

# Artesis AMT

## Condition Assessment Cases



This document presents fault detection and diagnosis examples of AMT for various equipment in various industries. Examples of fault comparison between two identical equipment, before-after maintenance measurements and basic PSD curve analyses are given.

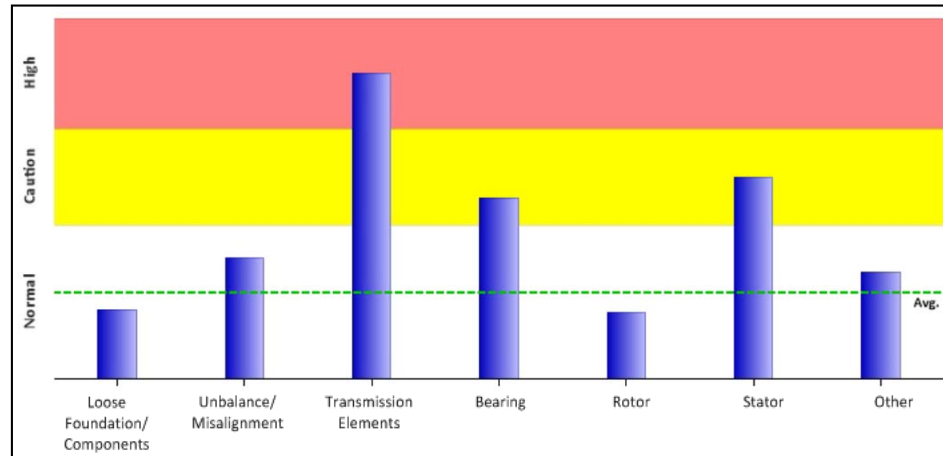
# Case 1

**Industry:** Cardboard Packaging

**Fault:** Transmission Element

**Equipment:** Fan

**Nominal Values:** 398V- 40.5A



Detected Faults, Cautions, and Warnings	Effects on Energy Efficiency (kWh)
Transmission Element	9771
Bearing	977
Stator	3908
<b>TOTAL</b>	<b>14656</b>

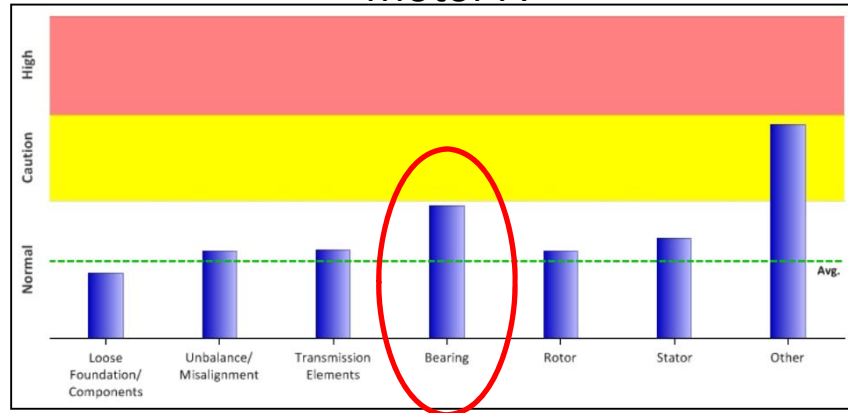
AMT test results indicate a fault in the transmission element. After a quick investigation in the transmission area, maintenance crew found that the belt was loose and was brushing against the housing.

# Case 2

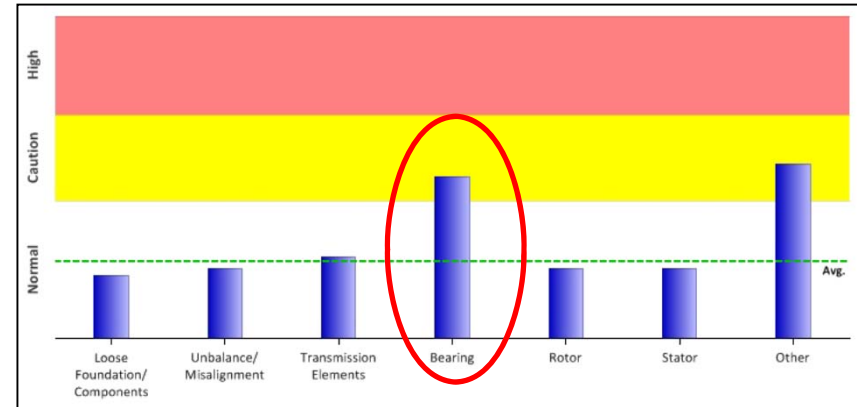
**Industry:** Mining  
**Fault:** Bearing

**Equipment:** Mill Motors  
**Nominal Values:** 6287V- 142A

Motor A



Motor B



Detected Faults, Cautions, and Warnings	Effects on Energy Efficiency (kWh)
Bearing	60958
<b>TOTAL</b>	<b>60958</b>

Even though these identical motors have been installed and been run altogether, AMT test results reveal that Motor B's bearing fault parameter is higher. Maintenance crew confirmed that Motor A's bearing house was replaced 9 months ago while Motor B was kept as it is. Motor B's bearing house will be replaced in the next scheduled maintenance.

# Case 3

Industry: Dockyard

Equipment: Marine Compressor

Fault: Current Unbalance

Nominal Values: 398V- 100A



Status	Name	Value
OK	Power Factor	0,30
OK	Active Power [kW]	5,5
OK	Reactive Power [kVar]	17
OK	Vrms [V]	390
OK	Irms [A]	30
OK	V Imbalance [%]	0,25
Watch	I Unbalance [%]	15
OK	Frequency [Hz]	50
OK	THD [%]	0,85
OK	3th Harmonic [%]	0,36
OK	5th Harmonic [%]	0,47
OK	7th Harmonic [%]	0,31
OK	9th Harmonic [%]	0,10
OK	11th Harmonic [%]	0,36
OK	13th Harmonic [%]	0,08
WATCH ELECTRICAL VALUES	Electrical values are outside of their expected range. They should be noted and watched to identify the cause.	

≤ 5.0

AMT test electrical parameter average results indicate that current unbalance parameter is substantially high. Maintenance expert in the firm has confirmed the finding of the report.

# Case 4

**Industry:** Pharmaceuticals

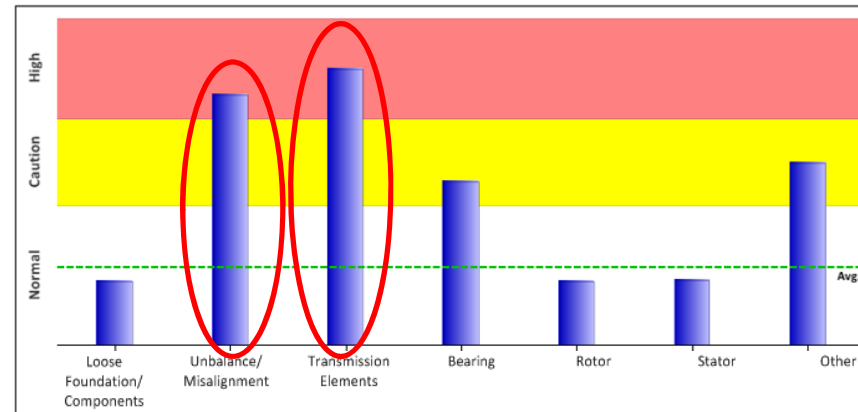
**Equipment:** Air Handling Unit

**Fault:** Transmission Element & Bearing **Nominal Values:** 398V- 44A



## CONDITION ASSESSMENT REPORT

<b>Equipment Name</b>	Firin switch House Klima Fan	<b>Nominal Voltage</b>	398 V
<b>Equipment Type</b>	Fan	<b>Nominal Current</b>	44 A
<b>DB Start &amp; End Date</b>	2015-03-19 12:40:42 - 2015-03-19 13:37:15	<b>Motor Speed</b>	1480 rpm
<b>Frequency</b>	50 Hz		



Detected Faults, Cautions, and Warnings	Effects on Energy Efficiency (kWh)
Transmission Element	10615
Unbalance	6369
Bearing	1061
<b>TOTAL</b>	<b>18045</b>

The report indicates transmission element and unbalance faults as well as a caution for bearing faults



