Celtic Explorer - Generating Engine Alignment Problems

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The Problem

- While carrying out a starboard generating engine scheduled 20,000 hour overhaul and Class survey at the A&P Shipyard, Falmouth, what appeared to be a small area of de-lamination was discovered in the main journal/thrust.

- Further examination of the crankshaft in the workshop found the journal not to be delaminated but layered with white metal in one area near the oil hole.

- Following re-assembly, the engine could not be aligned with the alternator. Further investigation on 23 January 2008 found that the transportation plates had not been removed from the engine movement limiters at the time of new building.

- Study of the port and centre engines also revealed that the transportation plates were still fitted.

Condition of Class

- The engine manufacturer Wartsila forbade any further operation of the engines until rectification work had been carried out and Lloyd's Register placed a Condition of Class upon the vessel.

- Examination of the flexi-mounts on all engines found them to be suffering from a high level of creep/settlement, having been subjected to an abnormal operating environment. The attending Metallistic (Trelleborg) specialist advised that although good enough to remain in operation for the short term, they should all be renewed. Unfortunately, new flexi-mounts could not be obtained at short notice.

Condition of Class Cont.

Lloyds requiring that certain criteria be met prior to lifting the condition, of class as follows:-

1. All flexi-mounts to be examined/replaced as required.
2. All travel chocks to be removed and engines restored to correct running criteria.
3. Engine alignment to be checked and restored to recommended running parameters.
4. Crankshaft deflections to be returned to recommended running parameters.
5. Engine blocks to be inspected.
6. Engine bed frame to be examined.
7. All bolts and bolt holes to be inspected.
8. All main bearings to be inspected.
9. Vulkan coupling between engine and alternator to be inspected/replaced.
10. All alternator bearings to be inspected/replaced as required.
11. Electrical status of alternators inspected and checked.
12. Wartsila must sanction unrestricted use and operation of all engines prior to operation.

