

SHAFT ALIGNMENT:

Where do I start, and what is the benefit?

Why precision alignment?

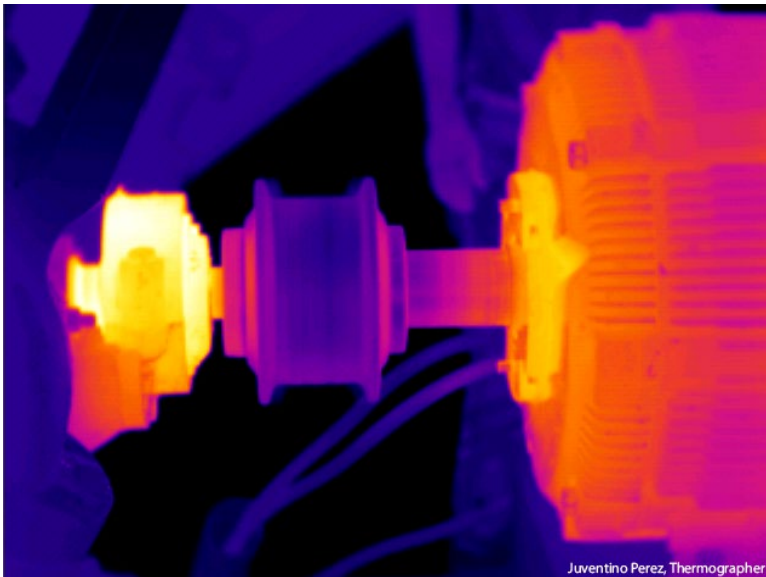
- Reduce your energy consumption
- Fewer failures of seals, couplings and bearings
- Lower temperatures of bearings and coupling
- Lower vibration levels—that result in fewer mechanical faults
- No shaft cracking or failures
- No loose foundation bolts



Asset uptime begins with precision shaft alignment

Misalignment in rotating machines can cause a number of problems from production losses to unplanned downtime to increased maintenance costs. These can all be significantly reduced when machines are correctly aligned during installation and properly maintained over time. Laser shaft alignment increases machine life, protects asset availability, and can increase production quality and machine performance because vibration levels are at their lowest.

Misaligned machines cause higher reaction forces in the coupling which leads to heat and wear in couplings, seals and bearings. Identifying this excess heat is often the first step in diagnosing misalignment. The effects of the heat due to misaligned shafts can be seen in the infrared thermography image below.



1. When machines are misaligned the flexible couplings begin to heat up and the machine operates at higher temperature, especially around the bearings.
2. High reaction forces and faults that lead to asset failure and production losses are drastically reduced after performing a precision alignment.

Why does precision shaft alignment matter?

Customers in any industry can benefit from precision shaft alignment and can expect:

- **Less energy consumption**—Alignment leads to significant power savings by eliminating reaction forces inside rotating machinery.
- **Increased reliability**—Precision aligned machines have fewer unexpected or catastrophic failures.
 - By checking alignment you can anticipate problem areas before failure occurs and prioritize repair actions.
 - Regular precision alignment reduces mechanical seal repairs by up to 65 %
 - When precision alignment becomes an integral part of pump repair schedules, the rate of pump repairs is reduced by up to 30 %
- **Reduction in costs**—Reduce spare parts inventory costs and extend the life of existing equipment.
- **Increased maintenance intervals from longer machine life**—As misalignment is reduced, the expected bearing life increases which means the time between repairs can also increase.
- **Revenue**—Well-maintained machines have fewer unexpected and serious failures, helping to prevent production stoppages that cut into the bottom line.

Alignment tolerances provide acceptable limits

If a machine is not aligned within the acceptable tolerance limits undue stress can cause increased heat and wear in couplings, seals and bearings which in turn can cause increases in unplanned downtime, energy consumption and necessary maintenance intervals.

Suggested alignment tolerances can be determined in several ways. Most often acceptable machine tolerances are provided by the manufacturer of the machine, but general industry standards for alignment tolerances are also available. Industry standards for alignment tolerances should only be used if no other tolerances are prescribed by the machine manufacturer or if in-house standards do not exist. In the instance that a machine manufacturer requires an alignment tolerance tighter than that recommended by industry standards, the manufacturer's recommendation should be used. It should be noted that rigid couplings have no tolerance for misalignment and should be aligned as accurately as possible.

