



JPS Reliability

A Reliable Plant is a Profitable Plant

Case Studies #3

Reality towards Theory

Working with MIRCE Science

PROfessional services for **PRO**active maintenance



INTRODUCTION



- This presentation is to showcase a selection of engineering issues from various clients we have worked with to determine the **Failure; Cause, Mechanism** and **Mode** in order to envision the elimination of common preventable failures
- Reliability Engineers and Maintenance Engineers/Teams have historically been separate entities and for a facility to be truly profitable there must be a science that links them
- We have been working with **MIRCE Akademy** to integrate the observed **Reality** and established **Theory**
- MIRCE Science is where the Theory is and the Reality is what the Maintenance and Condition Monitoring Teams observe daily in practice



CASE STUDIES #3



The integration of the **MIRCE Science Theory** and **JPS Reliability Reality** is illustrated through the following 6 case studies:

1. Electrical Motor Terminal Connection Defect
 2. Standby Fan Motor Defect
 3. **Variable Frequency Drive Deterioration**
 4. Vibrating Screen Gearbox Bearing Defect
 5. 4 Point Contact Bearing 23RPM Defect
 6. Dynamic Vibration Absorber
- Each slide we will discuss how the defect was detected and what actions were/were not put in place to protect the functionality of the system



CASE 3

VARIABLE FREQUENCY DRIVE DEFECT

We have been monitoring equipment at this production facility utilising Vibration Analysis and Infrared Thermography. On a routine survey a change in condition was noted and investigated.

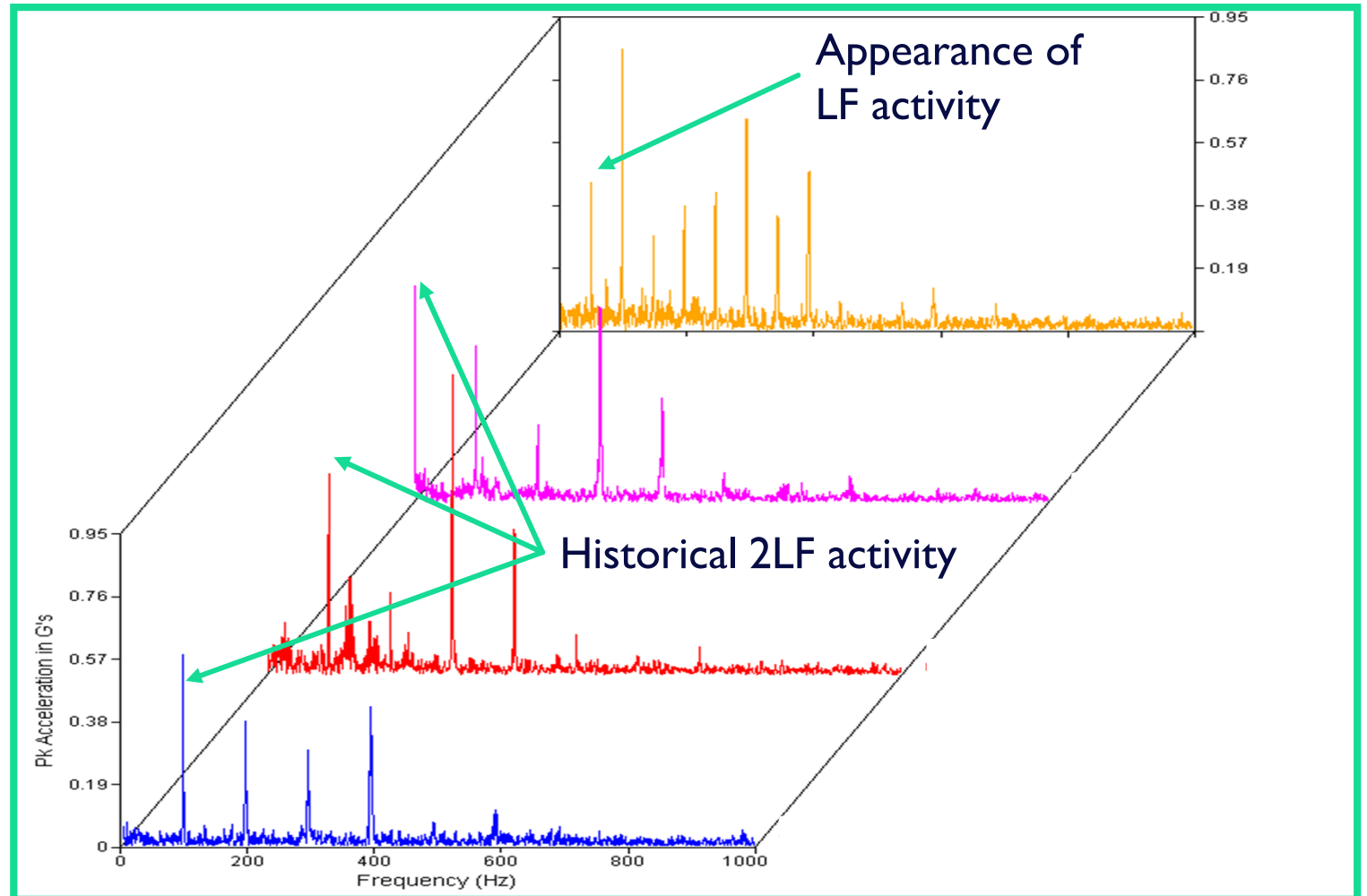
- The motor is a 4 Pole 50Hz AC motor on a Siemens Variable Speed Drive. This system has 2 of the same motors both driving a roller each to grind the raw product
- It was reported on the day that the motor windings temperature has been higher in the warm weather and is 10oC warmer than the comparable motor
- This survey there has been an increase in the electrical activity across the motor. Recommended actions to investigate the electrical drive

