Marina Tanker Sdn Bhd v Chan Fook Choon and Another
[2002] SGHC 67

Case Number : Suit 244/2001

Decision Date : 05 April 2002

Tribunal/Court : High Court

Coram : Judith Prakash J

Counsel Name(s) : Gerald Yee with Bazul Ashhab (Joseph Tan Jude Benny) for the plaintiffs; Jason Lim with Tan Kay Khai (Michael Khoo & Partners) for the defendants

Parties : Marina Tanker Sdn Bhd — Chan Fook Choon; Kwok Ai Ing (Both formerly trading as Mariner Engineering Company)

Judgment

GROUNDS OF DECISION

Background

1. This is a claim for damages arising out of allegedly negligent work done in respect of the engine of the plaintiffs' vessel.

2. In March 1995, the plaintiffs ('the owners'), were the owners of a marine tanker called *Nur Marina* ('the vessel'). They arranged for the vessel to be dry-docked at the premises of Pan United Shipyard in Singapore in order that it could undergo the special maintenance survey required by its classification society, the American Bureau of Shipping ('ABS'), every five years. As part of the survey, the ABS surveyor had to inspect certain engine parts and for this purpose, the owners employed the defendants ('the repairers') who were carrying on business in partnership as ship repairers, to open up the main engine, take out and overhaul certain parts and thereafter reinstate these parts and close the engine.

3. Initially the scope of work undertaken by the repairers was as follows:

> (1) to disconnect and remove the six cylinder heads and to service them;
>
> (2) to dismantle, take out and service two pistons and two journal bearings and prepare them for inspection by the ABS surveyor;
>
> (3) to open up two piston crowns for survey and to decarbonise the pistons, the rings and ring grooves;
>
> (4) to dismantle two main bearings for survey;
>
> (5) to clean the main engine lubricating oil sump;
>
> (6) to reassemble all the abovementioned items and reinstate them to their original positions in good order.

In the course of the works, the original scope insofar as it involved the main engine was expanded to include the servicing of main bearing units nos. 2 and 6 for the surveyor's inspection, the withdrawal of piston nos. 2, 3, 4 and 5 for the surveyor's inspection and the overhaul of fuel injectors and fuel pumps.

4. The vessel entered the dry-dock at the beginning of March. In the course of the works, the lubricating oil in the main engine was pumped out and placed in oil drums on the vessel's deck. It was originally intended to entirely replace the lubricating oil once the works were completed. The new stock of oil did not arrive by the time the vessel was ready for its mooring and sea trials and the owners were anxious to complete these so that the vessel could be loaded with a cargo bound for Haiphong. The decision was therefore made to reuse the old lubricating oil and this was re-pumped into the engine. The mooring trials and sea trials took place successfully on 17 March 1995. No engine problems were experienced.

5. The vessel then proceeded for loading. She commenced her voyage to Haiphong on 20 March 1995 at about 0600 hours. At about 0100 hours the next day, the main engine broke down. The initial inspection by the chief engineer found that the no. 3 piston and crankpin had sustained severe damage. The vessel then deviated to Kuantan for emergency repairs. She arrived in Kuantan on 22 March at 1940 hours. After the repairs were carried out, the vessel left for Haiphong at about 1024 hours on 25 March. One and a half-hours later, the engine was stopped again due to the presence of loud knocking noises. Investigation showed that the nos. 2, 5 and 6 crankpin bearings were excessively worn and the no. 6 piston and piston liner showed signs of seizure. Emergency repairs were effected and the vessel returned to Kuantan again.

6. Subsequently, representatives from the engine manufacturers, Wartsila Diesel (Singapore) Pte Ltd ('Wartsila') went to Kuantan to investigate. They concluded that the main engine could not be used and many parts required replacement. The vessel was then towed to Singapore for permanent repair. These repairs were carried out by Wartsila. The owners are now claiming from the repairers the costs they incurred for these repairs, for towage fees and for extra crew payments that they had to make.

The dispute

7. The owners' case is that the repairers were negligent in carrying out the contracted overhaul work and repairs to the main engine of the vessel and/or failed to carry out the overhaul and repairs properly, with due diligence, care and such standards as may have been reasonably expected of a professional ship repairer. They asserted that the damage to the main engine had been caused by the improper fitting of the connecting bolts or bearings during the works carried out by the repairers.

8. The repairers contended that they had carried out their works properly and that the loss or damage, if any, sustained by the owners was wholly due to the conduct or default of the owners or their agents or employees. They asserted that the main engine of the vessel had not been maintained in a good and operational condition. Prior to commencement of the works, the vessel had overheating problems. When the works commenced, it was found that the lubricating oil was watery and dark in colour and contained debris. The piston crowns of unit nos. 1 and 6 were found to be badly choked with accumulated hardened surfaces which prevented or made it difficult for the lubricating oil to reach the cooling system; the white metal bearing and crankpins were scratched and the exteriors of the piston crowns had grooves.

9. The repairers asserted that they had recommended to the owners' representative, one Mr Chan Kok Onn ('KO Chan'), that the other four piston crowns should also be opened for servicing but no instruction to do so was given to them. Further, they and the classification surveyor had advised KO Chan to change the lubricating oil but this had not been done. Instead, the vessel had reused the old oil for its mooring and sea trials and had not changed it before the vessel left Singapore en-route to Haiphong. As the evidence developed, it became apparent that the reuse of the old lubricating oil was the main plank of the repairers' theory of how the damage had arisen.

The evidence : (1) General

10. The vessel *Nur Marina* was from 1990 until 1995 classed with ABS. As WH Chan, a surveyor with ABS since 1981 confirmed, the primary purpose of ABS is to determine the structural and mechanical fitness of ships and other marine structures for their intended purposes. It does this through a procedure known as classification. An owner seeking the classification of a ship in accordance with the rules of ABS must submit the ship for periodic inspection by ABS surveyors to verify that the ship is constructed, operated and maintained in accordance with those rules.

