

# Alignment services

## Marine alignment solutions



### Improving machine efficiency and up-time

Shaft misalignment is an important cause of machinery failure. Generally, misalignment is caused by inadequate measurement techniques, an improper foundation, or degradation of the foundation. The alignment of a propulsion unit can also be influenced by deformations in a vessel's engine room and hull, caused by changes in the operating conditions, working environment or the draft conditions of a vessel.

An optimal shaft alignment increases the life of bearings, seals and couplings, but also reduces energy consumption, noise, vibrations and excessive wear. This reduces the chance of costly downtime. SKF is a specialist with decades of experience in solving alignment issues.

SKF combines its ShaftDesigner software with a range of technologies to provide precision shaft alignment solutions. Measurements SKF performs include:

- Dynamic alignment measurements (on vessels in operation)
- Static alignment measurements
- Geometric measurements





## Unique shaft alignment capabilities with ShaftDesigner software

SKF has developed the innovative ShaftDesigner software package to perform propulsion shaft alignment and vibration calculations. Created in close cooperation with OEMs, classification societies and end-users, ShaftDesigner can assist with optimizing propulsion shaft lines in any stage of a ship's life cycle.

### Cross-validation

SKF has unique alignment capabilities thanks to the reversed calculations module of the software. Measurements performed on board can easily be entered in the software that in turn calculates the alignment for the entire shaft line. A second measurement is then performed using a different method to validate the calculation of the first measurement. Combined with SKF measurement technologies, the time and thus costs involved in determining alignment issues can be significantly reduced.

SKF performs dynamic, static and geometric measurements for the entire propulsion train, from the nozzle, stern tube bearings, intermediate bearings, through gearboxes, main engines, shaft generators, pumps, pod thrusters and auxiliary power systems, as well as other components of a ship such as the hull, cranes and winches.

## Dynamic alignment measurements – on vessels in operation

### Dynamic shaft movement

Determines the shaft's position and orbit.

### Dynamic machine movement

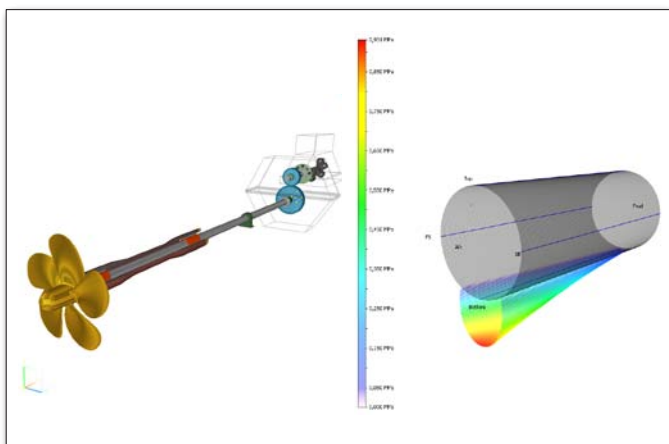
Movement of machines caused by torque, thrust and/or heat.

### Dynamic shaft alignment

Measurement of shaft bending stress to calculate the horizontal and vertical bearing loads and offsets.

### Vibration

Data collection and analysis of vibration of rotating equipment.





## Static alignment measurements

### Horizontal and vertical alignment

The positioning of two components relative to each other.

### Static shaft alignment

Measurement of shaft bending stress to calculate the horizontal and vertical bearing loads and offsets.

### Bearing loads / jack-up tests

Measurement of vertical bearing loads.

## Geometric measurements

### Straightness and line bore

Measurement of the relative position of components over a required distance.

Applications: bed plate of engines and steering installations, stern tubes.

### Flatness

Measurement to determine slope, tilt or curvature.

Applications: bed plates, slewing bearing beds.

### Perpendicularity

Measurement to determine if two planes are at 90 degrees of each other.

Applications: seal landing faces, positioning of container racks.

### Parallelism

Alignment of elements of an installation parallel to each other.

Applications: bores in gearboxes, guiding rails for hatches, cranes.

## SKF measurement technologies

SKF makes use of a range of alignment measurement technologies. These include:

### Laser alignment systems

Laser alignment systems are a proven technique for measuring many types of static alignment. SKF has its own laser alignment systems on sale for customers.

### Strain gauges

The ShaftDesigner software and strain gauges are an excellent alignment match. It eliminates the need to decouple shafts. Another advantage is that strain gauges make it possible to perform dynamic alignment measurements on a vessel in operation.