Note: Vibration Analysis can only detect indications of an electrical anomaly.

CASE 3

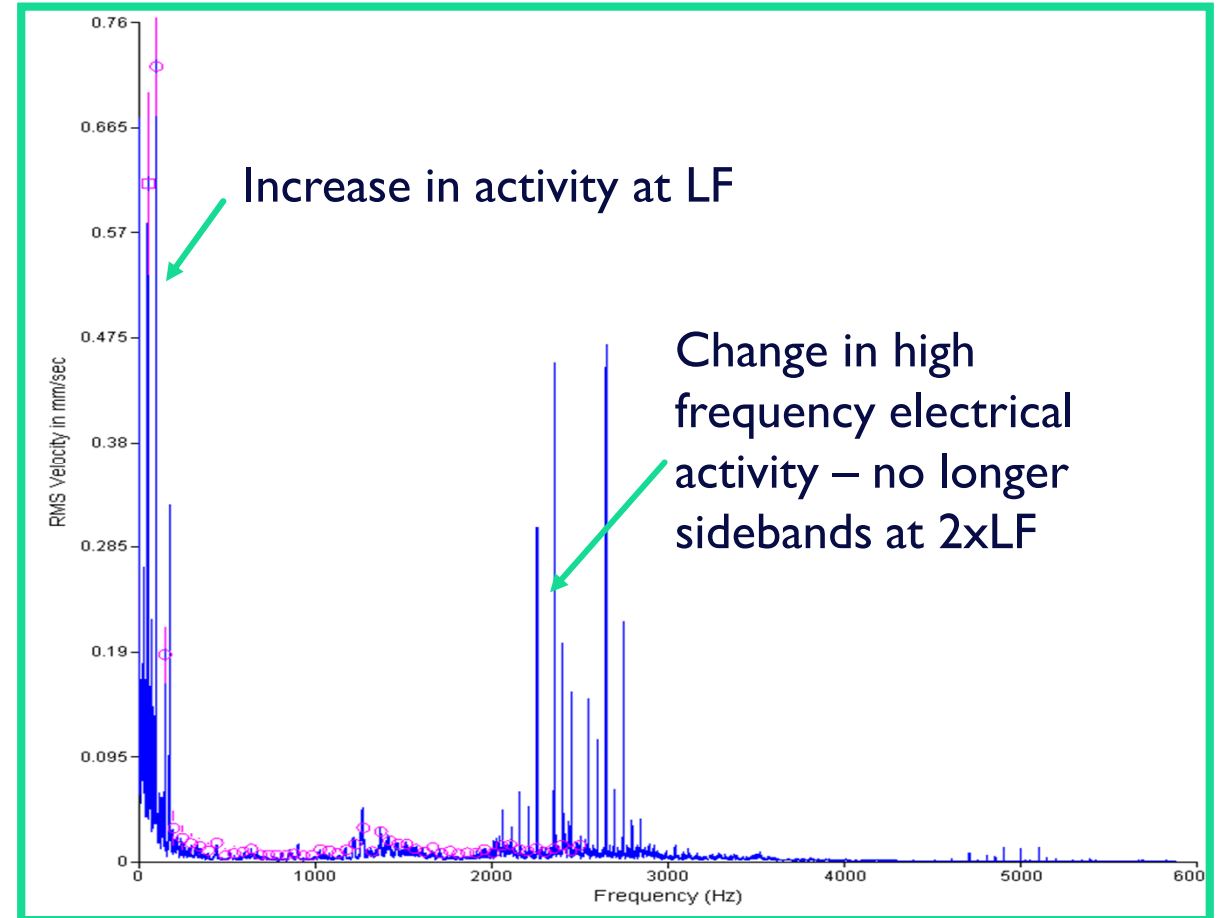
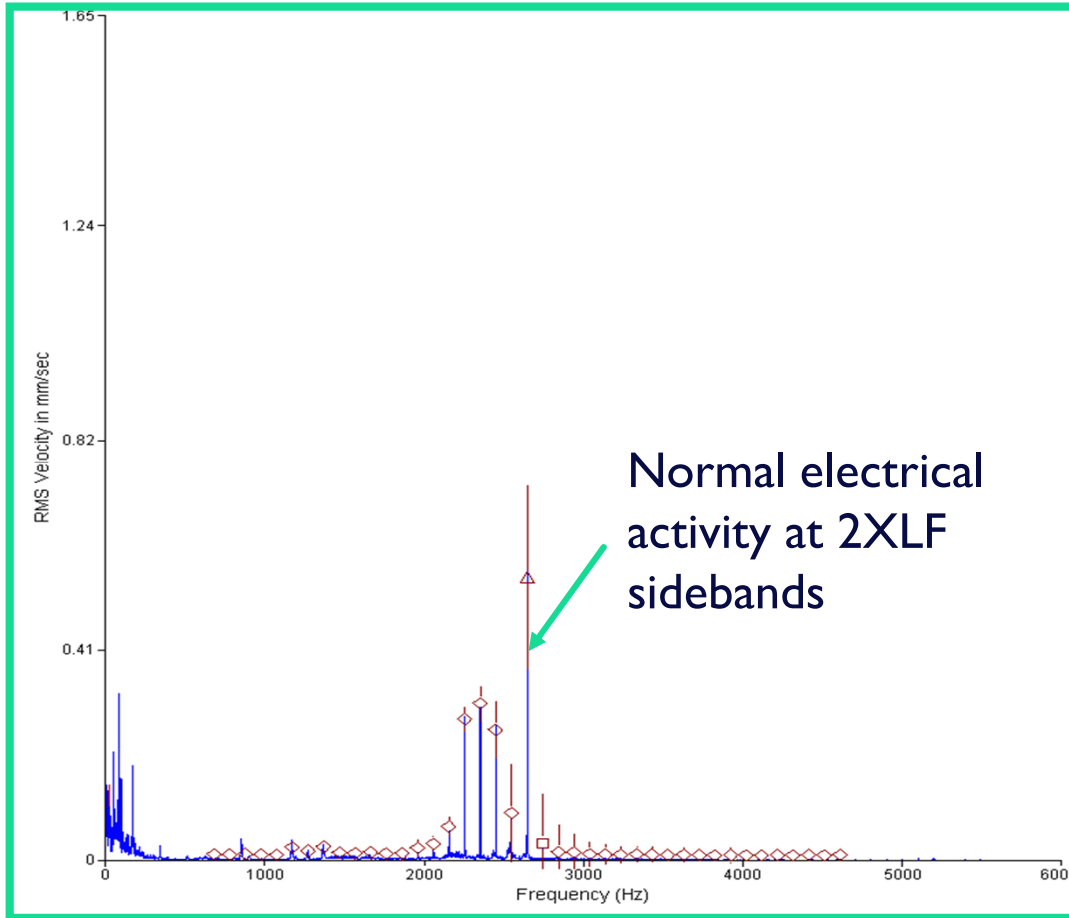
VFD DEFECT - WATERFALL

