IN THE HIGH COURT OF THE REPUBLIC OF SINGAPORE

[2017] SGHC 198

Suit No 225 of 2011/D

Between

Pan-United Shipping Pte Ltd

… Plaintiff

And

Cummins Sales and Service Singapore Pte Ltd

… Defendant

JUDGMENT

[Contract] — [Contractual terms] — [Exclusion clauses]

[Contract] — [Discharge] — [Breach]

[Contract] — [Formation] — [Acceptance]

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Pan-United Shipping Pte Ltd
v
Cummins Sales and Service Singapore Pte Ltd

[2017] SGHC 198

High Court — Suit No 225 of 2011/D
Chan Seng Onn J
5–6 May; 15–17, 22–23 August 2016; 13–15 March; 27 July 2017

14 August 2017 Judgment reserved.

Chan Seng Onn J:

Introduction

1 The port main engine, a Cummins KTA-50-M2 four stroke V16 engine ("PME"), of the Plaintiff's tugboat PU 3202 ("tugboat") was top overhauled by the Defendant from 16 to 31 January 2007 pursuant to a contract evidenced in writing by the Defendant's quotation dated 24 January 2007 accepted by the Plaintiff. After completion of the top overhaul and in the course of a free running test by the Defendant on 31 January 2007, the PME seized up after running for between five[1] to seven[2] minutes. Thereafter, the PME could not be started electrically and was not able to rotate freely by manual cranking.

2 The PME was brought back to the Defendant's workshop and stripped

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1 Exhibit Dl.

2 Chief Engineer's Statement, DCB 72 (PBD 129).

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down. It is undisputed that all the main bearings and journals were variously and severely wiped out and unevenly scored.[3] However, the connecting rod bearings ("conrod bearings") were not damaged. The crank journals were severely scored with a deep crack also found on the centre main journal.[4] The crankshaft was bent beyond the maximum allowable limit.[5] The main bearing bore was also out of alignment beyond the maximum allowable limit.[6] The piston, liners, cylinder heads, connecting rods and camshaft appeared to be in normal condition.[7] Metallic particles were also found in the lubrication oil ("lube oil").

3 Hence, the Plaintiff brings this suit against the Defendant for causing damage to the PME by failing to prime the PME before starting it for the free running test. Mr Peter Anthony Ryan ("Mr Ryan"), the Defendant's expert, provides a good explanation of the meaning of "priming" in the context of engine lubrication. Mr Ryan states[8] that priming is an engineering term that describes the action of pumping, filling, flooding or distributing sufficient lube oil around the engine lube oil system including pipes, manifolds and filters prior to any mechanical movement of the engine. Priming is a process that ensures that all components are coated in lubricant whilst the engine remains static in advance of any mechanical movement. For the purposes of this case, parties have adopted a loose meaning of "priming" and not the strict sense of the engineering term as described by Mr Ryan.

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3 DCB 79 (1DBD 224); DCB 150 (1DBA Tab 6 at para 15).

4 DCB 79 (1DBD 224).

5 DCB 79 (1DBD 224); DCB 151 (1DBD Tab 6 at para 17); DCB 152–153 (Exhibit D8).

6 DCB 81 (1DBD 225).

7 DCB 79 (1DBD 224); DCB 150 (1DBD Tab 6 at para 16).

8 1DBA Tab 10 p 33 at para 3.2.1.3.

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4 To prime the PME, the electrical wire from the fuel pump solenoid valve must first be disconnected in order to shut off the fuel to the engine. Otherwise, the engine operates at full combustion load upon starting, placing the crankshaft under such load before the lube oil is sufficiently circulated through the engine that it may seize up and be damaged.[9] That is what the Plaintiff says occurred in this case. From the specifications for mandatory gauges and alarms for the Defendant's engines found in the Defendant's Marine Application Bulletin on Controls, Gauges and Alarm Engine Protection,[10] it appears that there will be a risk of engine damage if the engine runs for at least 15 seconds with engine lube oil pressure below 12 psi.[11]

The pleadings

5 The Defendant accepts that its own "Operation and Maintenance Manual Marine Propulsion Units" for "N-NT-NTA-855-M, VTA28-M and K Series Worldwide" ("Engine Manual") sets out a procedure (see [36]) to prime the lube oil system before starting the engine when the engine has been shut down for more than five days *or* where there has been a change of lube oil.[12] As is admitted at para 17(b) of the Defence, the priming procedure stipulated in the Engine Manual is to "safeguard against damage to the main bearings caused by multiple dry starts. Multiple dry starts over a period of time would cause damage or accelerated wear to the main bearings."[13]

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9 Expert report of Mark Alexander McGurran (Plaintiff's expert) at para 97 (2PBA Tab 8 p 26).