# Case 4

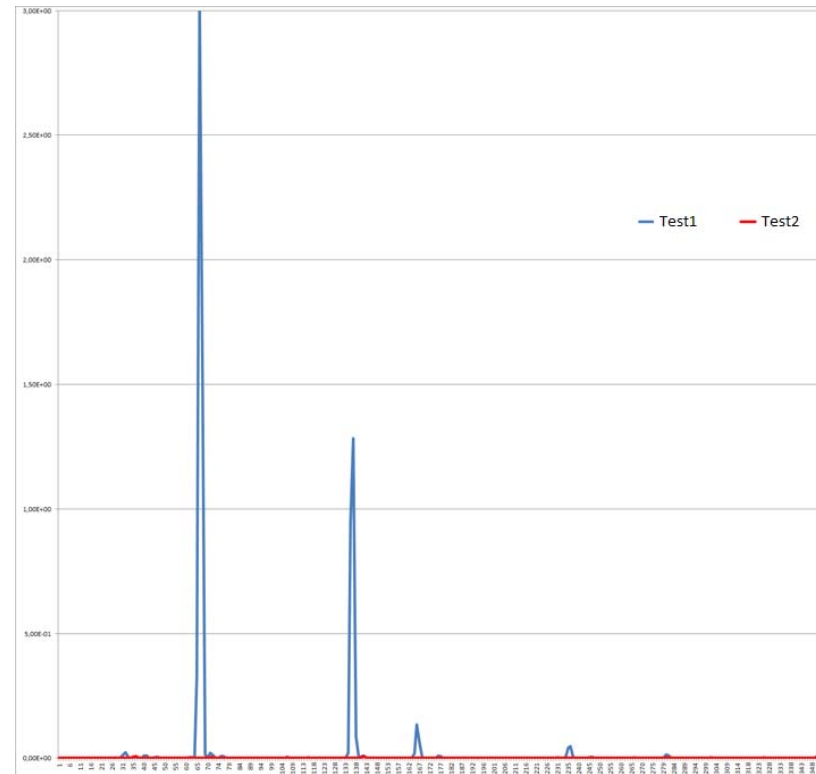
**Industry:** Pharmaceuticals

**Equipment:** Air Handling Unit

**Fault:** Transmission Element & Bearing **Nominal Values:** 398V- 44A



A second test was conducted after removing the transmission element. The second test indicated only the caution for bearing faults as expected.





# Case 5

Industry: Textile

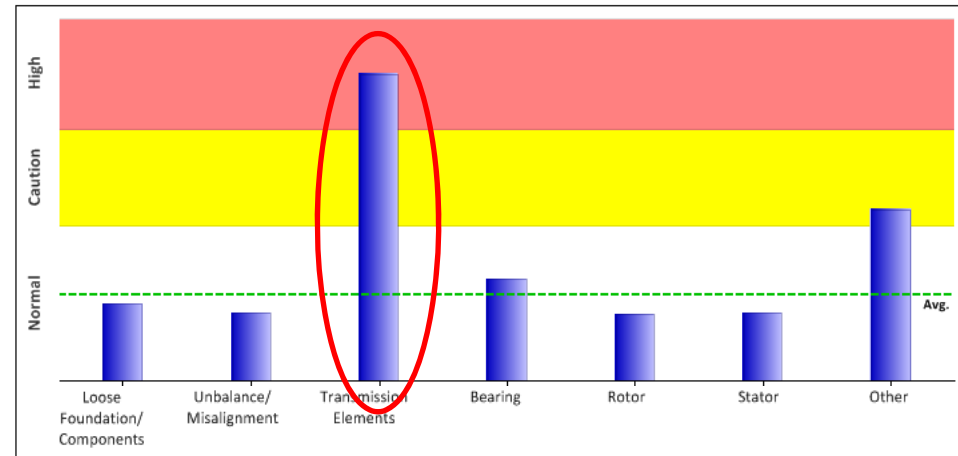
Equipment: Fiber Preparation Machine

Fault: Transmission Element Nominal Values: 398V- 11.7A



## CONDITION ASSESSMENT REPORT

Equipment Name	325 NO TÜM EKIPMANLAR BAĞLI	Nominal Voltage	398 V
Equipment Type	Other	Nominal Current	11,7 A
DB Start & End Date	2013-07-18 10:28:04 - 2013-07-18 11:07:20	Motor Speed	1695 rpm
Frequency	29,29 Hz		



Equipment comparison with MCM monitored equipment

Fiber preparation machines are commonly used in the textile industry. AMT test of such a machine indicates the transmission element fault.

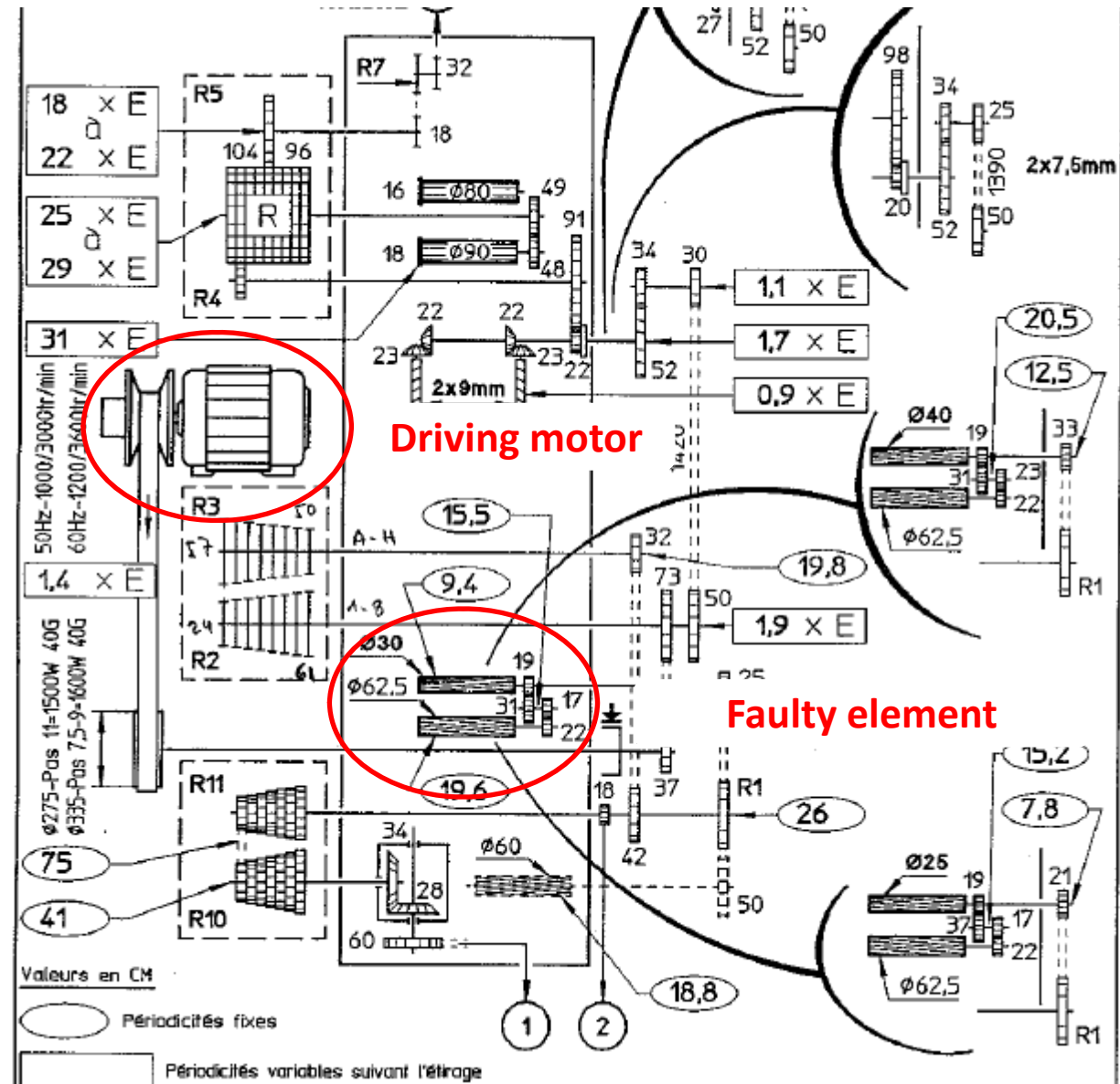
# Case 5

Industry: Textile

Equipment: Fiber Preparation Machine

Fault: Transmission Element    Nominal Values: 398V- 11.7A

According to the kinetic diagram on the right, driving motor is providing mechanical power for the Fiber Preparation Equipment through several transmission elements. Artesis AMT detected the unbalance at the surface contacting fibers only through analyzing current and voltage signals.