11. Annual surveys of the vessel were carried out in accordance with the Classification Rules of ABS in 1991, 1992, 1993 and 1994 and the vessel maintained her ABS classification. A special survey was due in March 1995 for the purpose of, among other things, checking on the main engine and its major components and ascertaining whether these would be in proper running order for the next five years.

12. The main engine was a stork Werkspoor diesel engine manufactured by Wartsila. It had sustained major damage in 1992 due to a sudden change in propeller direction. In July 1992, Wartsila had carried out repairs to the main engine and one of the issues that arose was whether a change of lubricating oil had been effected at that time. Mr Khoo Chin Yew who was the fleet manager of Maritime Consortium Management Sdn Bhd ('MCM') took the position that there had been a change of lubricating oil. The basis of his assertion was that the repairs that Wartsila had carried out had involved replacement of part of the lubricating system and thus the oil must necessarily have been changed as well. Mr Khoo inferred the change of oil from the invoices he produced showing what work Wartsila had done. He conceded, upon cross-examination, that he had no invoice directly showing the supply of oil to the vessel in July 1992.

13. The owners were not able to produce the vessel's engine logbooks to substantiate their assertion of the change of oil as the vessel had been sold and the logbooks were missing. The only records that were produced in court were extracts from the logbooks for the period between January 1994 and March 1995 made by Richards Hogg International (Asia) Pte Ltd when they investigated the engine breakdown of March 1995. These extracts did not disclose any change of oil during the period from January 1994 up to 21 March 1995. According to Mr Khoo, however, no problems were experienced with the main engine between the repairs in 1992 and the survey in March 1995.

14. In February 1995, Mr Khoo was looking for a ship repair firm to open up the main engine for the purpose of the special survey. He asked KO Chan, then MCM's technical manager, to find such a firm. Subsequently Mr Khoo was introduced by KO Chan to Mr Chan Fook Choon ('FC Chan'), the managing partner of the repairers' firm. After discussions between Mr Khoo and FC Chan, the repairers gave a quotation for the work and this was subsequently accepted after an amendment to it was made on 2 March 1995.

15. The vessel arrived at the Pan United Shipyard and was dry-docked some time in early March 1995. Mr Khoo deputed KO Chan to attend at the shipyard on behalf of the owners to facilitate the survey and liase with the repairers, the shipyard and the surveyor from ABS. WH Chan attended at the shipyard and on board the vessel as the ABS surveyor in charge of the special survey. The work was done by the repairers' workmen in the presence of the chief engineer of the vessel.

16. The work commenced on 4 March 1995. The vessel moved out of dry-dock on 10 March 1995 and left the shipyard altogether on 17 March 1995. Between 10 March and 17 March, work continued on the vessel whilst it was moored alongside the wharf.

17. In the course of the works, the lubricating oil was pumped out of the main engine and stored in drums on the deck of the vessel. The oil was not checked at the time it was pumped out and no sample was taken from it for analysis. At some stage during the works, it was decided to replace the lubricating oil. The repairers' position was that this decision was made at the very beginning and that is why the oil was put in the drums without being subjected to testing. Mr Khoo, however, testified that the decision to change the oil was made somewhat later and for convenience since the vessel was undergoing repair. He said that there was no pressing need to change the oil in March 1995 as the vessel had only put in 3119 running hours since the last oil change and the engine maker's specifications required a change of oil only after 12,000 hours. It should be noted here that the engine maker also recommended that the oil be analysed every 1000 hours in order to ascertain its condition and suitability for use. Whilst in cross-examination Mr Khoo maintained that there was a practice of regularly analysing lubricating oil on vessels managed by MCM, he did not have any records to show the results of such analysis for the oil on board the *Nur Marina*. Also it was common ground that the lubricating oil on board the vessel at the time of its dry-docking was not analysed prior to it being re-pumped into the main engine.

18. The question of whether the lubricating oil had needed to be changed drew some attention. The ABS surveyor testified that he had no comment on whether the lubricating oil needed to be changed. He did not check its condition since there was nothing in the rules that required him to make any recommendation as to the oil. He did notice that during the inspection the oil had been removed from the sump and that the sump was clean. He did not have any expectation that, simply because the sump had been cleaned, the oil would be changed. He agreed that it was not good marine practice to use 'old' oil but clarified that by this he meant using oil for beyond the length of time recommended by the manufacturer. ABS did not have any rule requiring owners to change the oil every time the engine was opened and it was up to the owners to keep track of how long the oil had been used for in any particular case.

19. As stated above, there was no direct evidence of when the previous change of oil had taken place. Michael Thompson, who was the surveyor appointed to investigate the cause of the damage to the main engine by the vessel's insurers, stated in his affidavit of evidence-in-chief that the main engine's running hours from October 1992 up to the time when the vessel was dry-docked in March 1995 amounted to 3119 hours whilst 18 running hours lapsed between the time the vessel left the dry-dock to the time the main engine broke down. When he was asked about this in cross-examination, he explained that he had got the figure of 3119 hours during discussions with the owner's representative and the chief engineer. He had either been told the figure or had been shown a record book. He confirmed that he had looked at the current logbook of the vessel and that it was standard practice for the chief engineer to update the running hours periodically. Thus the latest logbook would always show the vessel's current running hours.

20. Mr Thompson confirmed that he had no doubts about the running hours given to him and there was no reason to suspect that the figure was incorrect. It was pointed out to him that while in the notes he had made at the time of survey he had jotted down that the total running hours of the engine were '3119 from 10/92' he had also noted that the oil had been renewed at the last overhaul. It was put to Mr Thompson that by this he meant that the oil had been changed in March 1995. Mr Thompson denied this. He asserted that he had been told that there was no oil change in March 1995 and that it had been his mistake to use the words 'last overhaul'. What he had actually meant was that the oil had been renewed during the previous overhaul that took place in 1992.

