VIBTECH GENESIS

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Live Webinar

Transforming Your Motor Electrical Signals into Key Maintenance Decisions

18th November 2026 (Wednesday) 10:00 am zoom



Speaker
Nick Kang
Vibtech Genesis



Speaker
Roy Lim
Vibro Technologies
(Malaysia)

Learn how Electrical Signature Analysis can perform condition monitoring of motor-driven equipment without sensors

Webinar Date & Time are scheduled in Singapore Time (SGT)

ABOUT THE SPEAKER



Scan QR for Roy Lim's Contact

Roy Lim

Vibro Technologies (Malaysia)

Roy Lim is the Business Development Lead at Vibro Technologies (Malaysia). He has a deep understanding of Malaysia's industrial markets and recognises the practical needs, challenges, and priorities of businesses across diverse industries. This insight helps him understand what matters to industrial customers and align discussions with their operational needs.

Predictive Maintenance: Transforming Your Motor Electrical Signals into Key Maintenance Decisions



Panel-Based Condition Monitoring via Advanced Electrical Signature Analysis (ESA) and Model-Based Machine Learning

1. Core Objective: Eliminating catastrophic failures on essential assets.
2. The Paradigm Shift: Moving from physical vibration tracking to sensor-less electrical parameter monitoring.
3. Strategic Scope: Full operational coverage across varies critical operation fleets.

ASSET MONITORING GAP ANALYSIS

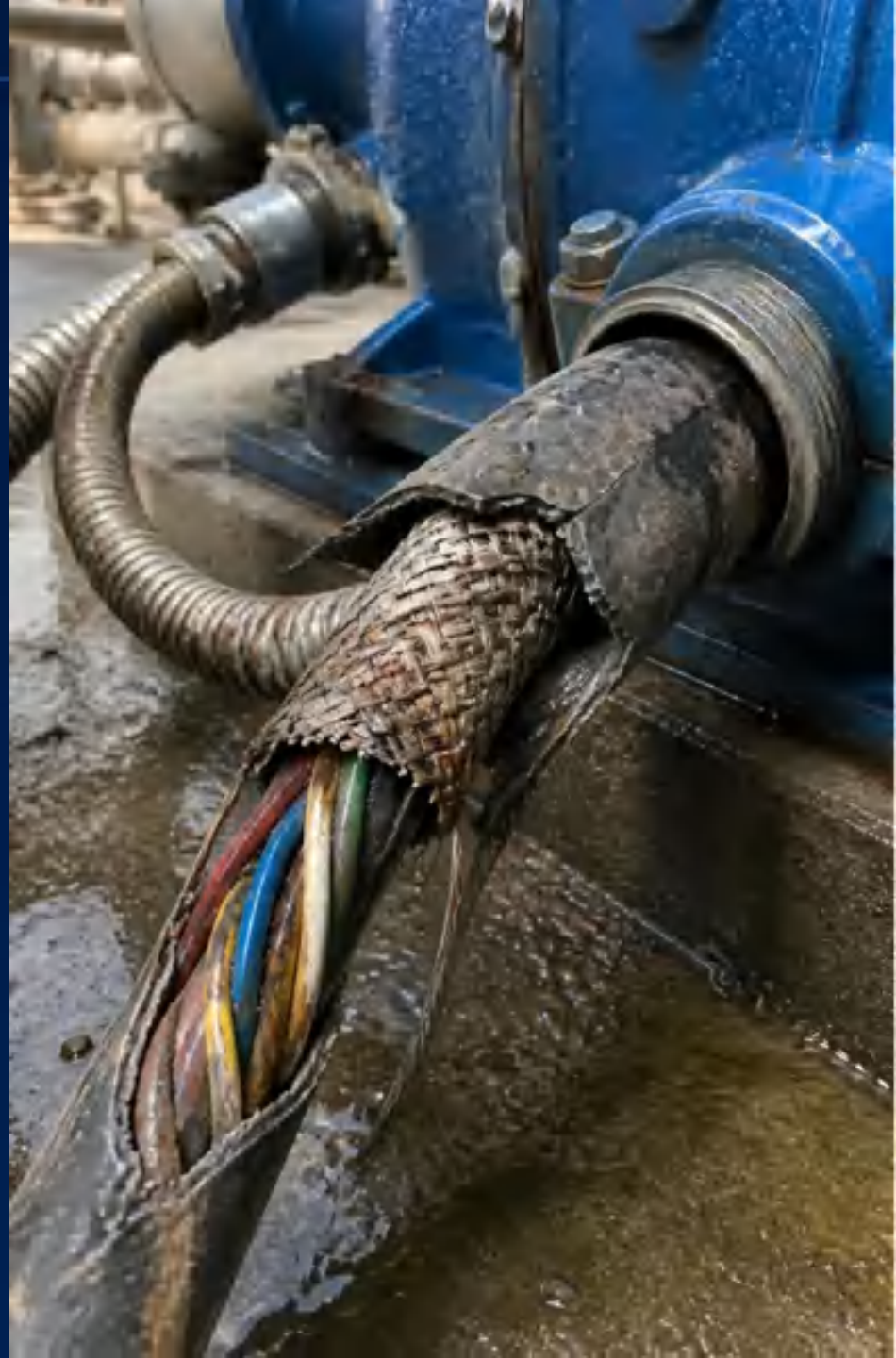
Physical Limitations of Traditional Condition Monitoring (CBM)

1. **Inaccessibility Constraints:** Submerged hydro-turbine runners, high-temperature thermal boiler zones, and deep-well dewatering pumps prevent physical accelerometer mounting.

2. **Infrastructure Vulnerability:** Oil & Gas ATEX area, long sensor cable runs across harsh industrial floors are prone to electromagnetic interference (EMI), moisture degradation, and physical damage.

3. **Resource Distribution:** Manually collecting vibration data across remote rural micro-hydro or solar hybrid stations creates major maintenance lag.

4. **Blind Spots:** Traditional methods can fail to identify early-stage internal electrical anomalies (stator/rotor insulation degradation) before they cause mechanical damage.



ESA Core Strategic Value for Critical Rotating Asset & Operations



Zero Structural Modifications

Bypasses costly field cabling, conduit, and ATEX/Ex field ratings.

Complete Field Safety

All installation and monitoring occurs inside safe, climate-controlled electrical rooms.

Predictable Long-Term Revenue

Eliminate catastrophic equipment failures with consistently meet delivery deadlines to retain high-value customer contracts, and predictable maintenance budgets.

e-MCM CONDITION MONITORING SYSTEM







SYSTEM ARCHITECTURE & METHODOLOGY

How eMCM Works – The Digital Twin & Model-Based Intelligent System

01

PHASE 01

Mathematical Modeling

eMCM builds a precise, dynamic **Digital Twin** of the specific AC motor/generator by measuring voltage and current time domain waveforms during an initial learning phase.

02

PHASE 02

Anomaly Detection Matrix

24/7 compares real-time measured current against the calculated model; residual current anomalies indicate developing faults.

03

PHASE 03

Spectrum Analysis

Utilizes advanced algorithms to separate mechanical load variations from true electrical or mechanical defects.

04

PHASE 04

Installation Blueprint

100% panel-mounted inside the Motor Control Center (MCC). Requires no field-side wiring, zero asset-side downtime for sensor placement, and no external physical probes

