FANS

Recirculation/Heat Transfer

Exhaust Fans

Industrial Blowers

RECIRCULATION/HEAT TRANSFER

Asset Overview:

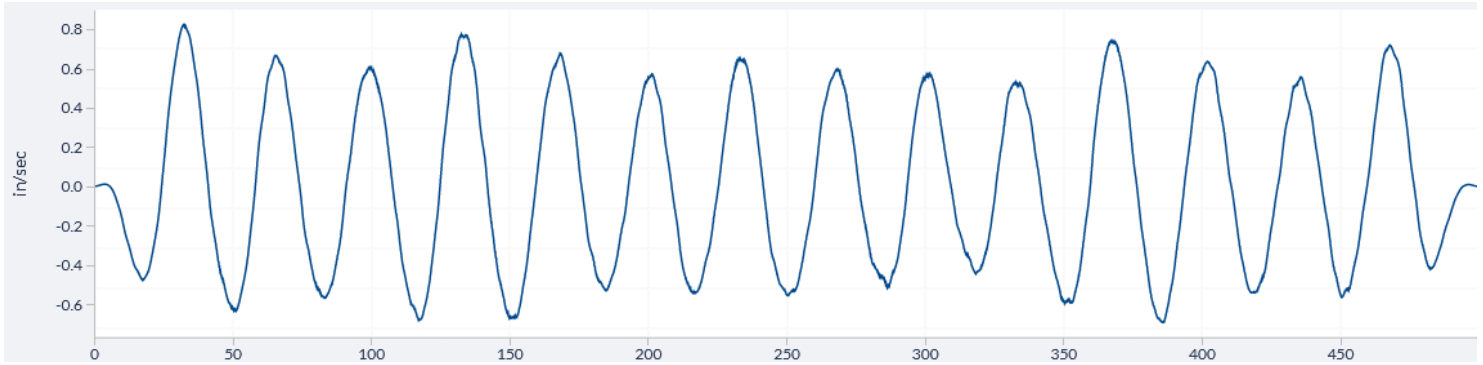
- Recirculation/Heat Transfer Fans are a way for industrial plants to circulating air as well as maintain air flow in certain applications.
- Heat transfer fans are often used to move warm air to/from areas, as the name implies (can also be used to cool air)

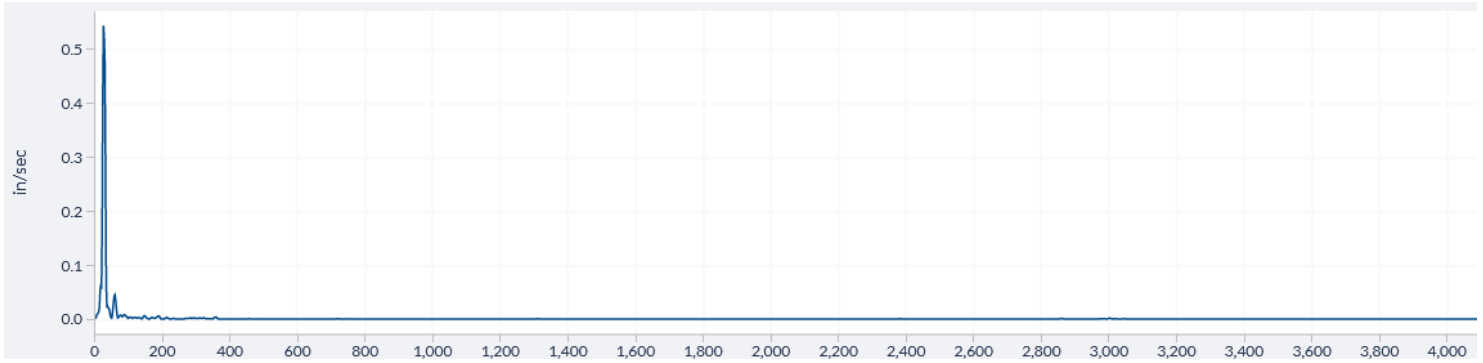
Common Failure Modes:

- Imbalance
- Misalignment
- Belt Issues

RECIRCULATION/HEAT TRANSFER

Fault Type 1: Imbalance





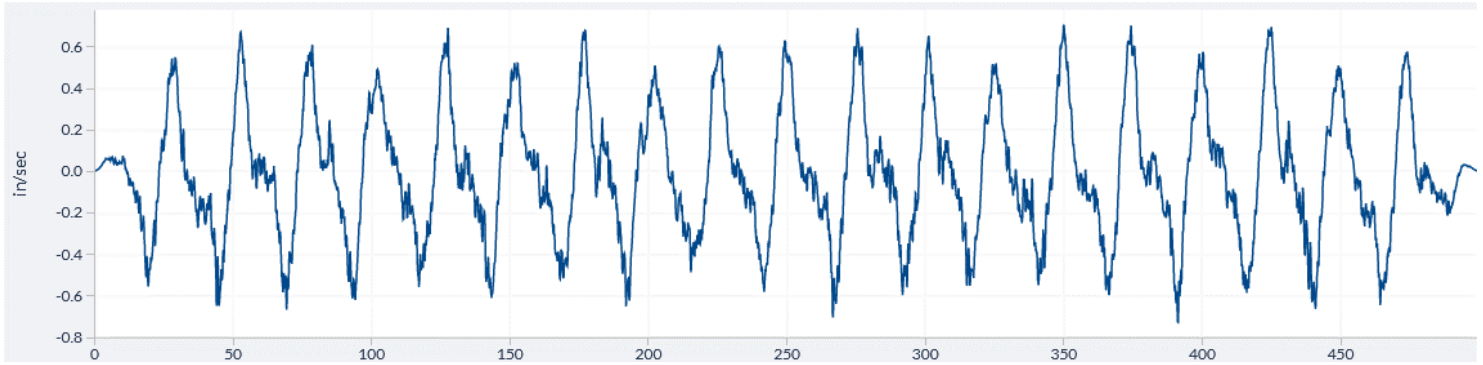
Time Waveform:
- Large Sine Wave in Peak Vel.