21. FC Chan gave evidence to the effect that during the course of the works he had recommended to the chief engineer and to KO Chan that they should change the lubricating oil. This was because the oil appeared to him to be dirty and possibly overused. He was also concerned that water and

sediment could have corrupted the oil as the oil separator was not working and appeared to have been out of order for some time. During cross-examination, FC Chan asserted that he was able to tell what the condition of the lubricating oil was simply by looking at it. In this case, the oil was very dark and had contained a lot of debris. On further questioning, however, he agreed that the actual condition of the oil and whether it was suitable for further use could only be ascertained by analysis. Mr Chan also testified that when he learnt that the owners were going to reuse the old oil, he had protested to KO Chan and told the latter that he was taking a big risk in reusing the old oil. This protest had not, however, been put in writing.

22. KO Chan, who gave evidence for the repairers, corroborated, in his affidavit of evidence-in-chief, the repairers' assertion that it was FC Chan who had recommended that the lubricating oil be changed as the oil separator had been out of order. He had accordingly, requested MCM to supply new lubricating oil. Pending the supply of the new oil, the mooring and sea trials were deferred for about a day or two. The new oil did not arrive, however, and the trials were eventually carried out without a change of lubricating oil. In court KO Chan said that it had been the intention to throw away the oil from the beginning and that since it was to be discarded, he had not paid much attention to the condition of the drums into which it had been pumped. He also did not check the condition of the oil because he knew it was to be disposed of. When I asked why he had wanted to dispose of the oil, the reply was that they were going to clean the sump tank and wanted to put fresh oil back into the clean sump.

23. In cross-examination, it was put to KO Chan that he had not made any arrangements to dispose of the oil. He disagreed and said that he had made such arrangements. These consisted of arranging for the empty drums to be supplied and for the old oil to be pumped into the drums. It was then put to him that he did not write to the shipyard to tell it that he would be giving it 20 drums of oil to dispose of. KO Chan's only reply to this was that he could not remember whether he had done so or not. In re-examination, he said that the oil was not filtered before it was pumped back into the sump. He was also asked in re-examination whether he was concerned when the decision to reuse the old oil was made. His reply was that he was a bit concerned because it was used oil but he did not know the exact condition of the oil. He did not ask for tests to be carried on the oil because during that period, the top management was pushing the ship to go on charter. He was not extremely worried about the oil situation. When I asked him why not, he then said that he was worried but the decision came from the top management to get the vessel moving and the new oil did not come so he had no choice about the matter. When asked whether he had made the decision that it was safe for the voyage to Haiphong to proceed without a change of oil, his reply was that that the top management had made decision and he had not discussed safety concerns with the top management. No analysis of the safety situation had been made. When it was put to him that in that case he could not have been that worried, his reply was 'No, I was a bit worried, not extremely worried.'

24. It should also be noted that whilst KO Chan had made an affidavit for the repairers on 6 December 2001, he had also made and signed a statement at the request of the owners' lawyers some seven days later. In 18 of this statement, he said that ordinarily lubricating oil would be renewed when a vessel is dry-docked to take advantage of the facilities available at the repair yard. Likewise, in this case, he had ordered fresh lubricating oil but the same did not arrive before 20 March 1995. He then decided that it was absolutely safe for the vessel to carry out her voyage to Haiphong without a change of oil and to change the oil when she returned to Singapore. He based his decision on the following:

> (1) the engine maker's recommendation that the oil be changed after 12,000 hours and the fact that, as at 20 March 1995, the engine had only run for 3119 hours; and

(2) the lubricating oil did not appear to be dirty. If it was dirty it would have damaged the bearings and the surveyor from ABS would have requested him to change them. The ABS surveyor after inspection here had found the bearings to be in satisfactory condition and suitable for reuse.

Thus, in 18 KO Chan made three statements that were at variance with his testimony in court, to wit:

(a) that he had been the person who had decided that it was absolutely safe for the vessel to proceed on her voyage without an oil change;

(b) that as at 30 March 1995, the engine had run for only 3119 hours; and

(c) that the lubricating oil did not appear to be dirty.

25. When KO Chan testified he was asked whether the matters in 18 of his statement were true. He replied that he could not confirm the truth of the contents of that paragraph. He was asked why he had signed the statement without correcting the inaccuracies and he replied that he was under pressure from the lawyers who had kept asking him to make another affidavit. Subsequently Mr Chan said 'I signed it because I assumed it was only a statement and not to be brought forward to the court. I thought it was only for their own investigation'.

26. There was also conflicting evidence on the issue of the oil separator. FC Chan said that this was not working. He also stated that during the trials he observed the purifier was not functioning and that the lubricating oil had been bypassed through a filter and an oil cooler and then sent back to the main engine sump tank. He had not brought up this matter of the non-functioning of the oil separator to the ABS surveyor, KO Chan or the chief engineer because the oil separator was not part of the repairers' scope of work. FC Chan's position on the oil separator was echoed by KO Chan in the latter's affidavit. The statement he made had, however, contained nothing about the oil separator. In court he repeated that the oil separator was not functioning during the mooring trials. In cross-examination, however, he admitted that he did not personally check the oil separator. He had said that it was not working because as far as he knew when the vessel went into the yard, the component was not functioning. KO Chan agreed that since the vessel was in dry-dock there was an opportunity to repair the oil separator and asserted that attempts to carry out these repairs had not been successful due to the non availability of spare parts. He was then asked how he could be sure that the separator was not repaired while the vessel was in the yard and his reply was that he could not be sure of this. KO Chan could not remember whether he had checked up on this point with the chief engineer.