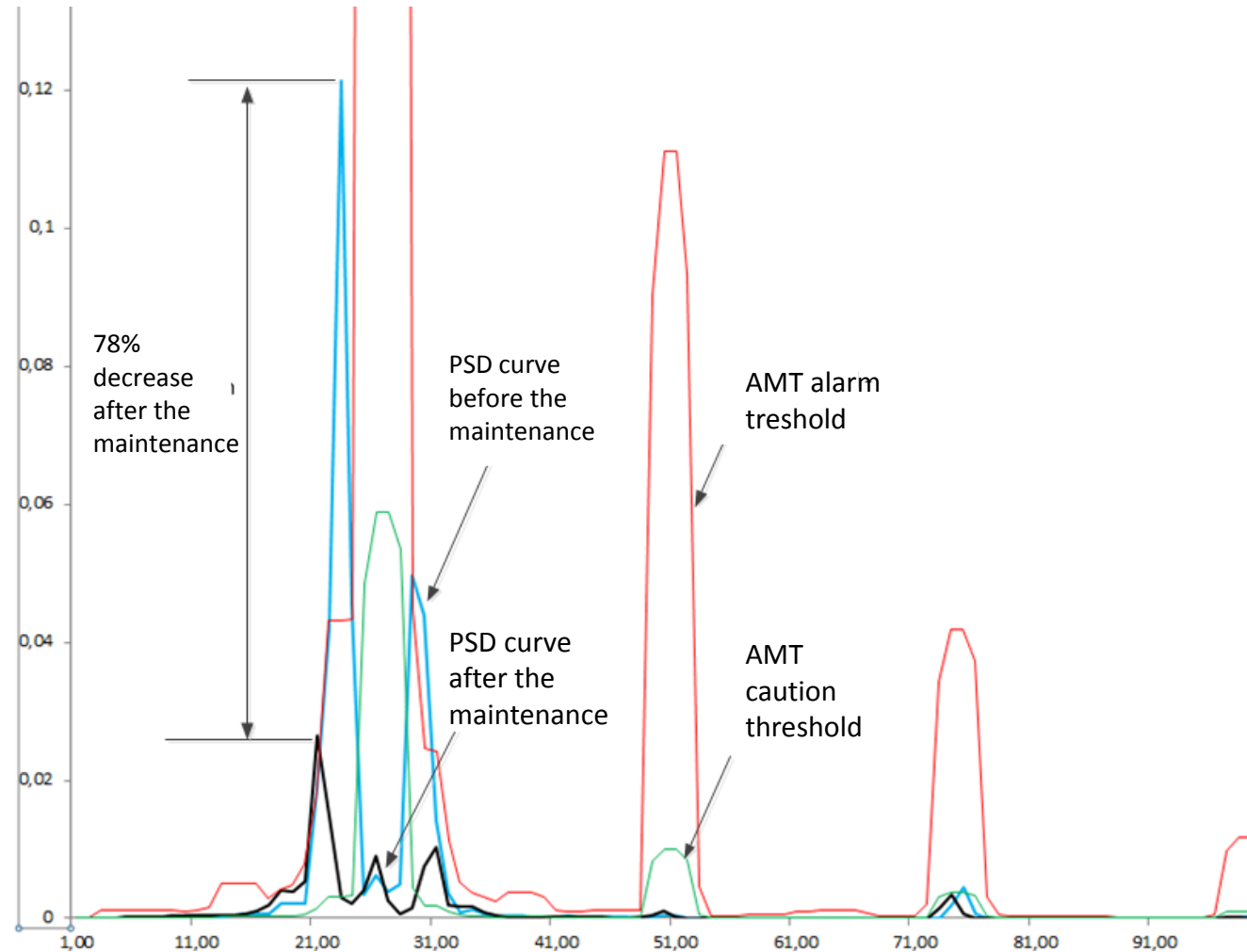
# Case 5

Industry: Textile

Equipment: Fiber Preparation Machine

Fault: Transmission Element **Nominal Values:** 398V- 11.7A

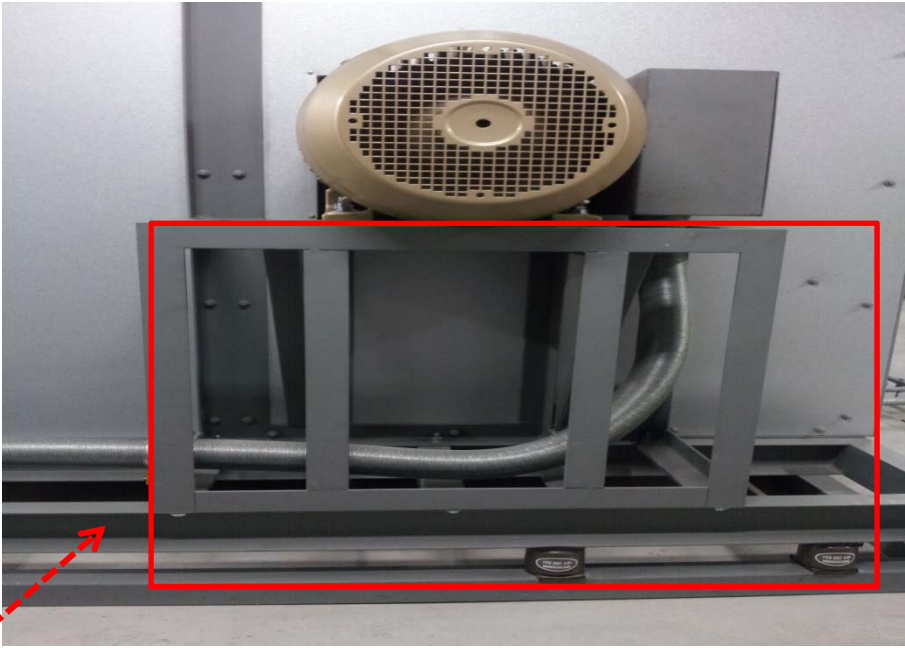
A second AMT test was conducted after a corrective maintenance action. Curves obtained before and after the maintenance are compared in the right figure. The comparison reveals that the maintenance action reduced the severity of fault 78% but not completely. This shows that AMT kit can also be used for evaluating the effectiveness of the maintenance action as well.



# Case 6

**Industry:** Semi Conductors **Equipment:** Air Handling Unit (AHU)

**Fault:** Loose Foundation **Nominal Values:** 199V- 44.4A



Two fan motors were tested using AMT. In one of the motors, loose foundation due to wrong mounting was detected.



