KCF
technologies

AC Motor

DC Motor

AC MOTOR

Asset Overview:

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, **an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field**. AC motors are used on a variety of equipment types.
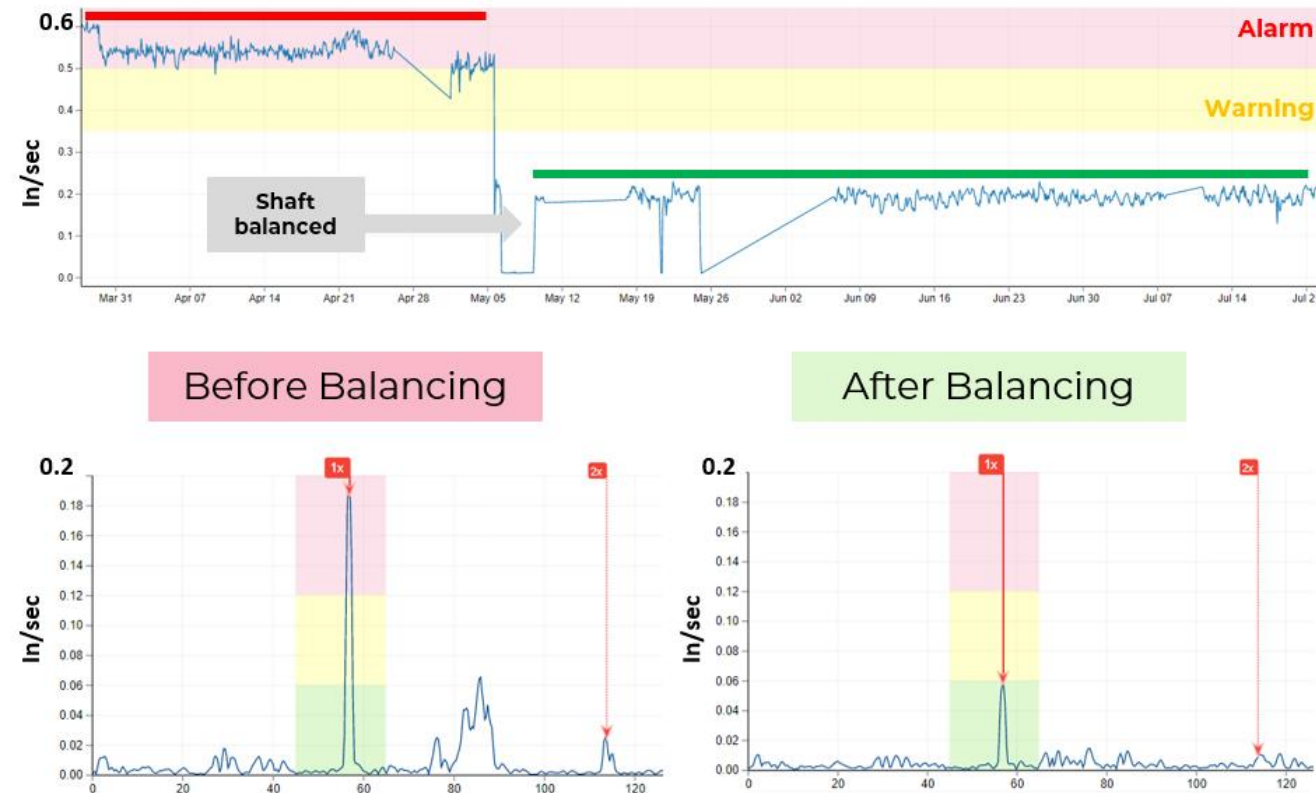
Common Failure Modes:

