NordTank N65 Inspection
Medicine Bow, Wyoming

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On August 13, 2005 Energy Maintenance Service, LLC staff climbed and inspected a Nordtank N65 Wind Turbine Generator located near Medicine Bow, Wyoming. The contents of this report summarize in general detail the findings of that climb and inspection.

All questions relating to this report should be direct to Jim Mikel, Director of Operations for EMS, LLC.

Tower Base Section Bolt Pattern

The center-to-center diameter across the tower from tower bolt to tower bolt is 6' 3.5" There are 30 bolts around the base of the tower on the inside of the tower, with an outside tower circumference of 21' 2.25".

Bull Gear and Yaw Drive

The nacelle bull gear and slew ring shows some wear on the prevailing upwind side of the gear (where the gear drive spent most of its operational life) but the rest of the gear (IMG 4258) has been well lubricated and appears to be in a good condition. EMS suggest complete replacement of the bull gear assembly. As well, the yaw drive has experienced a total failure (IMG 4282). There are 4 captured socket head cap screws 20MM in diameter that hold the yaw drive gear train to the nacelle, 2 of the 4 bolts have been broken off so the yaw drive cannot be re attached unless those bolts are repaired (requires removal of the nacelle). They yaw pinion gear is stripped (IMG 4260) out in the middle where it connects to the reduction drive. The gear reduction drives and drive motors appear to be complete and in good working condition.

Generator, Coupler and Generator J-box Leads

The generator appears to be in good operational condition. The turbine comes online and generates power. The generator turns smoothly without any bearing noise when turned by hand. The generator has a 1 per revolution tick to it that the operator said has been detectable on the machine as long as he has had it. It hasn't gotten worse or changed in anyway over that period of time. The cable terminations are in need of additional insulation around the terminations (IMG 4244). The wire insulation in general is in good condition, no signs of weather deterioration or heat stress. The coupler rubber was replaced a few years ago and appears to be in good condition.

Blades

Of the three blades on the turbine one appears to be in good condition while two have visible surface damage. The blade with the most damage has 2 cracks along the chord about 20 inches apart 36 inches from the root of the blade; they are each about 18 inches long and about 1/8 in wide (IMG 4232). The cracks have been filled with sikaflex (IMG 4238) in the past and will need repair. It also has a longitudinal crack (IMG 4234) where the whale tale meets the root. This crack is 8” long and hasn’t split open yet. The last

blade has a few very small root cracks that could be surface cracking only. The tip brakes will need service. According to the site operator; the blade tips haven't been serviced since the turbine was installed in Medicine Bow.

There was no fiberglass powder present near the root of the blades. There is a spot on one of the blades (IMG 4257) where the fiberglass root pack is exposed to the elements but there doesn't seem to be any damage to the area other than possible UV damage.

Overall the blades appear to be in average condition. Root failure doesn't appear to be an issue. The damage that is visible appears to be cosmetic. However, EMS can not be certain of true blade condition until a deflection test is completed and the blades are inspected more closely upon arrival in our Howard facility. The blades will require special attention during rebuilding.

Gear Box

The gears and bearings appear to be in excellent condition (IMGS 4221, 4222 & 4223). There is approximately 2 to 5 roughly 2-5degrees of backlash on the high-speed shaft. The gear teeth were all wearing evenly on both sides. This wear is consistent with similar wear on turbines that have motored down wind. The gear box, couplers and low speed shaft operate without any unusual noises. The gearbox appears to have a heater installed but was inoperable when inspected.

The oil analysis indicates there are minimal contaminants present in the box suggesting the gear box is overall, healthy.