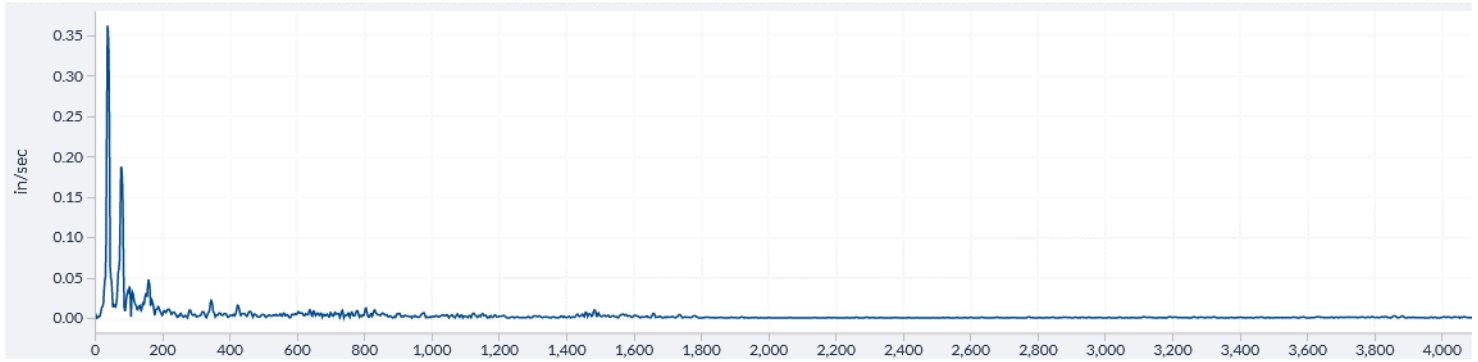
Frequency Spectrum:
- Single peak at running speed with excessive amplitude

Recommendations:
- Clean fan; balance asset

Possible Root Cause:
- Debris build-up; loss of balance weight; fan degradation

Fault Type 2: Misalignment





Time Waveform:

- "M's" and "W's" shape – two competing rotations

Frequency Spectrum:

- Harmonics at 2x & 3x of running speed

Recommendations:

- Laser alignment of shafts

Possible Root Cause:

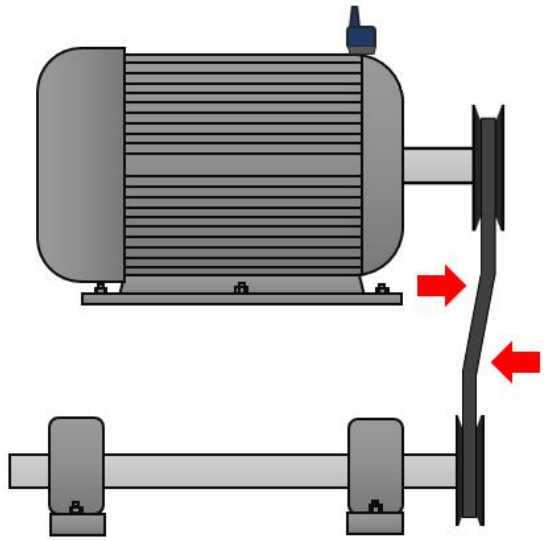
- Poor alignment to start; running with other faults for long time

RECIRCULATION/HEAT TRANSFER

Fault Type 3: Belts – Sheave Misalignment

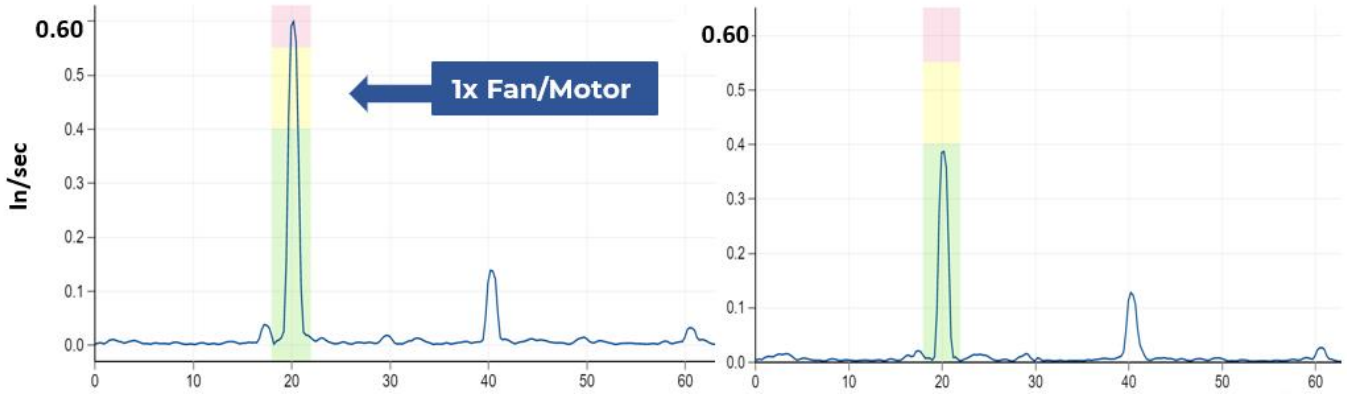
Sheave misalignment on belt-driven assets is a common failure mode that can lead to unplanned downtime and damage. Below is an example of how a KCF Sentry Analyst identifies sheave misalignment on a re-circulation blower, which then allows the analyst to notify the customer to avoid a failure and plan downtime for the maintenance required.

Frequency spectrum data shows high 1x peak in the axial direction indicating misalignment of the sheaves.



