

APPLICATION NOTE

# Top 5 questions all technicians should ask for more machine uptime

In today's competitive business environment, you don't have the time and resources to analyze every machine from the ground up. There is no time for analyzing endless graphs or meaningless data – you need to quickly and efficiently diagnose the fault that will return the machine to full capacity before production is lost.

Below are the most common questions you should be asking, and the Fluke solutions, tactics, and tools for the job.



## 1

### Why do I keep replacing the same bearings and seals?

Many teams find themselves performing the same repair time after time. A machine fails, so an electrician replaces the motor bearings and a mechanic replaces the pump bearings. A few months later, the machine fails again and the bearings are replaced again. Worn bearings and seals that need replacement are just the symptom of the problem that never reveals its root cause. There are ways of preventing the constant need to change them out.


Recent studies have shown that **up to 50% of damage to rotating machinery is directly related to misalignment**. Most people ignore it and simply replace the bearings and seals over and over, instead of aligning the machine. You could be losing thousands of dollars per year in replacement bearings and wasting hours of necessary repair time.

It is often thought that flexible couplings make up for misalignment, but they simply transfer the forces to the bearings and seals causing rapid wear and failure. In the past, shaft alignment has been found to be difficult, time consuming, or the work sent out to third party alignment partners. Fluke has a solution: the Fluke 830 Laser Shaft Alignment Tool allows you to perform quick, step-by-step precise alignment on the majority of your facility's machines, instead of just the critical few, with just one tool.

Fluke's 810 Vibration Tester diagnoses all of the common faults that exist (see report on next page). Don't just replace the bearings and return the machine to service if another fault exists even if the fault is not extreme and not changing. Other low-level machine faults (imbalance, misalignment, and looseness) can all cause forces on bearings, couplings and seals that would cause them to wear much faster. If your bearings are failing prematurely, you might want to look at other low-level faults in your machine before replacement.



Drive Train



**Diagnosis**

Fault description	Fault severity	Severity Score	Severity Scale
Parallel Misalignment	Serious	58/100	
Motor Drive End Journal Wear Or Looseness	Moderate	45/100	
Non-standard Fault Detected	Moderate	43/100	
Motor Free End Journal Wear Or Looseness	Moderate	31/100	

**Recommendations**

Recommendations	Priority	Priority Description
Monitor For Increased Vibration	2	Desirable

**2**

**How do I find faults on most of my machines?**

If you have a cold or flu, you don't see a surgeon or a specialist, you see a general practice doctor for most common ailments. Only after the general practice doctor is stumped would you get referred to a specialist or a surgeon. Just like a good doctor, a good technician will always start with the easy and common faults. The same holds true with most rotating machinery—there is no need to call in a vibration expert with an analyzer to start troubleshooting from the ground up: checking for resonances, then foundation problems, then process and environment, then machine faults.

Today's vibration testers give you another option – take a quick measurement and get an automatic diagnostic report of the four most common machine faults. Screen out the most common faults first, then ask for help only if it isn't one of the most common faults - which is 90 % of the time. The obvious have been eliminated. Start with the most obvious problems that are easy to fix and then call in the specialist only if it turns out to be something else.

**3**

**What tools should I have?**

Some teams choose one technology and just measure everything they can. A better method would be to focus on the most likely failure modes, and then match the best tool to the most likely problems. Vibration analysis remains the first line of defense for diagnosing the most common faults with rotating machines.

For the past 30 years, there have only been two choices for vibration measurement: the high end analyzer and the simple

vibration pen. The analyzer provides detailed waveforms but requires experienced analysts to read them. The pen provides a simple number but has high variation, based on how the measurement is taken, and provides no additional context to understand if the measured value is good or not.

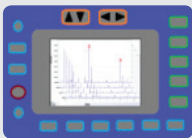
Now, Fluke offers two new categories of vibration test tools to help mainstream technicians fill the void between complex vibration analysis and simplistic pens. This puts vibration diagnostic tools in your hands, empowering you to find faults with the machines you work with day in and day out.