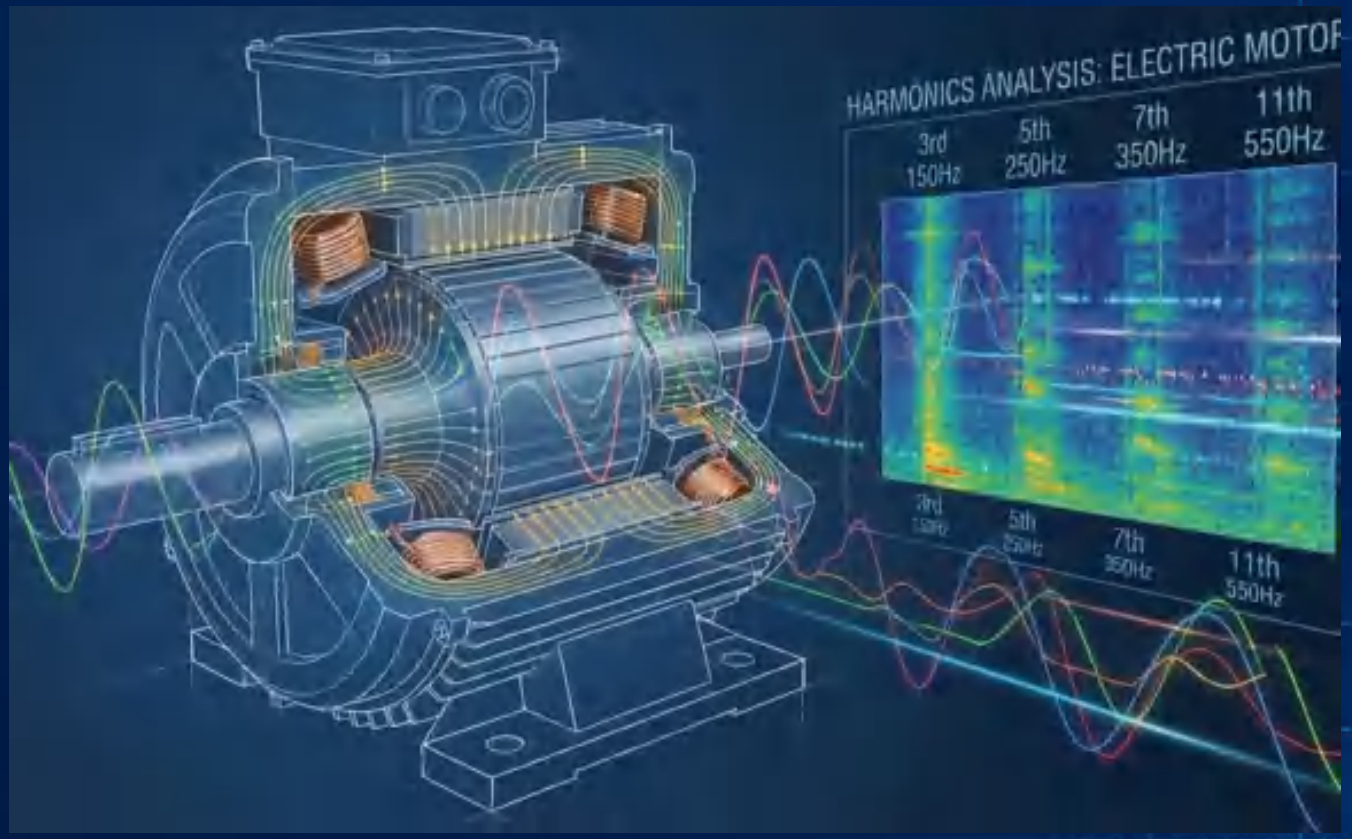
ZERO FIELD SENSORS · 100% MCC PANEL-MOUNTED ACQUISITION

Electrical Signature Analysis turns the motor into its own sensor network

Use the motor’s electrical supply lines as a high-fidelity diagnostic path

Move data capture from the field to safe, accessible Motor Control Centers (MCCs)

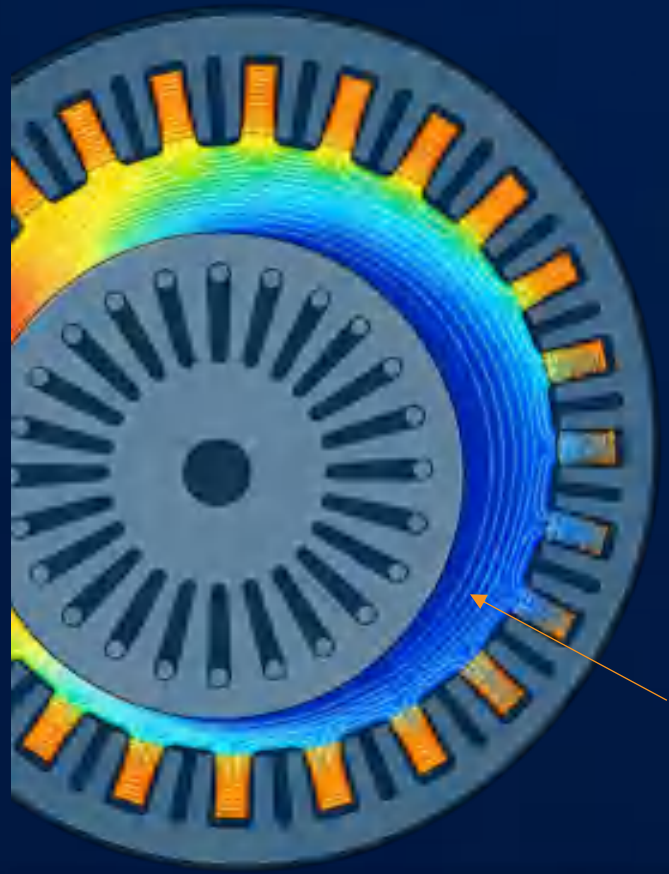
Enable non-intrusive monitoring for critical, inaccessible, or complex assets



TRANSDUCTION MECHANICS

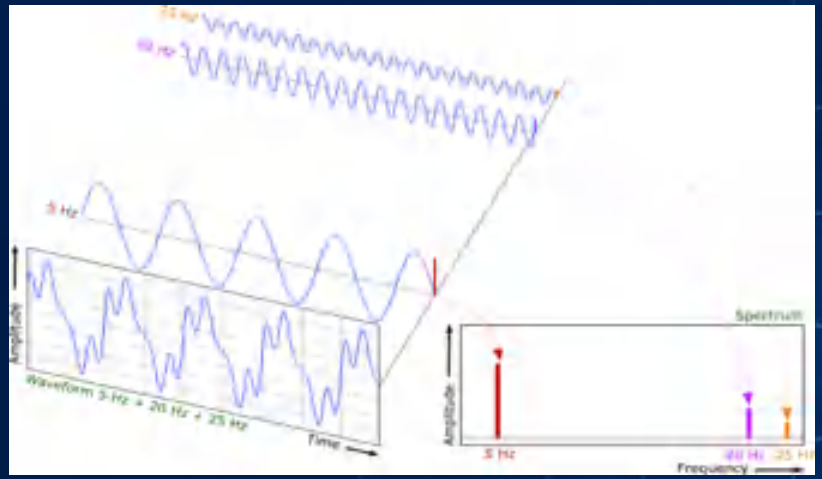
MECHANICAL ANOMALIES MODELLED AS TIME-VARIANT PERMEANCE DISTORTIONS

Kinetic-to-Electromagnetic Transduction Physics



- Anomalies micro-vibrations in the motor rotor alter the stator air gap, modulating the magnetic flux and inducing ripple variations in the time-domain current waveform.
- Processing this waveform through a Fast Fourier Transform (FFT) algorithm reveals distinct frequency spectrum peaks (sidebands) used to analyze mechanical, electrical, and process-related anomalies.





Early Fault Detection Horizon

What eMCM Detect Faults: Up to 6 Months Early Warnings & Trending for Monitoring

CATEGORY A

Mechanical Fault Diagnostics

- Unbalance & Misalignment
- Bearing Failure (Inner/Outer Race)
- Mechanical Looseness
- Shaft / Coupling Anomalies

CATEGORY B

Electrical Fault Diagnostics

- Stator Winding Insulation Faults
- Rotor Bar Cracks / Breaks
- Wiring Loose
- Phase Faults & Connection Degradation

CATEGORY C

Process & Power Quality Diagnostics

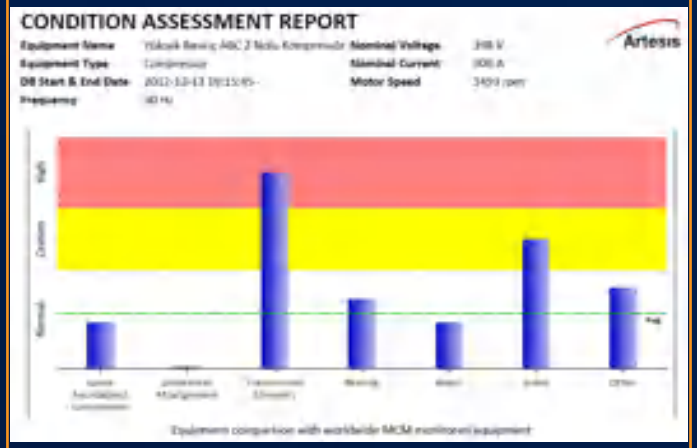
- Voltage Unbalance & Harmonics
- Cavitation (Pumps)
- Flow Restrictors / Blocked Intakes
- Transmission Coupling Slippage

How Does e-MCM Works?

Fault Detection



Diagnosis & Assessment

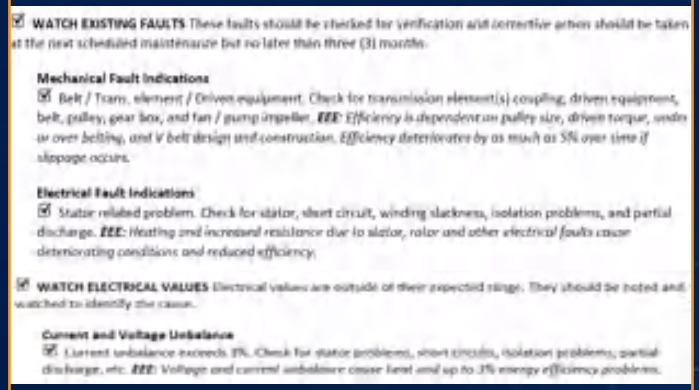

CONDITION ASSESSMENT REPORT

Artesis

Equipment Name
Equipment Type
DB Start & End Date
Frequency
Nominal Voltage
Nominal Current
Motor Speed

Equipment comparison with worldwide MCM monitored equipment

Diagnosis & Assessment


☑ **WATCH EXISTING FAULTS** These faults should be checked for verification and corrective action should be taken at the next scheduled maintenance but no later than three (3) months.

