

Short-term wear test results of scaled line-contact pitch bearings

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Test profile

The test represents worst-case conditions of one year of operation.

It combines wind speed measurements on a IEC class I site with aero-elastic simulations of the IWT7.5-164 reference turbine. The operation is near rated wind speed, with active load mitigation (IPC). This results in several relatively short pitch cycles in immediate sequence [1].

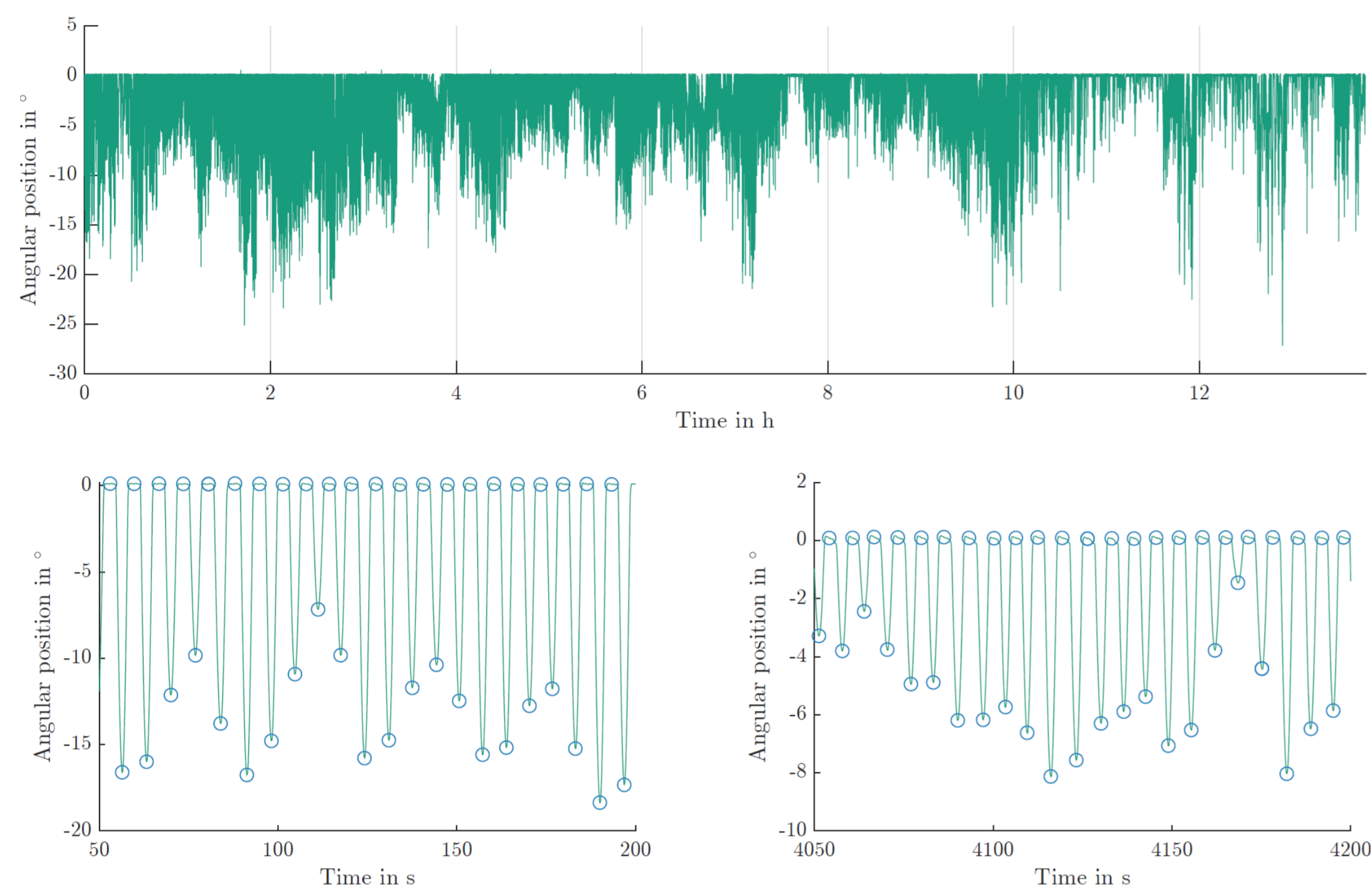


Figure 1: Test profile, scaled to 3x220 custom bearing with constant $x/2b$

Test rig

The BEAT0.2 rig applies a static axial load on two bearings. The servo drive allows to run position time series. Measurement signals are torque, temperature, and force.