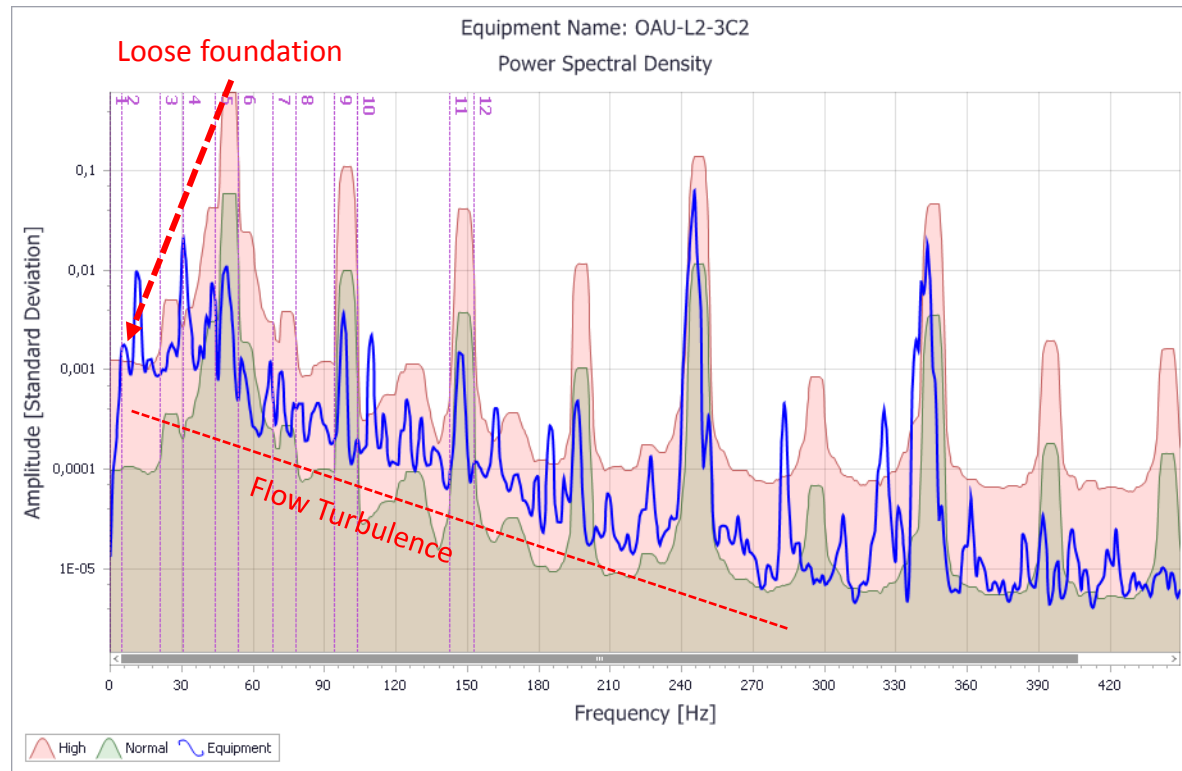
# Case 6

**Industry:** Semi Conductor

**Equipment:** Air Handling Unit (AHU)

**Fault:** Loose Foundation

**Nominal Values:** 199V- 44.4A

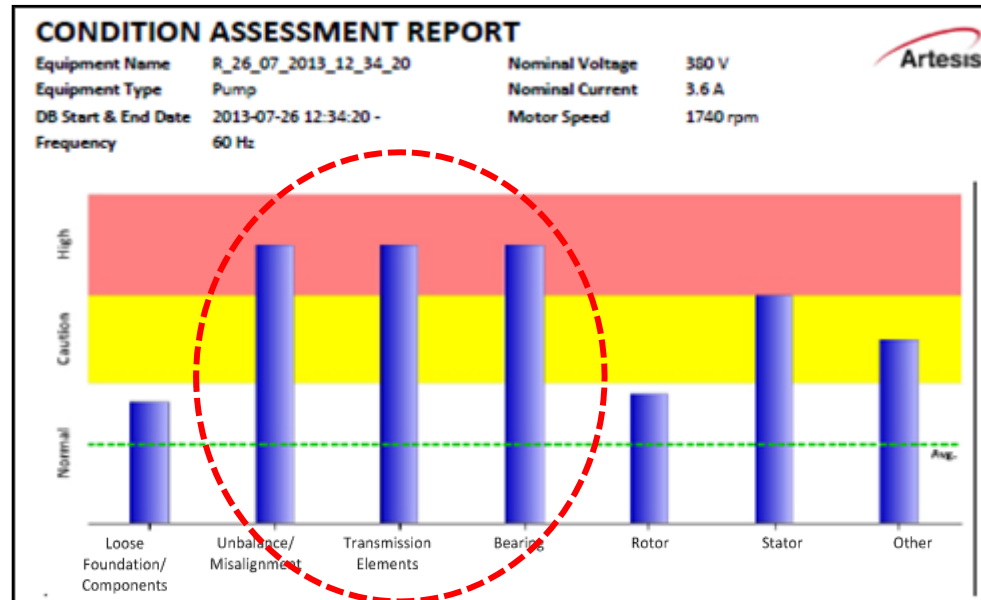


The loose foundation fault as shown above in the PSD plot was also confirmed by the maintenance crew.

# Case 7

Industry: Water  
Fault: Bearing

Equipment: Pump  
Nominal Values: 380V- 3.6A

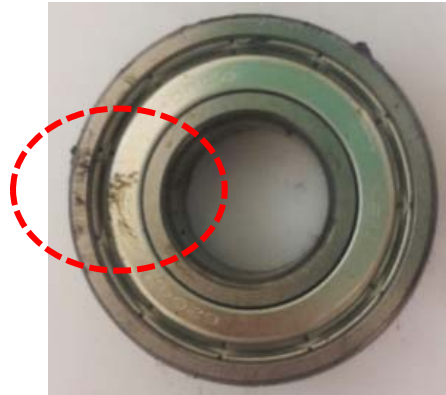


Artesis AMT analysis report clearly indicated faults in the transmission element, bearing and unbalance parameters, and relevant maintenance was planned accordingly.

# Case 7

**Industry:** Water  
**Fault:** Bearing

**Equipment:** Pump  
**Nominal Values:** 380V- 3.6A



Maintenance team removed the bearings and observed damages in the internal parts of the bearings as well as oil leakage.



# Case 7

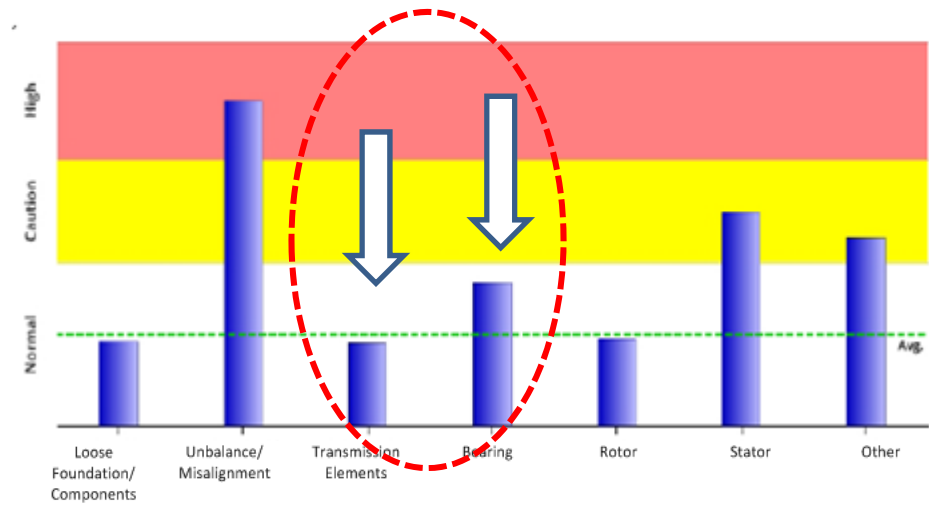
Industry: Water  
Fault: Bearing

Equipment: Pump  
Nominal Values: 380V- 3.6 A



## CONDITION ASSESSMENT REPORT

Equipment Name	R_31_07_2013_11_54_59	Nominal Voltage	380 V
Equipment Type	Pump	Nominal Current	3.6 A
DB Start & End Date	2013-07-31 11:54:59 -	Motor Speed	1740 rpm
Frequency	60 Hz		



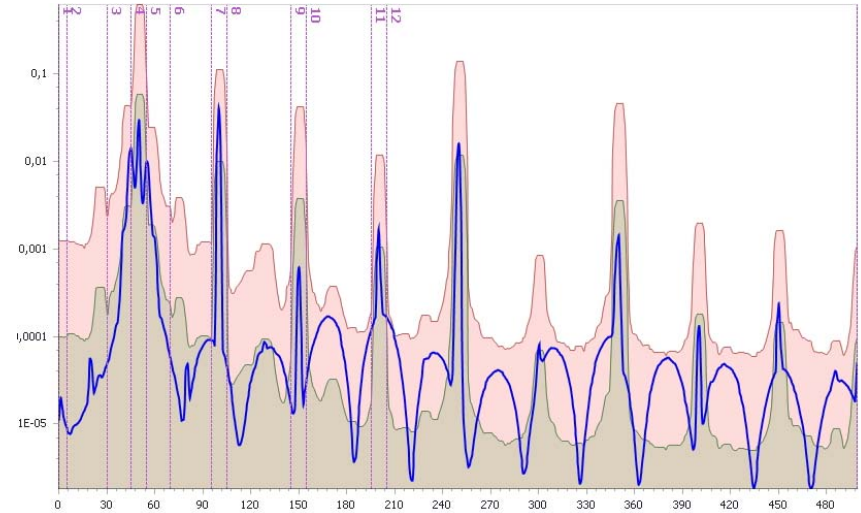
After the maintenance of bearing and transmission element, the equipment was tested again. The results indicated effectiveness of the corrective maintenance action for bearing and transmission element, while unbalance fault remained as it was.



# Case 8

**Industry:** Oil & Gas  
**Fault:** Cavitation

**Equipment:** Pump  
**Nominal Values:** 459V- 108A



AMT power spectrum density (PSD) curve indicated a cavitation in the pump.

Cavitation fault was observed by the maintenance team verifying the diagnosis of AMT.