10 Exhibit D7.

11 Defendant's Closing Submissions at paras 158–160.

12 Para 17(a) of the Defence.

13 Para 17b of the Defence.

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6 It is not disputed in this case that the PME was not only shut down continuously for a total of 15 days for the whole duration of the top overhaul, but there was also a complete change of lube oil. At this juncture, it is important to note that either of these circumstances on its own calls for the priming procedure to be adopted. In fact, the period of 15 days' shutdown for the top overhaul far exceeds the maximum period of five days beyond which the Engine Manual requires priming. Logic would dictate that the need for priming was all the more necessary given that both circumstances were present.

7 Although the Defendant admits at para 9 of the Defence that it did not prime the PME prior to starting the PME on 31 January 2007 despite both the extended shutdown of 15 days and the complete lube oil change, its defence is that the PME had sustained pre-existing damage which caused the seizure, and non-priming of the PME was not the cause.[14] The Defendant pleads that excessive vibrations from a bent or damaged port propeller or port propeller shaft had earlier damaged the PME.[15] No other pre-existing cause of damage to the PME has been pleaded.

8 I accept the Plaintiff's submission that the Defendant is not entitled to raise in its submissions other pre-existing causes that have not been pleaded. In any event, I shall consider them for completeness.

Sudden impact

9 The Defendant relies on an "extremely unusual incident"[16] on 10 January 2007 when the tugboat, which was then towing a barge laden with coal from

14 Para 16 of the Defence.

15 Para 16 of the Defence.

16 Defendant's Closing Submissions at para 9.

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Banjarmasin, Kalimantan (Borneo) to Ko Si Chang (Gulf of Thailand), had to be diverted midway through its paid voyage to Singapore. The Defendant says the problem was so serious that the tugboat could not continue with its voyage and had to be replaced midway by a chartered tugboat, the *Marina Venus 2*, on 15 January 2007.

10 An email dated 10 January 2007[17] was sent from the Plaintiff's operation control to the tugboat crew stating:

> 1) We r arrging [*sic*] diver for release of rope at propeller, ETA 15/01/07. …

11 The tugboat arrived at the outer port limit of Singapore on 15 January 2007, where an underwater inspection of the propellers was performed by Commercial Diving Services (Singapore) Pte Ltd. The divers did not find any rope or other foreign object at the propellers. Instead the propellers were found to be damaged. The Commercial Diving Report of 15 January 2007[18] described the various damaged areas at the tips of the port and starboard propellers, parts of which were bent. The tip of one blade of the port propeller measuring 32cm (L) by 6cm (D), and the tips of two blades on opposite sides of the starboard propeller measuring 10cm (L) by 13.5cm (D) and 5cm (L) by 5cm (D) respectively, were broken off. A divers' drawing[19] of the damage to the propellers is attached to the report. The port propeller blade was found touching the Kort nozzle,[20] and there was an extremely wide clearance of approximately 2.5cm in the port stern tube bearing.[21] No clearances were measured for the

17 DCB 26 (1DBD 92).

18 DCB 29–40 (1DBD 94–105).

19 DCB 39 (1DBD 104).

20 DCB 39 (1DBD 104).

21 DCB 40 (1DBD 105).

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starboard stern tube bearing as this was not part of the scope of the divers' inspection work.

12 I am of the view that the damaged propellers may have been a sufficient cause *per se* for the tugboat to be diverted to Singapore to have them repaired. It does not necessarily follow that the crankshaft of the PME must have been damaged at the same time just because the propellers were found to be damaged and the vessel had to be sent to Singapore for repairs to the propellers. Damaged propellers and damaged engines do not always go hand in hand. Propeller tips may be damaged without any associated damage to the engines. The American Bureau of Shipping Class Survey Report[22] for the tugboat dated 16 January 2007 described the damage as being "in non-critical area at the blades' tips" and recommended that the propellers be repaired.