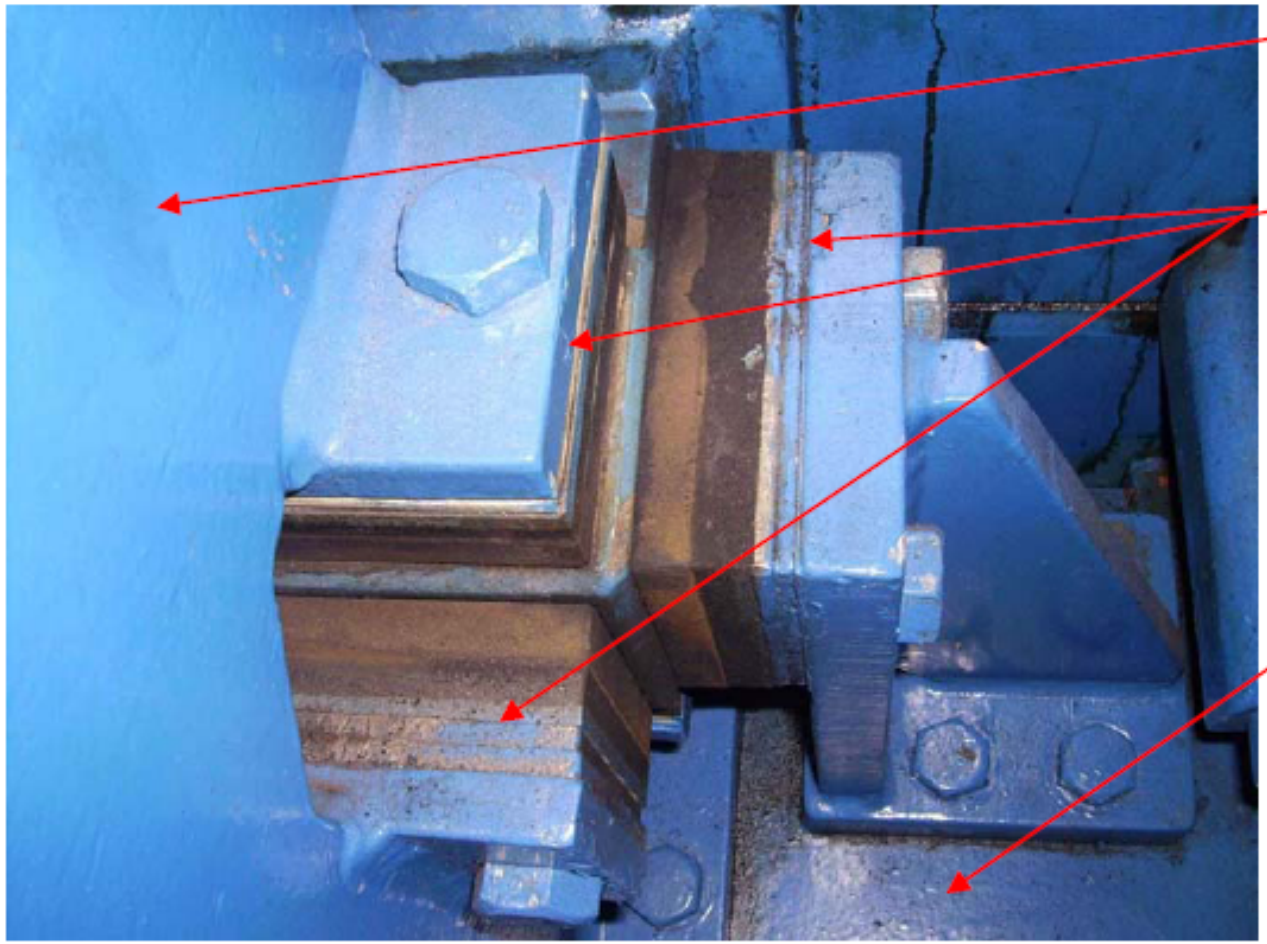
Back in Class

- In order to comply with the above criteria, Wartsila technicians attended and removed all transportation plates prior to examining the bearings and re-aligning all three engines to the alternators.

- With the exception item 1, the above work was carried out to the satisfaction of Lloyd's attending surveyor, who lifted the initial Condition and imposed a further Condition of Class, recommending that all flexi-mounts were to be renewed within three months, extended only after further survey if the delivery time is delayed.

Transportation Plates or Engine Movement Limiters

- The photograph below shows an engine limiter of which there are two fitted to each side of each engine.