- The dominant change in condition in the vibration data was an appearance of electrical line frequency (LF) in the PeakVue data and an increase in the high frequency electrical data
- This plot compares the last four PeakVue Acceleration Spectra taken from the motor non-drive end. This displays the normal 2xLF activity and then the appearance of LF activity this survey



CASE 3

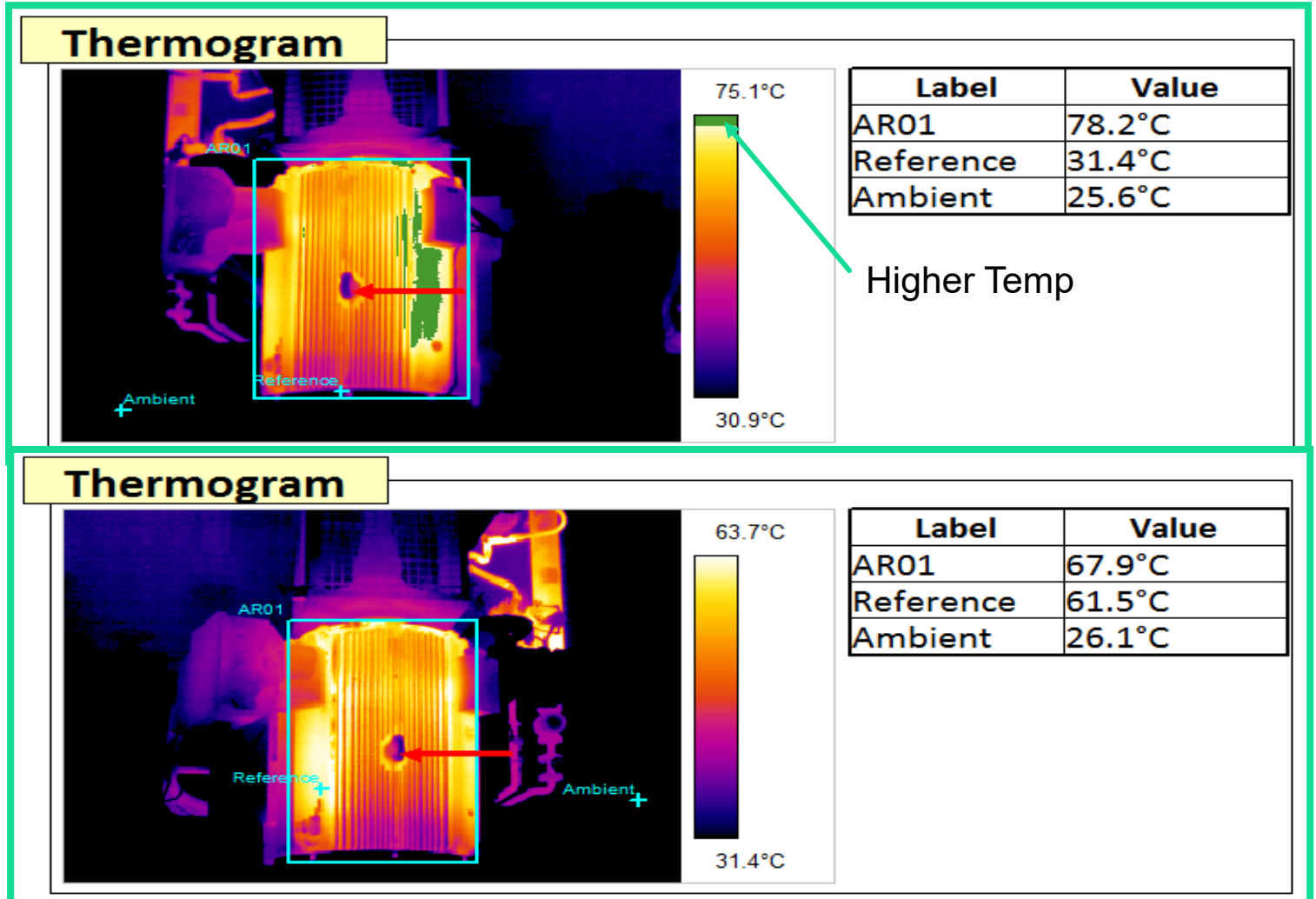
VFD DEFECT – VELOCITY



CASE 3

VFD DEFECT – THERMAL

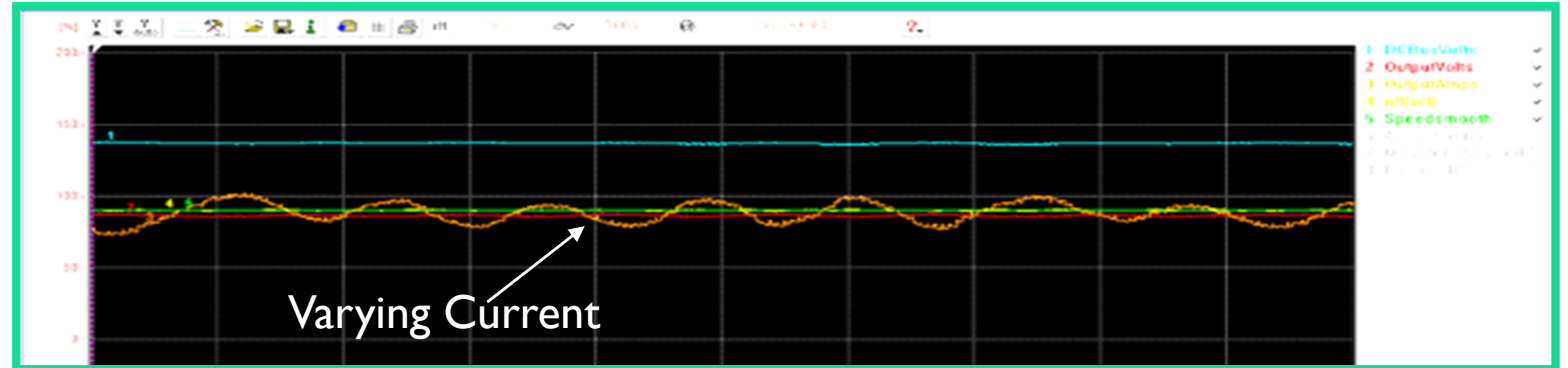
- The thermal data compares the suspect motor and the comparison motor
- These motors are on the same system performing the same duty at the same time
- This data confirms that the windings are indeed warmer on the suspect motor