- Imbalance

- Misalignment

- Bearing Fault
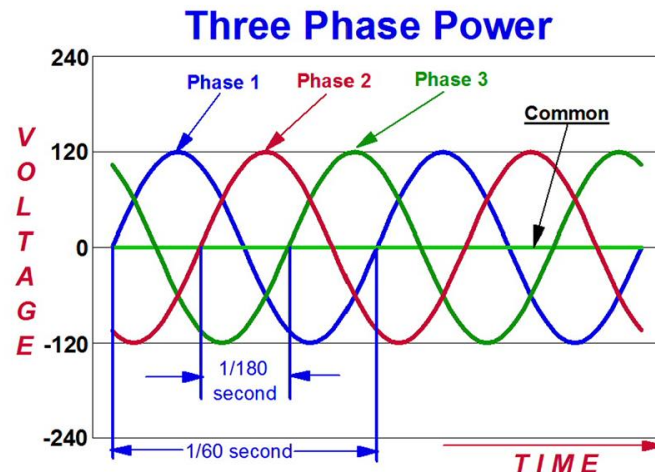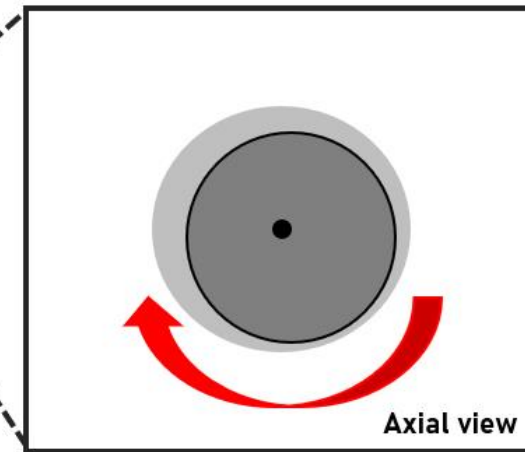
Fault Type 1: Imbalance

Below is an example of a motor with an imbalanced shaft. Based on ISO standards for acceptable vibration, SmartDiagnostics indicated this asset was running in the red Alarm area. That alarm, along with the vibration signature present in the frequency spectrum, allowed a KCF Sentry Analyst to accurately diagnose the imbalance. KCF alerted the customer of the damaging condition, who was then able to put in a work order and balance the motor. The trend and After Balancing condition shows the improvement after the balancing was performed.

Before Balancing

After Balancing

Look for a high 1X peak in the frequency spectrum.

Axial view

Possible Causes of Imbalance:

- Improper balancing practices
- Worn parts caused by wear and tear
- Distortion from stress
- Distortion from exposure to increased temperatures
- Buildups and deposits

Recommendations:

- If connected to a fan, check the fan for buildup
- Balance the shaft

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Fault Type 2: Misalignment

Below is an example of a motor with a misaligned shaft. Based on ISO standards for acceptable vibration, SmartDiagnostics indicated this asset was running in the red Alarm area. That alarm, along with the vibration signature present in the frequency spectrum, allowed a KCF Sentry Analyst to accurately diagnose the misalignment condition. KCF alerted the customer of the damaging condition, who was then able to put in a work order and laser-align the motor. The trend and After Alignment condition shows the improvement after the alignment was performed.
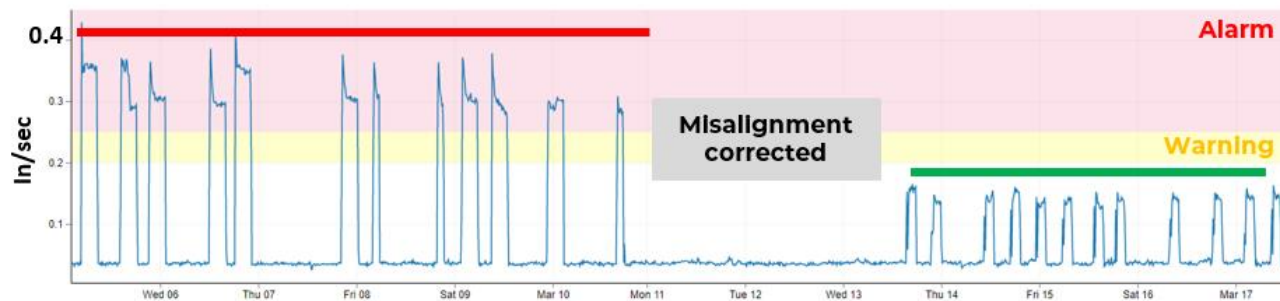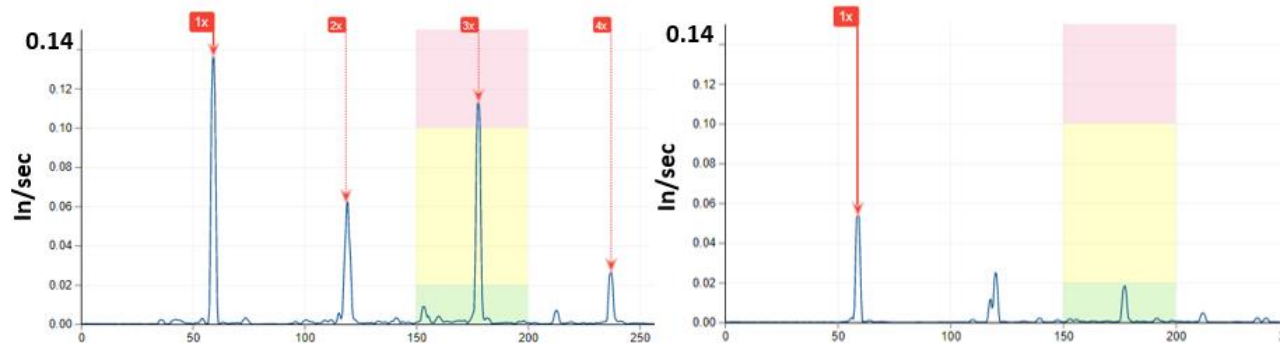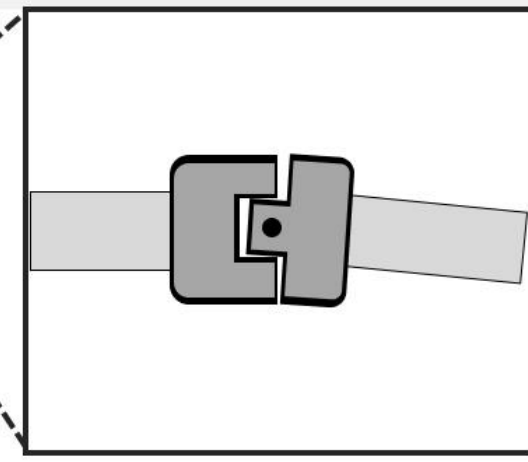

