

Alignment & Positioning of

ROTATING MACHINES

Fast, easy and accurate alignment of rotating machines, pumps, drives, foundations, etc.



To compete in today's marketplace, you have to outperform your competitors regarding price, quality and reliability. Also, meeting deadlines and quotas, keeping your machines in line and online are all crucial factors in order to stay ahead of the competition. Welcome to explore what Fixturlaser can do for your business!



Machines in line stay online

High vibration levels, premature bearing failures, hot couplings or leaking shaft seals can all be indications of misaligned machines. With Fixturlaser's laserbased alignment systems, you can make a quick check, align your equipment and keep the machines online without the risk of suffering unplanned stops due to misalignment.

Why precision alignment is necessary

Misaligned machines result in vibrations and premature wear of bearings, seals and couplings. Machines with rotating shafts are designed to run under optimal conditions. Misalignment will lead to harmful forces, deteriorating the machines' performance.

How is misalignment recognized?

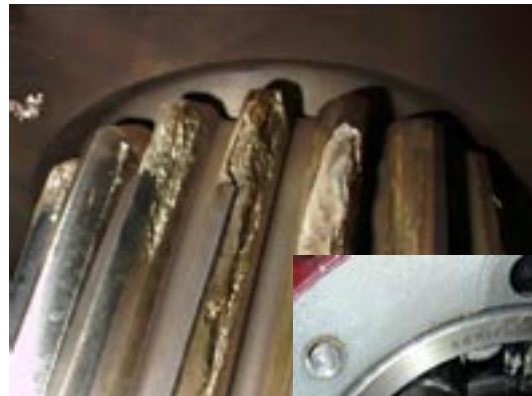
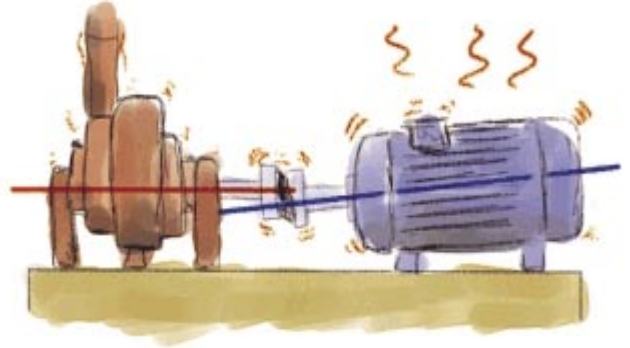
- Premature bearing, seal and coupling failure
- Excessive radial and axial vibrations
- High casing temperature at the bearings, or nearby them, or high oil temperature. High coupling temperature.
- Oil leakage at the bearing seals
- Loose or broken foundation bolts and/or coupling bolts
- Similar equipment has less vibrations or has longer operation lifetime.

Benefits of precision alignment

- Reduced vibration levels
- Increased meantime between failures
- Reduced maintenance cost
- Reduced energy consumption
- Increased production quantity and quality

Measurements

- Shaft alignment of pumps, motors and reducers
- Cardan shaft alignment
- Machine train alignment
- Dynamic measurements / thermal growth measurements
- Measurement of base flatness

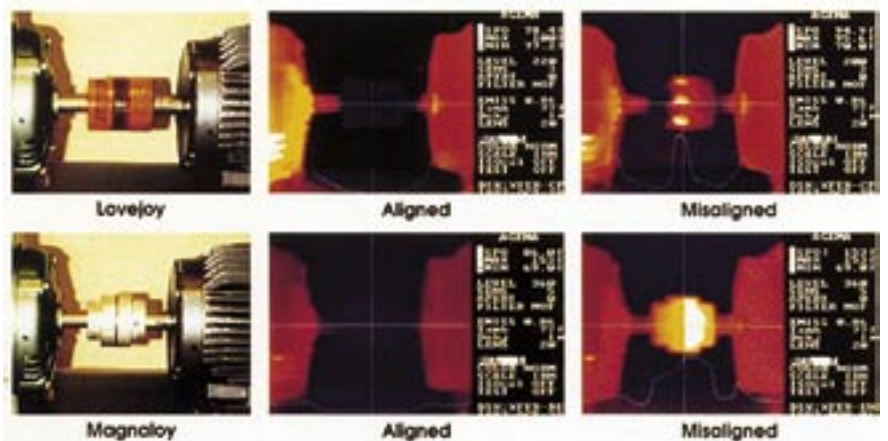


Misaligned machines contribute to huge costs in repair and production loss every year. By introducing preventive maintenance, including regular alignment control, you minimize the number of unplanned stops due to machine breakdowns.