Tower, Tower Hardware, Ladder and Safety Cable, Access Door

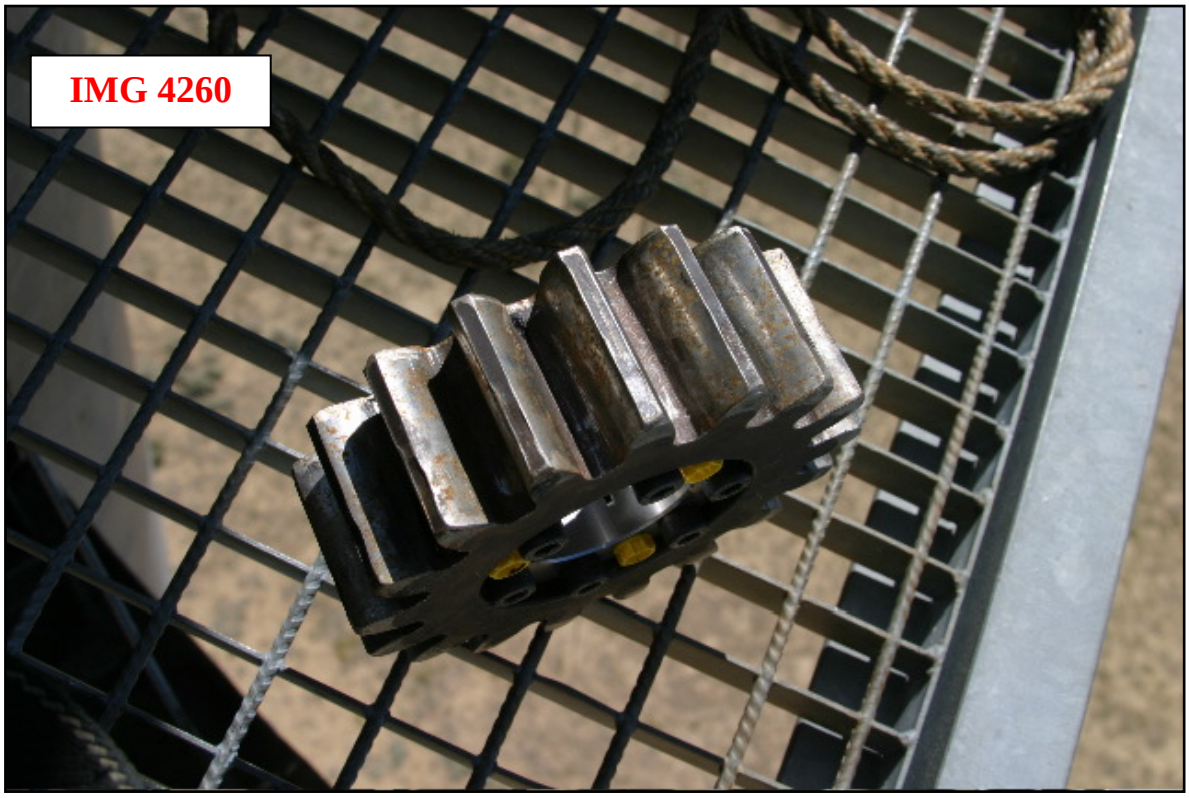
The ladder and safety cable are in good condition. The ladder is a slightly bent at the tower joints due to the tower being assembled without paying attention to ladder alignment (IMG 4268). The ladder is off by a bolt-hole or two but is otherwise safe to climb. The tower landings are made of plywood. The lower tower landing could use some extra reinforcement. There is a substantial amount of grease and oil at the top of the tower from the years of yaw bearing greasing. The safety cable appears to be in good condition.

Controller

The controller in the turbine is operational but has a few 'workarounds' build into it to eliminate the yaw system. Although functional, the controller is antiquated and generally unsafe. The turbines performance and availability will benefit greatly with the planned control system upgrade.