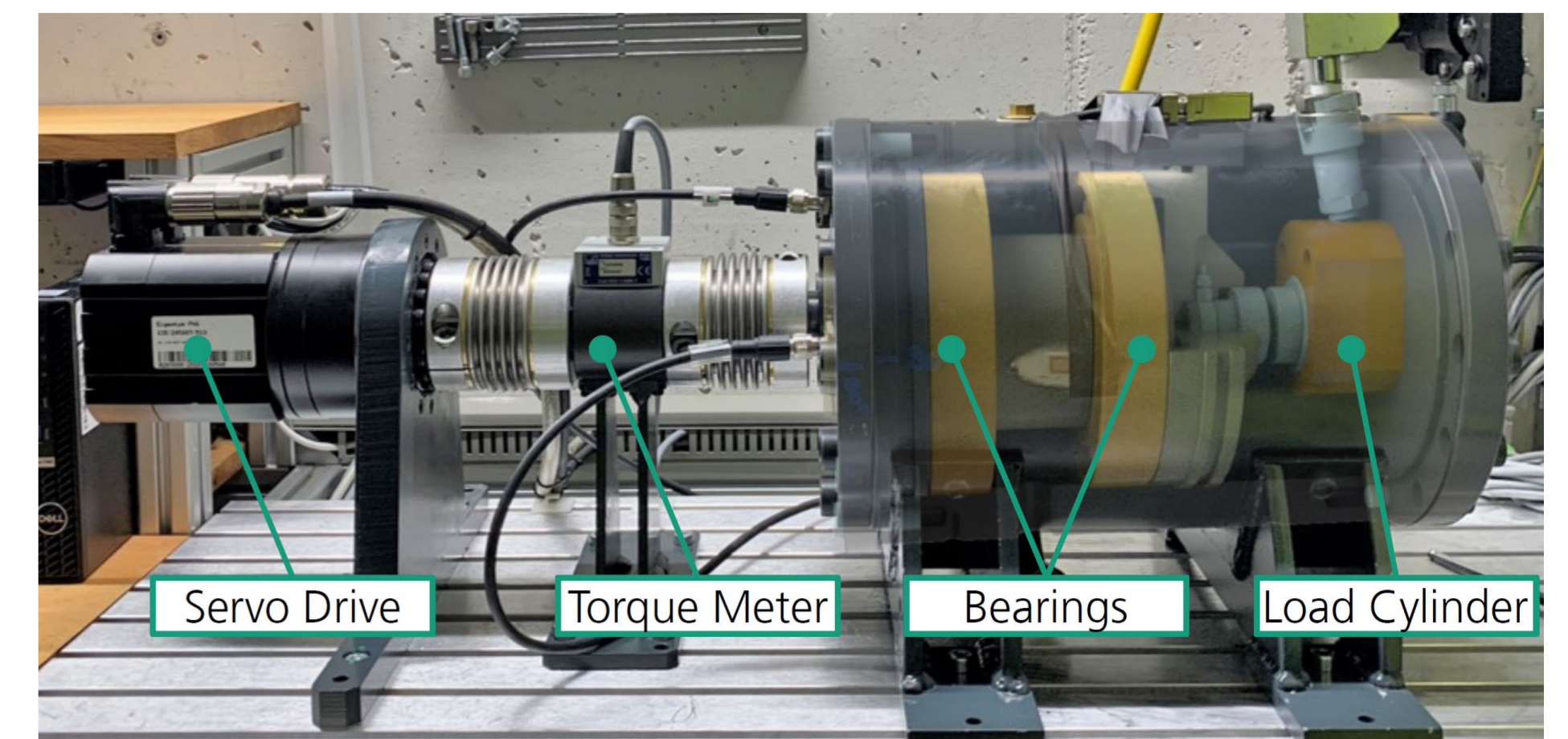


Figure 2: BEAT0.2 rig

Greases

Three commercial greases underwent the test, both in 'dry' and 'wet' – 10% demineralized water added – condition.

