

DETECTION OF STATOR WINDING INSULATION DEGRADATION



DIAGNOSIS

DETECTED ANOMALY

Early-stage stator winding insulation degradation detected through Electrical Signature Analysis (ESA).

PROBABLE ROOT CAUSE

Insulation breakdown between the stator winding and the magnetic core.

DETECTION LEAD TIME

Up to 1 month before potential functional failure

UP TO 10K

IN AVOIDED MOTOR REWINDING,
EMERGENCY INTERVENTION, AND
UNPLANNED DOWNTIME

LOCATION: **OMAN**

ASSET: **CRITICAL SUBMERSIBLE PUMP**

SECTOR: **WATER UTILITY**

690 V / 101.2 A / 90 KW / 50HZ

A critical submersible pump operating continuously within a water utility facility was monitored online using Enging's PreditMot Electrical Signature Analysis (ESA) platform. Because the pump plays a key role in the water circulation process, any unexpected failure could result in operational disruption, emergency maintenance activities, and increased repair costs.

During normal operation, PreditMot identified a sudden increase in the stator fault indicator (Figure 1), revealing a significant deviation from the motor's baseline electrical signature. The abnormal behaviour was automatically classified as a critical event, generating an alarm and notifying the maintenance team. The detected pattern was consistent with insulation degradation developing within the stator winding.

Following the alarm, the maintenance team performed on-site electrical validation tests. Insulation resistance measurements confirmed severe insulation degradation, with results approaching 0 MΩ, validating the diagnosis generated by PreditMot. Subsequent inspection of the motor revealed clear evidence of internal insulation breakdown, confirming the presence of a developing stator winding failure. A detailed inspection of the motor further revealed clear signs of internal insulation breakdown.

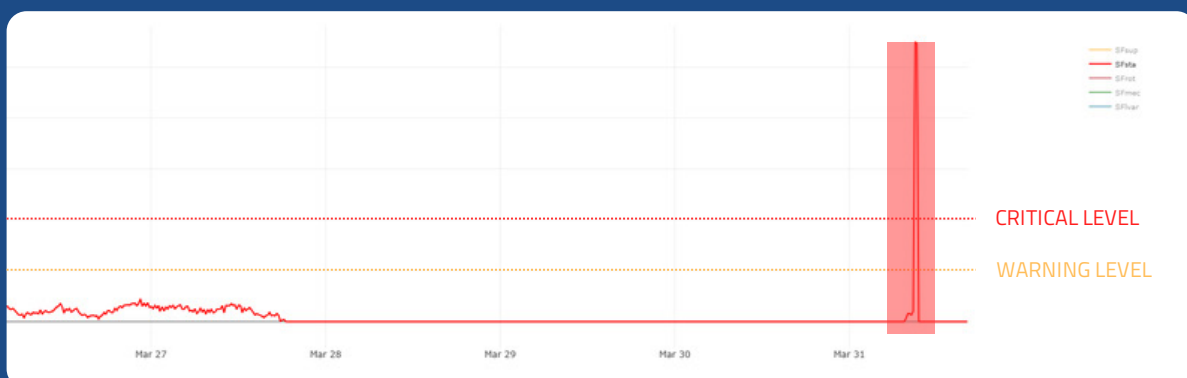


FIGURE 1 - TREND OF STATOR FAULT INDICATOR

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A)



B)

FIGURE 2 - PUMP DETAILED INSPECTION:
A) PUMP BEING REMOVED FOR DETAILED INSPECTION
B) INSULATION RESISTANCE TEST SHOWING 0 MOHM

Based on findings and inspection results, the client immediately initiated the required maintenance actions. The pump was taken out of service in a controlled manner, allowing proper inspection and corrective work without risking further damage or unexpected catastrophic failure (Figure 2) .

System provided clear visibility into the changing electrical condition of the motor, helping the maintenance team quickly understand the severity of the issue and take timely action. By identifying the abnormal stator condition before complete motor failure occurred, the monitoring system supported safer decision-making and reduced the risk of unplanned operational interruption. The event also highlighted the value of continuous online monitoring for critical rotating equipment operating under continuous duty conditions.

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IMPACT & BENEFITS

- ✓ Prevented unexpected pump failure
- ✓ Avoided unplanned downtime
- ✓ Reduced repair and operational costs
- ✓ Enabled proactive maintenance planning
- ✓ Improved reliability of critical water infrastructure
- ✓ Increased maintenance team confidence through data-driven decision making

KEY TECHNICAL TAKEAWAY

This case demonstrates how Electrical Signature Analysis (ESA) can detect stator winding insulation degradation at an early stage by identifying subtle changes in the motor's electrical behaviour.

By continuously analysing electrical variables, PreditMot provides early warning of developing insulation failures, enabling maintenance teams to intervene before catastrophic motor failure occurs.

The case highlights the effectiveness of physics-based electrical monitoring for critical rotating equipment, particularly in environments where conventional condition monitoring sensors are difficult, costly, or impractical to deploy.