Before Alignment

After Alignment



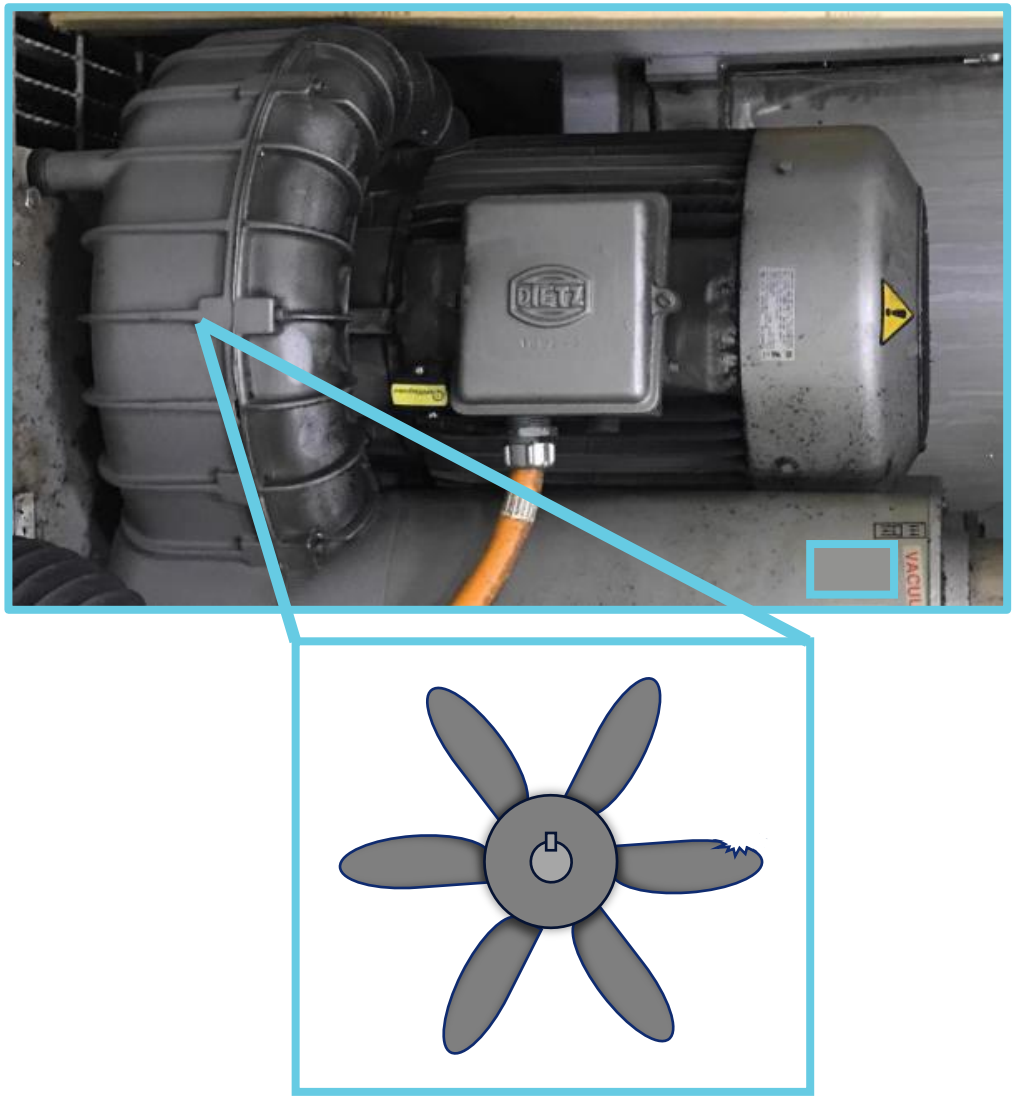
Root Cause:

- Improper installation and maintenance practices

Recommendations:

- Laser tools are best to use when aligning sheaves
- Laser tools correct horizontal and vertical angular misalignment

EXHAUST FANS



Asset Overview:

- As the name implies, exhaust fans are used to remove/expel gas in a process where air circulation is critical
- Exhaust fans are often paired with filtration units to help collect unwanted debris/contaminants from the air

Common Failure Modes:

- Imbalance
- Belt Issues
- Bearing Fault

EXHAUST FANS

Fault Type 1: Imbalance

Fan blades are often affected by buildup or wear during manufacturing processes. Below is an example of a fan that had become imbalanced, determined by the 1x harmonics shown below. When KCF alerted the customer, they were able to put in a work order and balance the fan. The trend then shows that the condition of the fan significantly improved, and unplanned downtime was avoided.

Time Waveform:
- Large Sine Wave in Peak Vel.

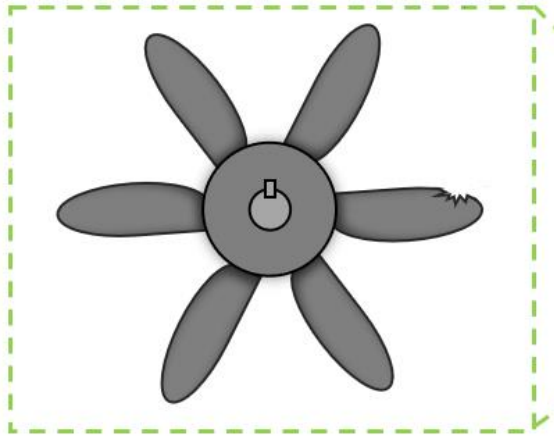
Recommendations:
- Clean fan; balance asset