Mechanical Fault Indications

☑ Belt / Trans. element / Driven equipment. Check for transmission element(s) coupling, driven equipment, belt, pulley, gear box, and fan / pump impeller. ***EEE:*** *Efficiency is dependent on pulley size, driven torque, under or over belting, and V belt design and construction. Efficiency deteriorates by as much as 5% over time if slippage occurs.*

Electrical Fault Indications

☑ Stator related problem. *Check for stator, short circuit, winding slackness, isolation problems, and partial discharge.* ***EEE:*** *Heating and increased resistance due to stator, rotor and other electrical faults cause deteriorating conditions and reduced efficiency.*

☑ **WATCH ELECTRICAL VALUES** Electrical values are outside of their expected range. They should be noted and watched to identify the cause.

Current and Voltage Unbalance

☑ Current unbalance exceeds 3%. *Check for stator problems, short circuits, isolation problems, partial discharge, etc.* ***EEE:*** *Voltage and current unbalance cause heat and up to 3% energy efficiency problems.*



Executive Summary

This outlines a **sensorless predictive maintenance strategy** for critical rotating assets across petrochemicals plant, fossil fuel, gas, and power generation, water & utilities & automotive manufacturing. Operations face pressure to secure uninterrupted grid transmission, eliminate catastrophic failure penalties, and reduce hazardous field maintenance

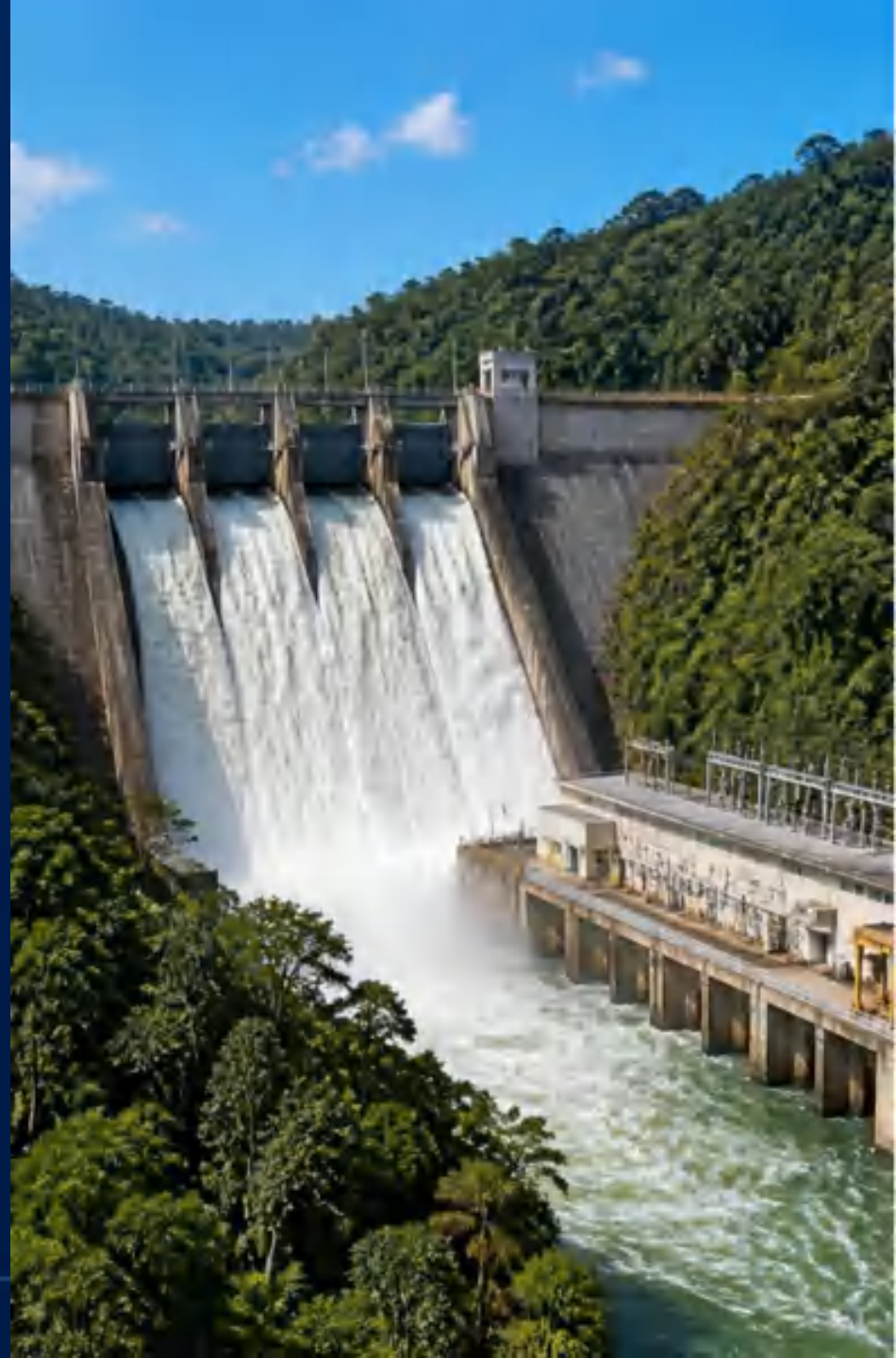
The Artesis e-MCM uses **Electrical Signature Analysis (ESA)**, installed inside the MCC, to evaluate current and voltage waveforms — identifying mechanical, electrical & process related anomalies faults up to **6 months** advance before failure, with zero field sensors required.



GENERATION FLEET · HYDROELECTRIC

Maximizing Uptime Across Major Hydroelectric Projects

1. **Hydro-Turbine Subsystems:** Continuous tracking of high-stress exciter systems and dynamic load variations.
2. **Submerged Dewatering & Drainage Systems:** Tracking inaccessible submersible pumps deep within the dam structure where physical inspection is impossible.
3. **Governor Oil Pressure Loops:** Protecting the critical hydraulic pumps that regulate water gates to ensure grid frequency stability.
4. **Auxiliary Systems:** Monitoring massive generator cooling water pumps to prevent emergency thermal trips.



GENERATION FLEET · THERMAL POWER

Securing the Combustion & Steam Cycles

1. **Boiler Feed Water Pumps (BFP):** Protecting the highest-pressure, most critical rotating components in the steam loop against mechanical failure.

2. **Air Handling Systems:** Continuous monitoring of massive Induced Draft (ID) and Forced Draft (FD) fans subject to high ash accumulation and unbalance.

3. **Fuel Processing Units:** Monitoring coal pulverizers, mills, and main conveyor drives operating in heavy dust environments where physical sensors degrade rapidly.

4. **Condensate Loop:** Ensuring the absolute reliability of Condensate Extraction Pumps (CEP) and cooling tower fan assemblies.



Air Systems, Fuel Handling & Material Processing



Combustion Air & Draft Systems

- **ID & FD Fans** — Detects blade erosion, fly-ash accumulation, unbalance, and coupling looseness before housing damage.
- **PA & Secondary Air Fans** — Ensures stable boiler combustion and prevents emergency load drops.

Fuel Handling & Material Processing

- **Coal Crushers & Pulverizers** — Evaluates torsional stress on motor shaft to spot gear tooth cracks, ignoring external structural noise.
- **Conveyors & Feeders** — Flags windup stress and motor insulation breakdown early.
- **Ash Slurry Pumps** — Identifies impeller degradation and efficiency drop-offs without manual inspections.

GRID INFRASTRUCTURE & RURAL NETWORKS

Substations, Transmission Network, and Rural Off-Grid Operations

1. **Transformer Safety Support:** Monitoring critical transformer oil circulation pumps to protect primary EHV substations (e.g., the 500kV backbone network).

2. **Substation HVAC & Blowers:** Ensuring indoor urban and industrial substation ventilation systems run reliably to prevent localized switchgear overheating.

3. **Remote/Rural Networks:** Remote asset health tracking for decentralized solar hybrid stations and rural microgrids, removing the need for regular manual technical site visits.



Plant Auxiliaries & Heat Rejection Systems



Main Cooling Water (CW) Circulation Pumps

Responsible for moving immense volumes to main condensers. A failure causes immediate turbine trip. e-MCM monitors for stator insulation breakdown and rotor bar degradation.

Cooling Tower Fans

Positioned in wet, humid, corrosive vapor plumes. e-MCM eliminates field cabling failure risk by tracking gearboxes and fan blades directly from the motor starter breaker panel.

Equipment Criticality & Monitoring Scope

Assets on Offshore Platform are prioritized by their failure consequence to production and platform integrity.

1

Level 1 — Critical: Zone 2 Gas Engine Generators (20kW Alternators)

Recently commissioned as primary power source. eMCM detects insulation breakdown, stator shorts, and phase imbalances. A failure here causes a **total platform blackout**, tripping all wellhead control panels instantly.

2

Level 1 — Critical: Submersible Seawater Lift Pumps

Submerged in highly corrosive splash zones where accelerometers and data cables degrade rapidly. eMCM monitors safely from the dry switchboard room. Loss of cooling water **trips all processing loops**, halting production export.