Grease ID	Thickener	Base oil type	Base oil viscosity in mm^2/s (cSt) at 40°C	NLGI consistency	Oil separation IP 121, 40°C (Bleeding rate)
A	LiCaC _x	Synthetic	110	1	2.4
B	Ca	Semi-synthetic	13	1.5	1.7
(C)	Li	Synthetic	50	2	1.2
D	LiC _x	Semi-synthetic	130	1	2.5

Table 1: Grease properties, from [2]

Bearings

Line contact: 3x220 bearings are custom angular contact roller bearings (ACRB) with same diameters as 30220 tapered roller bearings. Instead of 20 tapered rollers, these bearings have 10 cylindrical rollers with geometrical slip. Point contact: Type 7220 ACBB.

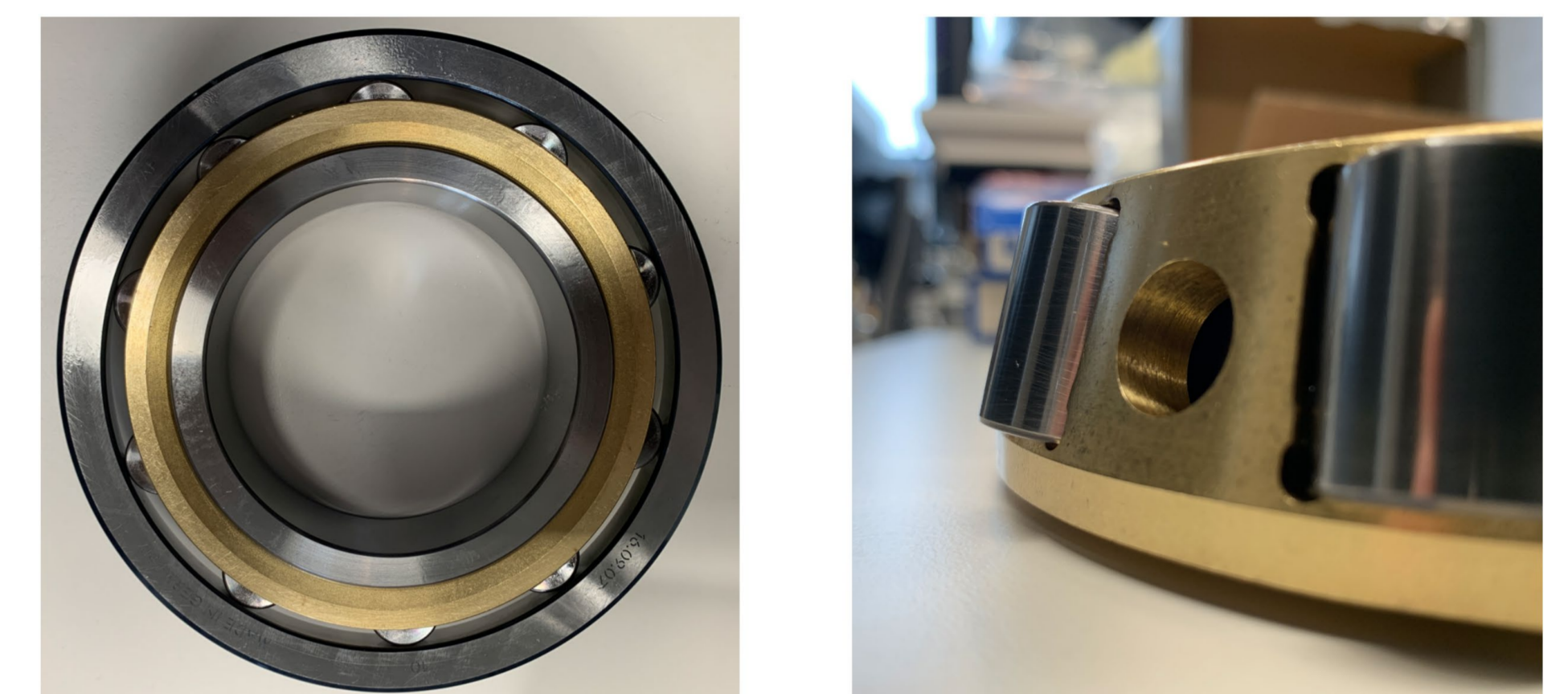


Figure 3: 3x220 bearing

Worst-case operating conditions can cause short-term fretting wear in line-contact pitch bearings. Lubricants perform different than in point-contact bearings.