Typical alignment tolerances

rpm	mm	
	↔	↑↓
0 - 1000	0.13	0.10
1000 - 2000	0.10	0.08
2000 - 3000	0.07	0.07
3000 - 4000	0.05	0.06
4000 - 6000	0.03	0.05

rpm	mils	
	↔	↑↓
3600	2.0	0.5
1800	4.0	0.7
1200	6.0	1.0
900	8.0	1.5



The picture above shows the thermograms for two different couplings. The far right column shows very clearly the heat generated by a misaligned machine. The pictures in the middle show the same machines when aligned correctly.

Photography by Infraspection Institute

Alignment preparations in the spotlight

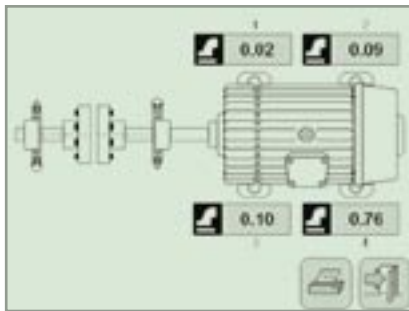
No matter how carefully you perform a precision alignment, the time spent might be time wasted, if you disregard the importance of alignment preparations. Fixturlaser alignment systems come with an extensive set of tools for pre-alignment tasks providing you with the best possible alignment conditions.

Softfoot

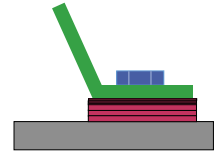


A softfoot is caused when one or more of the machine feet do not rest firmly on the base plate. Softfoot is a condition that could cause a lot of problem with repeatability in the positioning of the machine during the alignment process. When a machine with a softfoot is bolted down to the base, the machine casing is exposed to tension forces. This can affect bearing positions and result in the premature wear of bearing and other machine components.

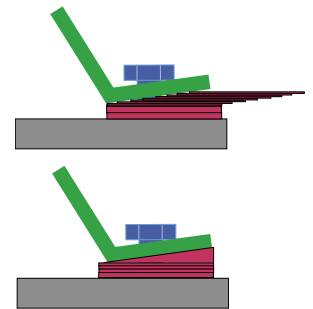
The Fixturlaser Shaft alignment systems provide an easy solution to identify if and where you have a softfoot condition.



One type of softfoot is called "short foot" or "parallel softfoot". This problem is solved by adding shims to the "short foot".



A second type of softfoot occurs as "angled foot". It can be solved by adding shims under the foot as shown to the right, but it is better to correct the angle of the foot or making a steel wedge.

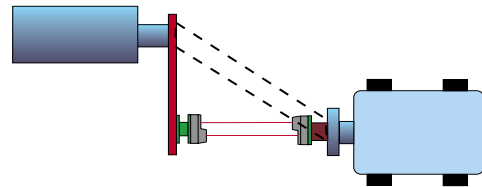


Alignment of offset mounted machines

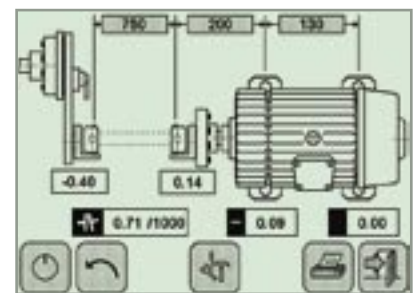


Cardan shafts are an excellent way of power transmission, when it is impossible to position two machines in line. There is the general misunderstanding, however, that offset mounted cardan driven machines do not require alignment. As shown in the diagram a misaligned cardan rotates with an uneven angular speed over a full turn. This generates vibrations with harmful forces throughout the drive chain. The risks with misaligned cardan shafts are similar to other misaligned machines plus the risks for damages caused by a broken cardan shaft.