3

Level 2 — Essential: Instrument Air Compressors

Supplies pressurized air to control and safety valves. eMCM detects mechanical unbalance, belt slippage, and rotor defects. Pressure drop below threshold triggers a **platform-wide Emergency Shutdown (ESD).**

4

Level 2 — Essential: MOL / Shipping Pumps (FPSO Host Link)

High-capacity crude and condensate export pumps. eMCM monitors impeller degradation, shaft misalignment, bearing wear, and seal failures. Failure **halts oil export** and forces upstream production choke.



Airport Facilities and Critical Power

Chiller: Detects motor, compressor, and hydraulic loops like liquid slugging, flow blockages, and efficiency drops.

Backup generator: Checks windings and shaft alignment continuously, so start-up readiness is assured.

Cooling tower: Spots fan unbalance and gearbox defects without high-roof inspections.

AHU and blower: Catches belt slippage, bearing wear and blockages inside restricted security zones.





Protecting The Underground

Tunnel ventilation fan: No sensors exposed to brake dust, humidity or vibration on lines like urban rail network.

Station AHU and chilled water pump: Monitored from safe switchrooms under **18-hour daily loads**.

Drainage and sump pump: Standby pumps tracked so they start in tropical downpours.

Escalator and lift drive motor: Flags looseness and bearing friction before a jam.



Municipal Water and Sludge Treatment Plants

Water treatment pump

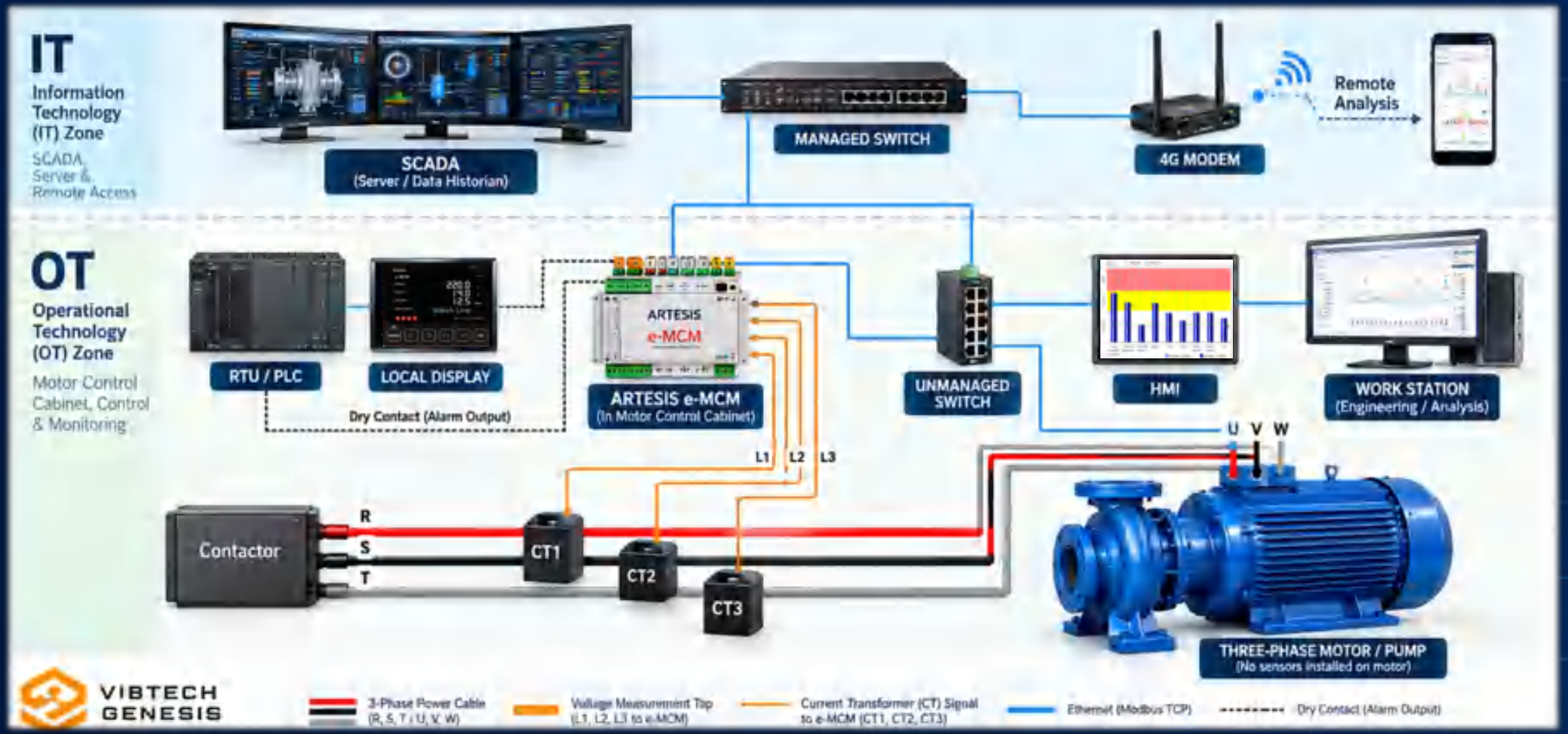
Isolates shaft misalignment and bearing wear faults **up to 6 months before** a supply interruption.

Sludge pump

Prevents winding short-circuits from humidity and corrosive gases in dewatering buildings.

CENTRALIZED MONITORING & SCADA WORKFLOW

Empowering the Central Condition-Based Maintenance Department



Pumps Fans Conveyor Chiller Mixer Ahu Compressor Generator

BUSINESS CASE & IMPLEMENTATION ROADMAP

Operational & Financial Impact

1. **Unmatched Maintenance ROI:** Drastically reduces forced outages, lowers emergency repair overheads, and safely extends asset lifecycles.

2. **Safety Excellence:** By keeping all monitoring hardware inside safe electrical switchgear rooms, personnel do not have to enter high-risk areas near active machinery.

3. **Proposed Next Step:** Initiation of a Proof of Concept (POC) pilot project on a high-criticality pump or fan at a designated facility.



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Technical Case Studies

Electrical Signature Analysis In Practice



ABOUT THE SPEAKER



Scan QR for Nick Kang's Contact

Nick Kang

Chief Engineer & Director (Vibtech Genesis)

- 35+ years of experience in industrial reliability and predictive maintenance
- Certified Vibration Institute (USA) ISO 18436-2 Category III Vibration Analyst
- Singapore appointed training (Cat 1,2 &3) representative for the renowned Vibration Institute USA