27. The other witness who gave evidence on the condition of the oil separator was WH Chan, the class surveyor. His testimony was that it was working throughout the period that he was on board the vessel. Mr Chan pointed to an item in his survey report entitled 'Lube Oil Purifier(s)' and the fact that he had marked a cross alongside this item thus indicating that he had examined it as part of his survey. He testified that some of the components had had to be examined in an open state and the oil separator was one such component. His examination of the opened up separator had revealed there was nothing abnormal about it. Mr Chan testified that in all cases where a component had to be examined in an opened up state, it had to undergo a function test after re-assembly as well. The oil separator had been tested after re-assembly and it had run.

28. In the course of the works, the crowns of pistons nos. 1 and 6 were removed and dismantled for survey. According to FC Chan, on dismantling, the crowns were found to be heavily layered with carbon which the workers had some difficulty in removing. He also asserted that the condition of the

piston crowns was drawn to the attention of the chief engineer but the repairers were not asked to dismantle or examine the other four piston crowns. Under cross-examination FC Chan agreed that he had not put his observation about the condition of the two crowns in writing. He maintained, however, that he had recommended a dismantling of the other four crowns but that this recommendation had not been accepted.

29. All witnesses agreed that the mooring and sea trials had passed without incident. The position taken by FC Chan with which the class surveyor agreed was that if the repairers had made a mistake in the tightening of the bolts securing the cylinder heads, the main bearings and the connecting rod (sometimes also referred to as the 'con-rod') assembly, the problem would have become noticeable during the trials. He asserted that it was improbable that the engine could have undergone the mooring and sea trials successfully if any part of the engine had not been properly re-assembled.

30. The ABS survey was completed by 20 March 1995. The vessel retained its classification status. The finding of the surveyor was that the main engine and its parts were in satisfactory condition. Although certain recommendations were made regarding matters of maintenance which the owners were advised to attend to, these did not impinge on the satisfactory condition of the main engine.

(ii) The breakdown and the damage

31. The chief engineer filed a breakdown report on 7 April 1995 in which he detailed what had happened during the vessel's voyage. Mr Thompson also included an account of the breakdowns in his original survey report dated 3 May 1995. From these accounts, it appears that the following was what happened.

32. At about 0110 hours on 21 March 1995, the crew heard heavy knocking sounds coming from the engine room. The chief engineer immediately stopped the main engine from the wheelhouse and proceeded to the engine room to stop the engine. He found that the push rods of the no. 3 piston were bent. He then dismantled the cylinder head of no. 3 piston and found that the liner has scratched. The piston crown was found to have detached from its skirt and the crankpin bearing was damaged. The crew then blanked off the no. 3 piston. They restarted the engine at 2015 hours on the same day and run at an idling speed with five cylinders for about one hour. They found the engine to be in satisfactory condition and departed for the Kuantan outside port anchorage at 2315 hours.

33. The vessel arrived at the anchorage outside Kuantan at 1940 hours on 22 March. A spare piston assembly was delivered on board and refitted into the no. 3 cylinder. The piston rings were set and the con rod bearings and push rods, taffet and fuel racks were readjusted. The main engine was tested at idling speed for one hour. All appeared to be normal and the vessel then departed for Haiphong again at 1024 hours on 25 March 1995.

34. At 1155 hours the same day, a loud noise was heard in the main engine crankpin and a subsequent inspection revealed that the no. 2, 5 and 6 crankpin bearings were damaged. The crew replaced the nos. 2 and 5 crankpin bearings, removed the no. 6 piston and connecting rod that were also damaged and blanked off the no. 6 cylinder. They then started the main engine with the other five pistons and returned to Kuantan anchorage.

35. The main engine was inspected by Wartsila and also by Mr Thompson. He found the following damage to have occurred:

> 'Crankshaft –

Nos. 2, 3, 4, 5 and 6 crankpins, 0.5mm undersize, scored and discoloured to varying degrees.
Nos. 3 and 6 crankpin with multiple heat cracks extending up to about 25mm length in way of no. 3 crankpin and over area approx. 150 x 60mm

Surface hardness was 650 Brh, exceeding Makers limit of 380 Brh. No. 3 crankpin worn down 0.22mm
Main journals lightly scored due to debris in oil.

Connecting Rods –

Nos. 2, 3 5 and 6 connecting rods heat affected and discoloured in way of bearing housing.

Pistons and cylinder liners.

No. 3 piston crown detached from skirt due to broken securing bolts and heavily scored.
Cylinder liner scored and valve push rods bent.
No. 6 piston and cylinder liner scored.

Turbocharger –

Turbocharger bearings suspect as the lubricating system common with main engine.'

(iii) Technical evidence

(i) The plaintiffs' expert

36 There were two expert witnesses, one called by each side. The owners' expert witness was Mr Michael Thompson. He has been employed as a surveyor by The Salvage Association since 1989. Previously he had worked as a chief engineer, engineer superintendent and fleet manager. In regard to this incident, The Salvage Association was appointed by the hull underwriters of the vessel to investigate the cause of the damage to its main engine in March 1995. Mr Thompson was assigned the job.

37. According to Mr Thompson's affidavit, he first went on board the vessel on 8 April 1995 after it arrived in Singapore. He inspected the vessel's main engine to ascertain the extent of the damage and reviewed the vessel's documents including the logbooks and the statement made by the chief engineer. He also interviewed the chief engineer and KO Chan.

38. Wartsila had been instructed by the owners to carry out repairs to the main engine and they were attending to the engine while Mr Thompson was on board. They were stripping down the main engine and he therefore inspected it. He found that the main engine was a 6-cylinder Stork Werkspoor diesel type 6SW280 engine. After Wartsila opened up the engine, various parts of it were transported to their workshop. Mr Thompson was able to take photographs of various damaged parts.