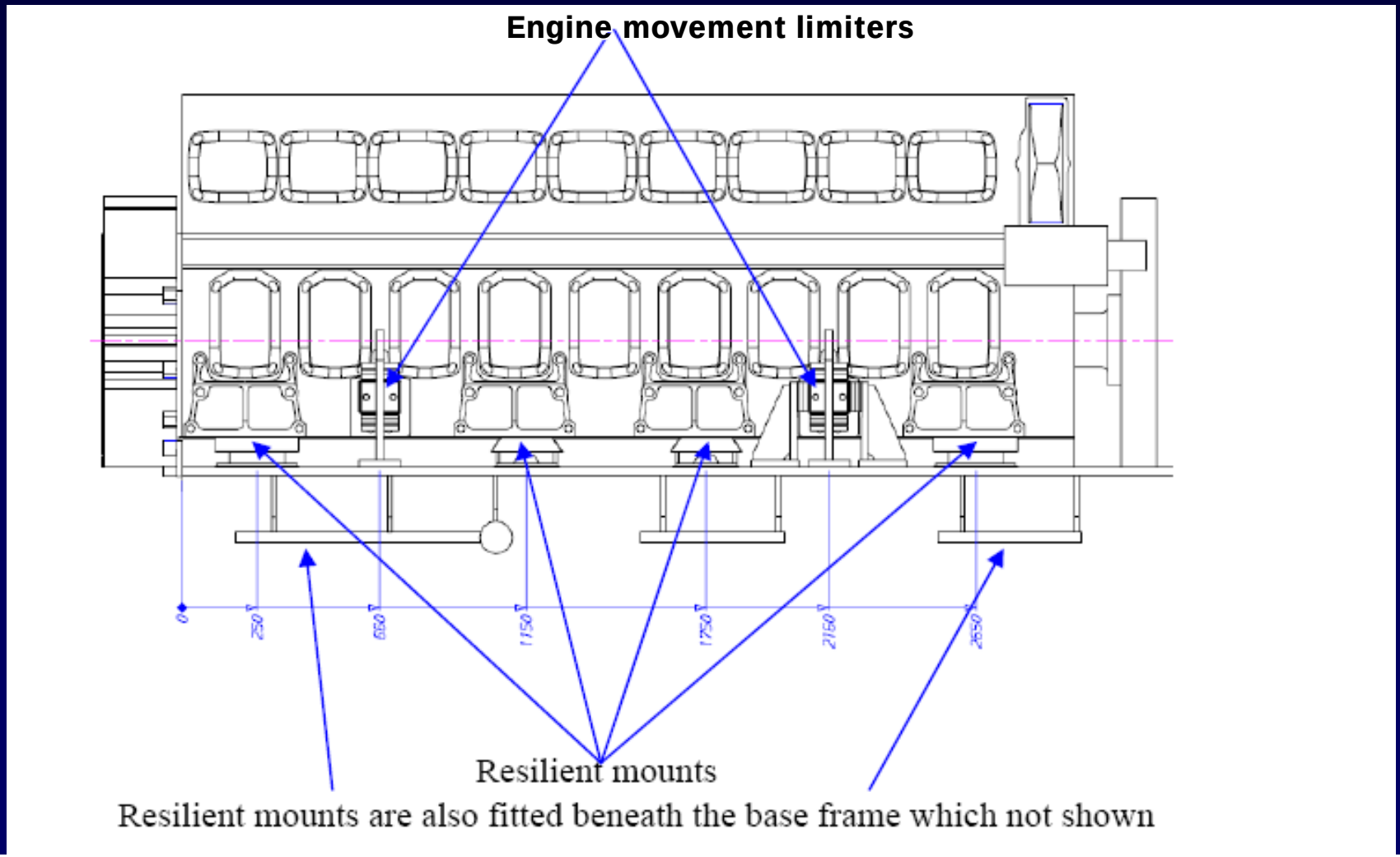


Transportation Plates or Engine Movement Limiters

- Transportation plates hold the engine rigidly for transportation purposes and should be removed when fitting into the vessel to give a limiter clearance of 6 mm. Thus the engines rest on the resilient mounts and are free to move within the specified clearances.
- The above photograph is of one limiter on the “Celtic Explorer” and clearly indicates the lack of any clearance due to the transportation plates being still in place and which are effectively holding the engine in a rigid position, vertically, axially and laterally.
- The above condition was common to all limiters on all three generating engines.