Case Study 01

Water Pumping Station

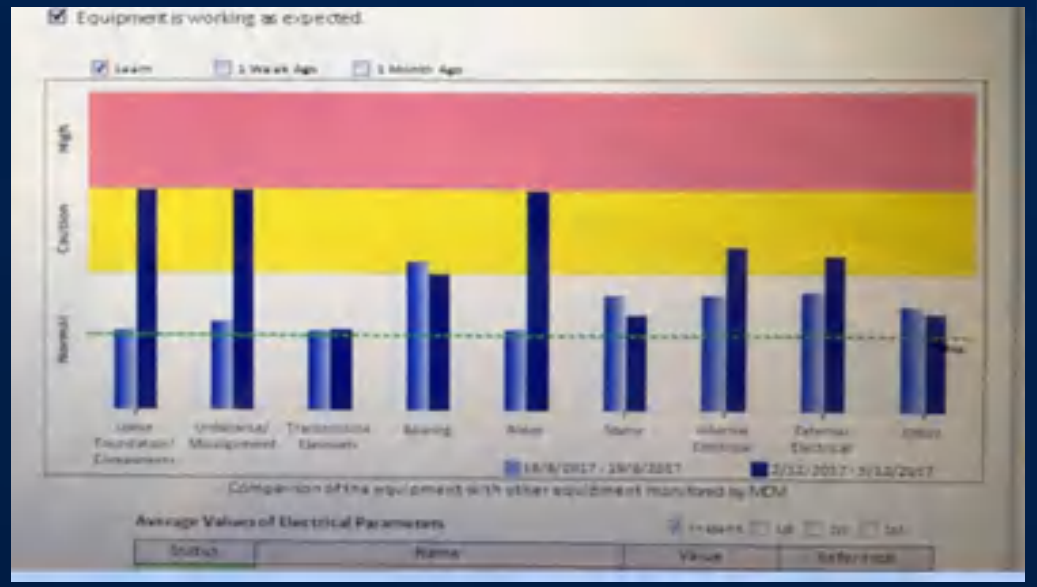
3300VAC Motor Unbalance Fault

Case Study 01

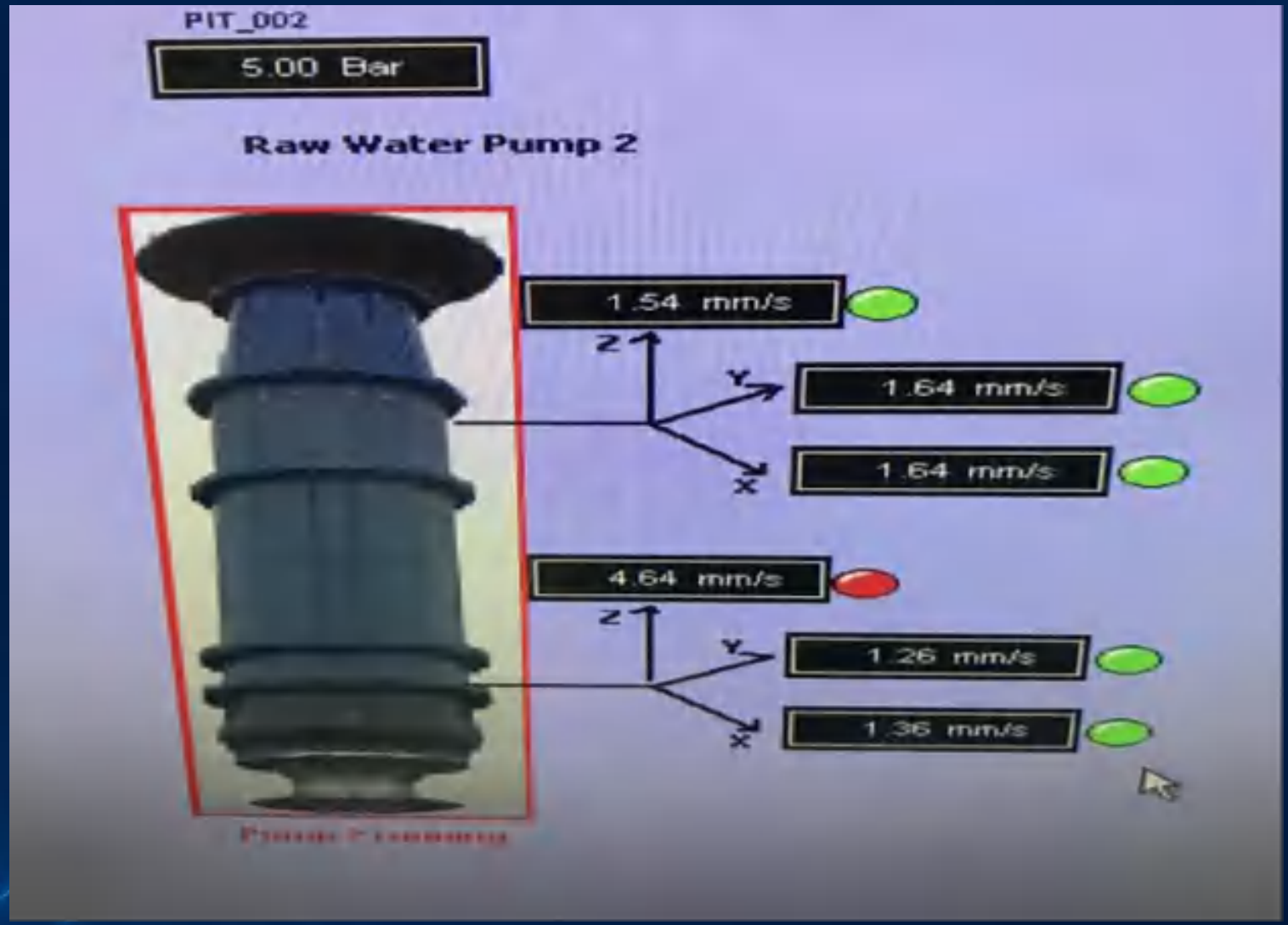
- One of the MCM units monitoring a 3.3kV deep well submersible pump was giving a warning about the pumps condition.
- The warning was given due to high level of unbalance in the system which was verified by the existing SCADA system.
- SCADA captured high vibration amplitude of 4.54mm/s rms on Z-axis on Pump casing (Suction side) via a separate on – line vibration sensor.

Case Study 01

- Looseness, Unbalance, Rotor condition was reflected in MCM locally.
- Visual impaction found dented pump impeller caused by sucking in the debris.
- Maintenance crew confirmed that the unbalance problem was due to a wooden debris jamming the rotation of propellers.



Case Study 01



Case Study 01

Type of detectable faults

1. Looseness,
2. Unbalance,
3. Rotor.

Finding

Condition reflected in MCM was caused of debris logged in between pump impeller.



Case Study 01

End Of Case Study 01

Case Study 02

DOES MCSA & VIBRATION Tells Same Stories?

Keeping PDM Simple

Case Study 02

AHU Plant

- Why My B8 Ahu always show high transmission & Bearing Failure in Mcsa Data?
- IS MCSA Data Collected CORRECT ?
- MY Mech Contractor did multiple belt & Bearing Change, Still we see High MCSA Readings !





Case Study 02

AHU-B8 - AMT Pro Fault Detection Findings

AHU-B8 @ 50 Hz Vibration Reading

Locations	Before Balancing & Alignment (10-Oct-2024)	After Balancing & Alignment (14-Nov-2024)	After Bearing Replacement (12-Feb-2025)	2nd Replace Bearing (03-Apr-2025)	Motor Solo Run High Vibration (06-May-2025)	Motor Solo Run Low Vibration (06-May-2025)	Unit
MNDE - Vertical	9.298	3.999	13.13	9.333	6.758	1.291	mm/s RMS
MNDE - Horizontal	6.383	2.68	10.96	5.801	9.35	2.116	mm/s RMS
MNDE - Axial	6.147	5.11	5.557	9.64	1.059	1.206	mm/s RMS
MDE - Vertical	4.893	3.893	2.724	6.898	2.775	2.036	mm/s RMS
MDE - Horizontal	4.849	2.524	2.959	8.144	6.185	1.976	mm/s RMS
MDE - Axial	9.071	2.635	8.699	5.167	4.276	1.597	mm/s RMS
FDE – Vertical		6.721	4.225	4.214			mm/s RMS
FDE - Horizontal	7.436	6.721	12.14	14.01			mm/s RMS
FNDE -Vertical	18.68		4.292	3.396			mm/s RMS
FNDE - Horizontal	9.298	7.346	6.64	7.924			mm/s RMS

As per ISO-10816-3, where below 4.5 mm/s as **Good** and 7.1 as **Caution**.

Case Study 02

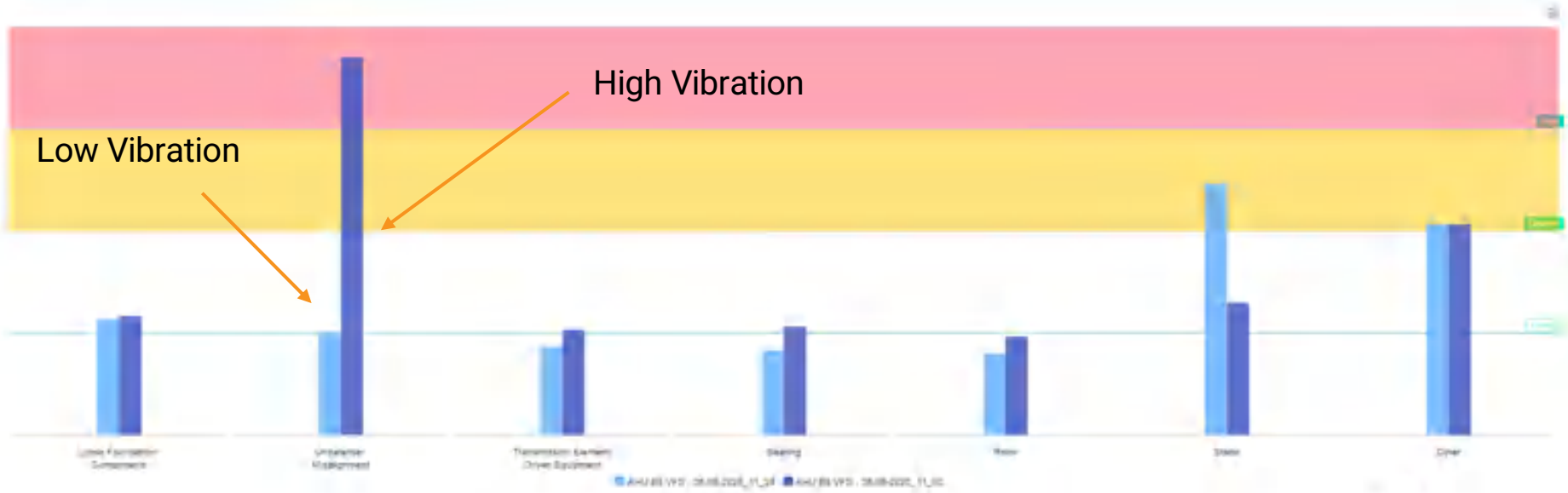
AHU-B8 - AMT Pro Fault Detection Findings

Reports Details

AMT Results Comparison Motor Solo Run @ 50 Hz

Equipment Name	AHU B8 VFD	AHU B8 VFD
Voltage	465.0	465.0
Frequency	50.0	50.0
Equipment Type	2	2
Current	13.7	13.7
RPM	1460.0	1460.0
Date	5/8/2025 12:00:00 AM	5/9/2025 12:00:00 AM

Equipment Status



Case Study 02

AHU-B8 - AMT Pro Fault Detection Findings

AHU-B-8 @ DOL Vibration Reading

Locations	Direct-Online (03-Apr-2025)	Motor Solo Run High Vibration (06-May-2025)	Motor Solo Run Low Vibration (06-May-2025)	Units
MNDE - Vertical	16.63	4.725	2.01	mm/s RMS
MNDE - Horizontal	13.44	8.208	1.987	mm/s RMS
MNDE - Axial	4.275	0.9965	1.412	mm/s RMS
MDE - Vertical	5.956	2.164	1.738	mm/s RMS
MDE - Horizontal	10.73	5.745	1.823	mm/s RMS
MDE - Axial	5.77	1.152	1.53	mm/s RMS
FDE – Vertical	5.315			mm/s RMS
FDE - Horizontal	13.18			mm/s RMS
FNDE -Vertical	5.433			mm/s RMS
FNDE -Horizontal	5.652			mm/s RMS

As per ISO-10816-3, where below 4.5 mm/s as **Good** and 7.1 as **Caution**.

