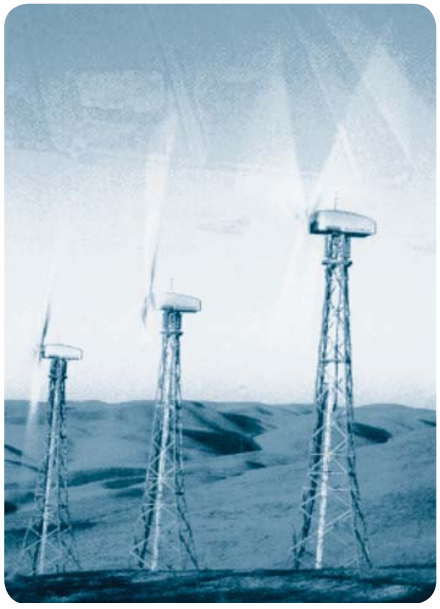
Industry: Power Generation Machine Type: Electrical Generator Gearbox

History



A large windmill power generating project in Northern California experienced abnormal gear wear. Gearboxes are used to transfer energy from the windmills to the generators. The gears wore fairly quickly, becoming excessively loose, much more quickly than the design specifications. No particular failure mechanism could be determined:

- Materials, sizes, installation, alignment and maintenance practices all according to specification
- Vibration found no particular problems, except steady but rapid wear resulting in looseness

The operator was replacing gears systems about every year or so, due to excessive wear. The oil supplier provided analysis of the lubricant showing that the oil supplied was of proper type and grade for the application and met the gear manufacturer's requirements.

Lubricant laboratory analysis

The oil analysis of used oils by the laboratory found oil was of proper type and grade. There were very high particulates and wear metals from both the gears and the bearings.
Tribological examination of the gears and the bearings showed evidence of severe abrasive wear.

- Deep gouges and grooves in the bearing surfaces
- Loss of metal on the gear teeth, with deep gouges and grooves
- Heavy notched steps worn into dedenum of the gear teeth
- Contact fatigue at the pitch line of the gear teeth

Evaluation

It was a very dry, dusty environment, with a lot of airborne dust. Fine airborne dust was getting into the gearboxes through the breather lines. The dust was getting caught between the bearing surfaces and the gear teeth and acting as an abrasive. The breather lines had no filters.

The hard dust particles were cutting, gouging and scraping away the bearing surfaces and gear teeth, leaving the deep grooves and notching the gear teeth. Looseness in the bearing and gears resulted. Dust particles trapped between the gear teeth at the pitchline as the gear teeth meshed were causing the entire load to be transferred at a point contact instead of across the entire width of the gear tooth, resulting in contact fatigue failures at the pitchline.

Solution

Lube systems were drained and flushed to remove all dust, dirt and debris. The operator put installed filters on the breathers and installed surface conforming plastic barriers (“bags”) on the top of the breather tubes. This allowed the system to continue to “breath” (gas volume to expand and contract with changes in temperature and atmospheric pressure), but prevented dust from being ingested into the system.

Impact

The operator found that wear rates decreased dramatically and life expectancy of the system came back to better than the manufacturer's specifications.

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