The Fixturlaser Shaft system combined with the Cardan shaft fixture make alignment of offset mounted machines possible. The payback time for a system like this is very short compared to the costs for a cardan shaft breakdown.

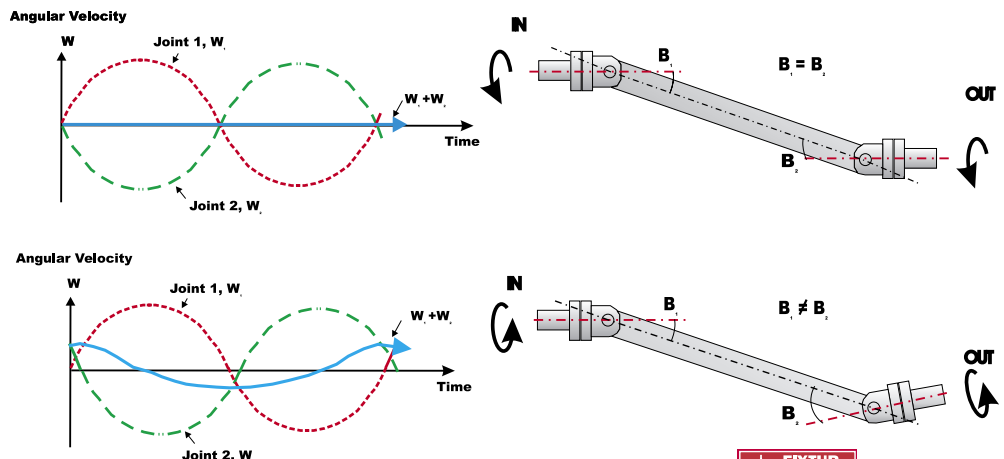


Alignment of offset mounted machines/ cardan shafts follows the same procedure as for horizontal shaft alignment. The result screen tells us the position of the machine. The angular error of the coupling/cardan in this case is 0,71 mm/1000 mm.



Benefits

- Minimized risk for cardan shaft breakdown.
- Reduced wear on gearboxes, bearings and cardan joints.
- Full documentation of measurement result.



Short pay-back time

Fixturlaser's alignment systems are userfriendly, guaranteeing frequent use. In combination with the product's upgradeability, the pay-back time for investing in a Fixturlaser alignment system is very short.

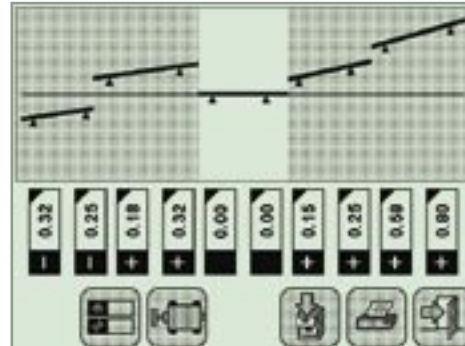
Machine train alignment



Machine train alignment is probably the most difficult and demanding task of all alignment engineering skills. Often a machine train is part of a critical production, the most expensive and the most costly to production loss when it goes down. With the Fixturlaser Shaft system, it becomes easier to align machine trains.

Benefits

- Same alignment procedure as for a standard motor and pump application
- Full documentation of measurement results



The most cumbersome part in aligning machine trains is to find out which machine to use as reference. The display screen guides you in finding the best solution in order to accomplish a perfect alignment.