Look for 1X, 2X, and 3X peaks in the frequency spectrum which are typical for misalignment.

Possible Causes of Misalignment:

- Improper alignment practices
- Worn parts caused by wear and tear
- Height differences between bases
- Clearance issues/incorrect fit
- Impact damage

Recommendations / ?s to Ask:

- What are your alignment practices? Do you use a laser aligner when aligning the shaft?
- Are the bases of the motor and the connected machine at the same height?

AC MOTOR

Fault Type3 Bearings

A KCF analyst was able to notify the plant of increased vibration and high amplitude bearing tones. Routine maintenance was scheduled for 6 months later, but irreparable damage would have occurred if this machine continued to run at elevated levels, causing the motor to fail. The bearings were greased, and further damage was avoided – improving the lifespan of this asset & eliminating downtime.
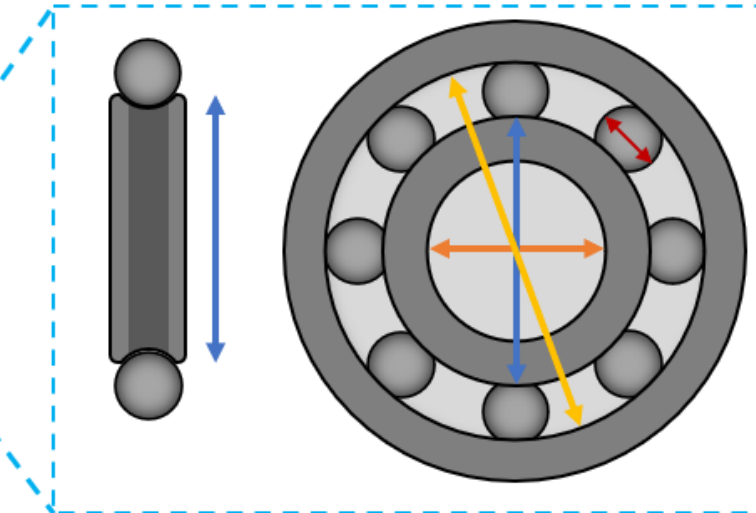