39. In his affidavit Mr Thompson dealt with the following allegations which the repairers had made:

(1) prior to commencement of works, KO Chan informed the repairers that the vessel was having overheating problems and could not achieve normal speed;

(2) the existing lubricating oil was reused and that oil was watery and dark in colour and contained debris;

(3) the piston crowns were badly choked with accumulated hardened substances;

(4) white metal bearing and crankpins were found scratched; and

(5) the exterior of the piston crowns had grooves.

40. On the alleged overheating problem, Mr Thompson commented that it might have been due to high exhaust temperature. The owners had instructed the repairers to overhaul all fuel pumps, fuel injectors and cylinder head valves. Defects in any of these could give rise to high exhaust temperature. The maintenance repairs and overhaul carried out by the repairers would have rectified the alleged overheating problem. In any event, such problems were not related to the damage suffered by the main engine. In Mr Thompson's opinion, the overheating problem would not and did not cause or contribute to the main engine damage.

41. Secondly, Mr Thompson considered that the allegation that the lubricating oil used was in poor condition was without merit. This was because all the crankpin bearings and the four main bearings that were removed for survey and inspection by the class surveyor were reused. If the lubricating oil had been in such a poor condition as the repairers alleged, the aforesaid bearings would have been damaged and the ABS surveyor would not have allowed them to be reused and would have recommended that they be renewed.

42. Further, after the main engine suffered damage, the main bearings were examined and found to be in satisfactory condition with no appreciable wear. If the lubricating oil was in poor condition or if there was insufficient lubrication, the main bearings would be the first engine part to fail or suffer severe damage or wear. In the present case, however, none of the bearings showed that it had suffered excessive wear or severe damage.

43. Mr Thompson then dealt with the allegation that the repairers had recommended that the piston crowns of units 2, 3, 4 and 5 be opened for servicing but that no instructions were given to them to do so. He stated that Wartsila had overhauled all the pistons in 1992 and in his view it was highly unlikely that hardened deposits would have built up in the pistons after they had run for only 3119 hours. The recommended running hours between one overhaul of the pistons and the next is between 6,000 hours and 12,000 hours. The ABS surveyor had surveyed the pistons here. He had seen the piston crowns of units no. 1 and 6. As there was no recommendation by him to disassemble nos. 2, 3, 4 and 5 pistons for further examination, Mr Thompson deduced that nos. 1 and 6 had been in satisfactory condition and were not badly choked with hardened substances.

44. Following the damage suffered by the main engine Wartsila's representatives and Mr Thompson examined the damaged no. 3 piston. He found no evidence of the piston crown being badly choked with accumulated hardened substances. Mr Thompson also noted that the no. 6 piston that had been serviced by the repairers had sustained severe damage whereas pistons nos. 2, 4 and 5 which were not serviced by the repairers did not sustain any damage at all. Had the pistons' oil space been badly choked with accumulated carbon causing overheating as alleged, all the cylinder liners would have sustained excessive wear. During the overhaul in March 1995, however, the cylinder liners were all

found to be in good condition.

45. As regards the allegation that the white metal bearings and crankpins were scratched, Mr Thompson repeated that the bearings and crankpins had been surveyed by the ABS surveyor and had then been reused. That reuse confirmed that these parts were in satisfactory condition.

46. Regarding the allegation that the exterior of the piston crown had grooves, Mr Thompson believed that this was a reference to scratches found on the piston crown. He noted that it is not unusual for piston crowns to have scratches as these are bound to occur on surfaces which come into contact and rub into each other. The fact that all the pistons were surveyed by the class surveyor and were reused confirmed that the pistons were in satisfactory condition.

47. Mr Thompson's conclusion after having considered all the various possible causes of damage to the main engine, was that the damage was caused by and attributable to the improper fitting/positioning of the crankpin bearings by the repairers. He explained that for fitting the crankpin bearings, there is a guide hole at the bottom of the bearing shell where the locating pin on the bearing cap fits. If the bearing shell is not properly positioned during installation of the bearing cap, the locating pin will cut into the bearing and would cause deformation of the bearing shell. Excessive wear of the bearing shells followed by knocking or hammering would result. The bearing shells could turn or twist within the housing, shutting out oil supply to the piston and thereby cause a seizure in the liner. His inspection of the bearing shell showed that the locating hole was deformed indicating that the bearing shell had been improperly positioned. It should be noted that Mr Pereira agreed that this evidence was technically correct although of course he did not agree that this is what had happened in this case.

48. Mr Thompson considered that his conclusion that the damage sustained by the main engine was caused by the improper fitting of the bearing shells by the repairers during the overhaul was supported by the fact that four out of the six crankpin bearings sustained damage within a short period after the overhaul.

(ii) The defendants' expert

49. The repairers called Mr Ronald Mervin Pereira as their expert witness. Mr Pereira is a qualified marine engineer and is presently a consultant and a director of RIS Technical Services (S) Pte Ltd. He obtained a first class engineering certificate of competency in July 1967 and after sailing as a third engineer and as a second engineer for five years, became a marine surveyor and consultant. He has had 34 years experience in this field.

50. Mr Pereira was appointed in November 2001 by the repairers' solicitors to review all pertinent documents and information including affidavits of evidence-in-chief and pleadings relating to the breakdown of the main engine of the vessel in March 1995. On the basis of all this information he prepared and submitted a report on 19 December 2001 giving his opinion on the cause of the main engine breakdown.

51. Mr Pereira first recited the details of the work carried out by the repairers and noted that upon re-assembly of the main engine, it had undergone successful mooring and sea trials before returning to operation. In his opinion the works were carried out specifically to comply with the classification society's requirements and although all cylinder heads were overhauled together with the fuel pumps and injectors, the scope of the work was insufficient to result in significant improvement of the performance of the main engine.

