



TECHNICAL CIRCULAR No. 541 of 05th March 2019

To: All Surveyors/Auditors

Applicable to flag: All Flags

Shaft alignment after repairs

Reference: CONARINA Instructions

Shaft alignment after repairs

1. Solution to Alignment Problem

The preferable condition for performing the propulsion shafting alignment procedure would be in the dry dock, just before the vessel is launched. At that stage, the repair work is nearly complete. However, to comfortably rely on dry dock alignment, the hull deflections need to be predicted with relatively high confidence.

2. Shaft Alignment Procedure

The reference line for positioning the shafts, bearings, main engine and gear box be established. This is not always the case, however.

After the sighting through is finished, the established shafting reference line is further rectified (if necessary) by a slope boring or inclination of the stern tube bearing.

Vessel is now ready for shafts to be put in place, propeller installation and system assembly (connecting the engine and gearbox, where applicable).

When shafts are positioned in place, if necessary, the additional (temporary) bearings are used to assist the assembly. Propeller is connected and, if required, the load is applied at the forward end of the tail shaft to hold it in contact with the forward stern tube bearing before assembling. At this stage, it is normal practice for the yard to verify pre-assembly alignment condition of the shafting by conducting a so-called "Sag and Gap" procedure.

Sag and gap is verified between mating flanges, and has to comply with appropriate, analytically obtained, values. If sag and gap is conducted in the dry dock, the yard should be able to fully control the alignment, meaning that the measured values of sags and gaps should be verified quite accurately against the analytically predicted values. If sag and gap is conducted on a waterborne vessel, then the accuracy of analysis may be in question, as the hull deflection effect needs to be considered.

Further verification of the alignment condition should proceed with the vessel afloat. On a waterborne vessel, it is more difficult to ensure compliance with the calculated alignment, as the hull deflections are difficult to predict accurately. However, with the controlled dry dock alignment, any deviation in bearing reactions from calculated to measured values should be attributed to hull deflections.

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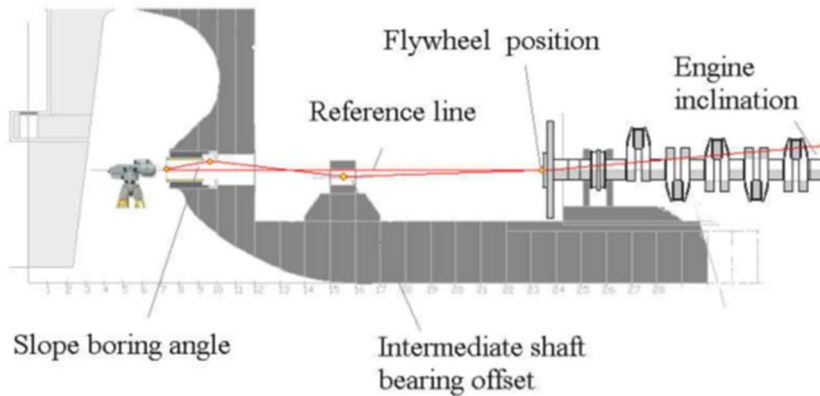
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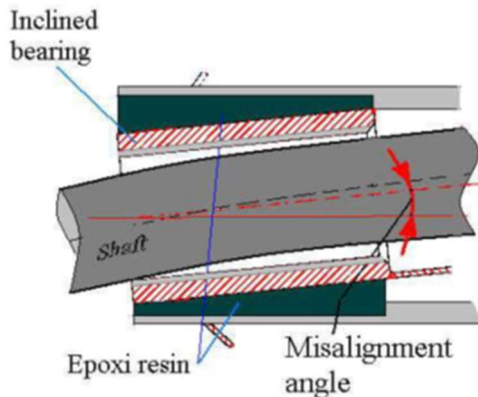
The general policy of the classification societies is to accept the procedures which result in a satisfactory solution. The problem in the alignment case is that the complexity of the procedure provides insufficient guaranty that initial nonconformance with alignment requirements (sighting through in particular) in the dry dock can be eventually rectified to comply with requirements as the vessel is waterborne.

The propulsion shafting alignment procedure can be summarized in the following activities:

- Sighting through (bore sighting)
- Bearing slope boring or bearing inclination
- Engine bedplate pre-sagging
- Sag and Gap
- Reactions measurements
- Bearing-shaft misalignment evaluation
- Shaft eccentricity (runout) verification
- Intermediate shaft bearing offset readjustment



Example of Optical/Laser Sighting Through



Bearing Inclination

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3. Shaft Alignment Survey

Alignment Acceptance Criteria

Shaft alignment is acceptable for all operational conditions of the vessel, if the following is satisfactory:

- Bearing reactions are positive on all bearings.
- Misalignment slopes are acceptable.
- Crankshaft deflections are within engine maker's limits.
- Gear contact is acceptable.
- Stresses are not contributing significantly to the total stress level.

Attendance

When and where is Surveyor's attendance important?

What is important to be verified during the alignment procedure?

- Equipment calibration record
- Pre-shaft-assembly Survey
- Sighting through
- Slope boring
- Sag and Gap
- After-shaft-assembly Survey
- Bearing reaction
- Shaft runout
- Bearing-shaft misalignment (front aft, port-starboard)
- Crankshaft deflections
- Engine bedplate deflections
- Gear contact
- Gear shaft bearing reactions

REFERENCES:

- CONARINA Instructions. Courtesy of ABS.

- ATTACHMENTS: No

Kindest Regards,

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