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RELIABILITY IMPROVEMENT

VIBRATION ANALYSIS

CERTIFICATION PER ISO 18436

PRECISION MAINTENANCE

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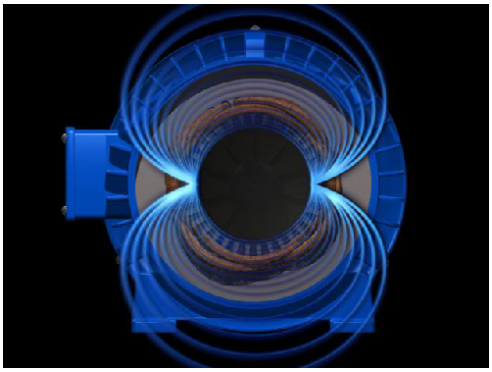
Destination DUBAI:
International Machine Vibration Analysis Conference – MIDDLE EAST
October 31 – November 3, 2016

VibrationMatters

The Vibration Analyst's Newsletter
Series 3, Issue 9 – March 2017

FEATURED LESSON

Electric Motor Analysis: Stator Problems



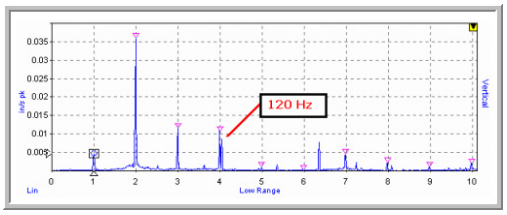
All electric motors are susceptible to unbalance; the rotor may bend or warp due to overheating; they may be misaligned with the component they are driving; and their bearings may begin to wear. These, and other faults conditions, are mechanical in nature and they can be diagnosed in ways well known to the vibration analyst.

However, electric motors develop unique fault conditions due to the electromechanical forces. If the rotor is off center, or the rotor rotates eccentrically; or the rotor bars or stator slots are cracked or broken, then the motor will generate a unique set of vibrations that can be detected.

Sources of Vibration in Electric Motors

Twice the line frequency (100 Hz or 120 Hz) is always a measurable vibration component in an electric motor. The magnetic attraction between the stator and rotor varies at this rate, and the iron itself changes dimension a little in the presence of the varying magnetic field due to "magnetostriction"*.

** Magnetostriction is a property of ferromagnetic materials that causes them to change their shape or dimensions during the process of magnetization).*



A peak at 2x the Line Frequency is near the 4x peak. 2x line frequency is common in electric motors.

FEATURED TRAINING VIDEO:

Where does the twice-line-frequency vibration peak come from?



Have you ever wondered where the twice-line-frequency peak (typically 120 Hz or 100 Hz) comes from in the spectrum? It can indicate a fault condition, and it can be confused with other fault conditions -- and it can mean absolutely nothing! In this presentation we hope to clarify two issues; why does the peak appear at twice the line frequency, and which faults are indicated by the appearance (or growth) in the peak at that frequency. In addition to understanding the origin of the twice-line-frequency peak, you will learn a little about magnetic fields and how three-phase induction motors work. As always we will use 3D animations and simulations to make the topic easy to understand (and interesting to view).

Length: 56 min

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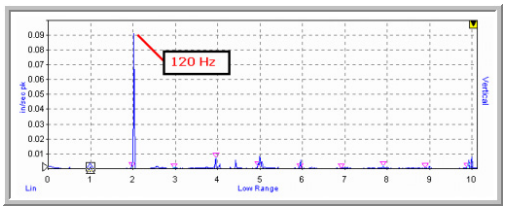
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In two-pole motors (synchronous speed of 3000 CPM or 3600 CPM), it is sometimes difficult to distinguish the 100 or 120 Hz (twice line frequency) peak from the 2X peak in the vibration spectrum. This is another good reason for collecting spectra with high resolution.

One test to verify the presence of a 2X peak instead of 100 or 120 Hz, is to take a measurement while the motor is running, and then cut power to the motor. The 100 or 120 Hz peak will disappear, whereas 2X will remain (as the motor drops in speed).

The 2x line frequency peak can dominate the spectrum and can be very strong and dominate the spectrum.



The 2x line frequency can dominate the spectrum. It is near the 2x peak.

Variable frequency drives

A variable frequency drive works in a similar way, however, instead of 50 Hz or 60 Hz line frequency, the voltage is supplied at a different frequency, thus controlling the motor speed.