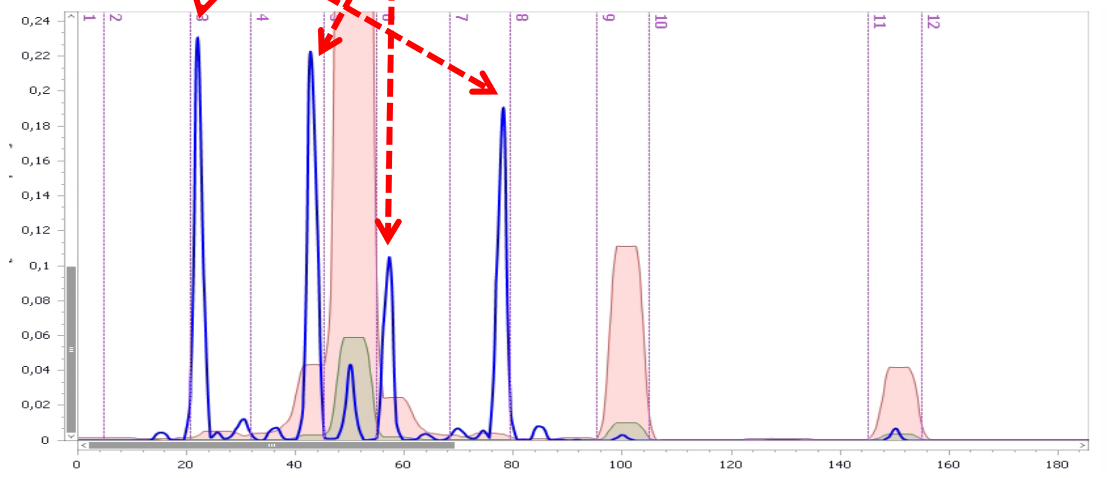
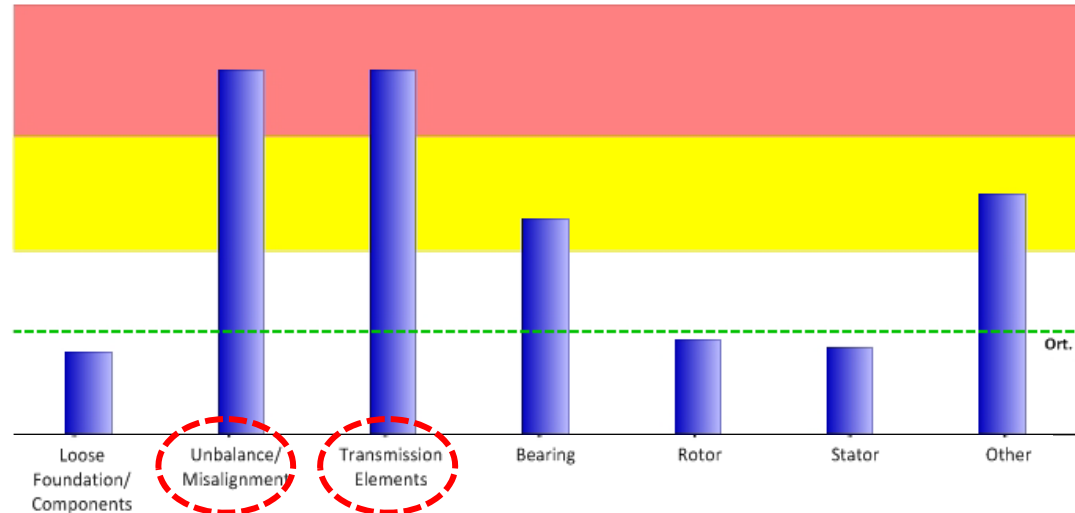
# Case 9

Industry: Automotive  
Fault: Transmission element

Equipment: Exhaust Fan  
Nominal Values: 398V- 1.6A



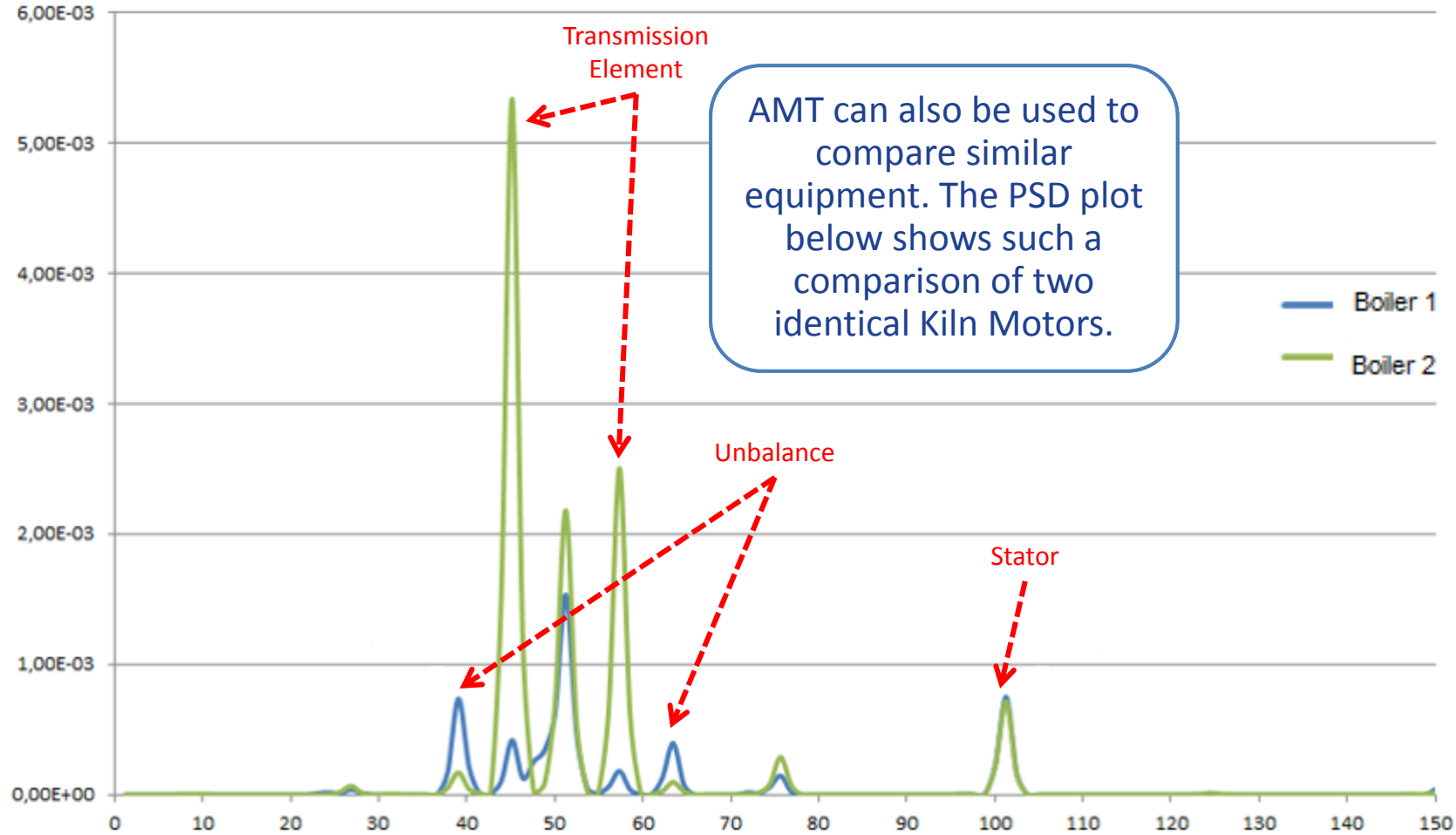
Artesis AMT analysis report reflected a fault alarm for the transmission element.



# Case 10

Industry: Food  
Fault: Multiple

Equipment: Kiln motor  
Nominal Values: 381V, 36A



# Case 11

**Industry:** Metallurgy

**Equipment:** Kiln Switch House Fan

**Fault:** Transmission, Unbalance **Nominal Values:** 398 V- 44A



Kiln switch house fan in a metallurgy facility were analysed using AMT two times. First AMT results yielded to transmission element and unbalance faults and maintenance was planned accordingly.

Although the maintenance was conducted, and belts and balance wheels were fixed, second measurement still reflected problems for these parameters.