Flatness measurements



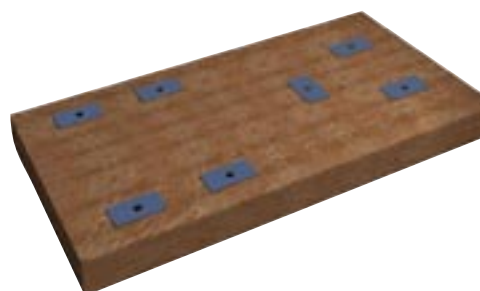
Foundations, base and sole plate conditions have a great impact on alignment of machines. If the foundation is skew, warped or affected by ground settings, it is very hard, if not say impossible to align machines to a satisfactory precision.

Using the flatness measurement software in the Fixturlaser Shaft system, you can very quickly find out if the base fulfills the requirements.

Flatness can be measured in up to 121 points and the distance between the measurement points can be set to equal or individual.



By using a laser measurement system, requirements are met on both accuracy and repeatability. Adjustments can be made at each point with live values and the results are stored for filing and traceability.



Flatness measurement results with Fixturlaser Shaft. The screen displays the status of the measurement points. The graphic with the user defined filter setting simplify the interpretation of the result. Each measurement point can be individually named and commented in the system.

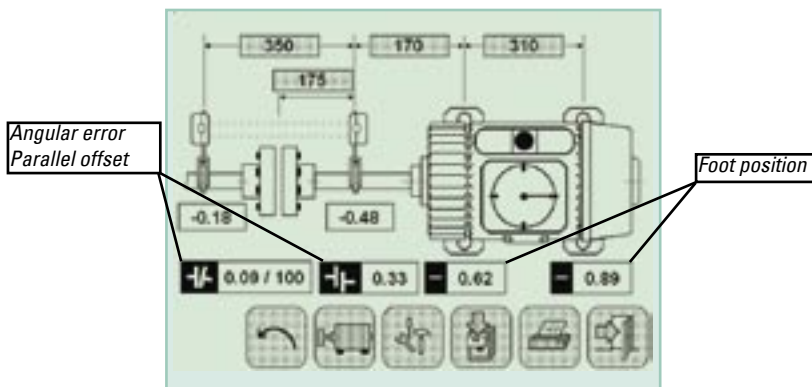
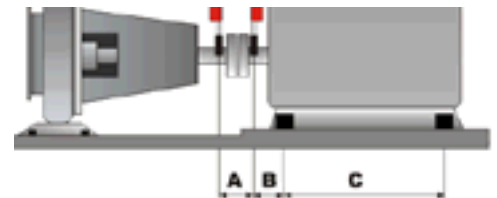
Do not loose valuable time - make a quick alignment check

With Fixturlaser systems you can fast, easily and precisely correct and document the misalignment. Other situations when alignment is needed, could be when documenting alignment conditions prior to removing machines from service, or prior to new or rebuilt machines are being put into production.

Alignment of horizontally mounted machines



A horizontally mounted machine is the most frequent application regarding shaft alignment. In every industry, there are numerous installations such as drives for fluid pumps, fans, gearboxes, transportation of goods, blenders etc. Most of the machines are critical components in the production process and every single installation requires precision alignment for optimal performance. An unplanned production stop due to machine breakdown will result in production loss and high costs. Nearly 50% of all breakdowns in rotating machines are caused by misalignment. Investments in alignment have a very short payback time and they can often be quantified in uptime minutes.



The measurement result is presented on the screen with all relevant information. Angular and offset errors as well as the current foot positions of the movable machine are displayed. All values are continuously updated during adjustment, guiding the operator to a perfect alignment.

The only information required to enter is the above measurements in order to perform a precision alignment.

Three readings are required to determine the machine position. The tripoint method provides a quick and easy way to register the readings. The result is instantly displayed on the screen.

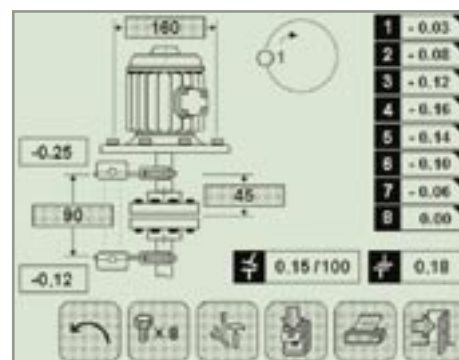


Alignment of vertically mounted machines



Vertical machines are normally mounted with bolts on a flange instead of feet, which make the calculation of the correction values different from horizontal machines. The bolts may differ in numbers and are situated on a circle around the flange.