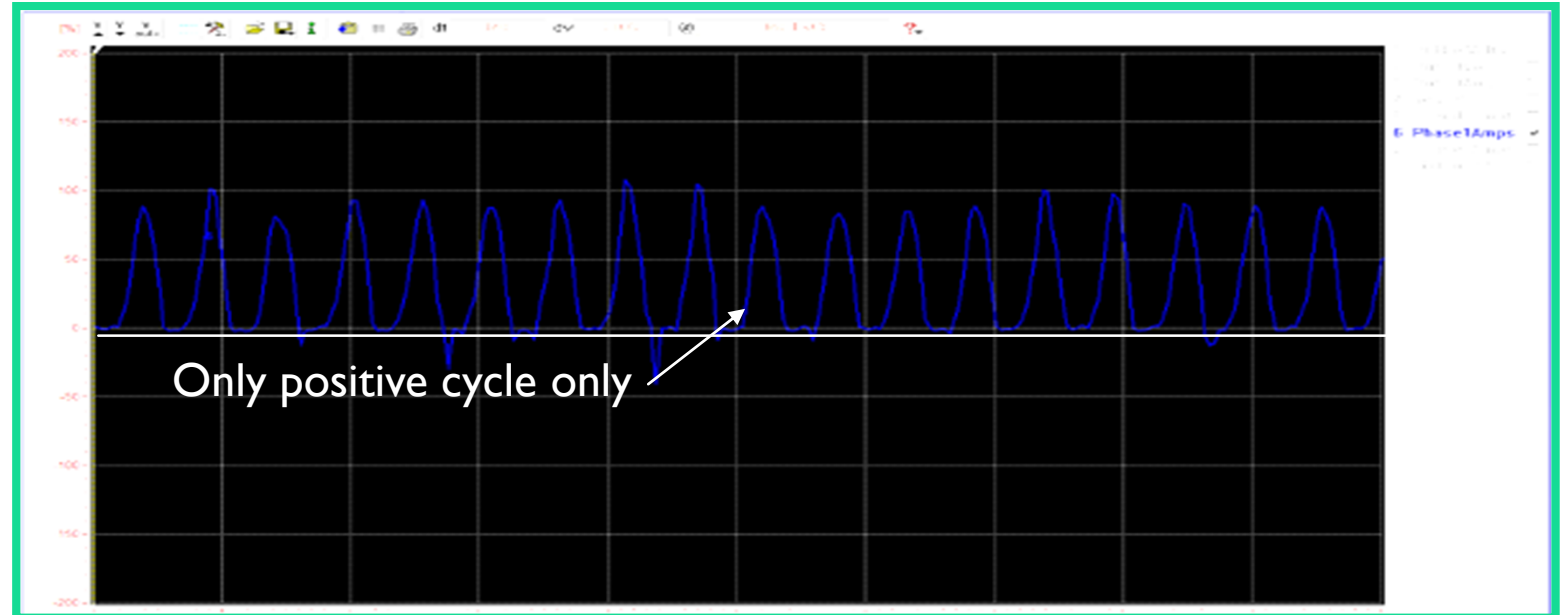
CASE 3

VFD DEFECT – ELECTRICAL

☞ The top trace shows the current varying



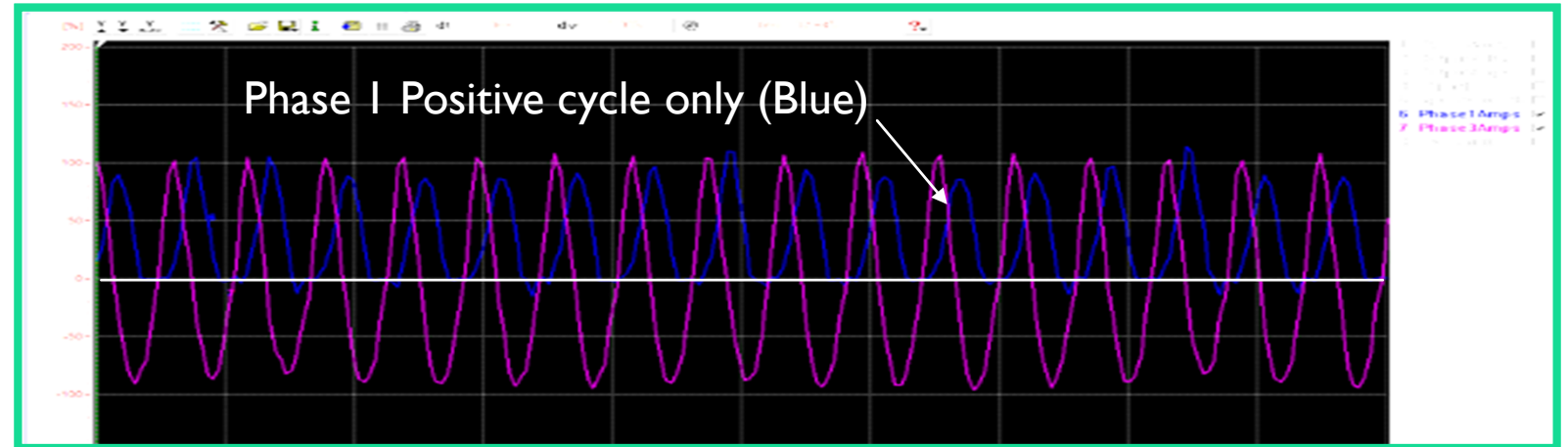
☞ The bottom trace is the Phase I Current under load conditions, only with the positive cycle



