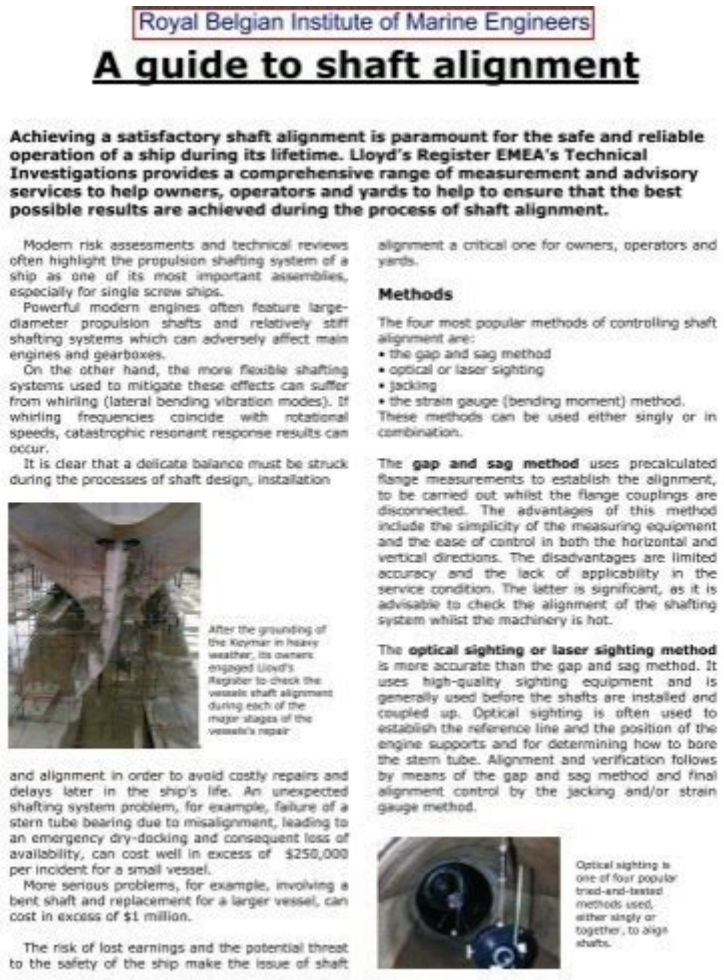
A Guide To Shaft Alignment Gallois



Royal Belgian Institute of Marine Engineers

A guide to shaft alignment

Achieving a satisfactory shaft alignment is paramount for the safe and reliable operation of a ship during its lifetime. Lloyd's Register EMEA's Technical Investigations provides a comprehensive range of measurement and advisory services to help owners, operators and yards to help to ensure that the best possible results are achieved during the process of shaft alignment.

Modern risk assessments and technical reviews often highlight the propulsion shafting system of a ship as one of its most important assemblies, especially for single screw ships.

Powerful modern engines often feature large-diameter propulsion shafts and relatively stiff shafting systems which can adversely affect main engines and gearboxes.

On the other hand, the more flexible shafting systems used to mitigate these effects can suffer from whirling (lateral bending vibration modes). If whirling frequencies coincide with rotational speeds, catastrophic resonant response results can occur.

It is clear that a delicate balance must be struck during the processes of shaft design, installation and alignment in order to avoid costly repairs and delays later in the ship's life. An unexpected shafting system problem, for example, failure of a stern tube bearing due to misalignment, leading to an emergency dry-docking and consequent loss of availability, can cost well in excess of $250,000 per incident for a small vessel.

More serious problems, for example, involving a bent shaft and replacement for a larger vessel, can cost in excess of $1 million.

The risk of lost earnings and the potential threat to the safety of the ship make the issue of shaft alignment a critical one for owners, operators and yards.

After the grounding of the Keymar in heavy weather, its owners engaged Lloyd's Register to check the vessels shaft alignment during each of the major stages of the vessels repair

Methods

The four most popular methods of controlling shaft alignment are:
- the gap and sag method
- optical or laser sighting
- jacking
- the strain gauge (bending moment) method.