13 Sudden impact to the port propeller causing damage to the PME is an unpleaded theory raised by the Defendant. I shall disregard it. In any event, I find it hard to accept that the engine could have been damaged through the shock load of the sudden impact, without there being any signs of damage in the Vulkan coupling of the gearbox or damage to the gear teeth. The Plaintiff relies on the Trans-Matic visual inspection report of the port gearbox on 8 February 2007[23] to prove that the gearbox was not damaged and the input side of the gearbox was able to rotate freely. The sudden shock load at the propeller must be transmitted first through the gearbox and Vulkan coupling before it can reach the PME engine crankshaft to bend or crack it. The lack of any apparent damage to the gearbox and coupling as stated leads me on balance to conclude that it is unlikely that the shock load transmitted to the PME (if any) was sufficiently

22 PBD 147.

23 DCB 77 (1DBD 221).

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large to cause the PME engine crankshaft to bend or crack.

Vibration

14 The Defendant's service report dated 16 January 2007,[24] acknowledged and signed by the Plaintiff's Chief Engineer La Hasan on board the tugboat, recorded that the "[c]ustomer also complained PORT engine [PME] with excessive vibration while on load". I accept that it is likely that there was some degree of vibration at the PME when it was on load. With damage to the port propeller and the wide clearance in the port stern tube bearing, it would not surprise me if there had been vibration. As there was also damage to the starboard propeller, I would also expect some vibration on the starboard main engine ("SME"). What is far more important is the degree of vibration, rather than the mere presence of vibration. However, there was no sea trial to establish the degree and nature of the vibration at the PME caused by both the damaged port propeller and the wide clearance in the port stern tube bearing. No measurements were taken of the frequencies and amplitudes of the vibrations (be they torsional and/or whirling vibrations) transmitted to the PME, which were alleged by the Defendant to be "excessive" but disputed by the Plaintiff. One cannot tell how "excessive" is excessive without the benefit of measurements. As stated by the expert for the Plaintiff, Mr Mark Alexander McGurran ("Mr McGurran"), little can be made of the vague term "excessive" vibration. No evidence was produced to show how long the engine was subjected to these vibrations and what the amplitudes and frequencies of these vibrations were at the location of the PME itself. These are important considerations to establish whether the PME could in fact have been internally damaged by these so-called "excessive" vibrations. Without such

[24] DCB 43–45 (1DBD 138–139, Exhibit D2).

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measurements, it is all too easy to speculate, as the Defendant has done, that these "excessive" vibrations caused internal damage to the PME and in particular to the crankshaft journals and main bearings. If that were the case, it seems incongruous that the contemporaneous work order did not even include any checks for vibration damage to the PME. I note that when the parties discussed what work was needed on the PME, the Plaintiff did not mention any excessive engine vibrations experienced on the PME for the Defendant to investigate and resolve as part of the top overhaul of the PME. Neither did the Defendant recommend that the Plaintiff check for damage to the PME due to "excessive" vibration.

15 The Defendant's technician, Mr Azahar, says that he did not experience excessive engine vibration on 16 January 2007, when he ran the PME for a free running test. He experienced only normal vibrations from the PME. I note of course that during this test, the PME was not put on load nor was it connected to the gearbox and the propeller shaft. This free running test establishes whether the engine can freely rotate at various rotational speeds without load and whether there is any unusual or excessive vibration at those rotational speeds without load. The service report of Mr Azahar dated 16 January 2007[25] did not disclose any unusual or excessive vibration detected during the free running test for the PME.

16 Mr Sivasothy Nanthagopal ("Mr Sivasothy"), the expert for the Defendant, maintains that vibration from the damaged propeller tip caused the crankshaft of the PME to bend.[26] However, I find it difficult to accept that. If the crankshaft had bent due to the severe vibration from the propeller tip, then

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25 DCB 43–45 (1DBD 138–139, Exhibit D2).

26 2DBA Tab 11 p 31 paras 71–72.

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how could the PME with a bent crankshaft have operated for so many continuous hours under load, and, together with the SME, powered the tugboat all the way to Singapore without seizing up? The free running test of the PME even up to a rated speed of 1,800 rpm *prior* to the top overhaul shows that the PME was still able to run normally and without excessive vibration (albeit not under load) *prior* to being taken over by the Defendant for the top overhaul.

17 It must be noted that the PME seized up only *within a few minutes* with no load and at idle speed during the free running test on 31 January 2007. The only significant fact is that there was no priming by the Defendant's technician as is required by the Engine Manual prior to starting the PME.

