WHITE PAPER

Why alignment?

Reliability starts with precision shaft alignment

Extend machine availability and efficiency
Eliminate misalignment

Precision alignment pays back

Rotating machinery is susceptible to misalignment. Machines that are well aligned at the commissioning stage and thereafter regularly maintained will in the long term reduce plant operating and maintenance costs.

Laser precision alignment extends machine availability as the Mean Time Between Failure (MTBF) increases. It protects assets and increases product quality, as vibration is reduced to very low levels.

When misaligned, the loading of the shafts dramatically increases due to the reaction forces created within the coupling.

Precision alignment guarantees

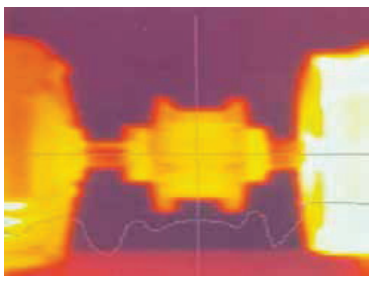
Here are the ways that correcting misalignment problems can improve how machines operate and save you time and money:

- Reduced energy consumption
- Reduction in bearing, seal, shaft and coupling failure
- Lower bearing and coupling temperatures
- Reduced vibration
- No breaking (or cracking) of shafts
- Secure foundation bolts

Accurate shaft alignment contributes in more than one way towards great savings and a cleaner environment.

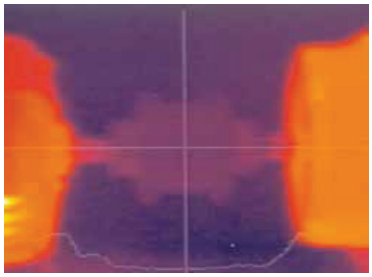
The effect of increased coupling loading due to misalignment can readily be shown using infrared thermography.

1. In this case, the flexible coupling element heats up. The machine develops elevated temperatures, particularly around the bearing housings.



Out of tolerance

2. Precision alignment drastically reduces factors that may cause machinery breakdown.

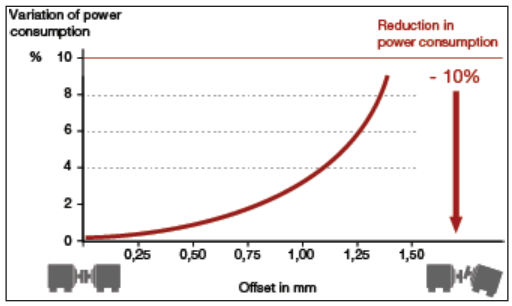


Within tolerance

Figures behind precision alignment
Key benefits of shaft alignment

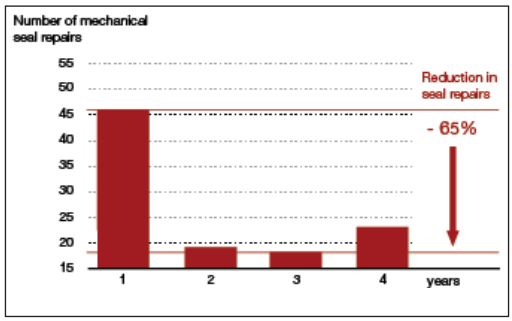
1. Precision alignment pays back

Effects on power consumption
Significant power savings can be made through accurate alignment. Precise alignment eliminates reaction forces and reduces energy consumption by up to 10%.

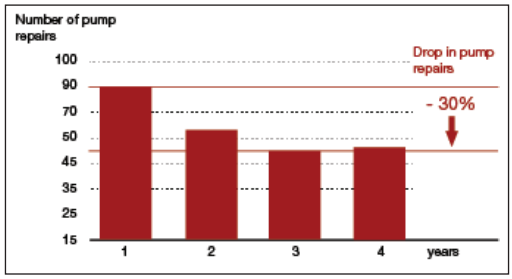


2. Reduced repair incidences

Mechanical seal repairs
Mechanical seal repairs decline by up to 65% when precision alignment is carried out on a regular basis.



Pump repairs
The rate of repairs declines by up to 30% when precision laser alignment becomes an integral part of the pump repair schedule. Maintenance costs are also reduced through lower parts expense and inventory levels.