Case Study 02

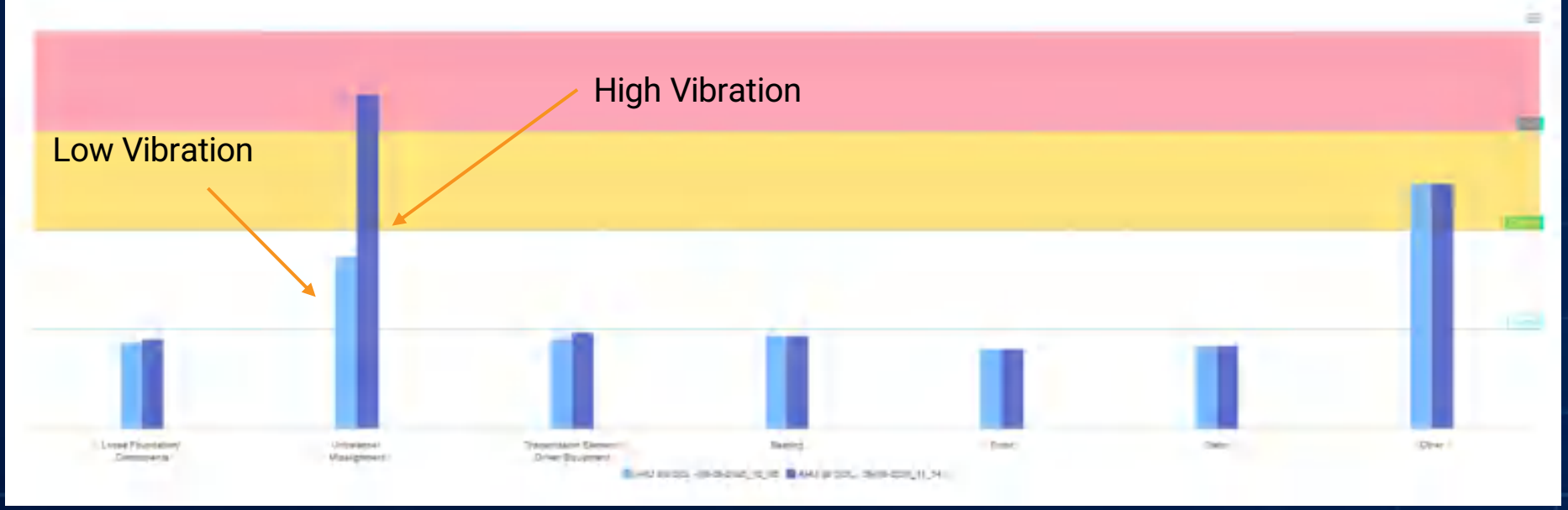
AHU-B8 - AMT Pro Fault Detection Findings

Reports Details

AMT Results Comparison Motor Solo Run @ DOL

Equipment Name	AHU-B8 (R)	AHU-B8 (DOL)
Voltage	415.0	416.0
Frequency	50.0	50.1
Equipment Type	2	2
Current	13.7	13.7
RPM	1490.0	1489.9
Date	5/6/2025 12:00:00 AM	5/6/2025 12:00:00 AM

Equipment Status



Case Study 02

AHU-B8 - AMT Pro Fault Detection Findings

AHU-B-8 @ 31 Hz Vibration Reading

Locations	Before Balancing & Alignment (10-Oct-2024)	After Balancing & Alignment (14-Nov-2024)	After Bearing Replacement (12-Feb-2025)	Motor Solo Run (Without Belt) (06-May-2025)	Motor Run with Belt (06-May-2025)	Unit
MNDE - Vertical	3.653	3.306	4.166	1.208	4.761	mm/s RMS
MNDE - Horizontal	2.872	3.296	2.756	1.055	6.326	mm/s RMS
MNDE - Axial	1.941	1.675	2.249	0.342	3.023	mm/s RMS
MDE - Vertical	4.498	3.671	2.654	1.1	3.782	mm/s RMS
MDE - Horizontal	4.52	1.255	3.277	1.444	5.419	mm/s RMS
MDE - Axial	1.733	2.241	3.311	2.25	3.818	mm/s RMS
FDE - Horizontal	2.127	2.396	3.659			mm/s RMS
FNDE - Vertical	5.434	2.836	2.651			mm/s RMS
FNDE - Horizontal	4.02	3.506	3.445			mm/s RMS

As per ISO-10816-3, where below 4.5 mm/s as **Good** and 7.1 as **Caution**.

Case Study 02

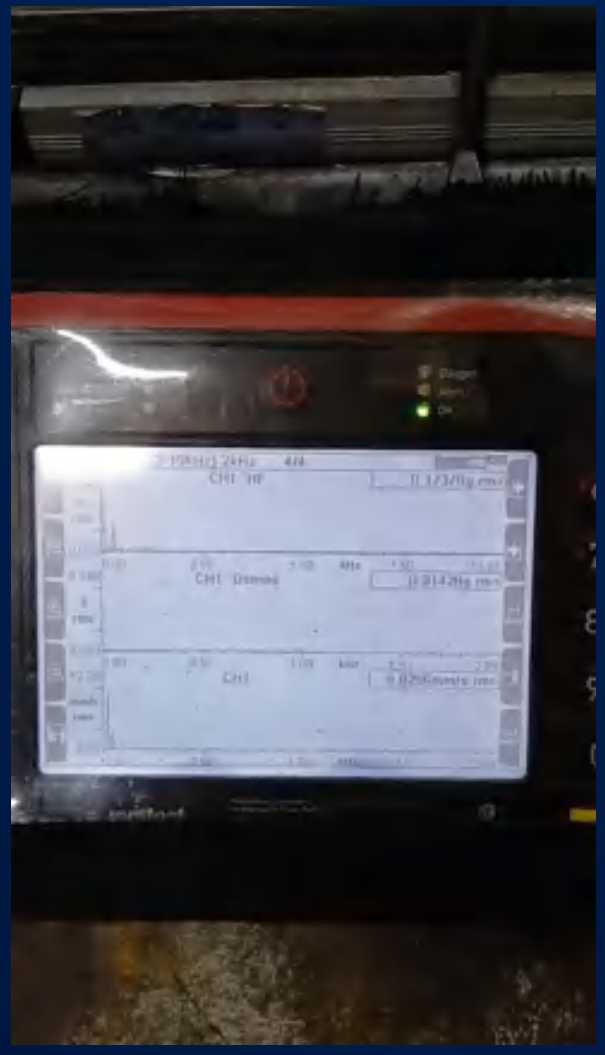
AHU-B8 - AMT Pro Fault Detection Findings

AMT Results Motor Solo Run @ 31 Hz



Case Study 02

AHU-B8 - AMT Pro Fault Detection Findings



B8 - Vibration Readings with and without Base Spring Compression (Video)

Case Study 02

AHU-B8 - AMT Pro Fault Detection Findings

AMT Results Motor Solo Run @ 50 Hz

Reports

Equipment Name:	AHU B8 VFD	**Nominal Voltage[V]:**	415.0	**Nominal Current[A]:**	13.7
Equipment Type:	Blower	**Test Frequency:**	50.0	**Test Rpm:**	1450.0
Report Name:	AHU B8 VFD - 05-06-2025_11_24	**Transmission Element:**	Belt/Pulley	**Starting Type:**	VFD
Report Date:	Tuesday, May 6, 2025	**Motor DE Bearing:**	6308	**Motor NDE Bearing:**	6306
Site Name:	ENGIE T2	**Driven Equipment Bearing 1:**	208	**Driven Equipment Bearing 2:**	208

Equipment Status



Case Study 02

AHU-B8 - AMT Pro Fault Detection Findings

AMT Results Motor Solo Run @ DOL

Reports

Equipment Name:	AHU B8 DOL	**Nominal Voltage[V]:**	415.0	**Nominal Current[A]:**	13.7
Equipment Type:	Blower	**Test Frequency:**	50.0	**Test Rpm:**	1480.0
Report Name:	AHU B8 DOL - 05-06-2025_12_06	**Transmission Element:**	BeltPulley	**Starting Type:**	Line
Report Date:	Tuesday, May 6, 2025	**Motor DE Bearing:**	6308	**Motor NDE Bearing:**	6306
Site Name:	ENGIE T2	**Driven Equipment Bearing 1:**	208	**Driven Equipment Bearing 2:**	208

Equipment Status



Case Study 02

AHU-B8 - AMT Pro Fault Detection Findings

Troubleshooting Timeline

#	Date	Action & Testing	Bearing	Transmission
1	18th September 2024	Initial Assessment	High	Caution
2	7th October 2024	Bearing & Belt Replaced	High	High
3	14th November 2024	Belt Alignment & Fan Balancing	High	Caution
4	12th February 2025	Operation at 50 Hz and DOL	High	High
5	6th May 2025	Solo Run (Belt Off)	Good	Good

Initial Findings

Mechanical & electrical (VFD) issues

Reported Root Cause

AHU base structural issue

Abnormal indicators persisted after maintenance.
Both bearing and transmission returned to the good zones during the belt off test.