18 It is for the Defendant to prove that the damaged port propeller and the excessive port stern tube bearing wear had together or individually caused excessive vibration to the PME when the tugboat was in operation out at sea, such that the PME was *already damaged* prior to the top overhaul.

19 If the propeller damage, excessive port stern tube bearing wear, vibration and bent crankshaft whilst out at sea caused the PME to breakdown during the Defendant's short free running test at idle speed under no load after the top overhaul, then I am most surprised that it did not break down much earlier when the tugboat was journeying back to Singapore for repairs, during which the PME was subjected to far more stringent operating conditions under load at higher rotational speeds for a much longer operating period. Not only did the PME not break down whilst out at sea before the Defendant's *post-overhaul* free running test on 31 January 2007, it also did not breakdown during the *pre-overhaul* free running test on 16 January 2007. The PME could still be cranked by hand on 16 January 2007 when it was handed over to the Defendant

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for the top overhaul, which is a good indication that there was no bent crankshaft within the PME to begin with. Importantly, the PME was not seized up when the Defendant took possession of the PME to perform the top overhaul. But the PME came back seized up after the top overhaul and a post-overhaul free running test by the Defendant. Logically, it could not have been the propeller damage, excessive port stern tube bearing wear, excessive vibration and bent crankshaft out at sea that (individually or cumulatively) caused the PME to seize up, but something that the Defendant had done when the PME was under its care.

20 The Plaintiff identifies the Defendant's failure to prime the PME prior to starting it for the post-overhaul free running test as the cause of the PME seizing up. If the Defendant had done nothing to cause the PME to seize up, then I would naturally expect the PME, after the top overhaul, to be able (*at the very least*) to pass a free running test without load, *similar* to that conducted on 16 January 2007 just *prior* to the top overhaul. But the PME could not. It seized up within a few minutes of the Defendant starting the PME for the post-overhaul free running test on no load and at idle speed after the top overhaul. According to Mr Ryan, the PME was only run at an idle speed of up to 700 rpm and did not even exceed 1000 rpm during the post-overhaul free running test of the PME on 31 January 2007 when it seized up.[27] By comparison, the PME was put through a *more stringent* pre-overhaul free running test on 16 January 2007 when it was run up to a much higher rated speed of 1800 rpm, and yet it passed the test without any detrimental effects (see [31]). If there was indeed such serious pre-existing vibration damage as alleged by the Defendant, it is also very surprising that the PME did not seize up during the far *more stringent* pre-overhaul free running test on 16 January 2007.

27 1DBA Tab 10 p 27 at para 3.1.11.3.

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21 The Defendant harps on the point that a free running test does not prove that the PME was in a "good serviceable condition" before the Plaintiff handed over the engine for top overhaul, which the Defendant says is an essential element or condition precedent for the purposes of the Plaintiff's claim.

22 In my view, the Plaintiff only needs to prove that the engine was not seized up and was at least in a good enough condition to pass a free running test when it first handed over the PME to the Defendant for the top overhaul. The Plaintiff need not prove that the PME was in a "good serviceable condition" that could perform under load to its designed rated power and speed (*ie*, engine performance specifications of a new engine). This is after all an old engine. Nobody knows what the maximum power and speed of the old PME will be, unless a full load test or perhaps a sea trial is conducted, but certainly its performance cannot be as good as when it was new.

23 The more important point is that the Plaintiff delivered to the Defendant an old PME that was at least in a condition that could pass a free running test to the satisfaction of the Defendant. After "servicing", the Defendant returned an old PME, albeit top overhauled, that was not even in a condition that could pass a free running test. The Defendant returned instead a seized up or unworkable old PME to the Plaintiff. The bottom line is that the PME could not even pass a free running test without load upon re-delivery to the Plaintiff.

24 For the purposes of this case, I do not need to concern myself with the maximum power and speed or actual condition or performance of the PME, and whether it met the supposed standard of a "good serviceable condition" (a term that is too vague for my consideration) for an old engine such as the PME, when it was first delivered on 16 January 2007 to the Defendant for "servicing". In

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any event, I am not expecting the PME to pass a full load test upon re-delivery by the Defendant to the Plaintiff, as long as it could pass a free running test similar to that successfully carried out pre-overhaul on 16 January 2007.