Results

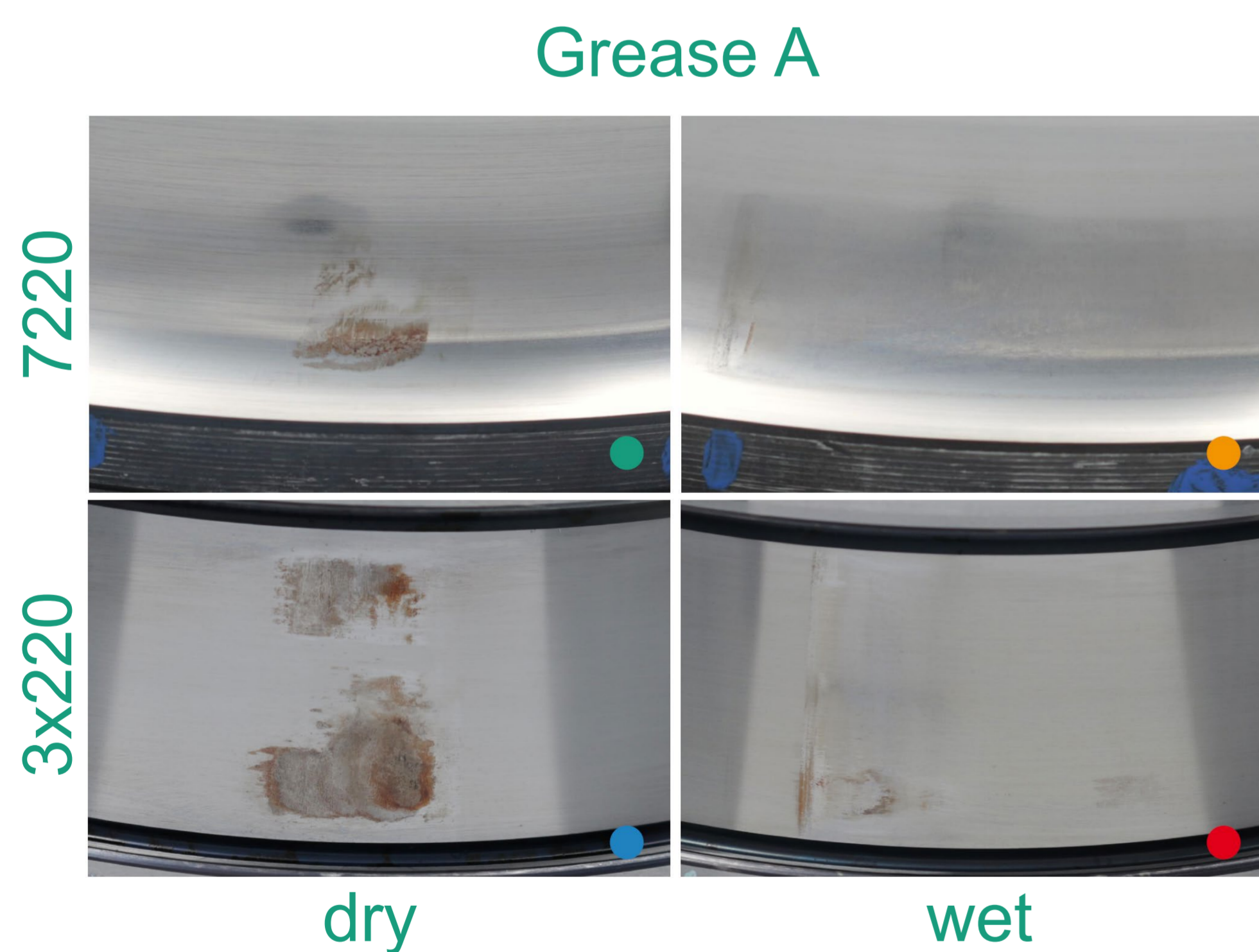


Figure 4: Raceway condition grease A after test