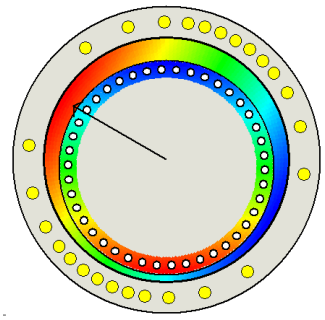
The 2xLF peak will still be present but it will appear at 2x whatever the actual line frequency is at the moment.

Stator Problems

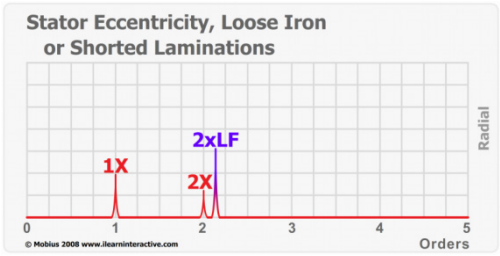
Stator problems will generate high vibration at twice the line frequency (100 or 120 Hz).

Static eccentricity

Static eccentricity produces an uneven stationary air gap between the rotor and stator that produces a very directional source of vibration. Instead of the magnetic forces being balanced between the rotor and stator, there will be very strong forces between the rotor and stator at the point where they are closest. 180 degrees away the force will be weakest because the rotor and stator will be furthest apart.



Because the magnetic forces rise and fall twice per electric cycle, we will see a high peak at 120 Hz or 100 Hz.



Stator problems

A case study

The following set of data demonstrates how a spectrum may appear when the rotor is not spinning in the center of the stator.

In the first set of data we could easily think that we had high 2X vibration:

STAY IN THE LOOP:

International Machine Vibration Analysis (IMVAC) BLOG



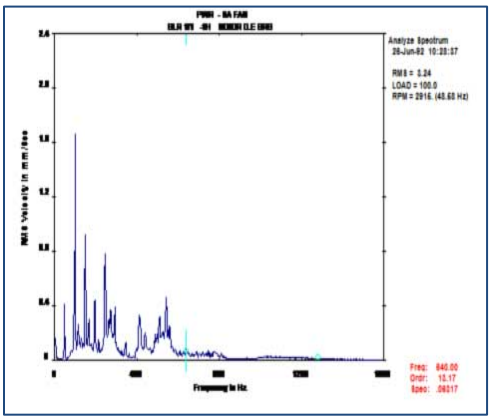
If you are interested in learning more about the International Machine Vibration Analysis Conference, bookmark the IMVAC Blog:

https://imvac.blogspot.com

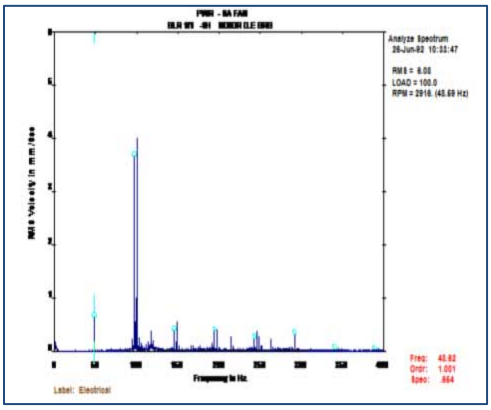
The blog highlights upcoming presentations, new technology and activities that will be held at the upcoming IMVAC conferences.

IMVAC INTERNATIONAL MACHINE VIBRATION ANALYSIS CONFERENCE

http://www.vibrationconference.com

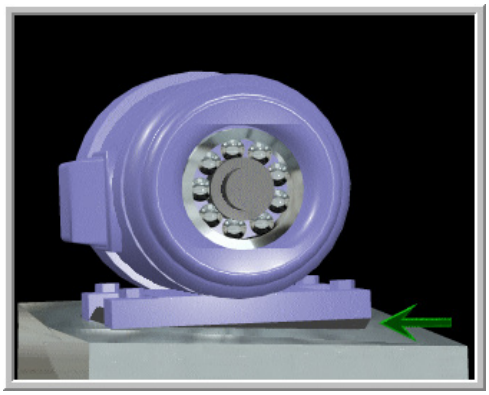


When we zoom in (or take a reading with higher resolution, it is apparent that there is in fact a 2X peak and a twice line frequency peak.



Soft Foot

Soft foot and warped bases can produce an eccentric stator. Altering the tension on the hold down bolts, correctly shimming the feet, reducing stress from conduit or piping, or repairing the foundation can resolve this problem.