52. Mr Pereira considered that although the vessel was class maintained at the commencement of the voyage to Haiphong she was unseaworthy in view of the fact that the main engine sump had been refilled with unserviceable lubricating oil. In his opinion, the act of reusing the previously used lubricating oil, which had been removed from the main engine sump for the purpose of cleaning it, initiated the sequence of accelerated wear of the crankshaft bearings during the sea trials (after re-assembly of the engine), which culminated in the seizure of no. 3 piston in its cylinder liner on 21 March 1995 while the vessel was on loaded voyage to Haiphong.

53. In Mr Pereira's opinion, the seizure of no. 3 piston was caused by overheating, brought about by inadequate piston cooling which probably arose from the blockage of the lubricating oil piping/passages providing lubricating oil cooling to the piston; the blockage being primarily caused by foreign particles and sludge present in the unserviceable lubricating oil clogging the small diameter piping/passages through which the lubricating oil flows to the crankshaft journals, crankpins and pistons whilst the main engine is in operation.

54. Mr Pereira considered that the main engine breakdown on 25 March 1995 was an extension of the breakdown on 21 March. In his view, the damage to nos. 2, 3, 4, 5 and 6 crankpin bearings already existed on 21 March but their eventual breakdown was pre-empted by the seizure of no. 3 piston on that day. The crankpin bearing damage was probably caused by inadequate lubrication to the crankpin bearings as a result of partial blockage of the lubricating oil passages in the crankshaft by foreign particles and sludge present in the lubricating oil.

55. The failure to fully overhaul nos. 2, 3, 4 and 5 pistons after they had been removed from the main engine also, in Mr Pereira's view, contributed to the seizure of no. 3 piston in its cylinder liner on 21 March. This was because the overhaul of nos. 1 and 6 pistons had showed that the piston crown were heavily internally layered with carbon and this condition probably also existed in the no. 3 piston crown.

56. It was Mr Pereira's considered opinion that the main breakdowns of the vessel's main engine on 21 and 25 March 1995 were primarily caused by the negligence of the chief engineer and the technical superintendent for the following reasons:

> (1) electing to reuse the unserviceable lubricating oil which had been pumped out of the main engine sump. As the oil purifier on board the vessel had not been operated for some time, the lubricating oil in the main engine sump was obviously in poor condition (containing a high degree of insolubles and water) and should have undergone reconditioning and analysis (to establish serviceability) before it was poured back into the cleaned engine sump. The fact that the repairers were requested to clean the sump indicates that the oil was in dirty and unserviceable condition and it was therefore necessary to fill new lubricating oil into the sump before putting the main engine back into operation; and
>
> (2) electing not to fully overhaul nos. 2, 3, 4 and 5 pistons although they had been removed from the main engine. The full overhaul of nos. 1 and 6 pistons showed that they were internally layered with carbon. This should have indicated that the internal condition of the other four pistons was similar and that their full overhaul was necessary. By allowing the re-assembly of the main engine without such overhaul, the chief engineer and technical superintendent acted negligently and contrary to correct engineering practice.

57. Mr Pereira also commented on the owners' assertion that incorrect tightening of the main bearing

bolts caused the damage. In his view, the incorrect tightening of the main bearing bolts and big-end bearing bolts would have resulted in damage of a different nature ie loosening of the securing nuts and detachment of the bearing caps which could have caused catastrophic impact damage to the crankshaft, bedplate and entablature, as a result of the detachment of the connecting rod from the crankpin or dislodgement of the main bearing cap with consequent crankshaft misalignment. The Wartsila engineers did find the crankpin bearings badly scoured and the corresponding connecting rod housing and crankpin overheated. This finding, in Mr Pereira's view, supported his opinion that operating the main engine using unserviceable lubricating oil had primarily caused the two main engine breakdowns.

Findings

58. Before I go on to discuss the experts' opinions, I should make findings on the other matters in dispute. First, the condition of the oil separator. It was FC Chan's position that this had not been working in early March 1995. He stated that he had not brought up the matter to the repairers or the ABS surveyor since the oil separator was not part of the repairers' scope of work. This excuse seems to me to be a feeble one for not mentioning that something was out of order especially since it could have been repaired at the time and FC Chan could have given a quotation for the work and obtained instructions to carry it out. As a ship repairer it was not in his interest to fail to point out malfunctioning parts to the owner. I find his evidence on this point to be unsatisfactory.

59. I am aware that KO Chan also stated in his affidavit that the oil separator was not working. This assertion was not contained in his statement and its strength was also undermined during cross-examination when he admitted that he had not personally checked the component and also that he could not be sure whether the component had been repaired during the time the vessel was at the shipyard.

60. On the other hand, WH Chan, the ABS surveyor, asserted quite firmly that the oil separator had worked both when it was tested on its own and when it was operating as part of the engine during the trials. He had checked this component for the purpose of his survey and had no doubts about its functioning. I accept this evidence in preference to that given by the repairers as WH Chan was there as an independent assessor of the situation. He was there to ascertain whether the vessel met the class requirements and he had no interest in the outcome of the survey one way or another. His evidence on the point was not subject to any of the doubts that undermined the testimony of WH Chan and KO Chan. I therefore find that the oil separator was functioning when the vessel left the shipyard.