Figure 5: Raceway condition grease B after test

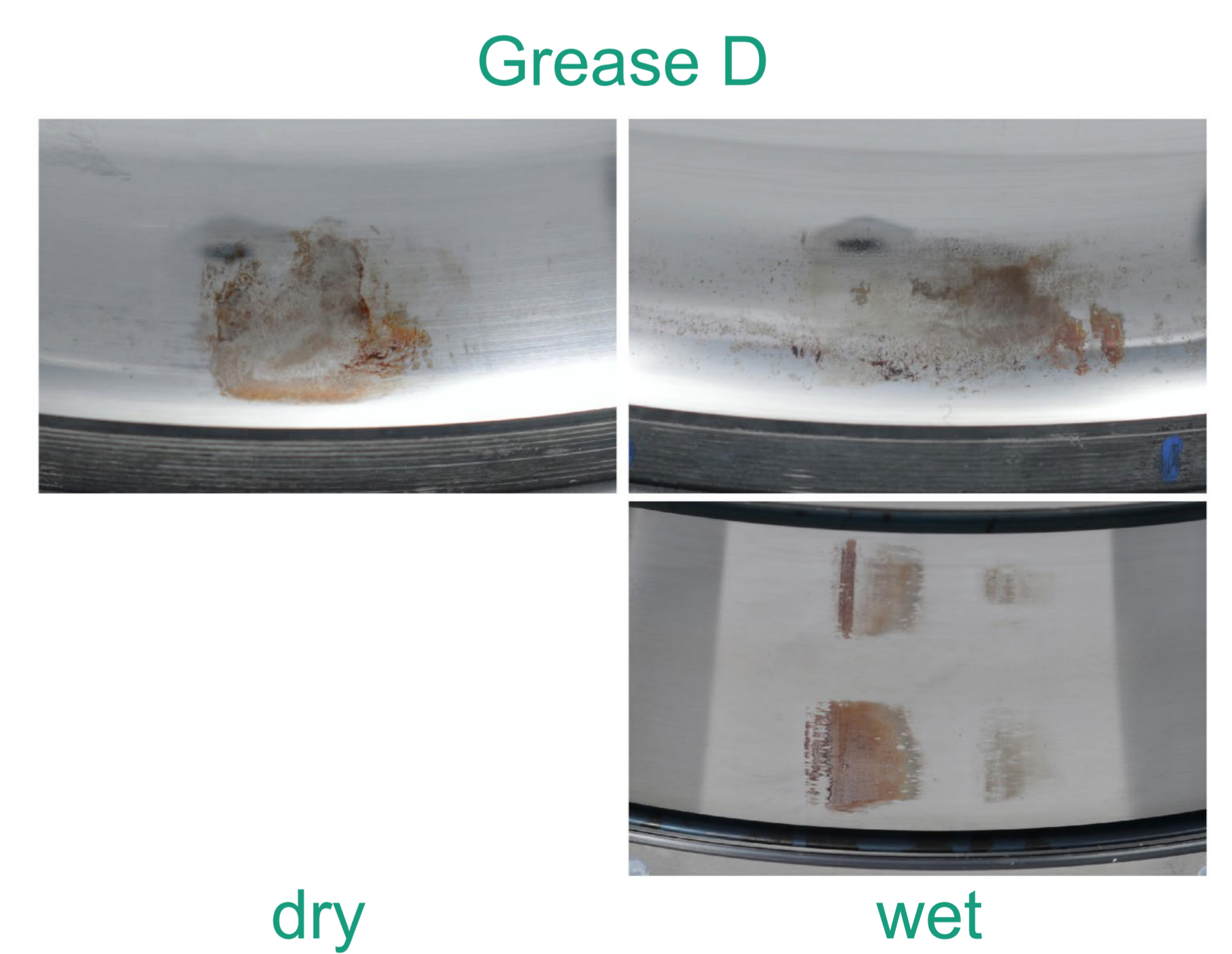


Figure 6: Raceway condition