IMG 4258

IMG 4282

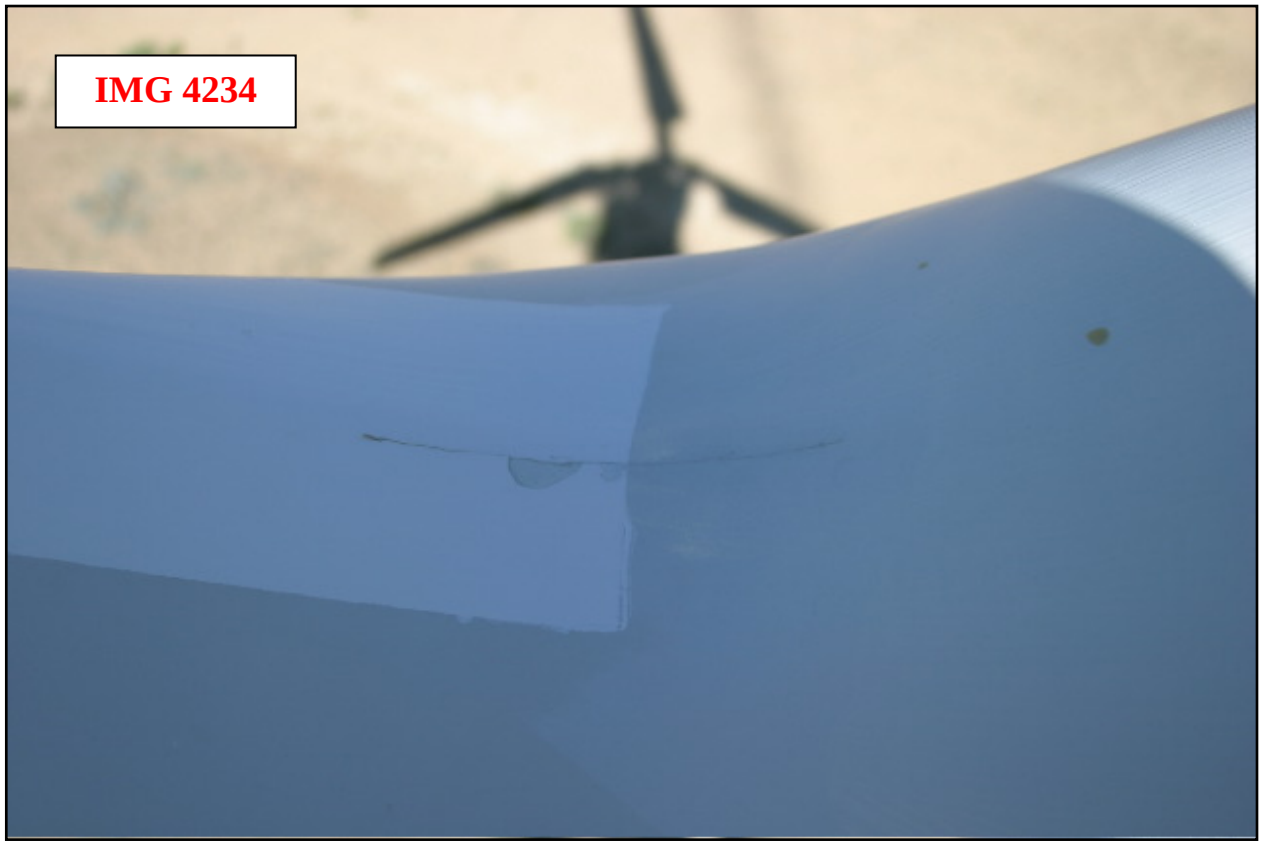

IMG 4260


IMG 4244

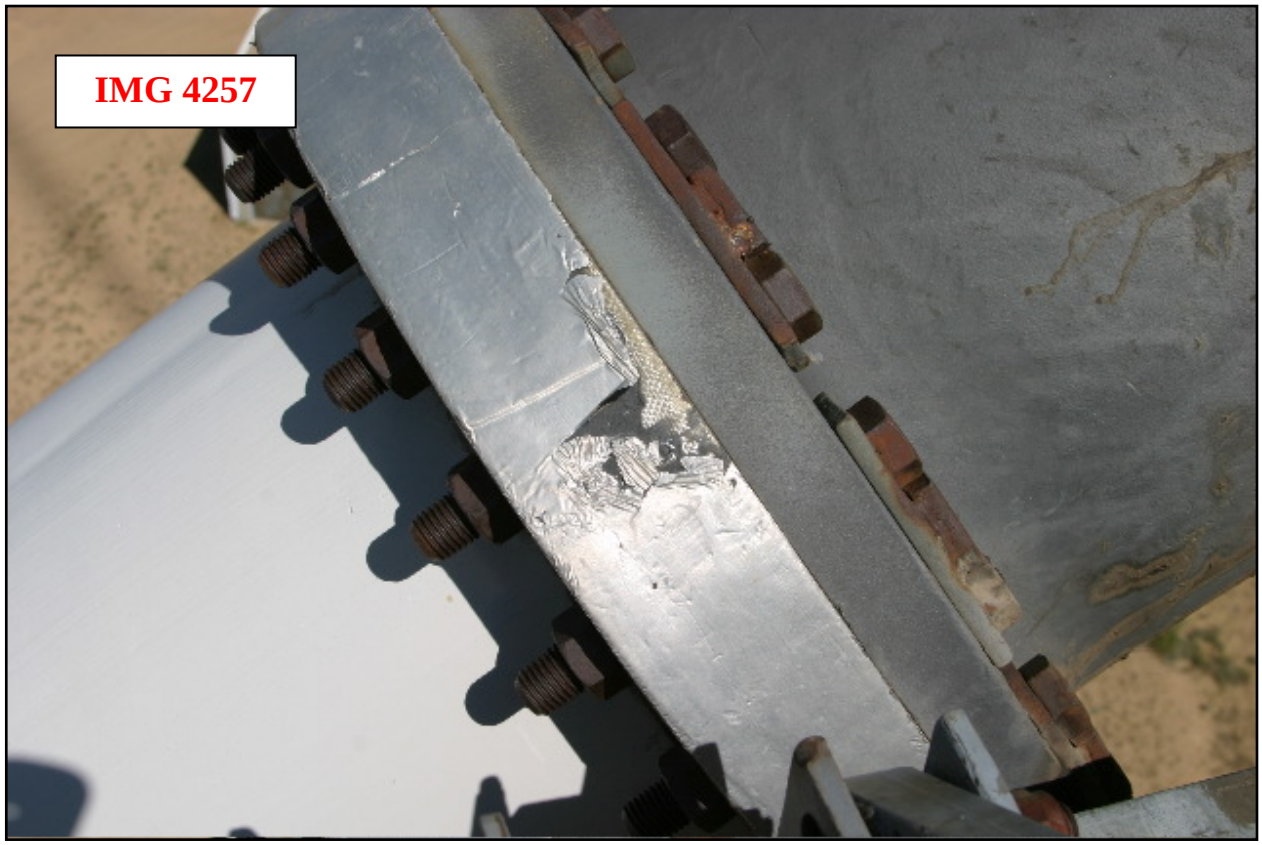

