

# Monitek, Inc. Case Study

## 1.5 MW Wind Turbine Step-up Gearcase

### 1. Background

The 1.5MW Wind Turbine containing a Moventas Model PLH-1100 Step-up Gearcase operates 8,700+ hours per year with average revenues of \$1,500 per day. A significant localized 2<sup>nd</sup> Intermediate Shaft pinion defect was detected through vibration analysis at the first on-line recording. The turbine was shut down and a borescope inspection was carried out. The borescope inspection confirmed a missing tooth on the 2<sup>nd</sup> Intermediate Shaft Pinion. The 2<sup>nd</sup> Intermediate Shaft Pinion is highlighted in red within Figure No.1.

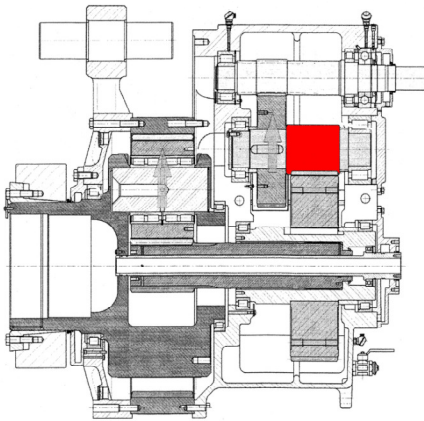


Figure No.1 - Moventas PLH-1100 Gearcase

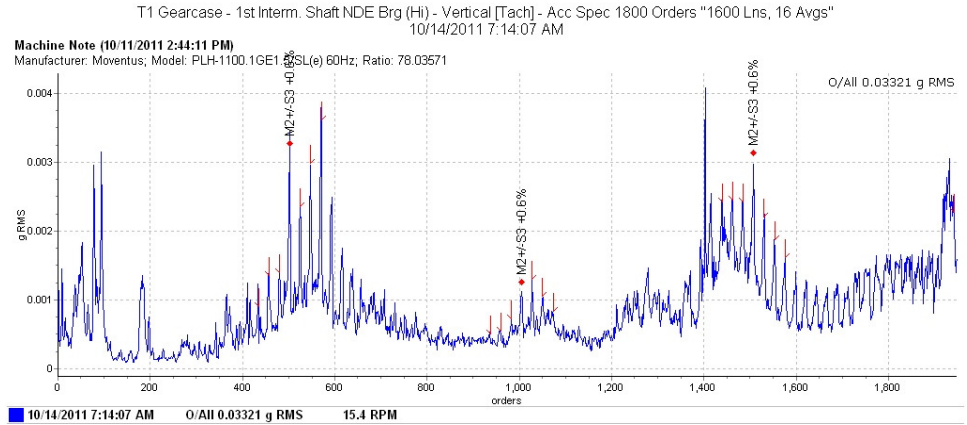


Figure No.2 - 1<sup>st</sup> Intermediate Shaft NDE Measurement Location Spectrum

### 2. Indications

Figure No.2 shows the 2<sup>nd</sup> Intermediate Shaft Pinion Gearmesh vibration components (M2) with the 2<sup>nd</sup> Intermediate Shaft (S3) sidebands around the M2 gearmesh highlighted in the 1<sup>st</sup> Intermediate Shaft NDE Measurement Location baseband spectrum just prior to the planned shutdown of the turbine. The vibration indications illustrated in Figure No.2 are typical of a gearmesh defect with localized damage on the gearmesh pinion.

The localized gearmesh defect vibration indications in conjunction with the borescope inspection confirmation of the missing tooth on the pinion resulted in an up-tower replacement of the 2<sup>nd</sup> Intermediate Shaft Pinion.

### 3. Borescope Inspection

The 2<sup>nd</sup> Intermediate Shaft pinion was replaced up tower at a planned shutdown. The borescope inspection results for the 2<sup>nd</sup> Intermediate Shaft pinion are illustrated in Figure No.3.

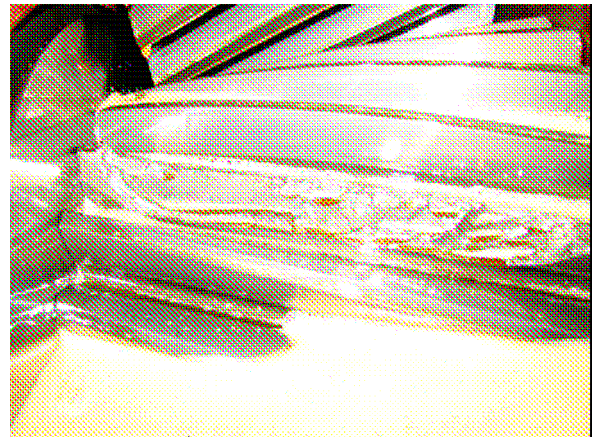


Figure No.3 – 2<sup>nd</sup> Intermediate Shaft Pinion Missing Tooth

### 4. Cost Benefit Analysis

\$3,150 Monitoring Costs over 36 months

#### Return on Investment

#### Planned Repair Costs

The planned change out without any secondary damage is \$50,000 parts and labor costs plus 10 days lost production.  
 Total cost: Approximately \$65K.

**620%** (based on 1 event per 36 month period)

#### Catastrophic Failure Costs

Catastrophic failure would include purchase of new gearcase, repair of failed gearcase and crane costs - estimated \$400K, plus 15 days lost production.  
 Total cost: Approximately \$422.5K.