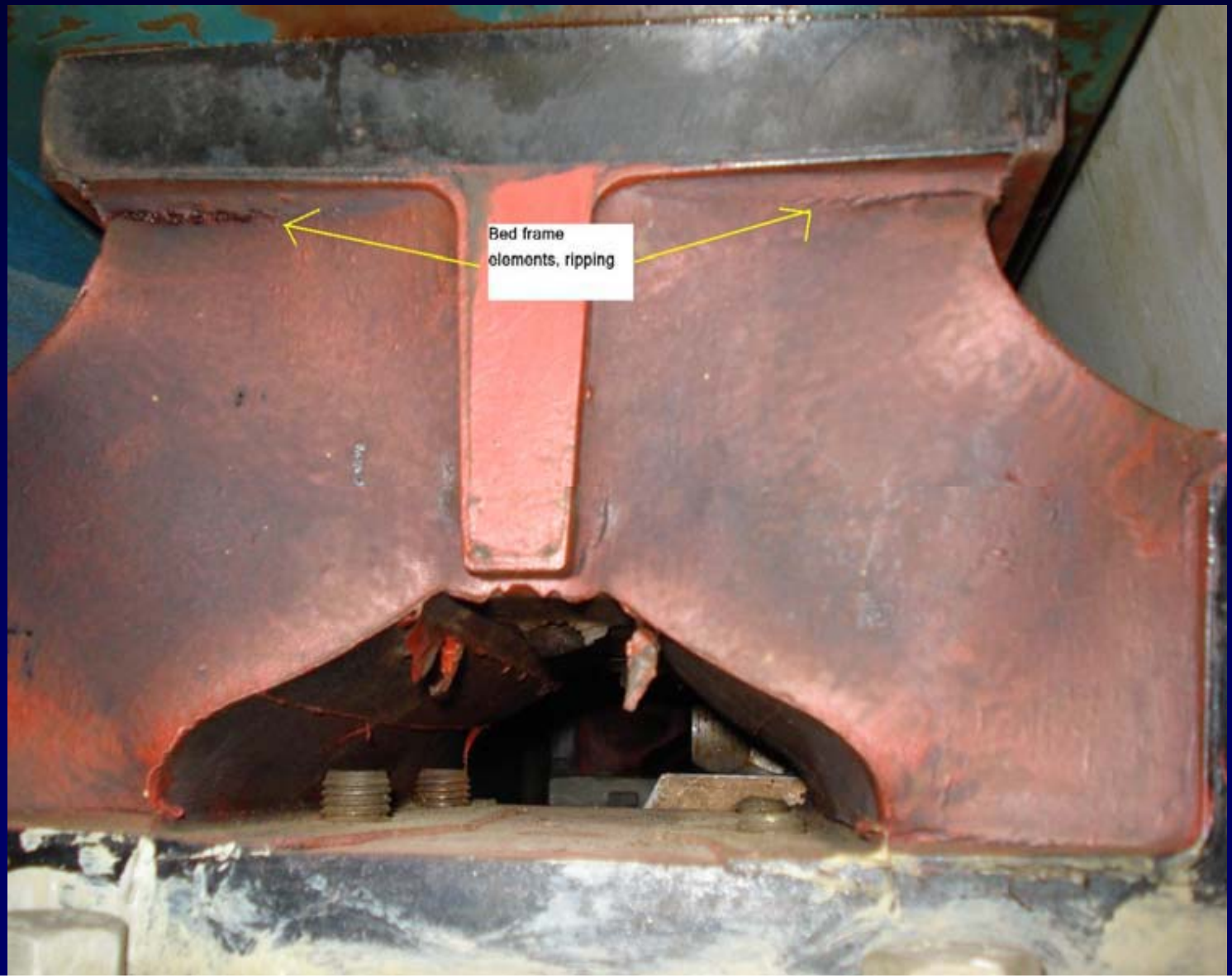
Transportation Plates or Engine Movement Limiters

- The drawing below is a side elevation showing the resilient mounts and limiters.