25 The Plaintiff's expert on vibration, Dr Yap Fook Fah ("Dr Yap"), opines that the loss of mass from the propeller tip damage was "minuscule" and hence, the imbalance was not likely to have triggered such excessive vibration as would have caused engine damage.[28] I accept that this is more an educated guess than a proper assessment by Dr Yap based on engineering calculations and analysis. Dr Yap could not perform such an analysis not because he is incapable of doing so but because the data required to perform such an analysis is simply not available. Neither has the Defendant produced any engineering computations or quantitative analysis to prove that the damaged port propeller tips would have transmitted sufficient vibration over a sufficiently long period of time to cause damage to the PME. It has only made a speculative bald assertion.

26 The Defendant's experts, Mr Ryan and Mr Sivasothy, both of whom are not qualified experts on vibration, unlike Dr Yap, are also in no real position to assist the court on the question whether there was vibration-induced damage to the PME as alleged by the Defendant.

27 On the totality of the evidence, I find that the Defendant has failed to discharge its burden of proving that the damaged tips of the rotating port propeller and/or the excessive port stern tube clearance generated vibration so severe that it damaged the PME. In particular, it is implausible that the vibration caused the engine crankshaft to be bent or cracked such that the PME seized up within only a few minutes of being started on no load at idle speed (albeit

[28] NE 13 March 2017 p 55 line 17 to p 56 line 5.

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without any priming) after the top overhaul, despite not having failed throughout hours of operation at sea prior to that. All the Defendant raises are various possible causes for the engine seizure. It has not been able to provide any concrete quantitative data or expert evidence of the nature and degree of the vibration transmitted to the PME so as to transform these mere possibilities into a probability. It has therefore failed to establish its defence.

28 It may be relevant to note that although the starboard propeller was also damaged, yet there was no damage to the SME, which is of the same make and model as the PME. This shows how difficult it is to establish positively whether or not vibration arising from a damaged propeller was indeed the cause of the damage. I accept the Defendant's argument that without more, the non-damage of the SME "does not prove that the port propeller damage and worn down stern tube bearing did not cause the PME damage".[29] Clearly, without measurements of the levels and duration of the vibrations at the PME and the SME, it would be very difficult to determine whether or not the vibrations at the PME were sufficient to damage it internally. Without data for quantitative analysis, it is all too easy for experts in their evidence and counsel in submissions to speculate that the PME suffered vibration-induced damage prior to the Defendant's top overhaul.

No pre-existing damage to the PME

29 On 8 January 2007, the tugboat was towing a barge from Banjamarsin to Thailand. On 14 and 15 January 2007, the tugboat arrived in Singapore. Based on the engine running hours, Mr Ryan concludes that "there is insufficient evidence to suggest that the [PME] was not in use throughout the

[29] Defendant's Closing Submissions at para 205.3.

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last voyage from Port Banjarmasin. In fact, the complaint of vibration would suggest that it was in use."[30] On 16 January 2007, a pre-overhaul free running test was conducted successfully on the PME. From 16 to 31 January 2007, the PME was in the custody of the Defendant for the top overhaul. On 31 January 2007, while the PME was still in the custody of the Defendant, it seized up.

30 The Plaintiff submits that the PME was undamaged and completely operable up to the time that the Defendant took custody of the PME for tests and top overhaul. Except for damage to the propeller tips on both the port and starboard propellers, there was no damage to the rest of the body of the propellers, propeller shafts, gearboxes and their Vulkan couplings found on the port or starboard side.

31 The most significant fact is the successful *pre-overhaul* free running test of the PME on 16 January 2007 conducted by the Defendant. Initially, the PME was run at 750 rpm for about 5 minutes.[31] The PME was also successfully tested up to 1800 rpm, which is its top rated speed, on 16 January 2007 by Mr Azahar.[32] There was only normal vibration. Mr McGurran is of the view, and I am inclined to agree, that if the crankshaft had been so bent, cracked and damaged as to lead to the damage observed during the *post-overhaul* free running test on 31 January 2007, that damage would have been so significant that the out-of-balance forces in the engine would have been very noticeable on the *pre-overhaul* free running test with quite severe vibration experienced.[33]

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30 1DBA Tab 10 at p 15.