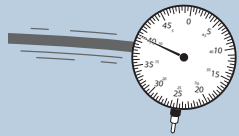
Conventional shaft alignment methods

Modern machines require precision alignment to remain within a recommended tolerance range, and conventional alignment methods can fail to meet these standards resulting in poor alignment. One common alignment method is to use a straightedge or feeler gauge, which only has the resolution of the human eye. For most machines, this resolution of 1/10 mm is inadequate for properly diagnosing misalignment.

Another common method for evaluating alignment is the dial indicator method—dial indicators provide a resolution of 1/100 mm, but require

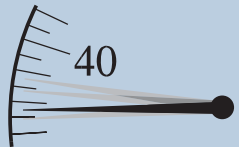
complex math to determine whether or not misalignment is present. In addition, this method is susceptible to human error that results from improperly reading measurements values and potential errors in the complex calculations that are required. Additionally, this method traditionally takes many hours to complete and requires a highly skilled user.

How accurate are dial indicator readings?



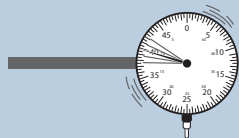
Sagging indicator brackets

Sag should always be measured before actual alignment readings are taken irrespective of how solid the bracket appears.



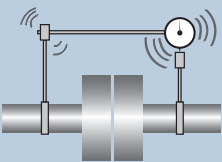
Low resolution

Up to 0.005 mm rounding error may occur with each reading—which easily results in an error of up to 0.04 mm in the calculated results.



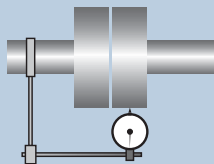
Sticking/jumping dial hands

Sometimes the indicator must be tapped in order for the needle to settle on its final value.



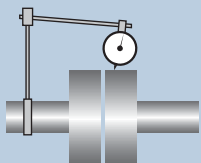
Play in mechanical linkages

Slight amounts of looseness may not be noticed, yet produce large errors in results.



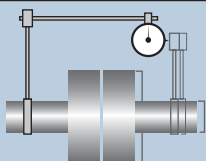
Reading errors

Human errors occur all too often when dials must be read under cramped, poorly-lit conditions and severe time constraints.



Tilted dial indicator

The indicator may not be mounted perpendicular to the measurement surface so that part of the displacement reading is lost.



Axial shaft play

This can affect face readings taken to measure angularity unless two axially mounted indicators are used.

What's the alternative to conventional methods?

A great alternative to traditional shaft alignment measurements is a laser shaft alignment system. Laser shaft alignment systems reduce the potential for human error and can have resolutions as good as 1/1000 mm or 1 micron (0.00004 in). When choosing a precision laser shaft alignment system you should consider:



Setup

- Quick and error free setup—pre-assembled brackets with zero sag
- Easy-to-use screens that are user intuitive
- Step-by-step guides that walk the user through the machine setup information

Measurement accuracy and flexibility

- High resolutions of 1/1000 or 1 micron (0.00004 in)
- Fast and accurate adjustment of laser sensor
- Measurement flexibility that allows you to take readings from almost any desired position

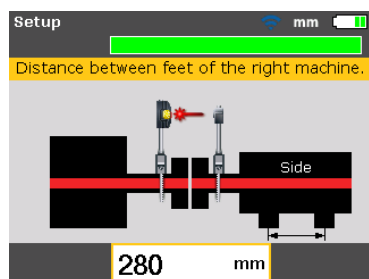
Diagnosis capabilities

- Actionable recommendations in terms of specific feet correction instead of complex calculations or guesswork
- Coupling and feet adjustment values in terms of both horizontal and vertical adjustments
- Robust machine tolerance tables that evaluate alignment compared to acceptable limits for specific machine speed
- Results that are accurate, reliable and extremely repeatable
- Reporting capabilities with both as found, and as left results to document the alignment correction per ISO 9001 requirements