First, use the **screening tool** (Fluke 805 FC Vibration Meter) to identify which machines are healthy and which have potential problems.

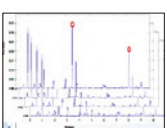
Next, use the **automated tester** (Fluke 810 Vibration Tester) to diagnose the most common machine faults, severity, and recommendation.

**Then**

**1 High-end vibration analyzer**




Detailed waveform—requires experienced interpretation



Simple number—  
not much information

0.20 in/sec

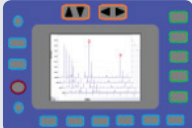
**2 Low-end vibration pen**



---

**Now**


**1 High-end vibration analyzer**



- Full featured tools allow users to perform deep, detailed analysis
- Advanced training and experience required


**2 Automated vibration tester**

Fluke has created two new product categories for the mainstream technician




- Fully automated machine condition answers
- Lower upfront costs, resources, and training
- Easy to use

**3 Vibration screening tool**

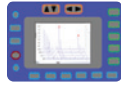
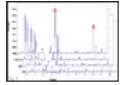



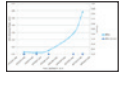


- 5 tools in 1—overall vibration, bearing impacting, IR temperature, machine health, bearing health
- Fast machine condition screening

**4 Vibration pen**



- Provides overall vibration number only

	Rotating equipment in a typical plant	Equipment types	Recommended vibration testing device	Data generated
Top <10% Production critical	<ul style="list-style-type: none"> <li>• Complex system</li> <li>• Reliability team</li> <li>• Data collector and analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Turbine generators</li> <li>• Diesel generators</li> <li>• Paper machines</li> <li>• Machine tools</li> </ul>	Vibration analyzer 	Manual data analysis 
Middle 60% Vital/important	<ul style="list-style-type: none"> <li>• Costly repairs</li> <li>• Basic machines—few variables</li> <li>• No support from reliability groups</li> <li>• Maintenance staff too busy running the plant</li> </ul>	<ul style="list-style-type: none"> <li>• Motors</li> <li>• Pumps</li> <li>• Fans</li> <li>• Blowers</li> <li>• Compressors</li> <li>• Spindles</li> <li>• Gearboxes</li> <li>• Belts</li> </ul>	Vibration tester 	Automated diagnosis, fault severity and recommendation 
Bottom 30% low priority	Non-vital—expendable		Vibration meter 	Automated pre-screening 

Finally, refer “any few” remaining complex faults “(less than 10% of faults)” to an expert consultant with an **analyzer**.

In order to get the right tools in the right hands, it helps to think of your machines in order of production critical assets, their types, and complexity.

These next paragraphs all refer to the machine pyramid chart above.

**The few complex machines at the top level** of the machine pyramid (above) have many variables and require a vibration expert to compare, trend, analyze and diagnose the machine. The expert relies on years of training and experience to learn how to evaluate variables. On the upper right of the chart, see how complex the waterfall trends and manual data analysis looks.

**Most of the remaining machines** in the plant (more than 90%) are mainstream machines—motors, pumps, fans, compressors and blowers that can effectively be diagnosed using automated diagnostic programs. The vibration tester (on the middle level) uses a database of real-world patterns developed over 30 years of analyzing machines. On the center right, see that an automated diagnostic tester provides machine faults and severity, along with a repair recommendation.

**At the bottom level of the pyramid**, the small and expendable machines that would typically be ignored can now be screened by trending overall

vibration levels and using built-in machine health severity scales to indicate when it’s time to call in more advanced tools. On the bottom right see the trend of the data from the vibration meter.

## 4

### When do I call in a vibration expert?

Vibration experts have been using vibration analyzers for many years, but the automated vibration tester simplifies things so that you can learn to use a vibration tester to diagnose the more common faults on the standard machines in the plant (typically 90% of machines).