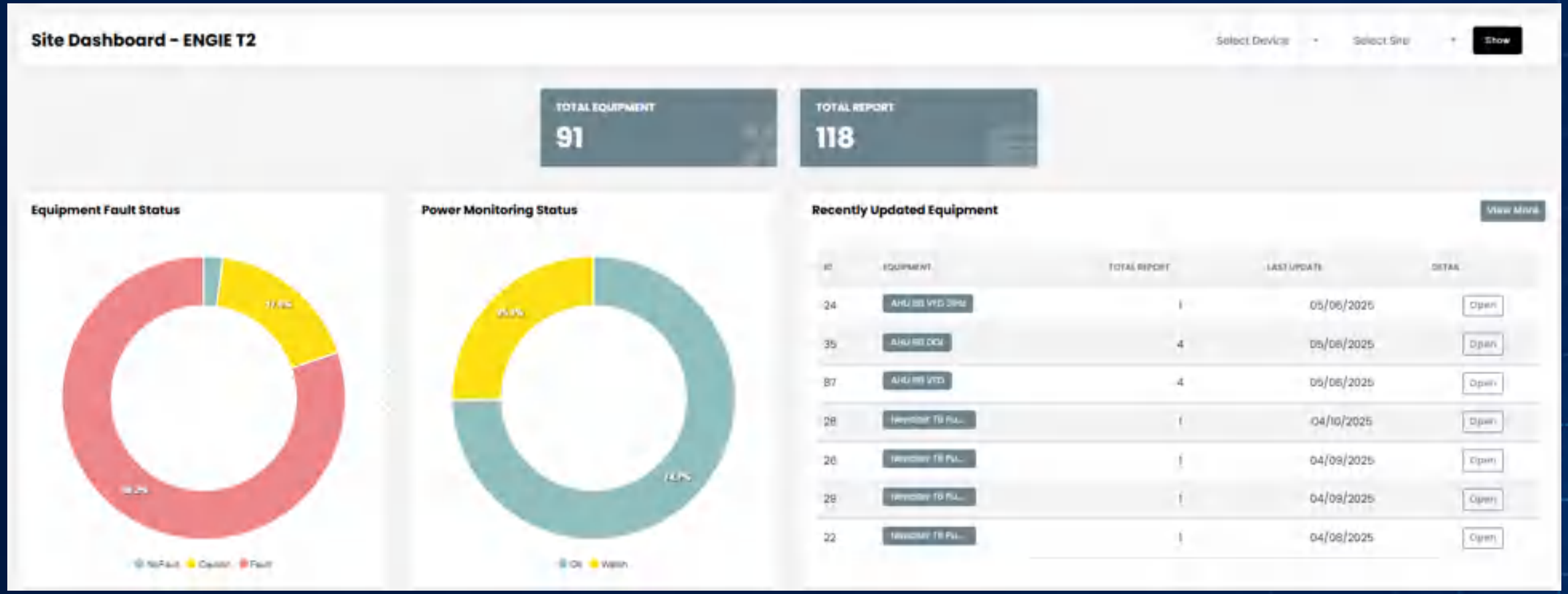
Case Study 02

AHU-B8 - AMT Pro Fault Detection Findings

T2 AMT Pro Equipment Test Status

68 Units in High Zone

19 Units in Caution Zone



Case Study 02

End Of Case Study 02

Case Study 03

- 6KV, Teco 850KW motor was schedule to under go in situ balancing on motor’s cooling fan due to high vibration.
- 20th Apr 18 , motor manufacturer did a balancing work at motor cooling fan. MCM was used to monitor newly balanced motor.
- Laser Shaft Alignment was conducted confirming motor – pump was within alignment tolerance. Procedure was conducted is to confirm misalignment as not vibration cause.
- On 30 Apr 2018, the balancing weight of the TECO Motor was removed, and shaft alignment was checked prior to MCM report