Soft foot causes stator eccentricity

The vibration will again have a large peak at 120 Hz or 100 Hz. Depending upon the shape of the stator, it may be that there are two points where the vibration is highest – the two locations where the stator is closest to the rotor.

Any time you have static eccentricity or a soft foot problem, you may also hear a beating sound when testing the motor, especially on 2-pole motors. The beating comes from the interplay between the 2X vibration and the 2xLF vibration. The period of the beat will correspond to the slip frequency.

In our next issue of Vibration Matters, we will take a look at electric motor ***Rotor Problems*** that can be identified using vibration analysis.

Condition Monitoring: **the Foundation of Plant Reliability**



Reliable plants understand that successful reliability initiatives are built on a foundation of effective equipment Condition Monitoring (CM) programs. Without the insight provided by CM, it becomes much more challenging to assess failure modes, root causes of failure, and to anticipate time-to-failure. Additionally CM is necessary to perform acceptance testing and support of precision and proactive maintenance activities. Without an effective CM program and insight into equipment operating life-cycle, RFCA, risk, scheduling, and continuous improvement

IN THE NEWS:

Mobius Institute Announces the Expansion of its Scholarship Program in 2017

Mobius Institute expands its International Scholarship program four-fold with quarterly awards provided to worthy candidates wanting to become qualified vibration analysts.

BAINBRIDGE ISLAND, Wash.--(BUSINESS WIRE)--Mobius Institute, the premier provider of reliability improvement, vibration analysis and precision maintenance courses and training products, in cooperation with the International Machine Vibration Analysis Conference (IMVAC) today announced the expansion of the Mobius Institute Scholarship Program, from three awards per year to 12 awards in 2017.

Read the full press release >

MOBIUS INSTITUTE INTERNATIONAL SCHOLARSHIP

becomes more difficult. For these reasons, smart companies establish effective CM programs using vibration analysis, oil analysis, infrared thermography, ultrasound analysis and other technologies ahead of diving into reliability improvement activities.

In addition to purchasing CM equipment and training, managers need a good understanding of the benefits and limitations of each technology, and where and how to apply them. While each technology supplier provides some level of training, there are few resources that put each into perspective, and how they fit into the overall reliability improvement picture. In reality, suppliers often put more weight into the importance of their own technology and not in a respective sense with all technologies that are needed to make up a proper CM program.

Mobius Institute recognized this issue and as a strong proponent of CM "education and awareness" serves as a foundation of reliability improvement success, created a new e-Learning product to help plants establish quality CM programs. Known as **iLearnReliability [Condition Monitoring]**, it includes over thirty training modules covering program management, CM awareness training for operators and maintenance personnel, and comprehensive skills training for plant technicians. It ensures that everyone in the CM group can do their job to their greatest potential, but it can be used to educate others in the plant, to demystify the technologies and explain why CM is so important.



To watch our iLearnReliability[Condition Monitoring] overview video, click on the image above or click here.

For more information about iLearnReliability [Condition Monitoring] click here to find it on our website.

- ✓ If you have questions to ask, contact us by:
- ✓ Email: learn@mobiusinstitute.com
  Tel: (+1) 615-216-4811 (GMT -5)



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The International Machine Vibration Analysis Conference ™ (IMVAC) is a professional conference that focuses on increasing the analyst's critical skills and knowledge, the related condition monitoring technologies, precision maintenance techniques, program management and reliability improvement strategy.





CALL US 1 (615) 216-4811
EVENT INFO Becky Partipilo - ext. 5 becky.partipilo@vibrationconference.com
EXHIBITION SALES Kaitie Conly - ext. 3 kaitie.conly@vibrationconference.com
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Upcoming Vibration Analyst Certification Courses

Course	Location	Start Date	Duration		
Vibration Analysis ISO Category II: Intermediate	Dungun, MY	3/19/2017	4.5 days		Details
Vibration Analysis ISO Category I: Basic	Al Khobar, SA	3/19/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Tihange, BE	3/20/2017	3 days		Details
Vibration Analysis ISO Category II: Intermediate	Hyderabad, IN	3/20/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	Couva, TT	3/20/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Miami, FL, US	3/20/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	Belo Horizonte, BR	3/21/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Senlis, FR	3/21/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	SENLIS, FR	3/21/2017	4 days		Details