The Fixturlaser Shaft series can be used to measure and align vertically mounted and flange mounted machines. Results are presented with positions for each bolt.



Vertical shaft alignment with Fixturlaser Shaft series. The result screen shows the current position of the motor and clearly advises necessary shimming.



Critical machines need extra attention

Critical machines need extra attention. You are now able to take all dynamic movements into account, when measuring and aligning a high speed machine from hot to cold, or vice versa. The result is an even more correct alignment and machines operating at their absolute maximum.

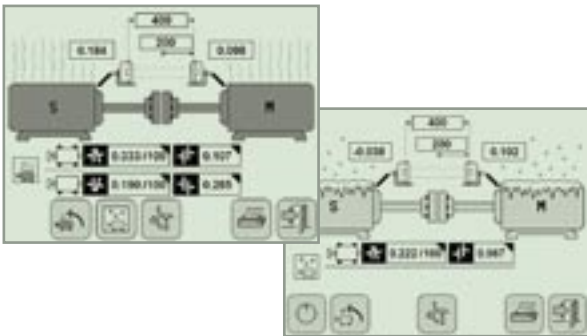
Off-line to running or Dynamic Measurement

Machine alignment has to be accomplished when the machine is shut off. Naturally, the machine is not in a working condition state. However, when performing alignment, you have to consider the running conditions, such as thermal growth. Manufacturer specifications often consider vertical growth, due to rising temperature in the machine housing. Unfortunately, that is not enough to ensure an aligned machine in running mode.

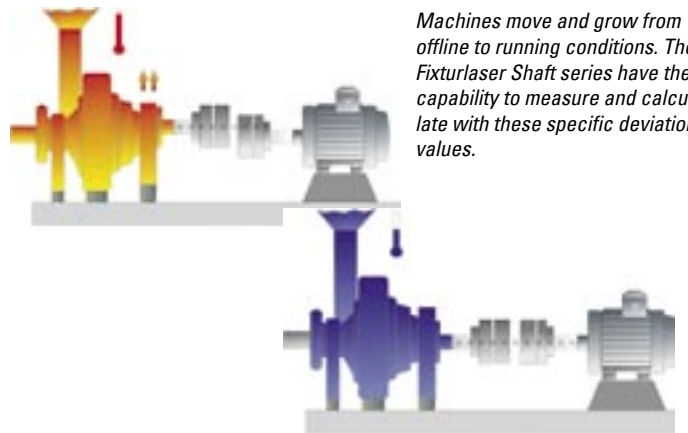
Two identical machines in identical installations do not behave identically from off-line to running. By measuring the machine positions, vertically and horizontally, in offline mode and in running mode, the correct compensation values are calculated.

Benefits

- Correct compensation values
- Considers all affecting forces, such as thermal growth, pipe strain, surrounding cooling effects, load forces



The Fixturlaser OL2R fixture mounted on motor and pump. Performing two measurements, one in offline mode and one in running mode, will give you the correction values for a precision alignment. The machine will be perfectly aligned considering all forces and movements from offline to running condition.

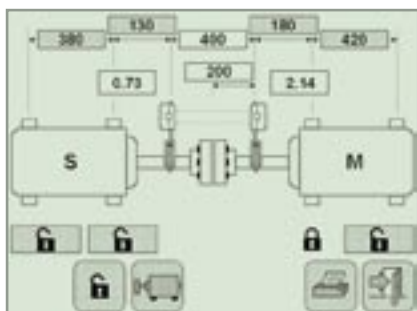


Machines move and grow from offline to running conditions. The Fixturlaser Shaft series have the capability to measure and calculate with these specific deviation values.