IMG 4232

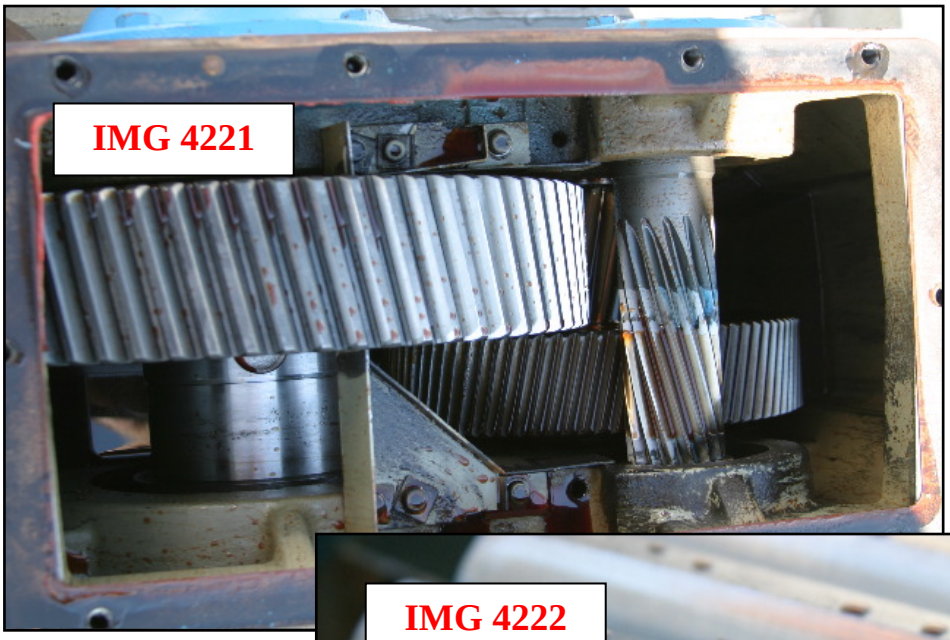

IMG 4238

IMG 4234



IMG 4257




IMG 4221


IMG 4222


IMG 4223


IMG 4268