Over a period of 30 years, a team of vibration experts learned that most groups of machines can be set up the same way and these default settings are designed into the vibration tester. This team of experts analyzed hundreds of thousands of machines - the database of normal baseline signatures, fault patterns and diagnostic rules are built into the vibration tester.

The vibration tester was not designed to replace the vibration expert, but to compliment the in-house program or consultant. Focus the in-house expert or consultant on the few complex machines you can’t diagnose and you can use the vibration tester on your rounds to look at the vast majority of standard machines.

5

**I have successfully diagnosed some machine faults, what now?**

When troubleshooting a car that won't start, you wouldn't begin by tearing into the fuel injectors, checking the motor mounts, draining the gas tank, or analyzing the gas. Instead, you would check the most common causes and the ones that you can actually do something about – battery status, fuel level, and possibly air or fuel filters. If you can fix your car yourself, you don't need to spend the time and money going to the repair shop. If you can't fix it yourself, you take your car to a specialist to investigate deeper issues, but at least the most common causes have been eliminated and the expert knows what not to try.

**Reality check**

Just because your machine is making noise doesn't mean that you should find high vibration.

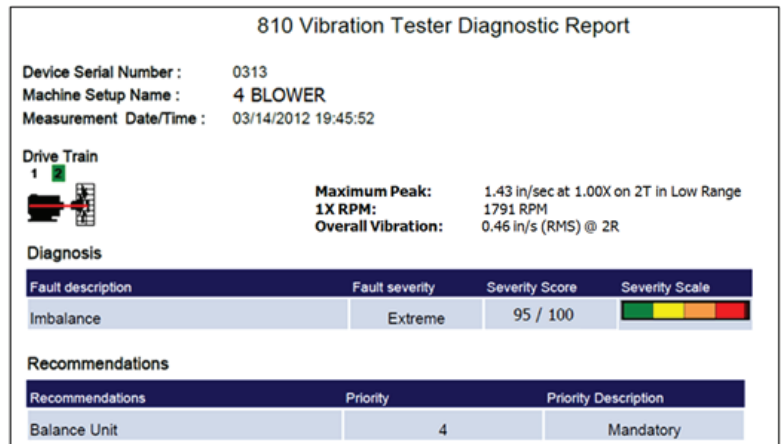
- Noise is outside the machine and vibration is inside – sometimes the noise is not at a frequency measured with vibration.

Just because the vibration measurements have increased doesn't mean the machine has a fault.

- Rotating machines are dynamic – sometimes the vibration increases due to another machine nearby, a change in the operation or process, the foundation, the environment, or some other source that is not related to a mechanical fault.

Just because the machine has faults doesn't mean it is time for repair action.

- A vibration tester can find machine faults even in the earliest stages long before it is time to repair the machine. Not only does it report all of the faults, but also the fault severity and recommendation on whether you should act now or wait.



- Act on the recommendation, instead of reacting to the fault (see report above)
- Here is a simple guide to follow:

**Slight** – No action

**Moderate** – Monitor for increased vibration (no repair yet)

**Serious** – Schedule repair for next outage (no repair yet)

**Extreme** – repair immediately to avoid catastrophic failure and production loss

**Fluke.** Keeping your world up and running.®

**Fluke Corporation**  
 PO Box 9090, Everett, WA 98206 U.S.A.

**Fluke Europe B.V.**  
 PO Box 1186, 5602 BD  
 Eindhoven, The Netherlands

**For more information call:**  
 In the U.S.A. (800) 443-5853 or  
 Fax (425) 446-5116  
 In Europe/M-East/Africa +31 (0) 40 2675 200 or  
 Fax +31 (0) 40 2675 222  
 In Canada (800)-36-FLUKE or  
 Fax (905) 890-6866  
 From other countries +1 (425) 446-5500 or  
 Fax +1 (425) 446-5116  
 Web access: <http://www.fluke.com>

©2017 Fluke Corporation.  
 Specifications subject to change without notice.  
 Printed in U.S.A. 3/2017 6009133a\_en

**Modification of this document is not permitted without written permission from Fluke Corporation.**