Vibration Analysis ISO Category I: Basic	Nairobi, KE	3/21/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	seoul, KR	3/21/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Lahore, PK	3/22/2017	3 days		Details
Vibration Analysis ISO Category III: Advanced	Bucaramanga, CO	3/27/2017	6 days		Details
Vibration Analysis ISO Category II: Intermediate	SENLIS, FR	3/27/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	SENLIS, FR	3/27/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Wrocław, PL	3/27/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Johannesburg, ZA	3/27/2017	5 days		Details
Vibration Analysis ISO Category IV Part 2: Master	Roodepoort, Gauteng, ZA	3/27/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	Edmonton, AB, CA	3/28/2017	4 days		Details
AMT01 ALIGNEMENT LASER Niveau UTILISATEUR à MULHOUSE	MULHOUSE, FR	3/28/2017	2 days		Details
AMT02 ALIGNEMENT LASER Niveau EXPERT à MULHOUSE	MULHOUSE, FR	3/30/2017	1 days		Details
Vibration Analysis ISO Category II: Intermediate	Nasr City, EG	4/2/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Melbourne, AU	4/3/2017	4.5 days		Details
Vibration Analysis ISO Category I: Basic	Jakarta, ID	4/3/2017	3.5 days		Details
Vibration Analysis ISO Category I: Basic	Jakarta , ID	4/3/2017	4 days		Details
Vibration Analysis ISO Category II: Intermediate	Jakarta , ID	4/3/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	Singapore, SG	4/3/2017	4.5 days		Details
Vibration Analysis ISO Category I: Basic	Beirut, LB	4/9/2017	4 days		Details
Vibration Analysis ISO Category III: Advanced	Dungun, MY	4/9/2017	4.5 days		Details
Vibration Analysis ISO Category II: Intermediate	HEFEI, CN	4/10/2017	4.5 days		Details
Vibration Analysis ISO Category II: Intermediate	seoul, KR	4/10/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	Kuala Lumpur, MY	4/10/2017	3.5 days		Details
Vibration Analysis ISO Category I: Basic	Petrovaradin, RS	4/10/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	ISTANBUL , TR	4/10/2017	4 days		Details
Vibration Analysis ISO Category III: Advanced	Al Khobar, SA	4/16/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Shanghai, CN	4/17/2017	5 days		Details

Vibration Analysis ISO Category I: Basic	Lima, PE	4/17/2017	3 days		Details
Vibration Analysis ISO Category II: Intermediate	Petrovaradin, RS	4/17/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	Vienna, AT	4/24/2017	4 days		Details
Vibration Analysis ISO Category II: Intermediate	Edmonton, AB, CA	4/24/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Ismaning, DE	4/24/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	CASABLANCA MOROCCO, MA	4/24/2017	4 days		Details
Vibration Analysis ISO Category II: Intermediate	Oslo, NO	4/24/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Lima, PE	4/24/2017	4 days		Details
Vibration Analysis ISO Category II: Intermediate	Lahore, PK	4/26/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Ismaning, DE	4/28/2017	1 days		Details
Vibration Analysis ISO Category I: Basic	Montreal, QC, CA	5/1/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Hobart, AU	5/2/2017	3.5 days		Details
Vibration Analysis ISO Category III: Advanced	Nasr City, EG	5/7/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Beirut, LB	5/7/2017	5 days		Details
Vibration Analysis ISO Category II: Intermediate	Bucaramanga, CO	5/8/2017	6 days		Details
Vibration Analysis ISO Category I: Basic	Middelfart, DK	5/8/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Madrid, ES	5/8/2017	5 days		Details
In-Field Balancing May 2017	Johannesburg, ZA	5/8/2017	2 days		Details
Vibration Analysis ISO Category II: Intermediate	Johannesburg, ZA	5/8/2017	5 days		Details
Vibration Analysis ISO Category I: Basic	Melbourne, AU	5/9/2017	3.5 days		Details
Vibration Analysis ISO Category I: Basic	Fabriano (Ancona), IT	5/9/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Gothenburg, SE	5/9/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Lymm, Cheshire, UK	5/9/2017	4 days		Details
Vibration Analysis ISO Category I: Basic	Dallas, TX, US	5/9/2017	4 days		Details
Shaft Alignment May 2017	Johannesburg, ZA	5/10/2017	2 days		Details
Vibration Analysis ISO Category II: Intermediate	Dungun, MY	5/14/2017	4.5 days		Details

See more courses listed on the Mobius Institute website by clicking here.