### 3D measurement systems (laser trackers, arms, scanners)

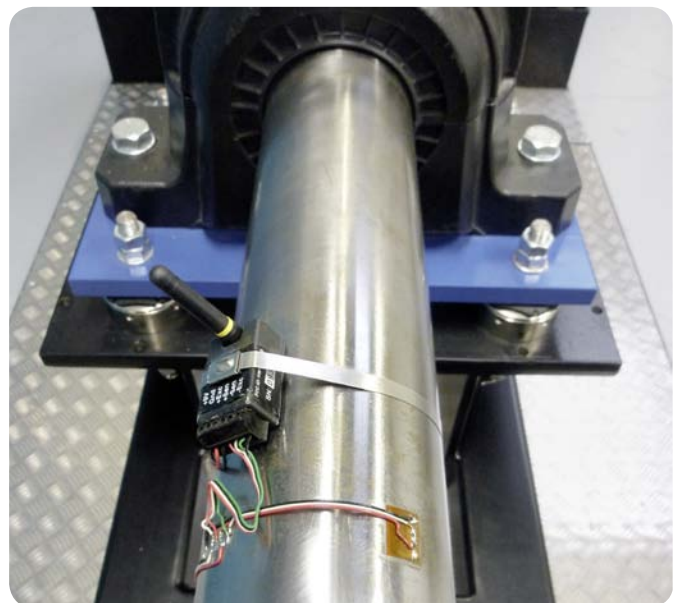
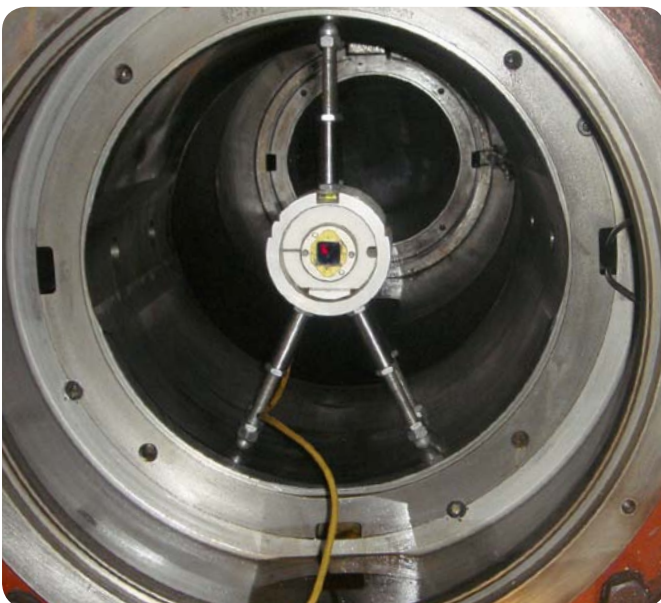
Measuring the alignment along longer distances and even in separate areas is possible with 3D measurement systems. Also hull deflections and thermal growth can be measured.

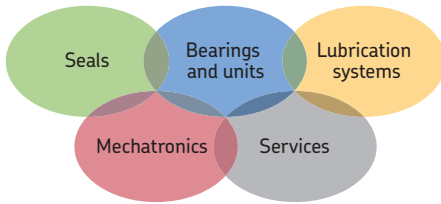
### Thermal imaging

Thermal imaging can assist with finding the source of friction. By visualizing the temperatures of various parts of the shaft line irregularities can be detected.

### Proximity probes

These probes are used to measure shaft orbit and movement on vessels in operation.





## The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry world-wide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

### Marine product portfolio

- ✓ Condition monitoring hardware and software
- ✓ Shaft alignment and vibration calculation software
- ✓ Bearings: roller bearings, customized bearing units, slewing bearings, intermediate shaft bearings, bushes, safe return to port bearings and thrust bearings
- ✓ Bearing housings
- ✓ OK couplings and Supergrip bolts
- ✓ Lubrication systems and lubricants
- ✓ Complete sterntube solution
- ✓ Oily water separators
- ✓ Stabilizers
- ✓ Steering gears
- ✓ Rudder roll stabilization
- ✓ Chocking solutions including SKF Vibracon
- ✓ Sealing solutions and auxiliary systems: including Simplex-Compact lip seals, face seals, bulkhead seals and customized seals
- ✓ Wear sleeves including SKF SPEEDI-SLEEVE
- ✓ Propeller sleeves
- ✓ Hydraulic nuts
- ✓ Maintenance products and tools
- ✓ Power transmission products
- ✓ Electromechanical actuation systems
- ✓ Hydraulic bolt tensioners
- ✓ Steer-by-wire systems
- ✓ Sensorised bearings

### Marine service portfolio

- ✓ Alignment (static and dynamic)
- ✓ Shaft alignment calculations
- ✓ 3D measurement surveys
- ✓ On-site machining
- ✓ Chocking and calculations
- ✓ Mounting
- ✓ Balancing
- ✓ Engineering
- ✓ Testing and validation
- ✓ Condition-based maintenance
- ✓ Vibration analysis
- ✓ Oil analysis
- ✓ Dynamic motor analyzing
- ✓ Torsional vibration analysis
- ✓ Turbocharger monitoring
- ✓ Electric motor monitoring
- ✓ Thermographic measurement
- ✓ Remote monitoring
- ✓ Training and certification
- ✓ Asset management
- ✓ Bearing analysis
- ✓ Remanufacturing services

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