These methods can be used either singly or in combination.

The **gap and sag method** uses precalculated flange measurements to establish the alignment, to be carried out whilst the flange couplings are disconnected. The advantages of this method include the simplicity of the measuring equipment and the ease of control in both the horizontal and vertical directions. The disadvantages are limited accuracy and the lack of applicability in the service condition. The latter is significant, as it is advisable to check the alignment of the shafting system whilst the machinery is hot.

The **optical sighting or laser sighting method** is more accurate than the gap and sag method. It uses high-quality sighting equipment and is generally used before the shafts are installed and coupled up. Optical sighting is often used to establish the reference line and the position of the engine supports and for determining how to bore the stern tube. Alignment and verification follows by means of the gap and sag method and final alignment control by the jacking and/or strain gauge method.

Optical sighting is one of four popular tried-and-tested methods used, either singly or together, to align shafts.

A guide to shaft alignment gallois is essential for anyone involved in the maintenance and operation of rotating machinery. Proper shaft alignment is critical for ensuring optimal performance, reducing wear and tear, and preventing costly breakdowns. In this guide, we will explore the principles of shaft alignment, the importance of maintaining correct alignment, the methods used for alignment, and the benefits of using the Gallois method specifically.

Understanding Shaft Alignment

Shaft alignment involves adjusting the relative position of two or more shafts so that they are aligned correctly. When shafts are misaligned, it can lead to a variety of mechanical issues such as increased vibration, excessive wear on bearings, and even catastrophic equipment failure.

Types of Misalignment

Misalignment can occur in several forms:

1. Angular Misalignment: This occurs when the shafts are not parallel but meet at an angle.
2. Parallel Misalignment: In this case, the shafts are parallel but not aligned along the same centerline.

3. Combined Misalignment: This involves both angular and parallel misalignments, making it a more complex issue to resolve.

Symptoms of Misalignment

Detecting misalignment early is crucial to prevent severe damage. Common symptoms include:

- Increased vibration levels
- Unusual noises from the machinery
- Excessive heat generation
- Increased power consumption
- Premature failure of bearings or seals

The Importance of Proper Shaft Alignment

Correct shaft alignment is essential for several reasons:

- Increased Equipment Life: Proper alignment minimizes wear on components, leading to a longer operational life.
- Reduced Downtime: Regular alignment checks can identify issues before they lead to significant failures, reducing costly downtime.
- Enhanced Efficiency: Well-aligned shafts operate more efficiently, meaning less energy is wasted, which can lead to cost savings.
- Improved Safety: Misaligned machinery can pose safety hazards; proper alignment helps mitigate these risks.

Methods of Shaft Alignment

There are several methods available for aligning shafts, each with its own advantages and disadvantages.

Traditional Methods

1. Straightedge Method: This is a simple technique using a straightedge to measure the gap between the shafts. While easy to perform, it is not highly accurate.

2. Dial Indicator Method: This method employs dial indicators to measure the shaft's alignment. It provides more precision than the straightedge method but requires a skilled operator.

3. Laser Alignment: This modern technique uses laser beams to measure alignment. It is highly accurate and can detect even the smallest misalignments, making it a favored method in many industries.

The Gallois Method

The Gallois method of shaft alignment is a sophisticated approach that is gaining recognition for its effectiveness in ensuring proper alignment. The method utilizes advanced technology to provide precise measurements and is based on the principles of geometric alignment.

Key Features of the Gallois Method

- High Precision: The Gallois method employs advanced measuring instruments that can detect minute misalignments that other methods might overlook.
- Simplicity of Use: Despite its precision, the Gallois method is designed to be user-friendly, allowing operators with varying levels of expertise to perform alignment checks effectively.
- Real-Time Data: This method often provides real-time data analysis, allowing for immediate corrective actions if misalignment is detected.
- Comprehensive Reporting: The Gallois method offers detailed reports, making it easier to track alignment over time and identify trends that may indicate underlying issues.