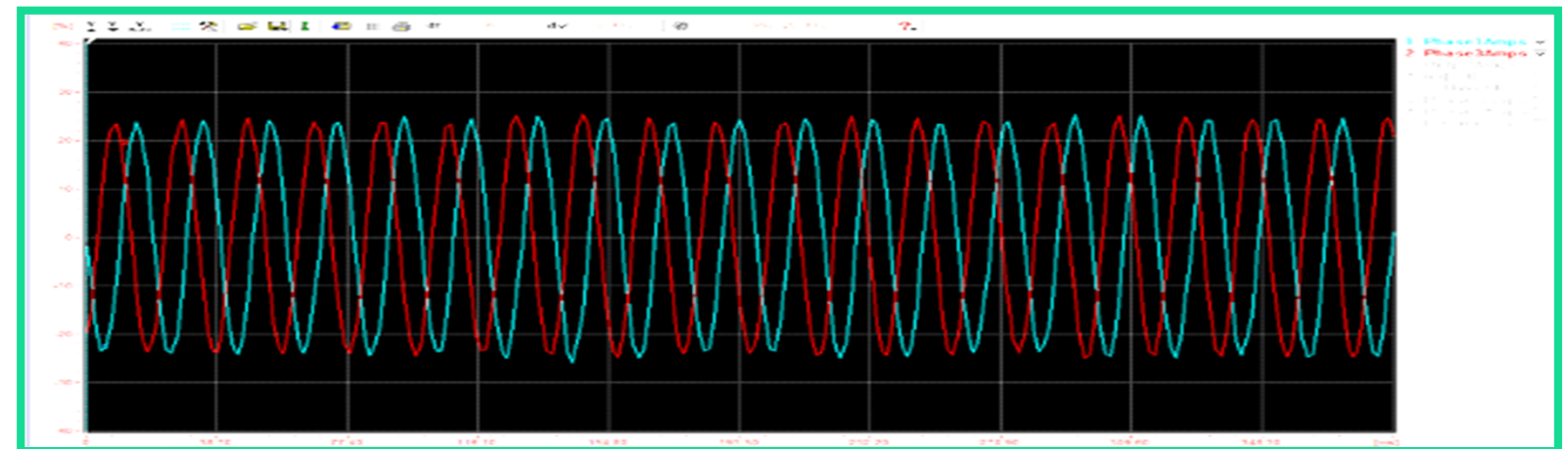
CASE 3

VFD DEFECT – ELECTRICAL

☞ The top plot compares Phases 1 and 3 motor current under load conditions. Phase 1 only reading positive part of cycle