61. The next issue is as to the condition of the lubricating oil. There was no direct evidence on this point since no analysis of the oil was performed. However, there was evidence from Mr Thompson and Mr Khoo that the vessel had run for only 3119 hours since its last oil change and therefore the existing lubricating oil should have been in good enough condition for continued use. Mr Thompson went to investigate the situation. He interviewed the chief engineer and saw the logbooks and he was quite clear that the figure that he was given was correct and that there was no reason to doubt that figure. I accept his evidence on this point. I note that FC Chan testified that the oil was dirty. He, however, did not make any written protest about the reuse of the oil at the time. KO Chan's evidence on the point was of dubious reliability since he had almost simultaneously given a contradictory account to the owners' lawyers.

62. I therefore find that there is no evidence that the lubricating oil that was pumped out of the vessel in early March 1995 was unserviceable at the time that it was put back into the vessel.

Further, accepting that only 3119 hours had elapsed since the last oil change, this lubricating oil should have been in good enough condition for further use since there were more than 8,000 hours to elapse before it would have to be changed in accordance with the manufacturer's recommendation. On this point KO Chan's evidence was also instructive. He had said in his statement that he thought it safe for the vessel to sail. Whilst he averred in court that the oil was dirty upon being pressed he confirmed he had not been extremely worried about the oil, only a bit worried. On consideration of his evidence on this point, it appears to me that the correct version was, probably, that at the time he did consider it safe for the oil to be re-used.

63. Mr Thompson's evidence was that if the lubricating oil had been in poor condition, the main bearings would have been the first engine part to be affected. In this case, the class surveyor examined the main bearings for the purpose of the special survey and found them to be in order. Thus, the lubricating oil must have been in reasonable condition. It is also noteworthy that the special survey took place only once in every five years and therefore if components examined by the class surveyor passed the survey, it would mean that their condition was good enough to last a further five years. This in fact was admitted by Mr Pereira in cross-examination.

64. The other preliminary issue relates to the condition of the two piston crowns that were dismantled by the repairers. FC Chan stated that he had found these to be heavily layered with carbon and that he had drawn the chief engineer's attention to the situation and suggested to the latter that the other piston crowns be cleaned as well. Again, his complaint was a verbal one only. One would have thought that he would have wanted the extra business and that when his suggestion to the chief engineer was ignored, he would have made it in writing direct to Mr Khoo in Malaysia. After all on the contractual matters and the scope of work, he knew that instructions came from Mr Khoo. It appears to me that the situation that the repairers found on dismantling the two piston crowns was not as serious as Mr Chan later made it out to be.

65. Turning to the cause of the damage to the main engine, the repairers relied on the opinion of Mr Pereira. His evidence was based on his analysis of the facts as gained from documents and affidavits. Unfortunately, he had not been engaged at the time of the incident and therefore had not had the opportunity of examining the engine or any of the damaged components. Also, he had not had an opportunity of speaking to the class surveyor before giving his opinion. His opinion on what could have caused the main engine damage is set out in 56. To summarise, the use of unserviceable oil caused the lubricating oil passages to be blocked by foreign particles and therefore the main engine was starved of lubricating oil and overheated. Secondly, the failure to fully overhaul the other four pistons meant that they continued to be heavily layered with carbon and this contributed to the seizure of the no. 3 cylinder.

66. Mr Pereira's hypothesis is that overheating of the piston, which caused it to seize, was caused by lubricating oil starvation. This in turn arose from the blockage of the lubricating passage. The cause of the blockage was the presence of dirt in the lubricating oil. Mr Pereira posited that the lubricating oil was dirty on two grounds:

> (a) because the owners had decided to clean the main engine sump (in fact when I asked him that he had deduced that the lubricating oil was dirty simply because the decision was taken to clean the sump, he agreed that that was so); and
>
> (b) the lubricating oil separator had not been working for some time.

As far as ground (a) is concerned, during cross-examination Mr Pereira conceded that the cleaning of

the main engine lubricating oil sump was because the ABS surveyor required it to be cleaned for the purpose of the survey. Thus, it would appear that whether or not the sump was dirty, was irrelevant to the decision to clean it. As far as ground (b) was concerned, as I stated, Mr Pereira did not have the benefit of WH Chan's evidence that the oil separator was working when the vessel left the shipyard. Thus, neither ground (a) nor ground (b) provided Mr Pereira with a solid basis for his hypothesis.

67. There are other grounds on which it is difficult to accept the hypothesis that the lubricating oil was extremely dirty and therefore unserviceable. As I pointed out above, the ABS surveyor found the crankshaft bearings and the main bearings to be in satisfactory condition. Mr Pereira agreed that there was no excessive wear of these items at the time of the damage. He was then asked to agree that that showed the lubricating oil could not have been dirty up to the time of survey. His answer was that that was not necessarily so as the bearings may have been passed because they were within tolerance. He then admitted, however, that passing the special survey meant that the items had been certified to be fit for the next five years. That being the case it appears improbable to me that the bearings were at the limit of acceptability. They must have been in fairly good condition to be passed as useable for a further five years.

68. Mr Pereira had also admitted that the dirt in oil by itself would not have caused the kind of damage that the main engine sustained. He agreed that for the various parts to be damaged the way they were, the oil supply had to be cut off. However dirty the oil could get it would not cause this damage because as long as the oil could flow through the system it would perform its cooling function. His theory about the causation of the damage was based on blockage of the system so that no oil got through to cool the main components.

69. There was, however, a difficulty with the theory that the system was blocked. Mr Pereira's evidence was that the lubricating oil would have passed through two filters. These filters had pores that were 30 microns or three hundredth of a millimetre in size. He also testified that the size of the oil passage in the crankshaft is between five to ten millimetres in diameter. Thus, it would appear that only very tiny particles could pass through the filters and enter the passage. Mr Pereira asserted, however, that such particles could consolidate into sludge and then block the passage. Mr Thompson's evidence was that the bigger particles would not be able to enter the oil passages because the filter would trap them before they entered the engine. Even if very tiny particles went through the filters a build up of sludge would be unlikely because of the high pressure, high velocity flow and temperature of 60C. He asserted that there are a number of forces that prevent sludge build up in the passage and, if at all, sludge would build up in the sump. Mr Pereira agreed under cross-examination that the oil flowing through the filters would be running at a high temperature and under great pressure though he disagreed that that would entirely prevent build up of sludge. It appears to me that in these circumstances and considering the minuteness of the particles that would be able to pass through the filter, even if a build up of sludge could take place as asserted by Mr Pereira, that build up would be a slow process and would not lead to blocking of the passage within a period as short as the 18 hours that elapsed between the vessel leaving Singapore and the no. 3 piston seizing in the South China Sea.