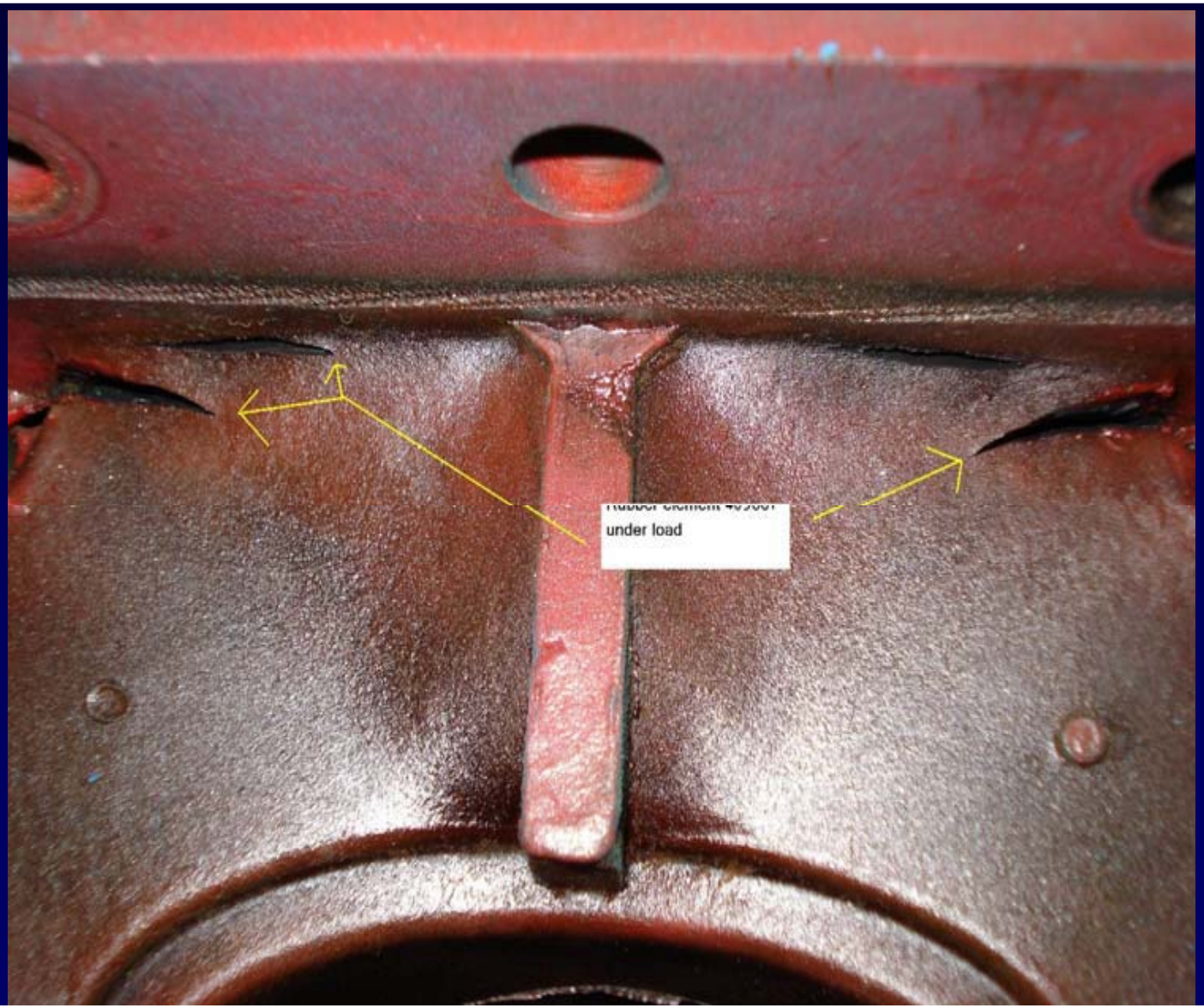


The photograph below shows the Vulkan coupling rubber element taken from the starboard engine which has suffered fatigue and ultimate cracking due to abnormal operating conditions. The port engine coupling also suffered from fatigue and cracking to a lesser extent.

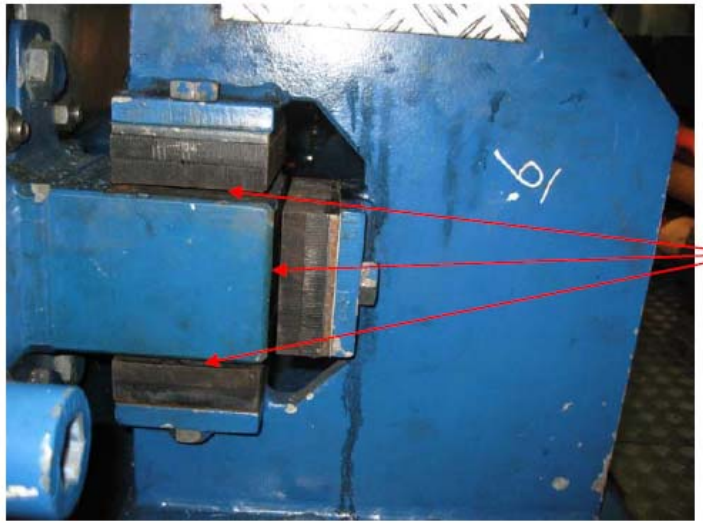
The photograph below is of a bedplate mounting Metalistic series super ‘D’ flexi-mount which clearly shows fracturing at the ends caused by abnormal high stress due to an incorrect working environment.