# Case 11

Industry: Metallurgy

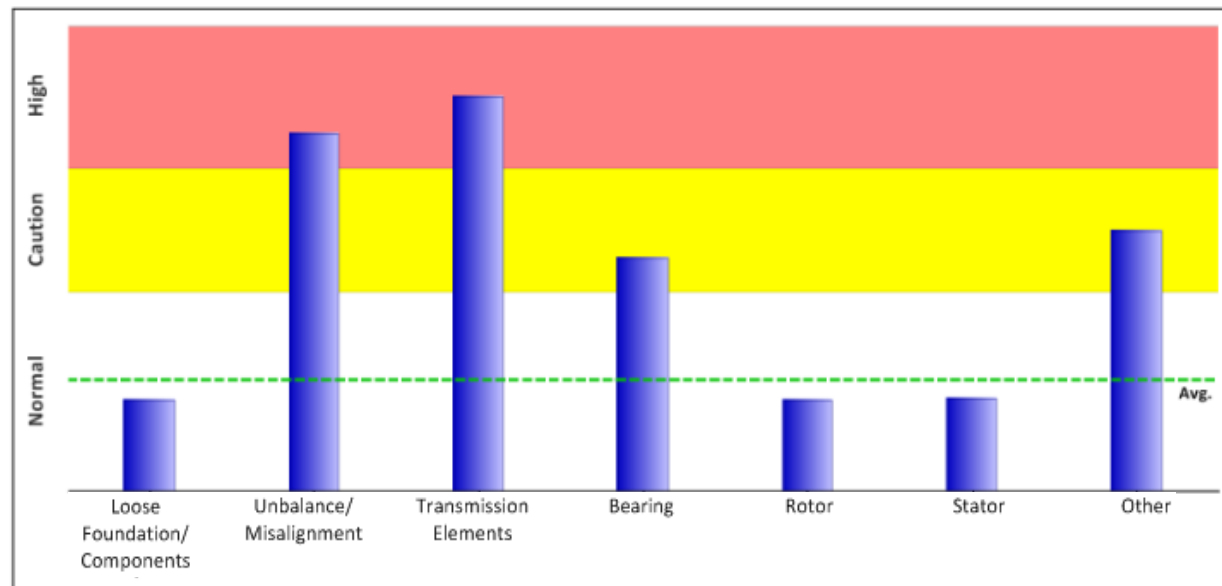
Equipment: Kiln Switch House Fan

Fault: Transmission and Unbalance Nominal Values: 398 V- 44 A

From the second AMT results it was determined that **maintenance should be repeated** and loose belt and unbalance problems should be fixed properly with the help of auxiliary devices.

## CONDITION ASSESSMENT REPORT

Equipment Name	Firin switch House Klima Fani	Nominal Voltage	398 V
Equipment Type	Fan	Nominal Current	44 A
DB Start & End Date	2015-03-19 12:40:42 - 2015-03-19 13:37:15	Motor Speed	1480 rpm
Frequency	50 Hz		



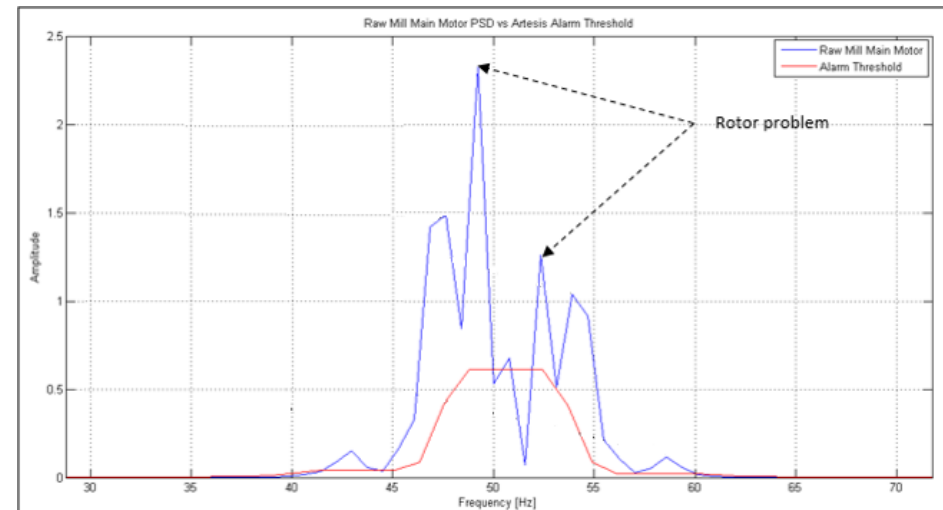
# Case 12

**Industry:** Cement  
**Fault:** Rotor

**Equipment:** Raw Mill Main Motor  
**Nominal Values:** 5kV- 330A



The PSD plot below shows peaks around supply frequency (51Hz). They indicate rotor fault as confirmed by the crew.





# Case 13

**Industry:** Textile Chemicals

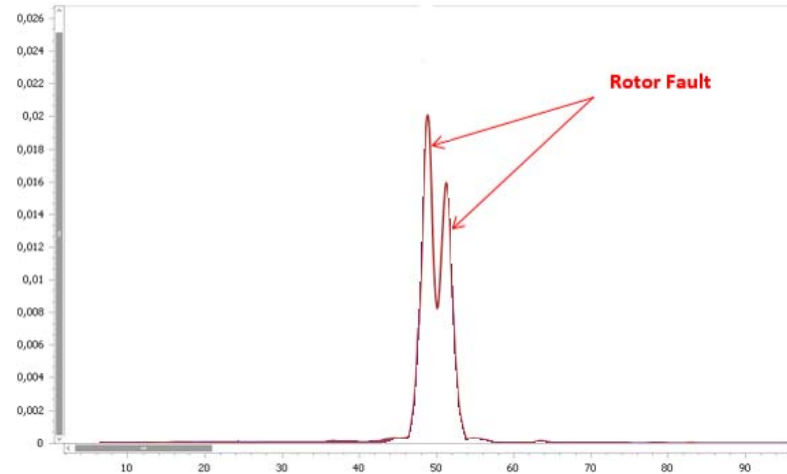
**Fault:** Rotor

**Equipment:** Boiler ID Fan

**Nominal Values:** 6kV- 172A



Boiler ID fan was suffered from a crack in the rotor bar according to the PSD curve and needed an immediate maintenance.



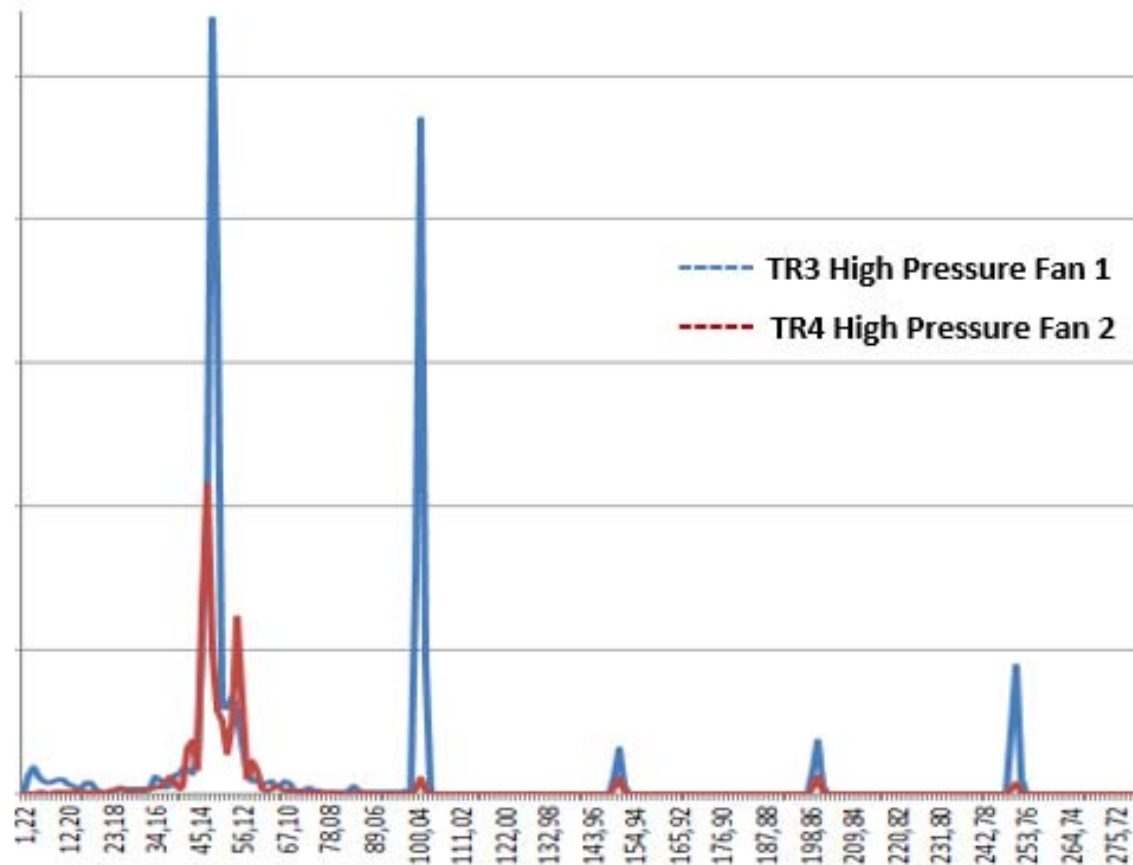
Two symmetrical peaks around  $50\text{Hz} \pm 1.2\text{ Hz}$  addressed to a crack or break in rotor bars or short circuit rings.