grease D after test

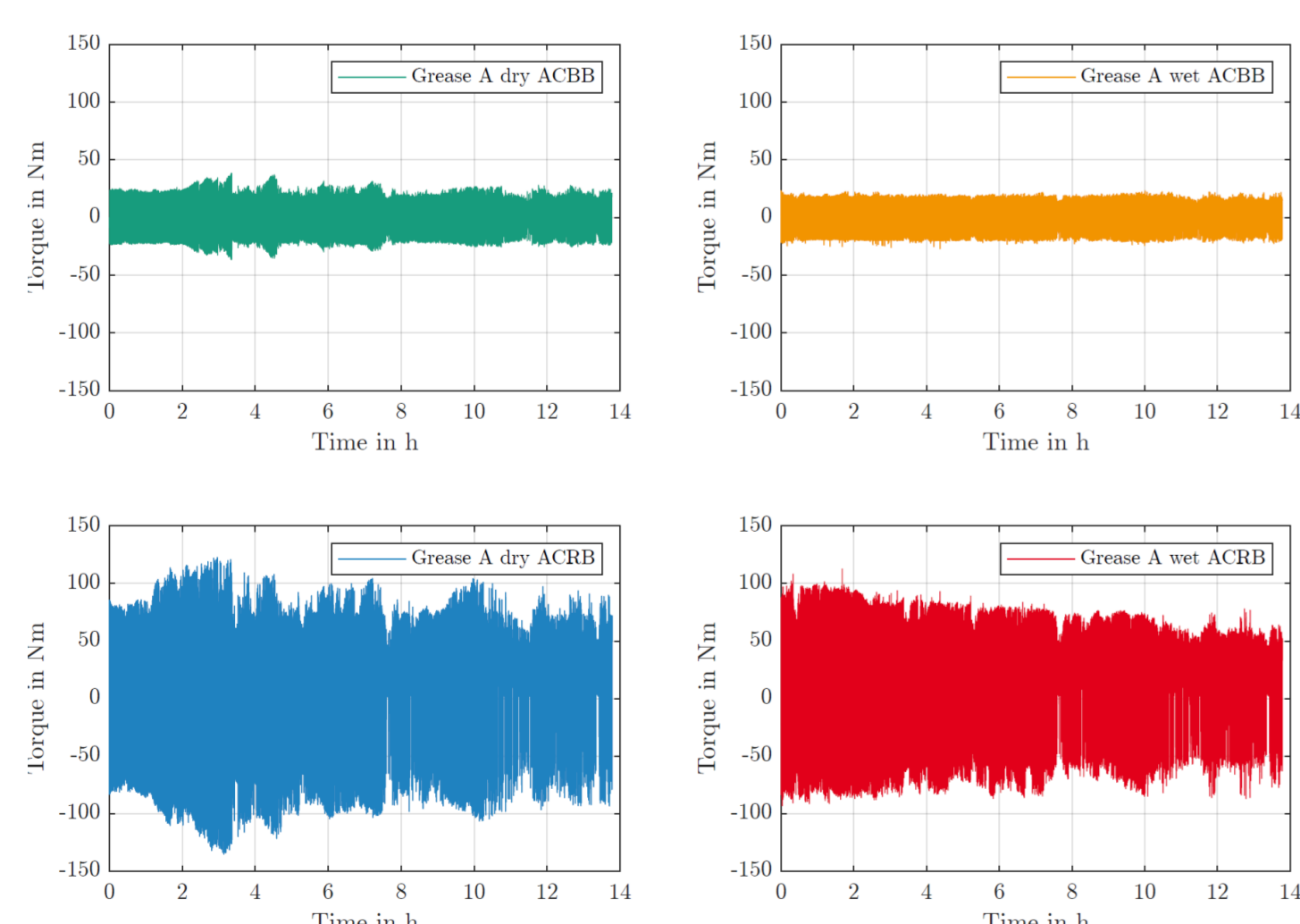


Figure 7: Torque grease A

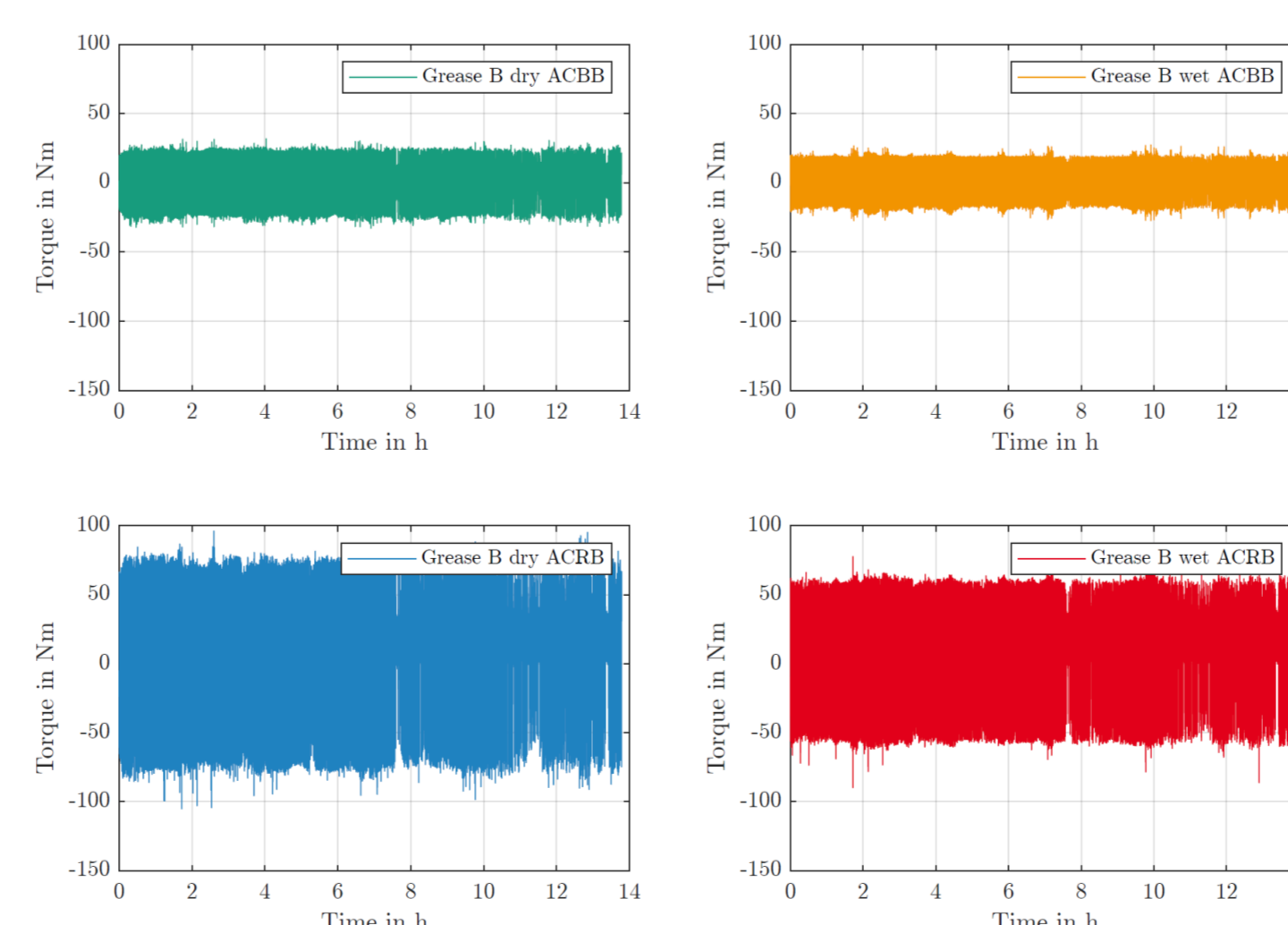