Possible Root Cause:
- Debris build-up; loss of balance weight; fan degradation

Before Balancing

After Balancing

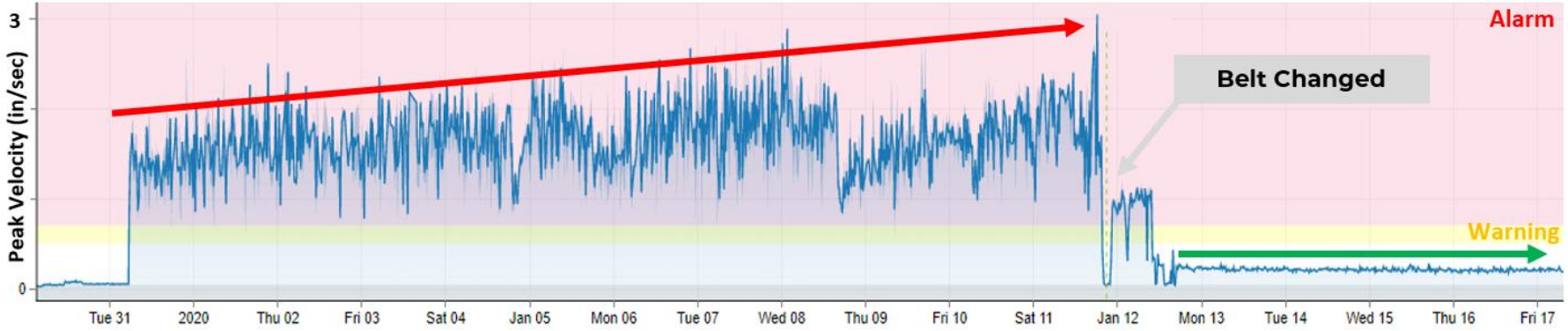
High 1x peak indicates **imbalance**



EXHAUST FANS

Fault Type 2: Belt Failure

Most automotive companies use belt-driven centrifugal fans for various applications within their shops. Due to their prevalence, an unplanned failure can have a major impact on production. For example, if a supply fan were to go down in a paint shop, production would have to be shut down due to the hazardous fumes. KCF's remote monitoring technology and SmartDiagnostics software allows for analysts to track vibrations in real time, and alert facilities to potential failures; actively preventing unplanned downtime.



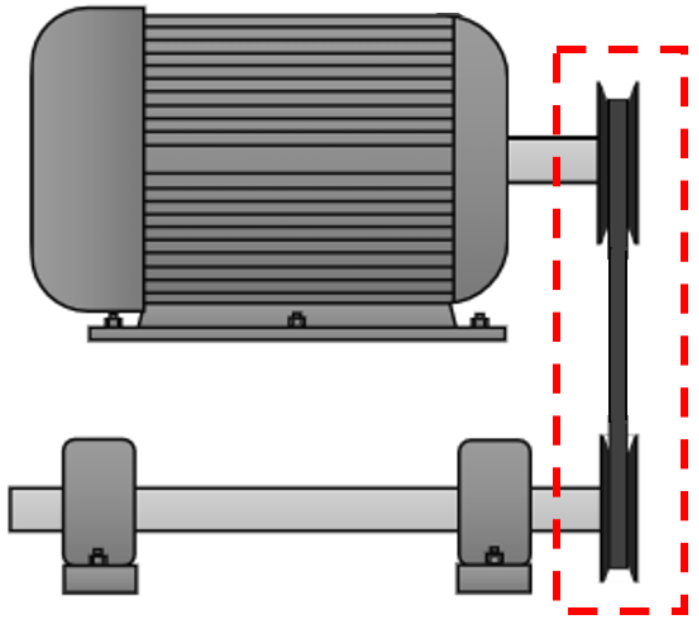
Alarm levels can be set to notify users of any changes in vibration **and** individual component fault frequencies.

Root Cause:

- Improper tensioning
- Wear and Tear
- Sheave misalignment
- Structural looseness
- Shaft unbalance on drive or driven equipment

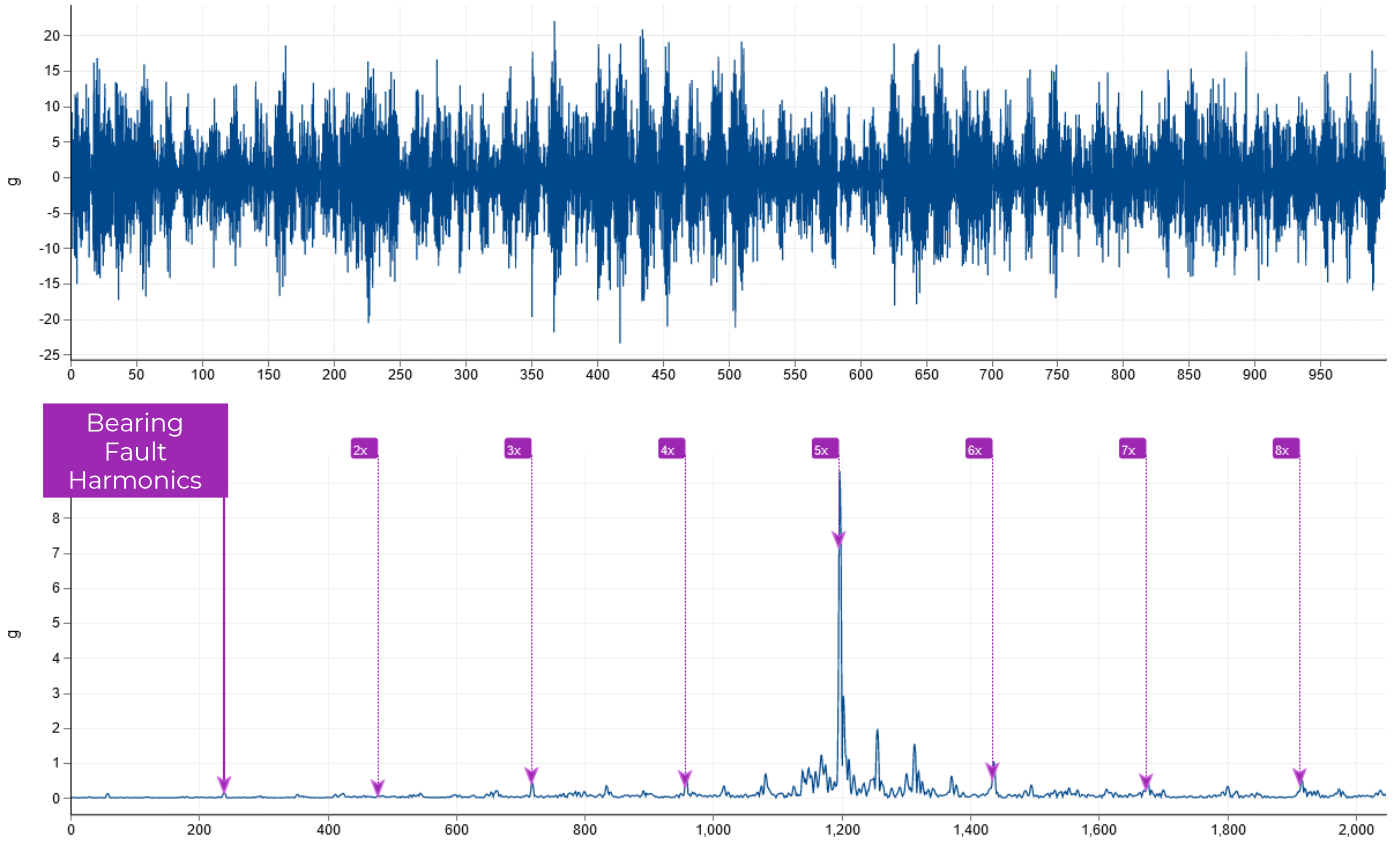
Recommendations:

- Re-tension belt
- Check alignment or sheaves
- Replace belt
- Ask: Do you use a laser alignment tool?



EXHAUST FANS

Fault Type 3: Bearings



Time Waveform:

- Sharp, non-synchronous impacting

Frequency Spectrum:

- High frequency noise; elevated noise floor in higher freq. range

Recommendations:

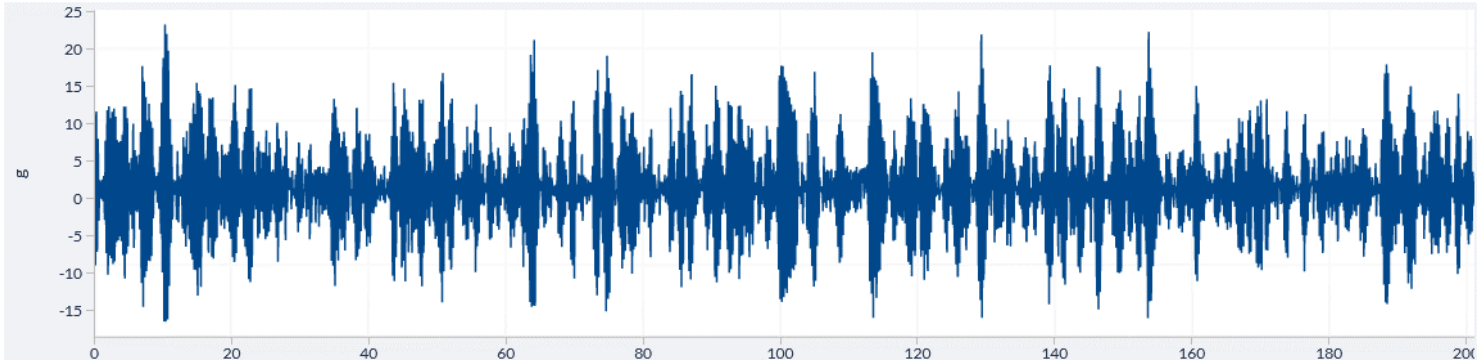
- Check lubrication levels; inspect bearing (audible noises); replace bearing

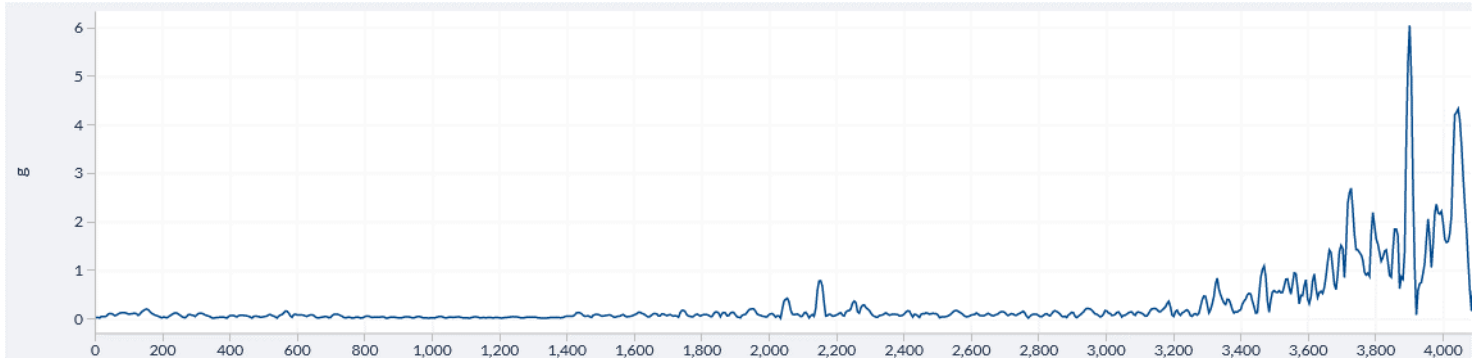
Possible Root Cause:

- Over/under lubrication; ingress of debris; electric discharge

EXHAUST FANS

Fault Type 3: Bearing (Bad Lubrication)





Time Waveform:

- Sharp, non-synchronous impacting

Frequency Spectrum:

- High frequency noise; elevated noise floor in higher freq. range

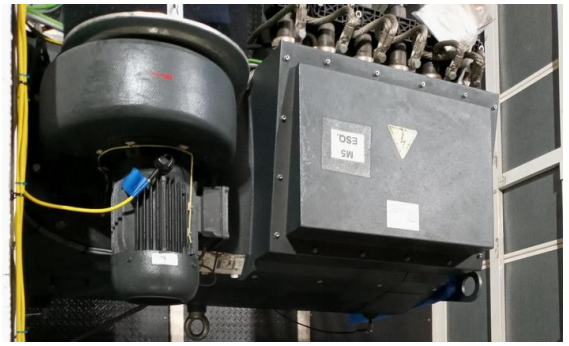
Recommendations:

