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Dedicated to the 150th Anniversary and
The 1st Congress of World Engineers and
Riga Polytechnical Institute / RTU Alumni

DIGEST

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Ship Main Engine Bearings Vibration Analysis

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Keywords – **ship main engine, vibrations, bearings.**

I. Introduction

Damages to the crankshaft main bearings and pins account for the most engine damages. Through bearing temperature monitoring in real time the damages listed hereafter can be quickly detected while the engine is running:

- Excessive wear of the bearing shells;
- Bearing misalignment;
- Detective lubrication.

During engine running operational personal can only trace temperature dynamic for some engine sensitive points (see Fig.1).

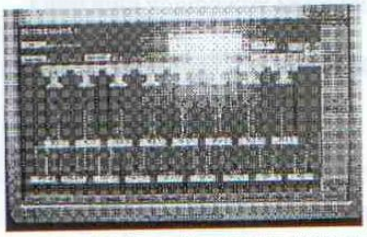

Fig. 1 Passenger ferry "Julia" one of 4 main engines bearing temperature indication screen

II. The Main Engine Bearing Behavior

Usually main bearing failures were in middle of engine. The bearing was a steel backed thin wall lead bronze with a tin lead overlay, tin lead gone, lead bronze held and crankshaft just needed a polish (see fig. 2). Class Inspection Society had no program for main bearings opening before 25 000 hours. All main bearings during 25 000 hours must be removed for inspection and if not satisfactory, to be changed. The thrust usually is at the aft coupling face. As it was mentioned above we usually see a lot of failures most in the middle of an engine.

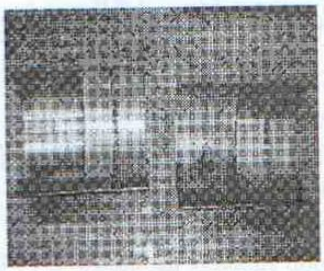

Fig. 2 SEMT PIELSTIC PC2-5 L bearing shells

If the engine is misaligned, there will be a lot more force on the drive end main bearing and that will become more worn than the rest, the overhanging mass of the flywheel can also cause more wear in the lower bearing supporting it. The "bend" in the shaft caused by the weight of the flywheel or misalignment can also cause excess wear on the opposite face of the next bearing.

If the chocking or supporting structure for the engine has failed causing excessive crankshaft deflections, the deflections may also indicate which bearings are likely to become damaged. The vibration measurement for a ship's main engine (SME) set with base system - an anchor bolt system could be conducted. The engine unit of an SME to be measured .The SME set is installed on a ship hull foundation with anchor bolts (anchor bolt system) (See fig. 3).

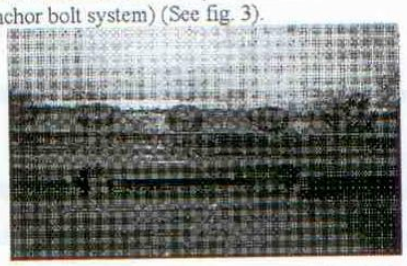

Fig. 3 Scheme of ship's hull underwater part survey [DetNorskeVeritas, 2010]

The engines are mounted on an elastic suspension system so that engine vibrations are minimum transmitted to the hull. This study evaluates the assessment of a coil spring-viscous damper system for the vibration and isolation of an SME from ship hull by measuring its operational vibration and ship hull responses. The vibration performance of a coil spring-viscous damper system could be evaluated by the vibration measurements for 1 SME set with existing base system - an anchor bolt system .The performance of the coil spring-viscous damper system could be evaluated by tests with a scaled model of a base isolated on a ship hull frame. The effects of SME base isolation on the fragility curve and core damage frequency in ship plant could also be investigated through a case study.

The SME set of ship in research Unit 4 is mounted on a rubber plate system in order to prevent a transfer of an operational vibration from the SME body to the ship hull. A rubber plates consists of 18 rubber elements and has a vertical stiffness of 35.6 N/mm and a horizontal stiffness of 24.9 N/mm, as shown in fig. 3. A viscous damper has a damping coefficient of 2.5 kN/m in both the vertical and horizontal directions.

III. Conclusions

The resultant vibrations could be measured by using 8 PCB Piezotronics model 393B12 accelerometers whose locations is proposed in engine bedplate, during both non-operating and normal operating conditions of the engine for comparison. For the anchor bolt system, 6 accelerometers (P1-P6) could be installed on the surface of the SME steel foundation separated from the floor frame by a gap, one could be installed on the engine, and one accelerometer could be installed on the floor slab, as shown in fig. 3.

The accelerations measured from the SME with the anchor bolt system normal operating conditions of the engine must be shown in Tables. For the SME with the anchor bolt system, the average accelerations measured on the hull foundation must not exceed 0.166 m/s2 or 84.0 dB under normal operating conditions. A larger acceleration measurement during engine operation indicates growing problem with engine bearings and it give time to plan engine maintenance.