Feetlock

Sometimes during an alignment, the movable machine cannot be moved sufficiently in order for the alignment to be completed within specified tolerances. Base or bolt bound conditions restrict adjustments during the alignment process.

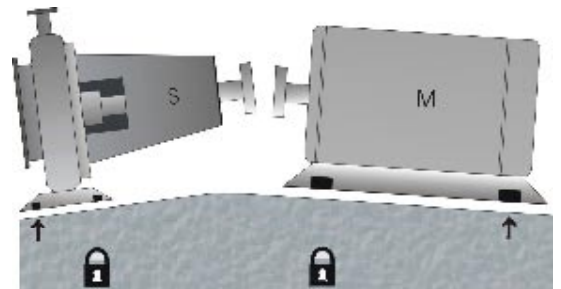
The Fixturlaser Shaft systems' solution is to lock the feet that are restricted in movement and to present adjustment values for the feet that can be moved.



Restrictions in bolt holes.



Restrictions due to the foundation.



Creating customer value

Fixturlaser alignment systems are designed for providing a long-lasting value to our customers. Wherever our systems are used, frequently or occasionally, they prove their value in the preventive maintenance programmes.



All of the Fixturlaser alignment systems are based on the same technical platform providing full flexibility for future alignment requirements. Starting off with a basic shaft alignment system, it can easily grow into a full featured geometric measurement tool as your needs alter or grow.

Two lasers - Twice the value

The Fixturlaser Shaft series utilizes two lasers, one in each TD-unit. Except for the obvious technical advantages with this design, there is another major benefit for the user: **rough alignment**. When measuring over large distances, it is often required to make a rough alignment before proceeding with precision alignment. With such conditions the two lasers are unbeatable. You begin by just visually registering where the laser beam from each unit hits. Then continue by rotating the units a half turn and measuring the distances between the two hitpoints. Half this value and you are home free! No matter how much misaligned the machines are, you can always make a rough alignment and then follow up with a precision alignment.

Long lasting investment

The Fixturlaser Shaft series have components in common with other Fixturlaser products. This makes it easy to expand your system to include functions for applications such as roll parallelism measurement and advanced geometric measurement, without risking earlier investments in Fixturlaser products. The display unit with its touch screen interface and standardized hardware components makes it easy to upgrade.

Multi-lingual or non-lingual

Fixturlaser products utilize a battery driven display unit with a touch screen interface. Together with our own software design,

totally based upon symbols and graphic presentation, we provide easy to use equipment that requires a minimum of training. The absence of language specific terminology, totally free from text, makes it easy to use and minimizes the risk for errors.

Measure - Align - Document

Fixturlaser develops products as well as measurement methods. By learning our customers' processes, we know how to develop products that fulfill customer requirements not only on accuracy, but also on usability. An investment on the shelf is a bad investment.

Fixturlaser systems are as easy to use for measuring as for aligning machines. Realtime values are displayed during the alignment process guiding the operator towards a perfect precision alignment. The final measurement values can be documented by the supplied printer or transferred to PC software, the Fixturlaser Documenter.

Alignment and measurement service

Fixturlaser has over the years earned a tremendous experience of alignment and measurements. Our alignment experts have been all over the world serving all kinds of industrial customers, using our alignment and measurement skills. This experience is the base for development of new products, but also a valuable resource for you as a customer to utilize.

AFTER SALES SERVICE AROUND THE WORLD

DISTRIBUTION NETWORK AND AFTER SALES SERVICE

Fixturlaser markets and distributes products in more than 70 countries around the globe. Our distributors are experienced, skilled engineers and measurement technicians carefully selected and certified by our training institute.

One of Fixturlaser's strongest features is the after sales service. Owners of a Fixturlaser system will always have access to assistance in operation and application support throughout our organization. Our certified service centers around the world perform maintenance and calibration of systems.

Fixturlaser also offers all customers product and application training. During training, held by experienced application engineers, we go through all the three phases of alignment - measure, align and document.

For more information, contact your local distributor or visit www.fixturlaser.com.



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