Steps in Performing Shaft Alignment Using the Gallois Method

Performing shaft alignment using the Gallois method involves several steps:

1. **Preparation:** Ensure that the machinery is in a stable position and that all components are clean and free from debris.
2. **Initial Measurement:** Use the Gallois alignment tool to take initial measurements of the shafts.
3. **Data Analysis:** Analyze the data to determine the extent of misalignment.
4. **Adjustment:** Make the necessary adjustments to the machinery to correct the misalignment.
5. **Final Measurement:** After adjustments, take final measurements to confirm that the shafts are properly aligned.
6. **Documentation:** Record the data and adjustments made for future reference and preventive maintenance.

Benefits of Using the Gallois Method

The Gallois method offers numerous benefits that make it an attractive option for those involved in shaft alignment:

- Increased Accuracy: The precision offered by the Gallois method reduces the chances of human error, ensuring that alignments are consistently accurate.
- Cost-Effective: By preventing misalignment-related failures, the Gallois method can save organizations significant amounts in repairs and downtime.
- User-Friendly Technology: The tools and software used in the Gallois method are designed to be accessible, allowing less experienced operators to perform accurate alignments.
- Adaptability: The Gallois method can be applied to various types of machinery, making it versatile across different industries.

Implementing a Shaft Alignment Program

To fully leverage the benefits of shaft alignment, organizations should consider implementing a comprehensive shaft alignment program. Here are some steps to consider:

- **Establish a Baseline:** Conduct initial alignment surveys to understand the current state of your machinery.
- **Regular Maintenance Schedule:** Create a schedule for regular alignment checks to catch issues before they escalate.
- **Training:** Invest in training for your maintenance staff on the Gallois method and the tools required for effective shaft alignment.
- **Continuous Monitoring:** Utilize technology to monitor alignment continuously and identify issues in real time.
- **Documentation and Analysis:** Keep detailed records of alignment checks and adjustments to monitor trends and improve practices over time.

Conclusion

In conclusion, proper shaft alignment is crucial for the efficient operation of rotating machinery. The Gallois method stands out as a highly effective approach for achieving precise alignment, providing numerous benefits that can lead to increased equipment lifespan, reduced downtime, and enhanced safety. By understanding the principles of shaft alignment and implementing a structured program utilizing the Gallois method, organizations can ensure their machinery operates at peak performance, ultimately leading to significant cost savings and operational efficiency.

Frequently Asked Questions

What is shaft alignment and why is it important?

Shaft alignment refers to the proper alignment of rotating shafts in machinery to ensure efficient operation. It is important because misalignment can lead to increased wear, vibration, energy loss, and premature failure of equipment.

What tools are commonly used for shaft alignment?

Common tools for shaft alignment include dial indicators, laser alignment tools, and optical alignment tools. Each has its own advantages in terms of precision and ease of use.

What are the common causes of shaft misalignment?

Common causes of shaft misalignment include improper installation, thermal expansion, foundation settling, and wear of bearings or couplings. Regular maintenance can help mitigate these issues.

How can you determine if your shafts are misaligned?

You can determine shaft misalignment through visual inspections, vibration analysis, or by using alignment tools that measure the angular and parallel misalignment of shafts.

What are the benefits of proper shaft alignment?

The benefits of proper shaft alignment include reduced wear and tear on components, lower energy consumption, decreased vibration levels, longer equipment lifespan, and improved overall machine performance.

What is the difference between static and dynamic shaft alignment?

Static shaft alignment is performed when the machinery is not in operation, while dynamic shaft alignment is conducted while the machinery is running. Dynamic alignment can provide more accurate results in certain applications.

Are there specific guidelines or standards for shaft alignment?

Yes, there are several guidelines and standards for shaft alignment, including those from organizations like the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO). These provide best practices for alignment procedures.

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