Damaged Bearings

Healthy Bearings
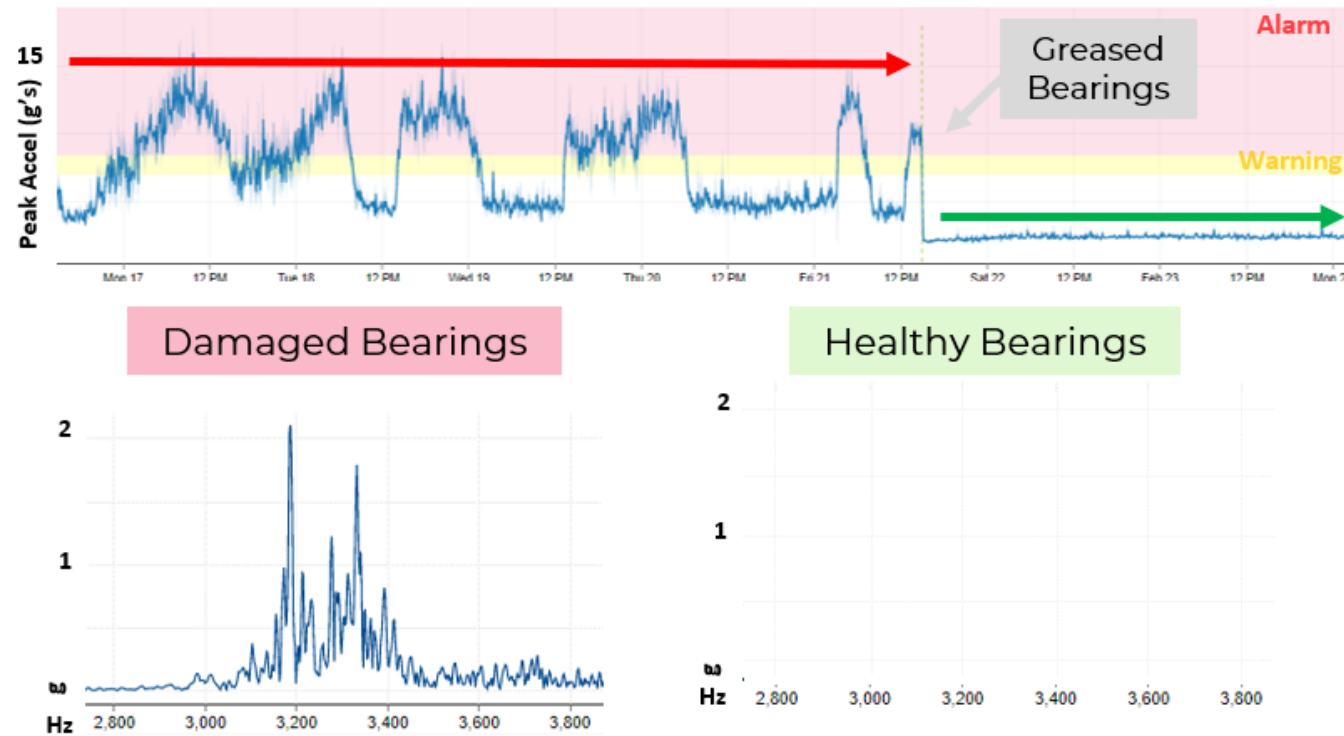
Look for haystacks in the mid-to-high frequency range in the frequency spectrum.

1x Frequency

Inner Race Frequency

Outer Race Frequency

Ball Spin Frequency

Each bearing element creates a unique signature, allowing the analyst to identify the exact cause of failure.

Possible Causes of Bearing Failure:

- Improper installation
- Machine imbalance
- Machine misalignment
- Poor lubrication practices
- Loose bearing fit
- Improper grounding

Recommendations:

- Lubricate the bearing
- When was the last time this bearing was lubricated? Do they have a PM schedule for lubrication? Ask for the type of lubrication they are using & perform research to determine if it is the right lubrication for the application
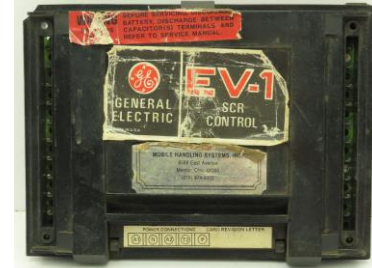
DC MOTOR

Asset Overview:

- A DC motor or direct current motor is an electrical machine that transforms electrical energy into mechanical energy by creating a magnetic field that is powered by direct current. When powered, a magnetic field is created in its stator.

- Commonly used as main drives on paper machines as well in heavy duty applications such as steel rolling mills, hoists, lifts, and cranes.