Fluke 830 redefines shaft alignment

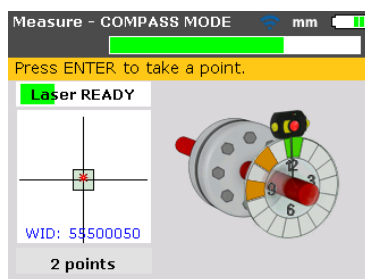
Simple AND effective:

Many tools are simple, but they can take a lot of time to re-learn how to use them and to remember what the numbers mean—especially if it's been a long time since the last alignment was performed. You need a tool that walks you through the steps so that you can get back to running the plant. With the Fluke 830 Laser Shaft Alignment tool evaluating alignment can be done in three simple steps:



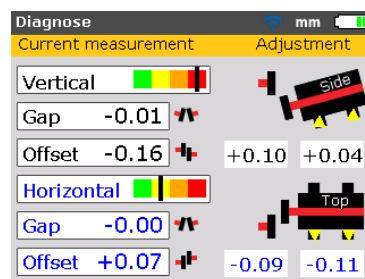
1. Setup

Step-by-step interface for inputting machine dimensions (machine profiles can also be saved for later use)



2. Measure

Active sweep starts as soon as shafts are rotated—take readings from three sectors and watch them turn green on the screen indicating the correct data will be gathered.



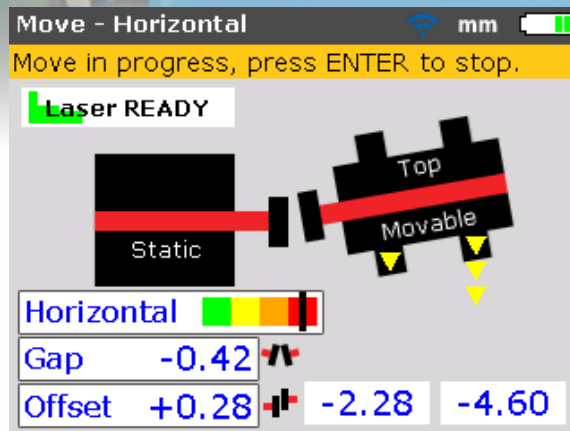
3. Diagnose

Actual correction numbers are given and a four-level color severity scale gives you at-a-glance measurement results: then use precision shims to save time and perform a precision alignment every time

Answers NOT just data:

Any tool can give numbers—dial indicators give numbers but require complex calculations that take time to perform. When asset uptime is on the line you need fast answers that can quickly help you align the machine and get it up and running fast.

1. "All-in-one" result screen shows both coupling results and feet corrections (vertical and horizontal).
2. "Live" mode gives you immediate and dynamic feedback of the alignment status while you are adjusting the feet. No additional steps are required to retake readings and evaluate results.
3. Tolerance tables (input machine speed) help you complete adjustments quickly letting you know precisely when the machine is within acceptable alignment.
4. Result confidence—Perform final alignment checks and print reports with 'as found' and 'as left' measurement results to document the procedure.



"Live" mode—do you want a caption?

Best in class repeatability:

Unlike other tools, we are so confident you will see the same results every time you take measurements that we recommend that you re-check your results. Before returning the critical machine back to service, it's a good idea to double check your alignment to make sure it has improved the machine's status—and it only takes two minutes.

Optimized user interface:

The new Fluke 830 Laser Shaft Alignment Tool has been designed with the same ease of use, ruggedness and reliability that customers have come to rely on to keep their world up and running. If you have a Fluke vibration tester, you can use the Fluke 830 alignment tool. It has the same ergonomic design and user friendly interface, and on top of that it's easy and fun to use.

With this revolutionary way of precision shaft alignment, even small organizations can afford and enjoy big benefits:

Many facilities don't have the time and resources to develop a reliability team, yet they struggle with mechanical breakdowns. The good news is that the recent advances in laser shaft alignment have enabled programs that can quickly and repeatedly align shafts without the need for complex equipment or continuous re-training. With the advances in the

technology, a guided user interface, and easy to understand measurement results precision shaft alignment is now within the reach of everyone. Every organization can benefit from the energy savings, extended machine life, reduced production losses and reduced parts inventories that can be realized from precision alignment—and now it's more accessible than ever.

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

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