Case Study 03

Work Done Before Test



Shaft alignment checked by Vibro Technology's Servicemen

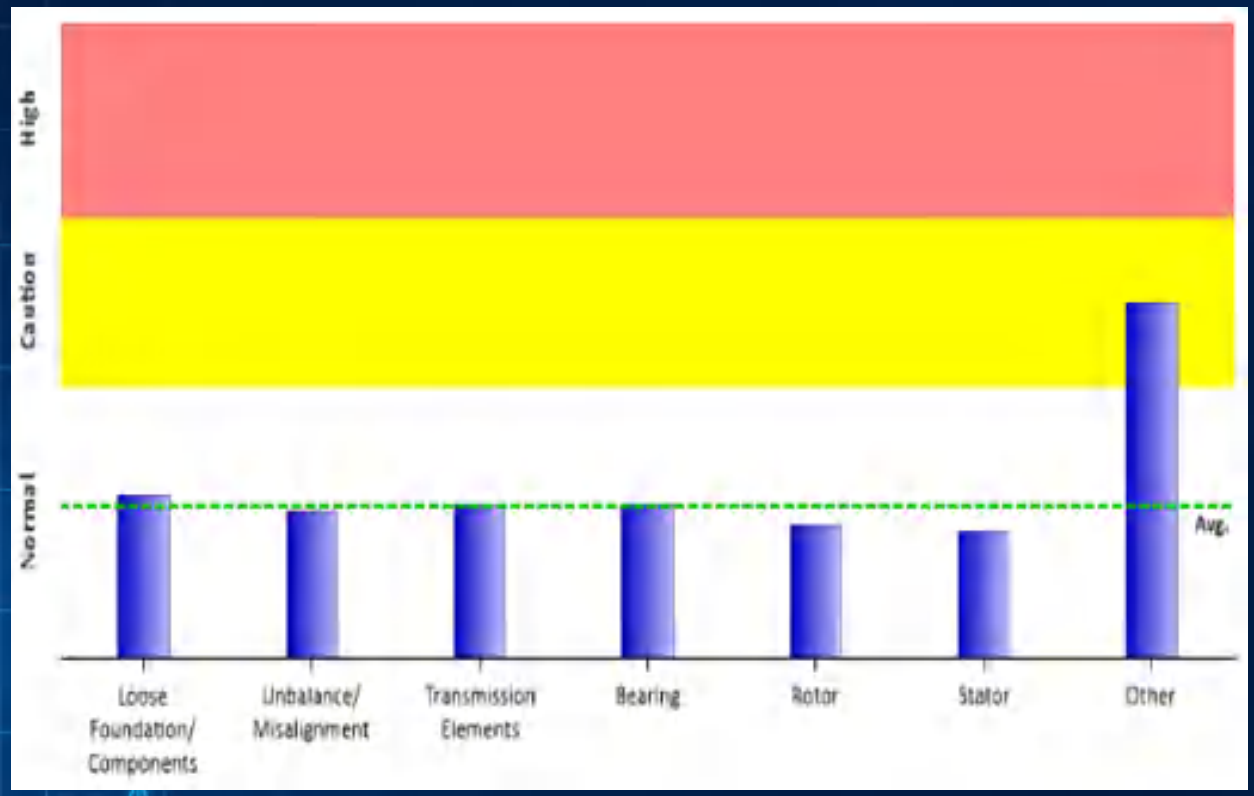


Removed balancing weight from TECO Motor by TECO's Servicemen

Case Study 03

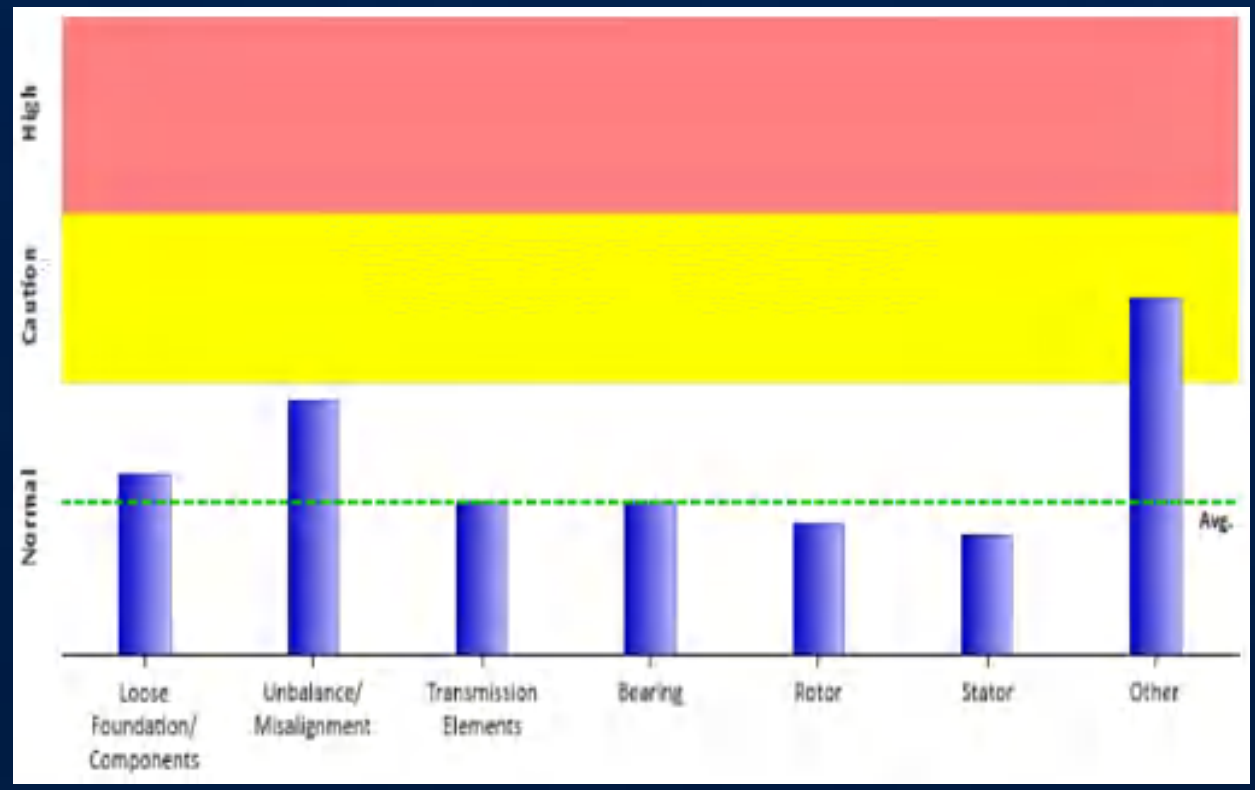
Findings

Test 1 – 20 Apr 2018



Before Balancing Weight Removal

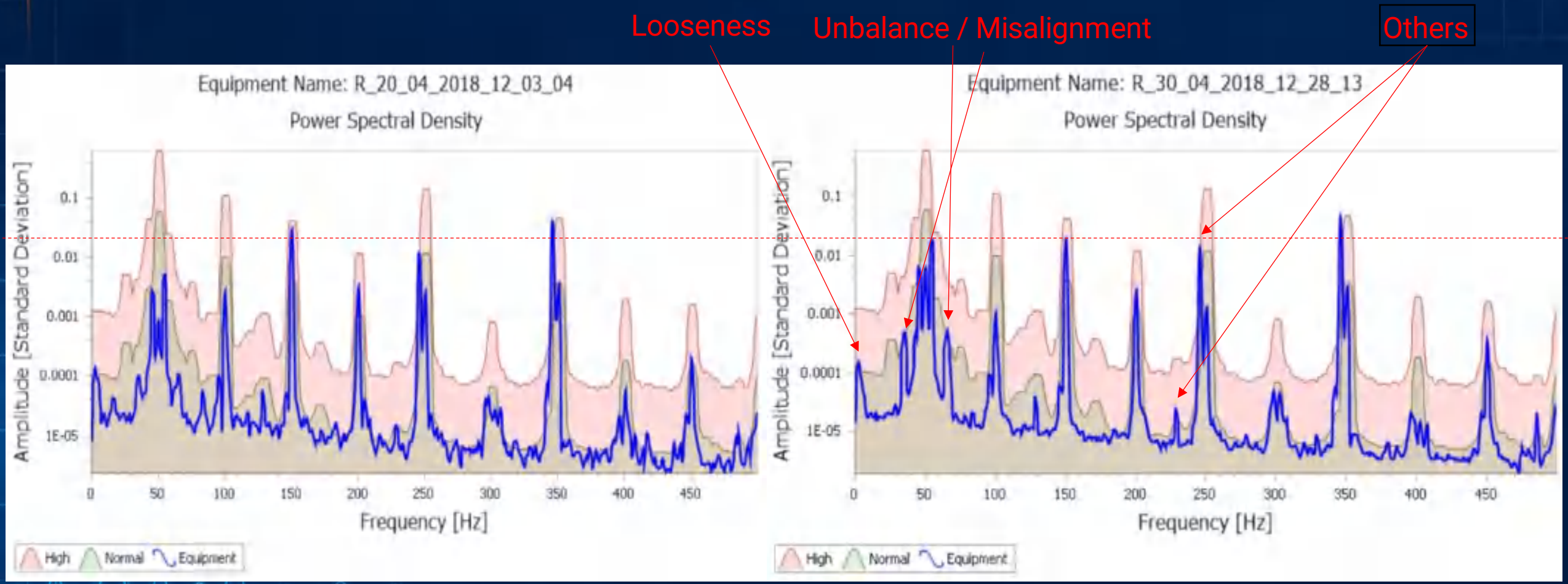
Test 2 – 30 Apr 2018



After Balancing Weight Removal

Case Study 03

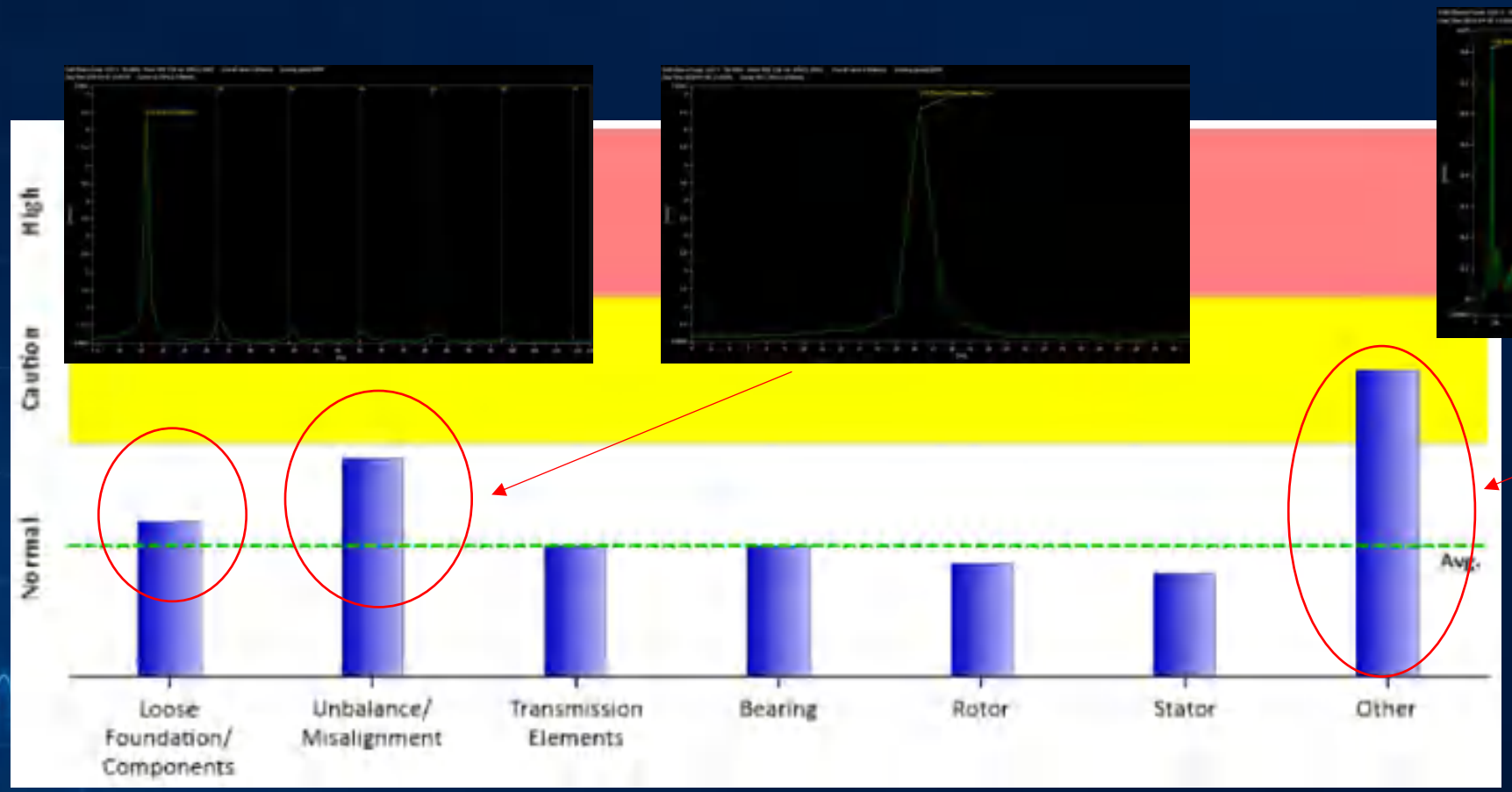
PSD Comparison



Case Study 03

Conclusion

- The test was proven that by removing the weights, the unbalance fault showed an increase
- Benchmarking also done against VMS system to verify detection



Case Study 03

End Of Case Study 03

Q & A

Thank you!

Keen to continue the conversation?

If you have a specific equipment challenge, get in touch with us below. We are ready to answer your questions and explore whether and how ESA could help address your particular maintenance needs.

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