# Case 14

**Industry:** Glass Manufacturing **Equipment:** High pressure fan 1-2  
**Fault:** Stator **Nominal Values:** 400V- 296A

Comparison of two identical high pressure fans are observed in the PSD curve plot. There was a substantial difference between stator fault bands.

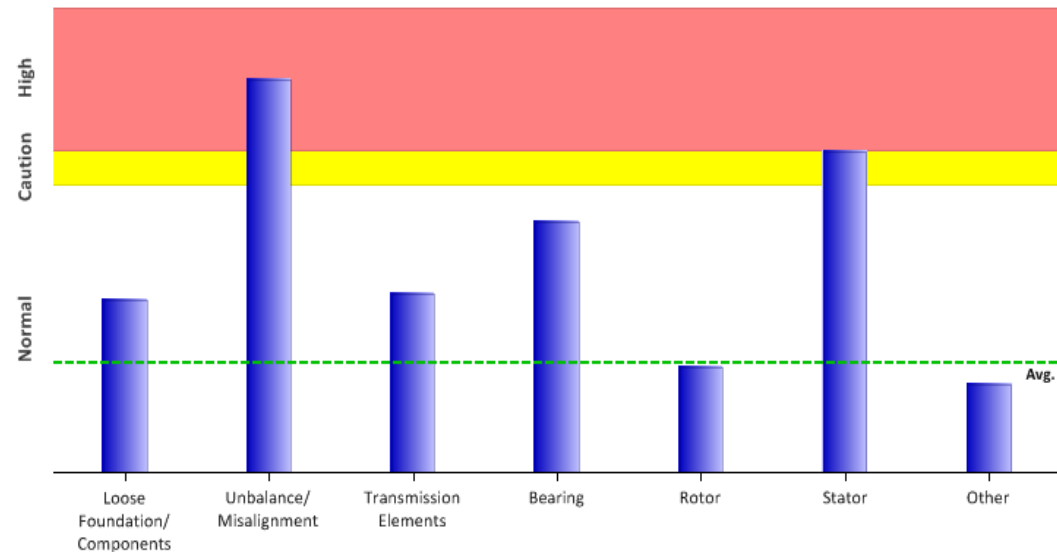
For Fan 1, maintenance action was required within 3 months.



# Case 15

**Industry:** Metal (Chrome)  
**Fault:** Multiple

**Equipment:** Rotary Kiln Fan  
**Nominal Values:** 400V- 296A



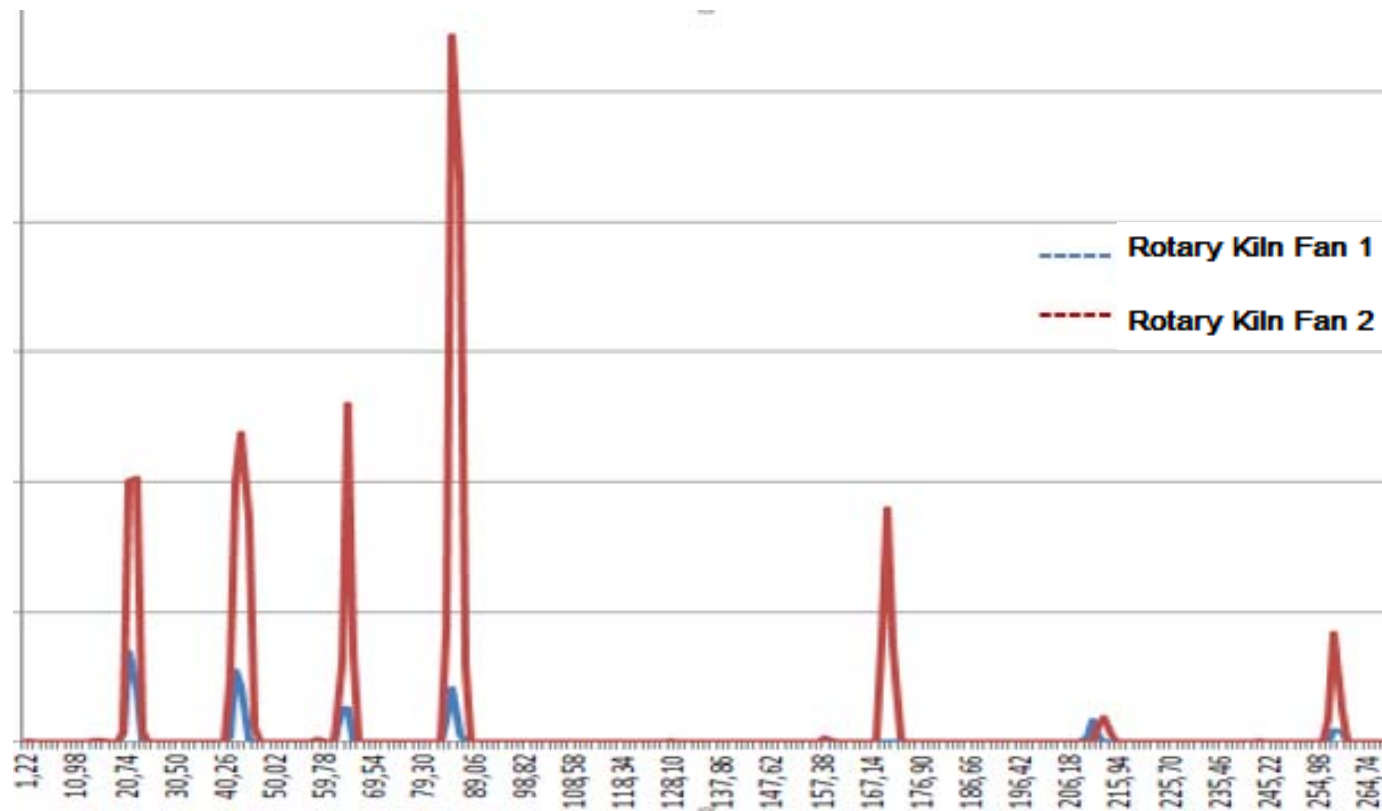
Rotary Kiln Fan in a chrome facility was suffering from faults such as unbalance and stator at serious levels; loose foundation, transmission element and bearing faults at moderate levels.

# Case 15

**Industry:** Metal (Chrome)  
**Fault:** Multiple

**Equipment:** Rotary Kiln Fan  
**Nominal Values:** 400V- 296A

PSD curves of two identical Rotary Kiln Fans showed that unbalance, stator fault parameter and total harmonic distortion (5.6%) were much higher in Fan 2 compared to Fan 1. Fan 1 and Fan 2 was required a maintenance within 6 and 3 months respectively.

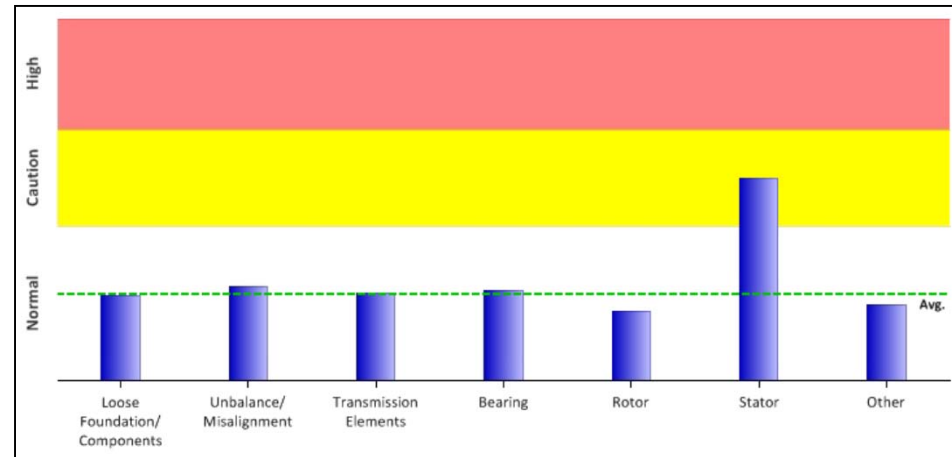


# Case 16

**Industry:** Metal  
**Fault:** Stator

**Equipment:** Multi-Wire Compressor  
**Nominal Values:** 398V- 380A

Detected Faults, Cautions, and Warnings	Effects on Energy Efficiency (kWh)
Stator	36750
Power Factor	12862
<b>TOTAL</b>	<b>49612</b>



AMT test indicates a stator fault.