Figure 8: Torque grease B

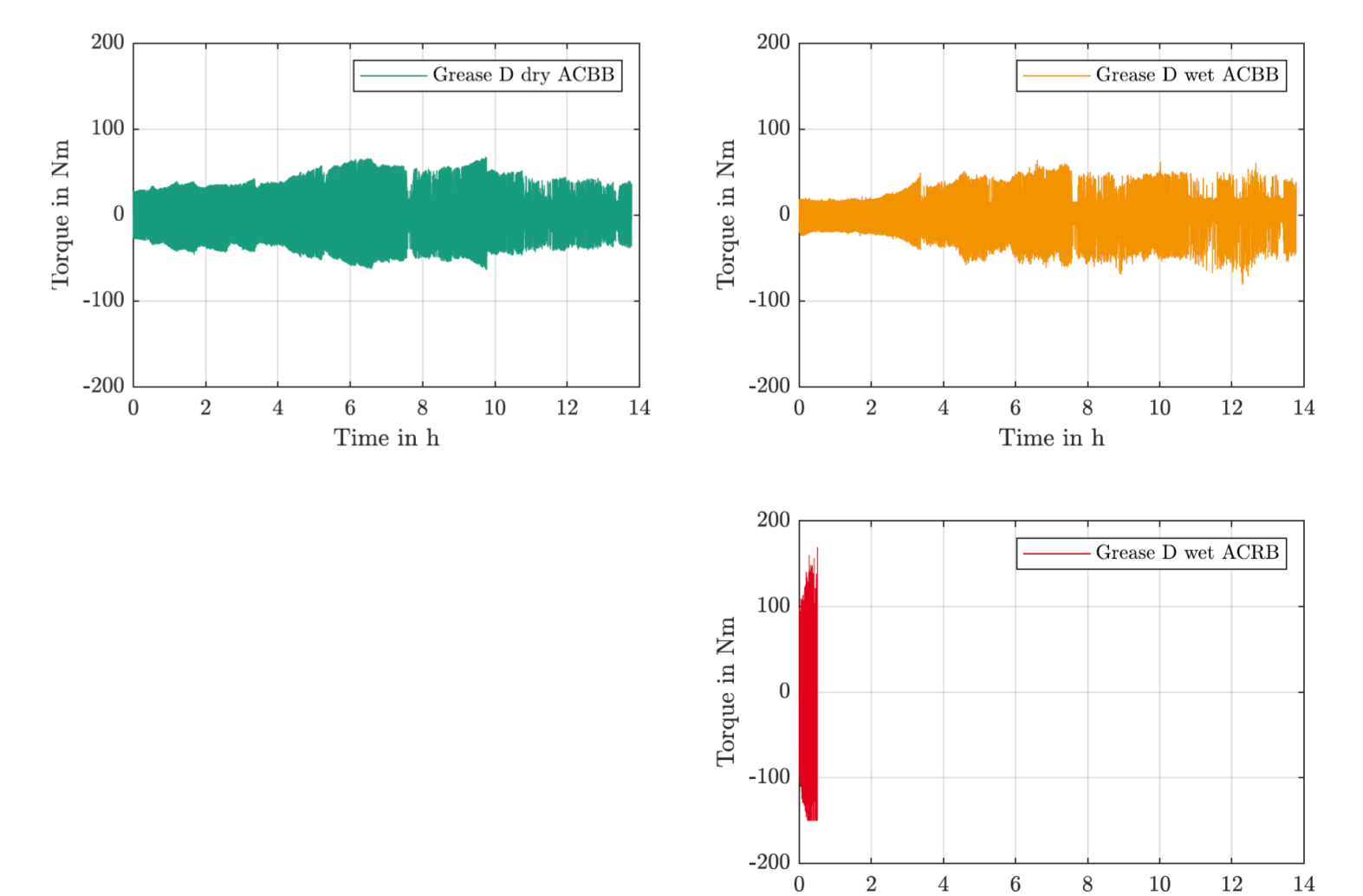


Figure 9: Torque grease D, 3x220 test exceeded limits

References:

[1]



[2]



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