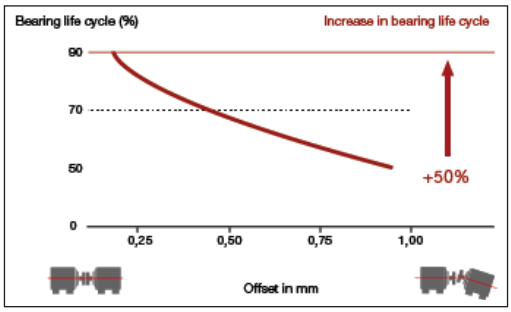


FLUKE®
Reliability

3. Longer machine life

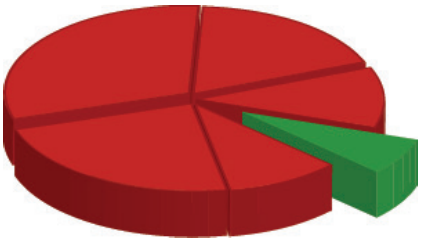
Relation between offset and bearing life cycle

The smaller the offset misalignment, the higher the expected bearing life cycle.



Align machines to specified tolerance move

A survey conducted by one of the world's leading rotating equipment service organizations shows that fewer than 10% of the 160 machines randomly chosen for measurement were found to be aligned within acceptable limits.



Only 7% of the measured machines fall within the acceptable alignment tolerances.

Offset (mm)	Machines measured (%)	
0.00 – 0.05	7%	acceptable alignment
0.06 – 0.10	10%	
0.11 – 0.20	23%	
0.21 – 0.50	31%	out of tolerance
0.51 – 1.00	18%	
> 1.00	11%	

Traditional shaft alignment methods

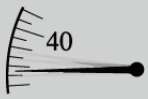
How accurate are they?

Conventional measurement methods possess a low resolution for the adjustment of modern machinery. The straightedge/feeler gauge methods depend on the limited resolution of the human eye. The resulting resolution of 1/10 mm is inadequate for most machinery.

Dial indicators normally have a resolution of 1/100 mm, but calculations tend to be complicated, requiring highly experienced users, so jobs take longer to accomplish. These methods are prone to human influences when reading dial indicator values or computing the alignment condition.

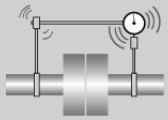
How accurate are dial indicator readings?

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

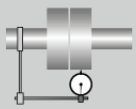


Low resolution
Up to 0.005 mm rounding error may occur with each reading – which easily results in an error of up to 0.04 mm in the calculated results.

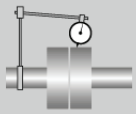
Sticking/jumping dial hands
Sometimes the indicator must be tapped in order for the needle to settle on its final value.



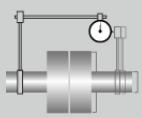
Play in mechanical linkages
Slight amounts of looseness may not be noticed, yet produce large errors in results.



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.



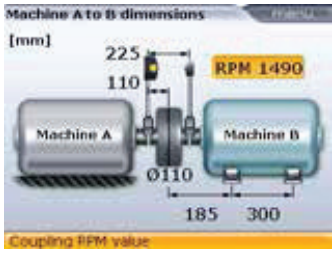
Axial shaft play
This can affect face readings taken to measure angularity unless two axially mounted indicators are used.

Advantages of laser shaft alignment

Quick and accurate measurement

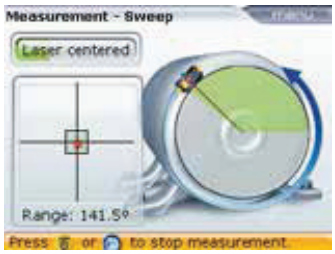
Dimensions

- Systems are user-friendly and intuitive
- Quick setup of the fully assembled ready-to-use sagfree brackets
- Follow the simple on-screen guidance to enter required machine data
- Bracket variety for any shaft or coupling



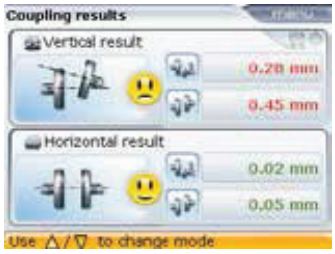
Measure

- Error-free and accurate measurement with a resolution of 1 micron (0.00004")
- No human reading errors and bracket sag influences
- Quick on-screen laser beam adjustment
- Take readings at any desired position



Results

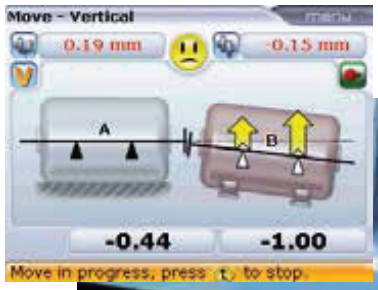
- Instant display of the coupling and feet values in both horizontal and vertical directions
- Evaluation of the alignment condition according to coupling tolerance
- Repeatability of results
- Reports generated directly from instrument, in conformity with ISO 9001 requirements