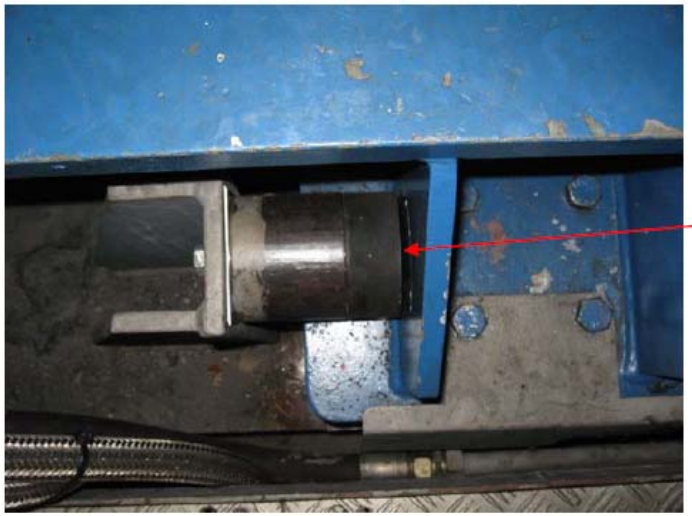
This next photograph is of an engine mounting metalistic series'D' flexi-mount showing tearing of the rubber under load. Condition of all super 'D' and 'D' types was found on the occasion of previous survey to be similar and obviously requiring renewal.



The photograph below show one engine limiter. Following removal of transportation plates, the 6 mm clearance can be clearly seen in all planes.



Height and side clearances.



Longitudinal clearance

Manufacturers Instructions

- Wartsila Installation procedure advises that additional distance plates are installed behind the rubber elements in the limiters for transportation. Remove the additional distance plates and adjust all clearances to 6 mm. The clearance is adjusted by adding or removing distance plates of different thickness, delivered in 1 mm, 5 mm and 6 mm thicknesses.

- The above would indicate that it is the responsibility of the shipyard to ensure that correct clearances are obtained. However, commissioning of engines is more often than not the responsibility of the engine builder.

- In any event, Owners could not possibly have known about the transportation plates, engines having been installed and commissioned prior to delivery as the initial Wartsila maintenance manual issued to Owners makes no mention of limiters, only stating that the flexi-mounts are to be inspected at 24,000 hours and replaced if necessary.

Current Situation

- Wartsila confirmed that the transportation plates were still in place at Falmouth following the 20,000 hours overhaul in December 2007/January 2008 and most definitely should be removed prior to operation. They have also agreed that the transportation plates were not removed prior to commissioning in 2001.

- Following exhaustive investigation and in light of findings MI alleged that damage sustained in way of the port and starboard generating engine crankshafts and the ensuing abnormal conditions found in way of all three generating engines is as a result of shipbuilders and/or engine manufacturers negligence by way of not removing the transportation plates from the engine limiters prior to installation and commissioning in 2001.

- The case has now gone to arbitration; however the Marine Institute has decided not continue its involvement in the arbitration and so the engine damage claim is now being pursued by the underwriters.

Final Thoughts

- Costs for all of the repair works are subject to a claim under the owners H&M policy and this claim is progressing well.
- A 20% loading on the policy for 2009 will come into effect pending the outcome of the arbitration process.
- Insurance – If the MI were self insured pursuit of this claim through arbitration would be unavoidable to recover of costs.
- Damage resulted in the charter of the Thalassa; however, the MI decided not to pursue a claim for consequential losses.
- Food for thought - ICES 209 achieved even with limiters in place!