☞ The IVI card in the inverter was replaced. The bottom plot shows Phases 1 and 3 motor current equal after changing IVI card





CASE 3 MIRCE EVALUATION

- The **Failure Cause** was **Age Related Fatigue – End of Life**
- The **Failure Mechanism** was **Electrical Fatigue**
- The **Failure Mode** was **Vibration and Thermal Pattern Change**

Summary:

The change the in the Vibration pattern initiated further investigation.

This then detected a hidden electrical failure and a negative functionality event was prevented by controlled replacement of the Variable Frequency Drive IVI card.



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HOW WE CAN HELP



When a business requires support with or development of Health Based Maintenance we work in partnership in;

Upskill your team with Practical Mentoring in

- Ultrasound Airborne and Structural Borne
- Infrared Thermography-Low Voltage, Mechanical and Process
- Vibration Analysis
- General Maintenance Practices
- Practical Reliability Engineering

Contracted Reliability Services

- Contemporary Condition Monitoring consultancy to assist clients with the management of their Health Based Maintenance program



TECHNOLOGIES AND SERVICES

Vibration Analysis

- Unbalance
- Looseness
- Resonance
- Pump issues
- Gear faults/wear
- Inadequate lubrication
- Bearings
- Steam traps/valves

Lubrication

- Gear faults/wear
- Wrong oil/mixed
- Oil degradation
- Contamination
- Fuel dilution
- Leaking seals
- Bearings
- Overheating

Thermography

- Bearings
- Overheating
- Steam traps/valves
- Flammable gas leaks
- HV issues
- Electrical wiring faults
- Heat exchanger blockage
- Refractory applications

Ultrasound

- Inadequate lubrication
- Steam traps/valves
- Bearings
- Flammable gas / air leaks
- HV issues
- Corona discharge arcing
- Heat exchanger tubes/plate



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ABOUT JPS RELIABILITY



Over 40 years' combined experience in the fields of Condition Monitoring, Practical Reliability Engineering and Maintenance Practices.

Worked with many of the Blue-Chip companies in the UK and Australia.

Our experiences ranges from Lubrication, Thermal Imaging, Vibration Analysis, Ultrasound, NDT, Maintenance Planning, Maintenance Improvements, Project Management and Mechanical Maintenance including on-site Dynamic Balancing and Laser Alignment.

We are qualified to ISO 18436-2 VA Level 3, ISO 18436-4 LM Level 2, ASNT-SN-TC-IA IRT Level 2, ASNT-SN-TC-IA UT Airborne Level I & Asset Reliability Practitioner Category I (ARP).

Registered with Engineers Australia in the Mechanical College, Engineering Council UK as Engineering Technician and with the British Institute for Non-Destructive Testing as an Associate Member.

Author of “ [Enhanced System Reliability Through Vibration Technology](#)” ISBN 978-1-5272-5386-5.



MIRCE SCIENCE APPROACH

The MIRCE Akademy is an independent institution engaged in scientific, educational, literary and professional endeavours to advance and apply the knowledge of MIRCE Science. Our contribution to engineering and management professions is the body of knowledge that is essential for designing and managing the life of working systems in a manner that delivers the maximum reliability and effectiveness, with the least possible investment in resources and impact on the environment.

MIRCE Science comprises of mathematical axioms, equations and methods that enable predictions of expected functionability performance of the future functionability system type to be done, based on the complex, time-dependent, interactions between physical properties of consisting components and applied functionability rules regarding operation, maintenance and support processes.

Dr Jezdimir Knezevic, Founder and President.

<http://www.mirceakademy.com>

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CONTACT JPS RELIABILITY



info@jpsreliability.com



<https://jpsreliability.com>



07387 986 454

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