Common Failure Modes:

- Electrical Issues

- Fluting – Bearing wear

DC MOTOR

Fault Type 1: Electrical Firing Card

1/3 SCR or 2xLF X

2xLF (120Hz, 7200 RPM)

			Marker	Freq (CPM)	Amp (in/sec)
▼				60.0	0.0004027
▼			1x	1200.0	0.0031174
▼			BPFO	0.0	0.0002473
▼			BPFI	0.0	0.0002473
▼			BSF	0.0	0.0002473
▼			FTF	0.0	0.0002473

Trend:
- Elevated Velocity (Peak & RMS)
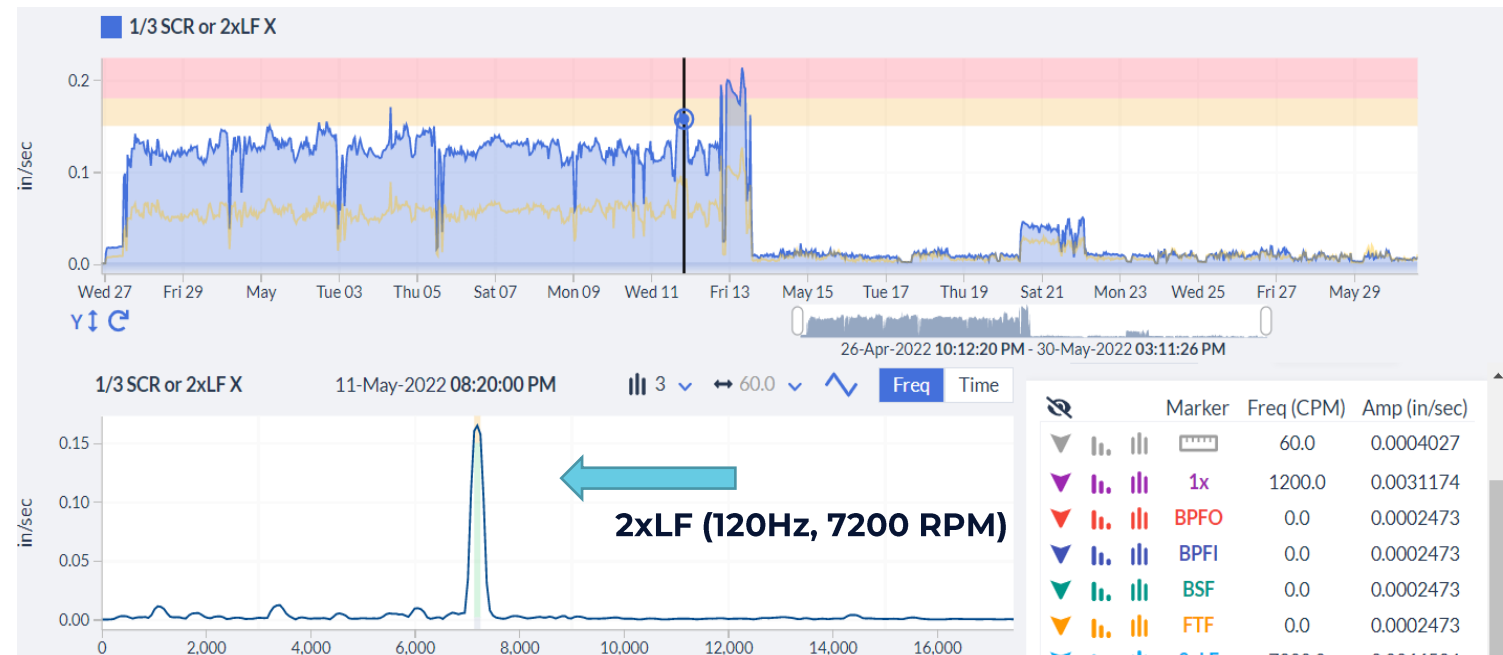
Frequency Spectrum:
- Faulty Firing Card / Blown Fuse
- 1/3 or 2/3 SCR will appear in FFT indicating power loss
- SCR = 6xLF (Full rectified)
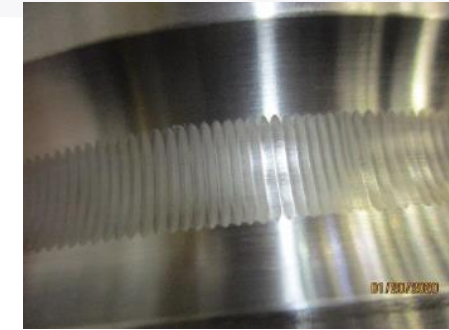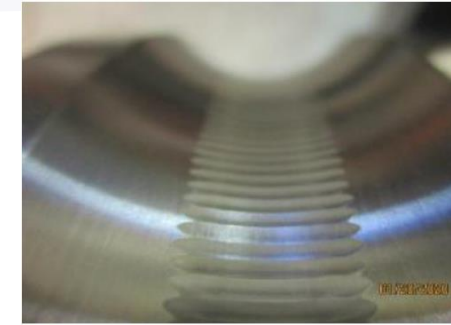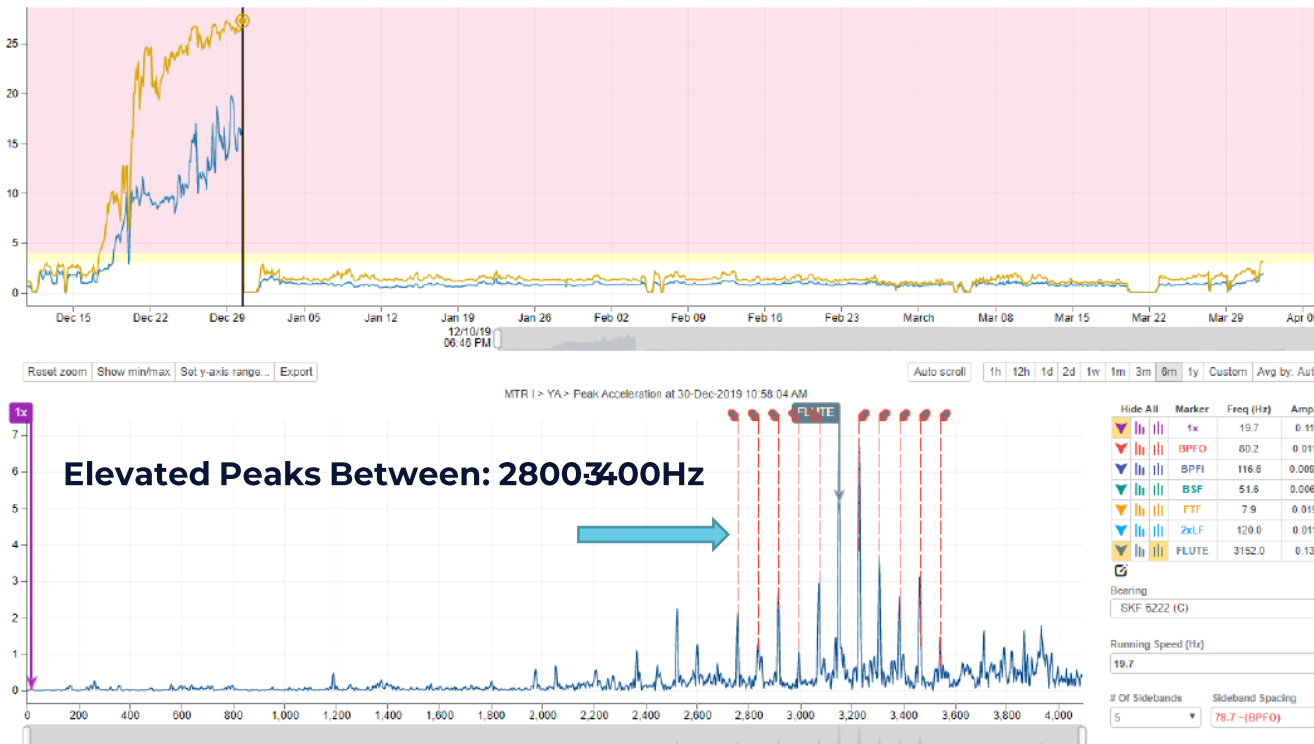- SCR = 3xLF (Half rectified)

Typical root causes
- Short circuit or breaker issue
- Damaged wiring
- Moisture build up

Recommendation
- Inspect fuse, wiring, and other electrical components

DC MOTOR

Fault Type 2: Fluting

Elevated Peaks Between: 2800-3400Hz

Trend:
- Elevated Peak Acceleration levels in both the X and Y axis. Over 7 times higher than industry standard.

Frequency Spectrum:
- Elevated peaks in the FFT typically between 1600 & 3000 Hz. The Peaks will typically be spaced by the BPFO frequency.

Typical root cause
- Caused by electrical current passing through the motor bearings. Common in DC motors.

Recommendation
- Inspect motor ratings. If applicable inspect VFD.
- Inspect Grounding points
    - Inspect VFD grounding
- Install grounding rings
- Install insulated bearings