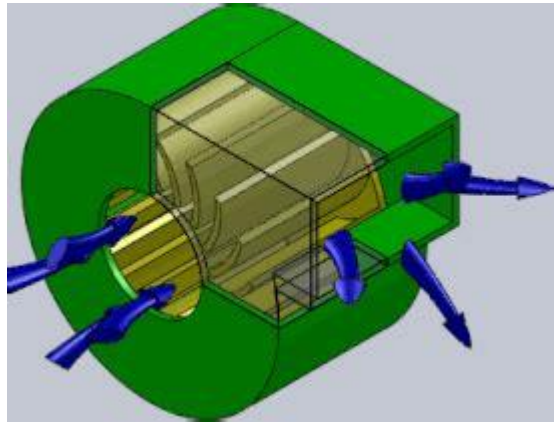
- Check lubrication levels; inspect bearing (audible noises); replace bearing

Possible Root Cause:

- Over/under lubrication; ingress of debris; wear & tear

INDUSTRIAL BLOWERS





Asset Overview:

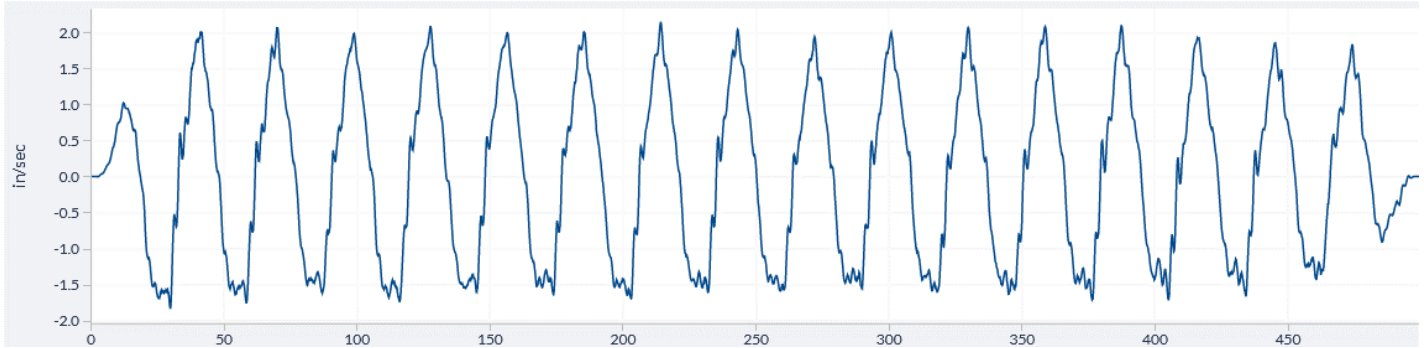
- Blowers are an effective way to circulate air thoroughly and increase pressure of a system when needed
- Most blowers will have an impeller inside used to move air – fans have blades
- According to ASME: A blower is a device with a pressure ratio between 1.11 and 1.2

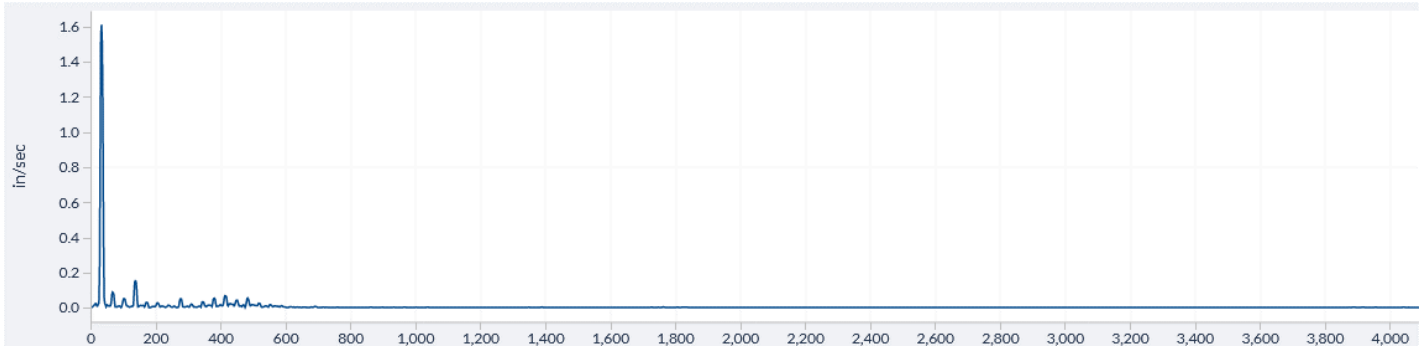
Common Failure Modes:

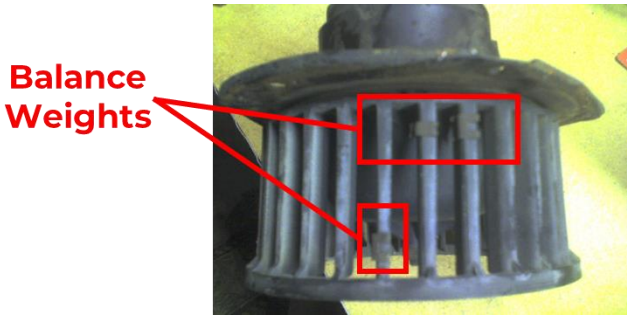
- Imbalance
- Bearing Fault
- Looseness

INDUSTRIAL BLOWERS

Fault Type 1: Imbalance







Time Waveform:
- Large Sine Wave in Peak Vel.