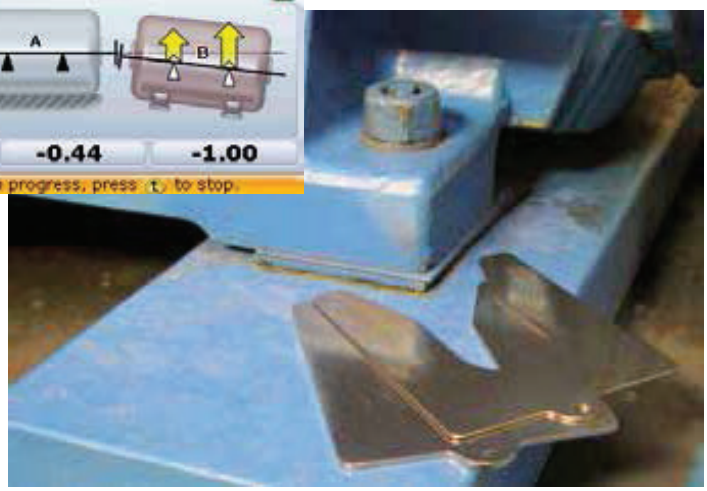


Live move

The unique measurement principle offered by laser alignment systems from PRUFTECHNIK, part of Fluke Reliability, allows the machine feet corrections to be monitored during live adjustment.

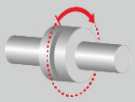
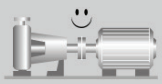
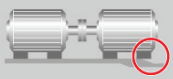
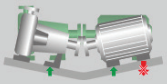
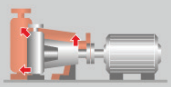
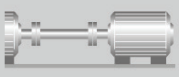
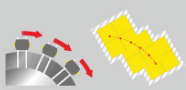
PERMABLOC® precut shims from PRUFTECHNIK are the quality shims for fast and accurate alignment correction.





Benefits of PRUFTECHNIK laser alignment systems

User-friendly and extremely reliable alignment correction.

Benefits of PRÜFTECHNIK laser alignment systems	
	**Continuous SWEEP mode** Measurement data is automatically and continuously collected from any start position as the shafts are rotated capturing a large number of measurement points to accurately determine the alignment condition.
	**Tolerances (TolChek ®)** Avoid unnecessary moves by automatically evaluating alignment condition with respect to tolerances using the "smiley" which is also active during live machine correction.
	**Soft foot** For good alignment, soft foot must be eliminated. The machine feet should rest properly on the foundation. Soft foot is measured, corrected and documented.
	**Base-bound or bolt-bound** Problems arising from base-bound or bolt-bound feet are resolved by redefining fixed/movable feet.
	**Thermal growth and target specifications** The specifications can be input to take into account the expected positional change of the machine during operation.
	**Choose coupling type** Short flex, single plane, cardan or spacer couplings can be selected to apply the correct tolerance and display criteria for your machines.
	**InfiniRange ®** The measurement range of the detector can be infinitely extended to accommodate gross misalignment. This is ideal to perform and document initial rough alignment and easily handle long spans across spacer shafts.
	**Machine train alignment** Measure and display the entire alignment condition of machine train; allowing the user to make the optimal machine adjustment.

Alignment is our business

Proven technology for all industries

PRUFTECHNIK, the inventor of laser shaft alignment, is a division of Fluke Reliability. It has more than 30 years of experience in developing, manufacturing, and applying laser-based alignment measurement systems. PRUFTECHNIK from Fluke offers a full range of shaft alignment products.

All our devices have a modular design in order to meet the exact needs of our customers. They are also available in intrinsically safe versions for use in hazardous areas. Our measurement systems are used worldwide across industries for many alignment applications of rotating machinery.

PRUFTECHNIK from Fluke Reliability offers maintenance solutions worldwide

Alignment systems

Laser measurement systems and services for optimum alignment of machines and systems.

Condition monitoring

Vibration measurement systems for machine condition monitoring – including services such as machinery fault diagnosis.

Nondestructive testing

Systems and services for quality assurance and process control in production.

Service and support

We offer professional services anywhere in the world to support our customers with alignment and condition monitoring.

PRÜFTECHNIK

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

For more information call:
In the U.S.A. 856-810-2700
In Europe +353 507 9741
In UK +44 117 205 0408
Email: support@accelix.com
Web access: www.accelix.com
www.pruftechnik.com