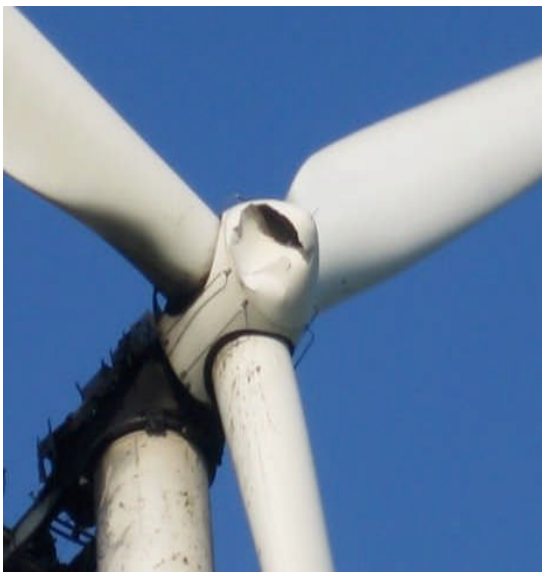
IMIA.
Wind Turbine Generators.

Claims.

Codan Insurance / September 2007
Risk Engineer Truels Kjer

Claims involving the main components of the turbine.

Overspeed I. Fire in the nacelle.
Root causes. Pitch system.
Due to mechanical/electrical problems with the pitch system the turbine went overspeed. Oil from a broken component was ignited when the oil hit the disk brake which due to overspeed was activated.
Damaged parts. Nacelle, at least one blade, upper section of the tower.
Estimated costs. 800.000 Euro. Plus business interruption.



The burned nacelle.
Notice the nosecone. Due to the overspeed an implosion have occurred.

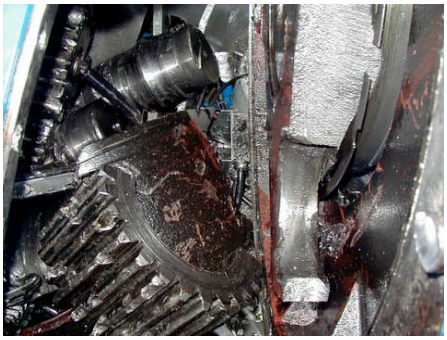
Overspeed II. Mechanical damages.
Root causes. Pitch system.
Due to problems with the control system of the pitch system the turbine went overspeed.
Damaged parts. Nacelle (repairable), 3 blades, upper section of the tower, foundation
Estimated costs. 600.000 Euro. Plus business interruption.

The damaged turbine.
Notice the cracks in the foundation and damaged upper tower section.

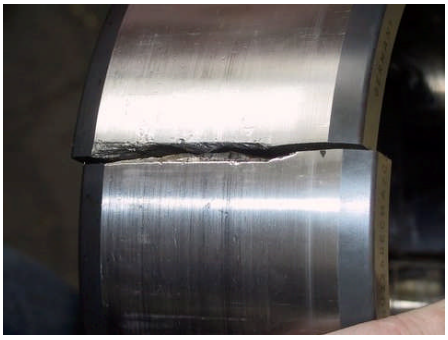
Overspeed III. Mechanical damages.
Root causes. Bad workmanship. Pitch system.
Due to human interference with the control system of the pitch system the turbine went overspeed. During this one of the blades hit the tower and the whole nacelle broke loose and fell to the ground.
Damaged parts. Nacelle, 3 blades, upper section of the tower.
Estimated costs. 1.300.000 Euro. Plus business interruption.

The damaged turbine.
Notice the marks on the tower from one of the blades. When the nacelle crashed to the ground it was totally destroyed.

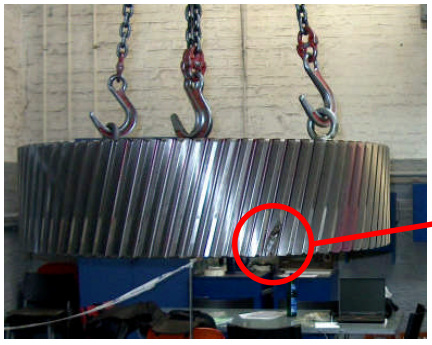
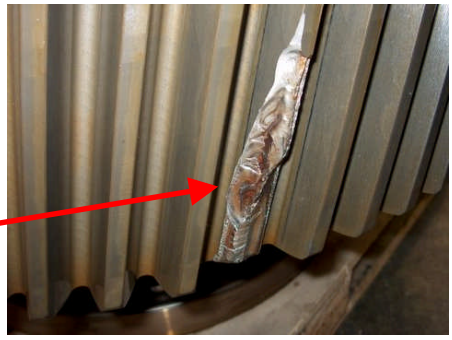
Gearbox. Bearing and gearwheel damages.
Root causes. Never concluded. It has been a general problem for many years independent of the manufacturer.
Damaged parts. All parts of the gearbox. Bearings, shafts and gear mesh both in the planetary and the helical stage. Though pitting/wear of the bearings in the planetary stage are most common.
Estimated costs. Up to 270.000 Euro. Plus business interruption. At the moment the lead-time can be up to 15 month both on gearboxes and on the big components such as the low speed gearwheel.


Damages gearbox in a 750 kW turbine, resulting in damage of the generator, hydraulic system and the control system. Of some reasons the turbine was not stopped at time and the planetary stage locked resulting in server damages not only on the gearbox but also on the other components in the nacelle.



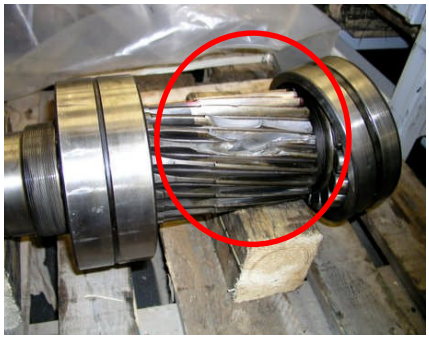
Brocken bearing from one of the two helical stages.

Broken tooth on the low speed gearwheel in a 2 MW gearbox.

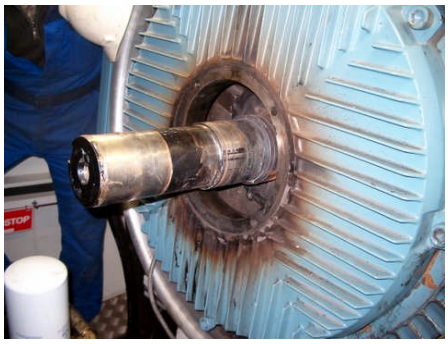
The three wheels and the 6 bearings from the planetary stage of a typical gearbox.

Pitting (wear) on one of six bearings from the planetary stage.



Broken tooth on the pinion in a 750 kW gearbox.

Electrical components. Generator, transformer, power panels.
Root causes. Bad component, bad construction, external causes such as lightening, bad workmanship among others.
Damaged parts. The component itself. But it can result in burning and loss of a complete nacelle.
Estimated costs. Up to 1.000.000 Euro. Plus business interruption.



Hot bearing from a 1 MW generator. Root cause could among others be lack of grease, unsuitable grease or loos connection between bearing and shaft.

Short circuit in a power panel. Root cause was a forgotten tool. It was traced back to the manufacturer.

Short circuit in a power panel. Root cause was a bad connection on a high power cable.

Short circuit in a power panel. Root cause was lightening.

Short circuit in the transformer. Root cause was probably high temperature due to insufficient cooling.