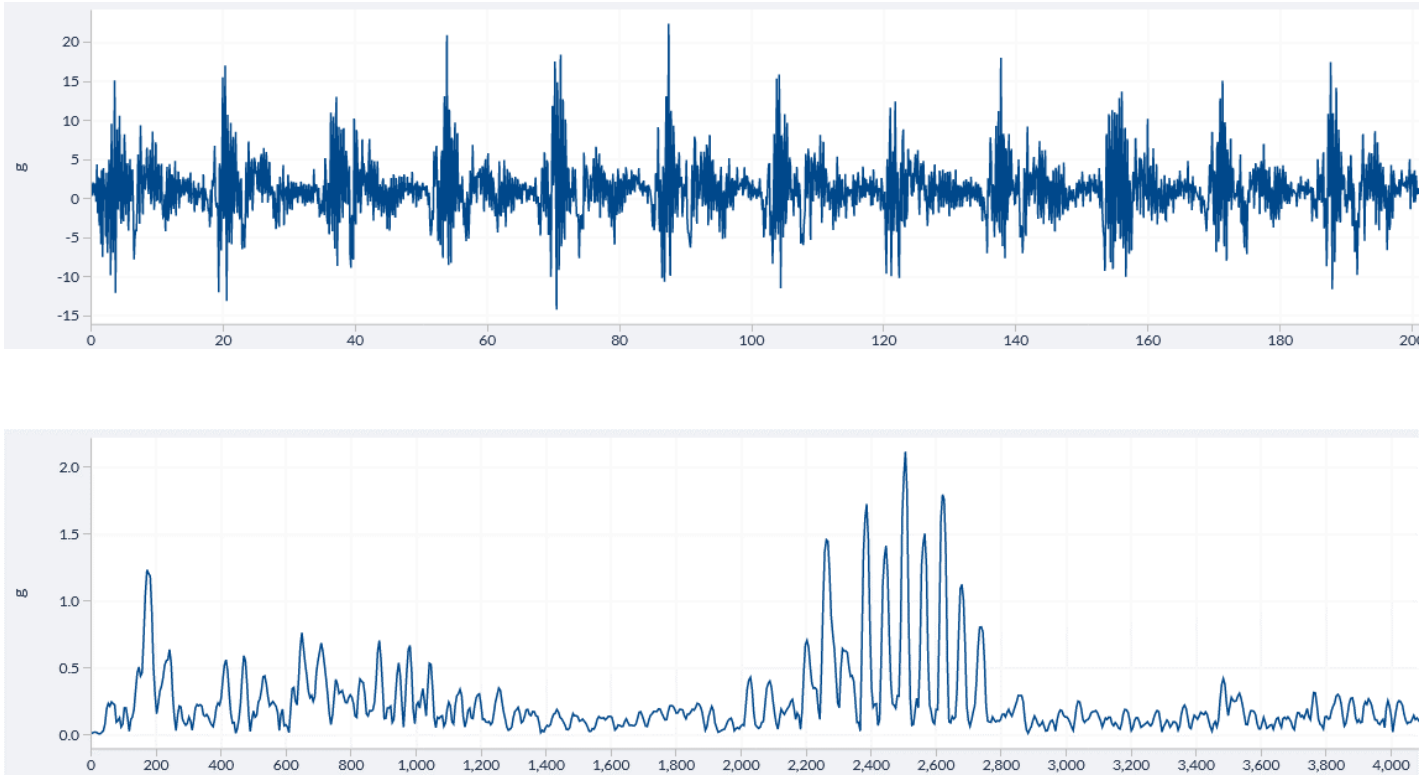
Frequency Spectrum:
- Single peak at running speed with excessive amplitude

Recommendations:
- Clean fan; balance asset

Possible Root Cause:
- Debris build-up; loss of balance weight; fan degradation

SMARTdiagnostics Link

Fault Type 2: Bearing Failure



Time Waveform:

- Sharp, non-synchronous impacting

Frequency Spectrum:

- High frequency noise; elevated noise floor in higher freq. range

Recommendations:

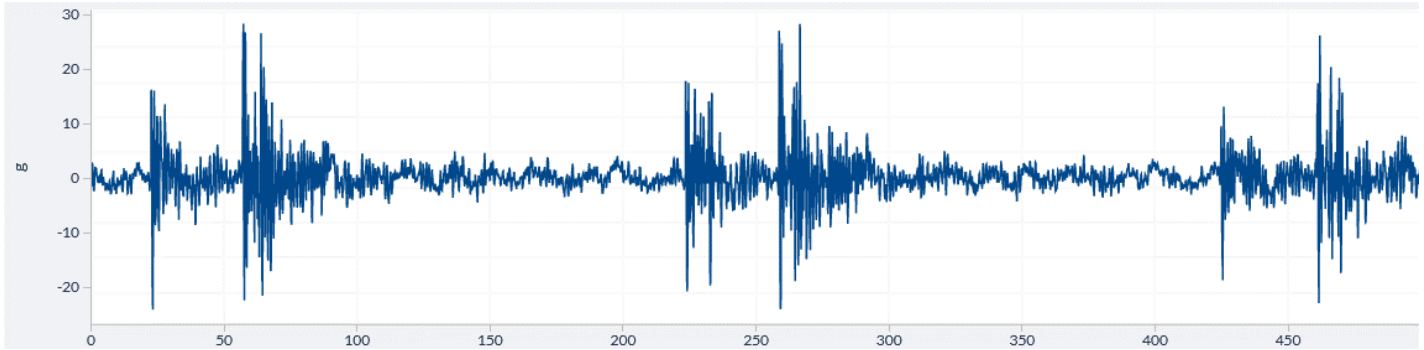
- Check lubrication levels; inspect bearing (audible noises); replace bearing