70. Further, Mr Pereira gave evidence that the blockage was between the main bearing and the no. 3 crankpin bearing. Even if Mr Pereira was correct in his assumption, the blockage between the main bearing and the no. 3 crankpin bearing could not have caused damage to the other crankpins ie nos. 2, 4 and 5. The blockage theory does not, therefore, explain all the damage sustained.

71. The other reason why Mr Pereira considered the owners negligent was that they had not ensured that all the pistons were fully overhauled. However, as I have stated, the evidence of CF Chan that

pistons no. 1 and 6 were internally layered with carbon was not satisfactory. In addition, Mr Thompson's evidence is that he had examined the damaged no. 3 piston and found no evidence of the piston crown being badly choked with accumulated hardened carbon. That evidence does not support Mr Pereira's theory that all the other pistons must have been affected in the same way as no. 1 and no. 6. It should also be noted that even though the no. 6 piston was fully overhauled, it still seized. Mr Pereira agreed that that was so but asserted that separate factors had caused the seizure. If that was the case, then overhauling pistons no. 2, 4 and 5 would not necessarily have prevented them from seizing either.

72. Overall, I am not able to accept the theory put forward by the repairers as to the cause of the damage. As I have stated earlier, Mr Pereira's opinion depended on the presence of certain facts. Once the facts he relied on were shown to be incorrect, the strength of his opinion was greatly diminished. There were also other difficulties in the repairers' version of events.

73. The other theory put forward on the causation of the damage was that espoused by Mr Thompson. I have set out his evidence in more detail above. I found his evidence to be coherent and consistent. He considered that the seizure of the no. 3 and no. 6 pistons and the damage to the no. 2, 4 and 5 crankpin bearings were caused by the improper fitting of the crankpin bearings by the repairers. Mr Pereira agreed that such improper fitting could have caused damage of this nature but did not think that this had happened in this case because after the main engine was assembled, sea trials had taken place successfully. His view was that improper fitting would have manifested itself during the sea trials.

74. Mr Thompson was cross-examined on his belief that the damage was caused by the improper fitting despite the fact that there were no signs of improper fitting during either the mooring or sea trials. He explained that during the mooring and sea trials, the damage to the bearing metal had already been initiated and that the bearings had started to wear down. As, however, the bearings were lined with a thin layer of white bearing metal which was relatively soft, this layer was the first layer to be worn down and the wear was not appreciable enough to cause obvious manifestations of damage ie knocking sounds and, subsequently, piston seizure. With the continuous running of the engine as the voyage continued, more wear of the bearing shell metals took place. The next layer to be eroded was the copper layer but the damage may still not have manifested itself because the gap (or clearance) would be small since the layers are thin. As the crankpin bearing metals became excessively worn down, a larger space (more clearance) was created which caused the 'knocking' because of the motion of the piston and total bearing failure occurred. Mr Thompson asserted that the damage would only manifested itself after total failure of the bearings. I find this to be a coherent and credible explanation of why no damage was noted during the sea trials.

75. When Wartsila examined the main engine and its components after the incident, they found the main bearings to be damaged: three of them were badly scored and the other three were lightly scored. On this basis, the repairers submitted that the damage was due to insufficient lubrication. Mr Thompson had agreed that if the lubricating oil was in poor condition or if there was insufficient lubricating oil, the main bearings would be the first engine part to fail or would suffer severe damage or wear. He was therefore cross-examined by counsel for the repairers in an attempt to show that the main bearing damage had occurred before the other damage sustained by the engine.

76. Mr Thompson asserted that the damage to the main bearings had arisen as a consequence of the other damage. He had noted in his note book at the time that when he inspected the no. 4 and no. 6 main bearings, he had found them to have sustained damage that was a lot less severe than the crankpin damage. He took photographs of the bearings and these photographs showed that the soft bearing metal was still in existence. This was an indication that the bearings had not been subjected

to as severe damage as the crankpin bearings had because in the latter case, the bearing metal had sustained excessive wear. The metal debris from the crankpin bearings had entered the oil and circulated with it and this is what had caused damage to the other components like the main bearings. Mr Thompson was convinced that the debris had entered the oil only after the crankpin bearing metals had been worn because the bearings had been inspected during the overhaul, the liners and the piston had been calibrated and the components had not shown any appreciable physical wear at that time. He also said that visually, it was obvious that the particles embedded in the crankshaft bearings had come from the crankpin bearings or from the other excessively worn parts of the engine. He had done this visual inspection and was very sure where the metal debris had come from. Mr Thompson's great advantage over Mr Pereira in this case was that he had seen the main engine and its components in their damaged state and had had access to all equipment parts and personnel necessary for the purposes of his investigation.

77. Having considered all the evidence, I accept Mr Thompson's testimony and opinion that the cause of the damage was the improper fitting of the connecting rod bolts or bearings by the repairers during the overhaul of the engine in mid March 1995.

Conclusion

78. As a result, there must be judgment for the plaintiffs against the defendants as regards liability and costs. As to quantum of damages, I would like further submissions on this issue. I will see parties in chambers on the same.

Sgd:

JUDITH PRAKASH
JUDGE