Cycle life	very high	very high



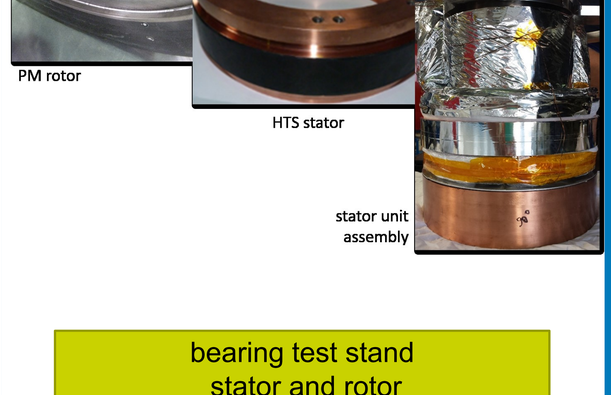


- internal rotor
- two motors
- disc rotor

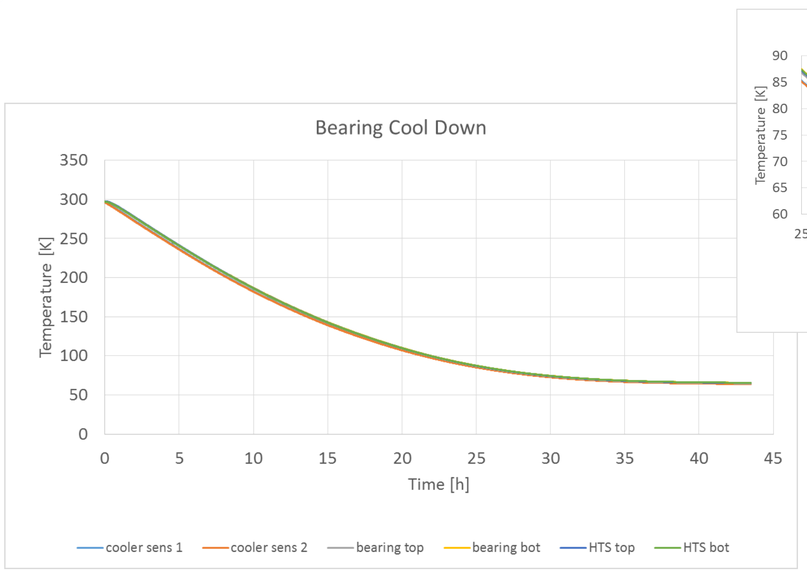
- external rotor
- one motor
- cylinder rotor

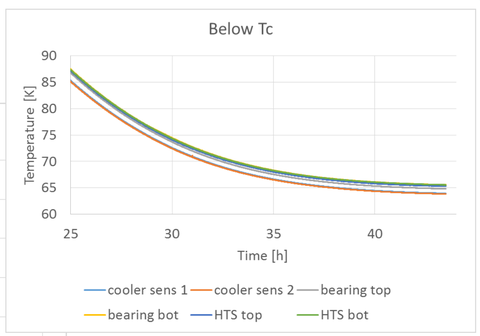


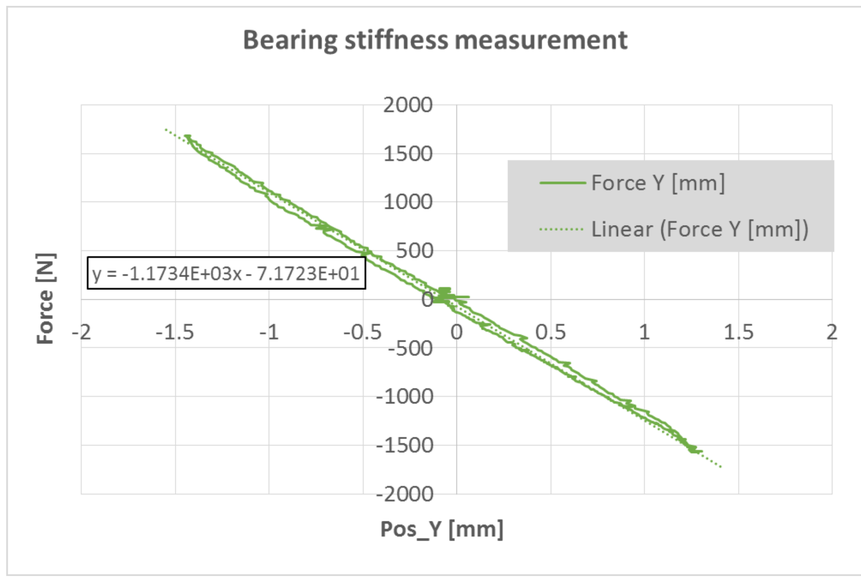
bearing test stand

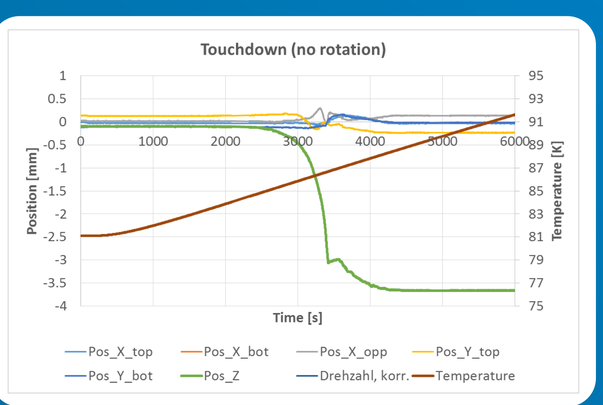


bearing test stand
stator and rotor



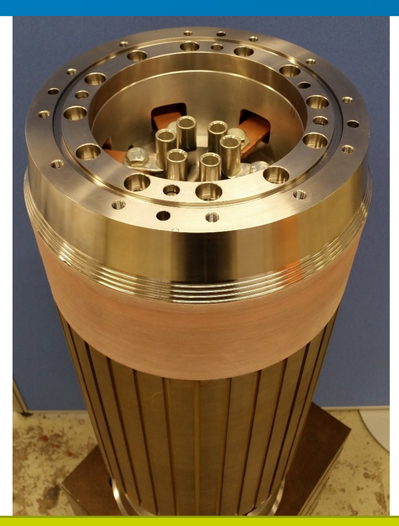






flywheel vessels

CRP machine rotor balancing



motor/generator stator

Conclusions

- All technologies are qualified
- All subcomponents are produced
- Rotation in test stand up to 2400 rpm
- System assembly started
- Market expectations in UPS, renewable power, distributed generation, island networks