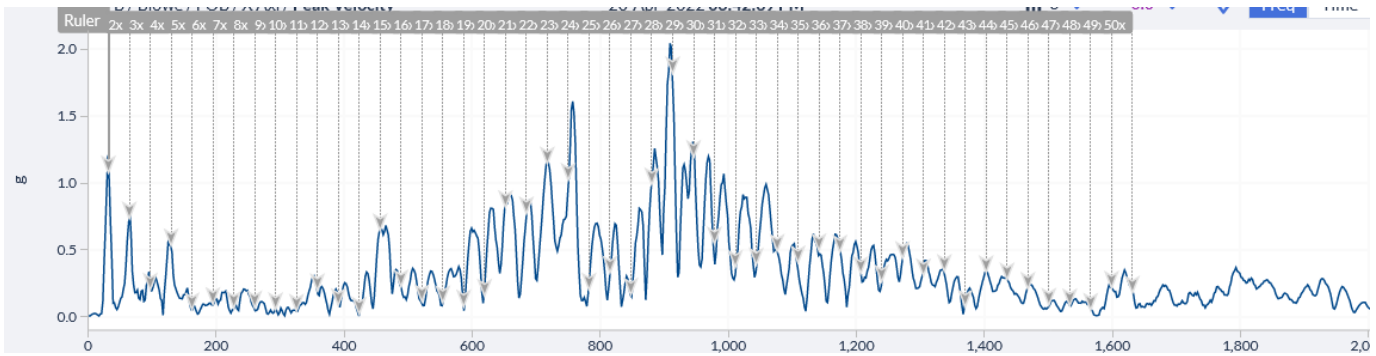
Possible Root Cause:

- Over/under lubrication; ingress of debris; electric discharge

INDUSTRIAL BLOWERS

Fault Type 3: Looseness





Time Waveform:

- Large Sine Wave in Peak Vel.; impacting in Peak Accl.

Frequency Spectrum:

- Single peak at running speed with excessive amplitude; harmonics of that peak

Recommendations:

- Inspect for loose components

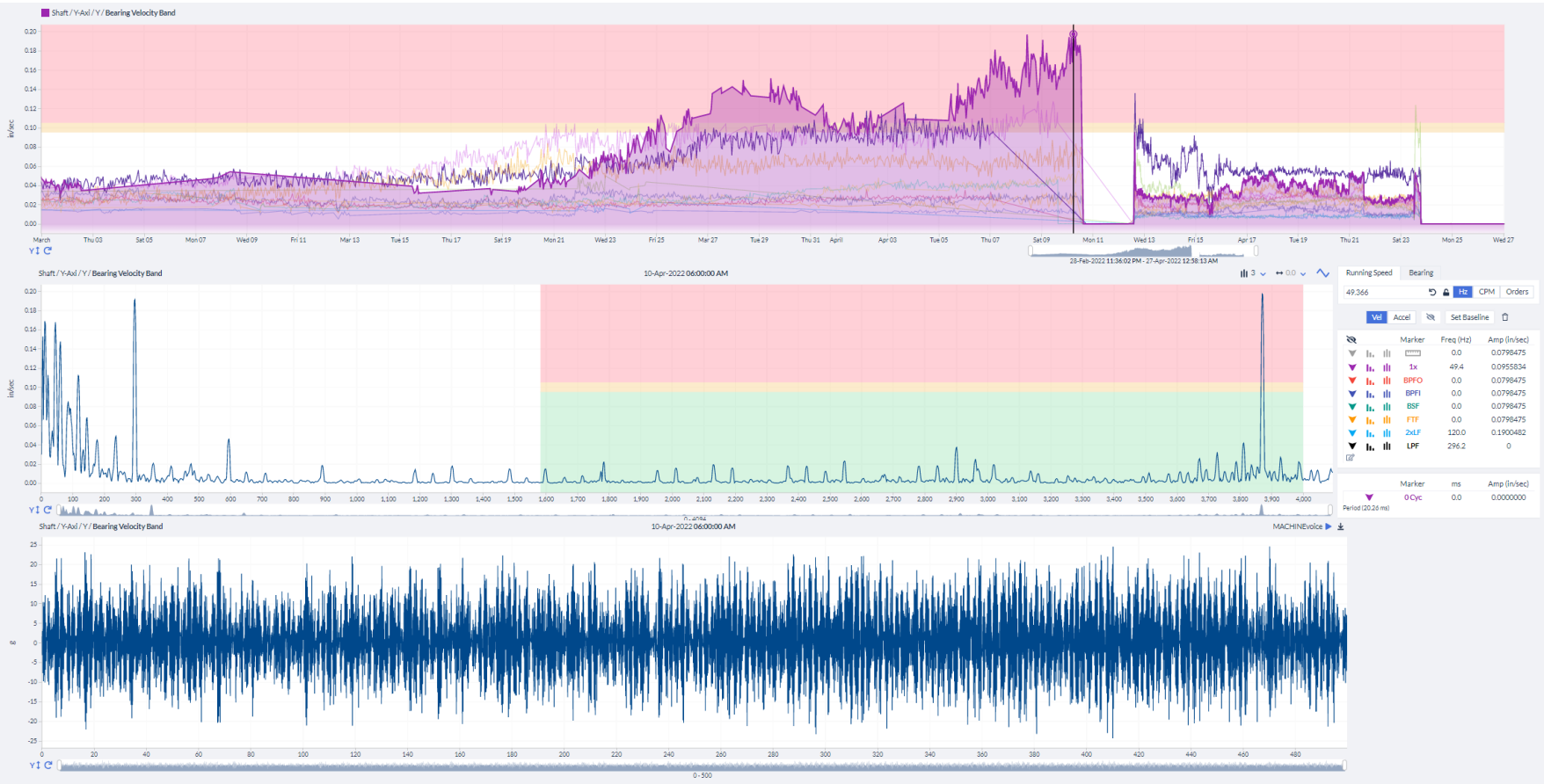
Possible Root Cause:

- Excess Vibration; improper install; wrong component

PSA: If you can spin something by hand - it's loose!

SCREW COMPRESSORS

Fault Type 1: Thrust Bearing Failure



Time Waveform:

- Spikes above 1.0 in/sec and impacts greater than 20g's

Frequency Spectrum:

- High frequency noise greater than 0.105 in/sec

Recommendations:

- Shut down compressor and replace thrust bearings

Root Cause:

- Improper loading of screw compressor can lead to back pressure against thrust bearing which is what causes the additional stress for failure