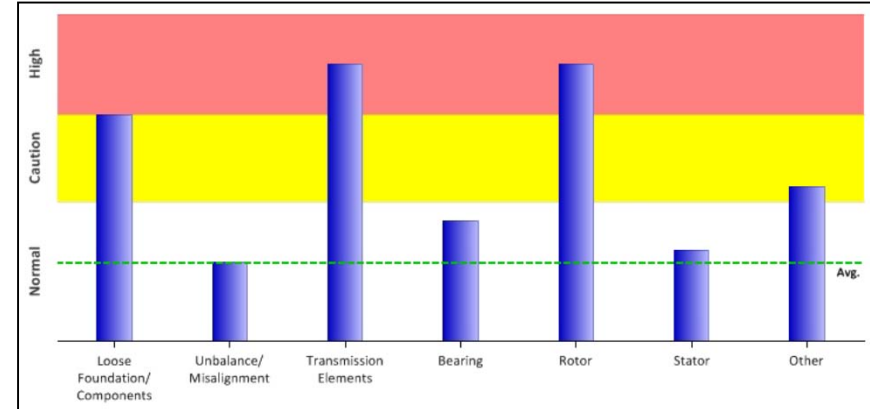
# Case 17

**Industry:** Ceramics  
**Fault:** Multiple

**Equipment:** Mill Motor  
**Nominal Values:** 398V- 150A

Status	Name	Value
OK	Power Factor	0.93
OK	Active Power [kW]	79
OK	Reactive Power [kVar]	30
OK	Vrms (L-L) [V]	302
Watch	Irms [A]	163
OK	V Unbalance [%]	0.10
OK	I Unbalance [%]	0.23
OK	Frequency [Hz]	50
Watch	THD [%]	7.4
OK	3th Harmonic [%]	0.07
OK	5th Harmonic [%]	0.65
OK	7th Harmonic [%]	0.33
OK	9th Harmonic [%]	0.53
OK	11th Harmonic [%]	0.52
OK	13th Harmonic [%]	0.15
<b>WATCH ELECTRICAL VALUES</b>	Electrical values are outside of their expected range. They should be noted and watched to identify the cause.	

Electrical Parameters



AMT test indicates transmission and rotor faults, as well as caution for loose foundation. Warnings for over current and high THD were issued as well.

Detected Faults, Cautions, and Warnings	Effects on Energy Efficiency (kWh)
Loose foundation/Components	7253
Transmission Elements	36266
Rotor	14507
THD	7253
<b>TOTAL</b>	<b>65279</b>

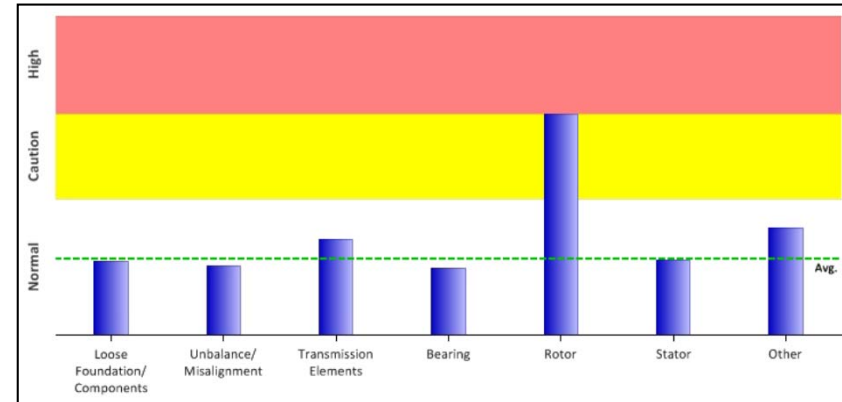


# Case 18

**Industry:** Iron and Steel  
**Fault:** Rotor

**Equipment:** Hydraulic Pump  
**Nominal Values:** 381V- 150A

Detected Faults, Cautions, and Warnings	Effects on Energy Efficiency (kWh)
Rotor	13876
Power Factor	4857
<b>TOTAL</b>	<b>18733</b>



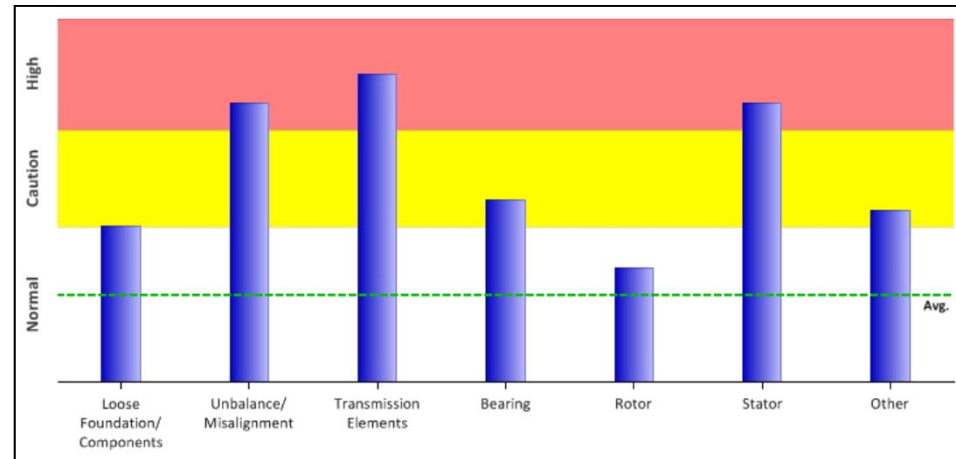
AMT test indicates a rotor fault.

# Case 19

**Industry:** Railroad Repair Shop  
**Fault:** Multiple

**Equipment:** Compressor  
**Nominal Values:** 398V- 265A

AMT test indicates unbalance, transmission and stator faults, as well as caution for bearing.

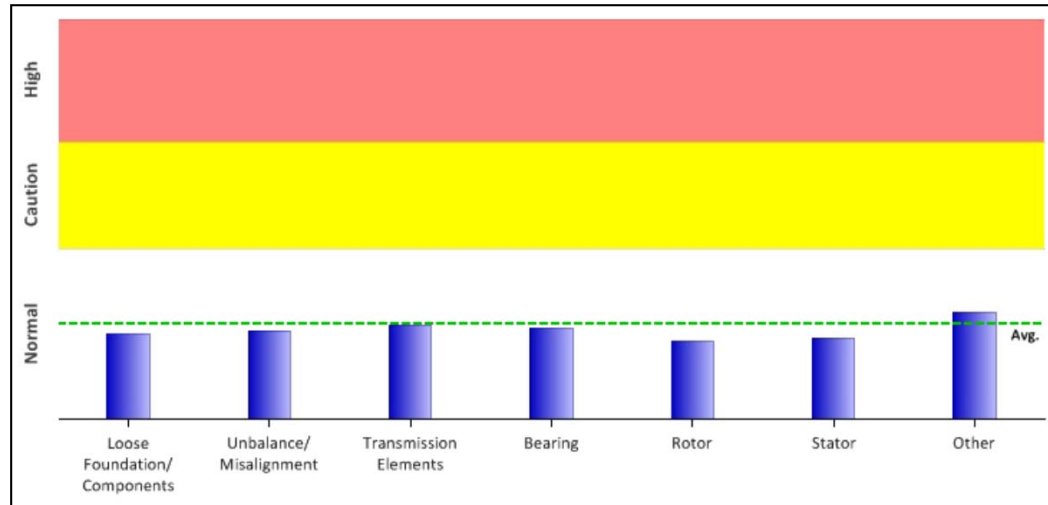


Detected Faults, Cautions, and Warnings	Effects on Energy Efficiency (kWh)
Loose foundation/Components	14416
Unbalance / Misalignment	43248
Transmission Elements	72079
Bearing	7208
Stator	28832
THD	14416
<b>TOTAL</b>	<b>180199</b>

# Case 20

Industry: Metal  
Fault: None

Equipment: Multi-Wire Compressor  
Nominal Values: 398V- 390A



Status	Name	Value
OK	Power Factor	0.91
OK	Active Power [kW]	184
OK	Reactive Power [kVar]	82
OK	Vrms (L-L) [V]	405
OK	Irms [A]	291
OK	V Unbalance [%]	0.38
OK	I Unbalance [%]	2.4
OK	Frequency [Hz]	50
OK	THD [%]	1.5
OK	3th Harmonic [%]	0.43
OK	5th Harmonic [%]	1.2
OK	7th Harmonic [%]	0.35
OK	9th Harmonic [%]	0.05
OK	11th Harmonic [%]	0.32
OK	13th Harmonic [%]	0.32
OK	Electrical values are within their expected range.	

Electrical Parameters

AMT test indicates the equipment was in good condition.



**simplifies predictive maintenance**