31 NE 22 August 2016 p 102 line 19 to p 103 line 1.

32 NE 13 March 2017 p 195 lines 1–9.

33 NE 13 March 2017 p 195 line 12 to p 196 line 24.

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32 I agree with Mr McGurran's observation[34] that the PME was started up and run the same way during the testing on both 16 January 2007 and 31 January 2007: the gearbox had not been connected, the PME was not on load and the PME was not primed before being started up on either occasion. However, the PME did not break down during the pre-overhaul testing on 16 January 2007. The only difference was that *no priming was needed* before starting the PME during the *pre-overhaul* free running test because the lube oil had not been changed and the PME had not shut down longer than five days yet, whereas *priming was needed* for the *post-overhaul* free running test as stipulated by the Engine Manual because there had been a complete change of lube oil and the PME had been shut down for 15 days during the top overhaul. There were also no excessive vibration or unexpected engine sounds observed during the *pre-overhaul* free running test on 16 January 2007 by the Defendant. The PME was handed over to the Defendant in a completely operable condition, at least in the sense that it passed the *pre-overhaul* free running test up to its rated speed of 1800 rpm without unusual vibrations or engine sounds observed. Very importantly, the PME could also be cranked manually with no problem. But after the repairs by the Defendant and the subsequent breakdown on 31 January 2007 within a few minutes of the *post-overhaul* free running test conducted by the Defendant, which did not even exceed 1000 rpm (a much lower speed than that tested during the *pre-overhaul* free running test), the PME seized up and could no longer be manually cranked thereafter.

33 Mr McGurran concludes, and I agree, that the fact that the engines could be cranked before the repairs showed that the cause of the breakdown was not *inherent* in the engine before the repairs.[35] Mr McGurran explains that if the

[34] 2PBA Tab 8 pp 31–32 at paras 114–117.

[35] 2PBA Tab 8 p 10 at para 32.

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crankshaft was already damaged or if there was some unknown *inherent* problem in the PME that would cause the engine crankshaft to seize up, then the engine would not have cranked; but it did crank during the pre-overhaul free running test on 16 January 2007.[36] I find Mr McGurran's explanation to be very logical and reasonable. Furthermore, the Defendant had also reported that it "did not find any abnormality or difficulty in cranking the engine which was apparent during valve setting/adjustment process"[37] at the time of the top overhaul, which was *prior* to *starting* the PME for the post-overhaul free running test without priming on 31 January 2007.

34 On the totality of the evidence, I find on a balance of probabilities that there was no pre-existing damage to the PME, in particular an already bent and cracked crankshaft as alleged by the Defendant, before it was handed over to the Defendant for the top overhaul.

Why lack of priming was the probable cause of the engine damage

35 It is not disputed that the PME was shut down for a total of 15 consecutive days from 16 to 31 January 2007 for the top overhaul performed by the Defendant. The lube filters and lube oil were changed during the top overhaul. It is unclear if the instructions in the Engine Manual to fill the oil filters up to the brim with lube oil before installing them on the PME were strictly followed. If not, it would mean that more air was present in the lube oil system, and it would have taken a longer time to remove all the air in the system before the lube oil could fully circulate throughout the lube oil system to lubricate the various parts of the engine.

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36 2PBA Tab 8 p 10 at para 34.

37 2PBA Tab 8 p 92.

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36 It is also not disputed that the Defendant's technician did not prime the PME as required by the Engine Manual before starting it on 31 January 2007 for the *post-overhaul* free running test. The Engine Manual states[38] the following at p 1-7:

> Starting Procedure – After Extended Shutdown or Oil Change
>
> Complete the following steps *after each oil change*, or *after the engine has been shut off for more than five (5) days* to make sure the engine receives the correct oil flow through the lubricating oil system.
>
> - Disconnect the electrical wire from the fuel pump solenoid valve.
> - Rotate the crankshaft, using the starting motor, until oil pressure appears on the gauge or the warning light goes out.
>
> [emphasis added]

37 The Defendant's literature, "Analysis and Prevention of Bearing Failures", Exhibit D6 at p 7, states that as many as 15 to 20 seconds may be required to establish sufficient oil flow through an engine after engine shutdown and explains why there can be bearing failure:

> As much as 15 to 20 seconds can be required to establish sufficient oil flow through the engine after starting, depending on the engine temperature at shutdown and how long the engine has been shut down. If the engine is accelerated to high speeds within a few seconds after starting and before sufficient oil flow is established, the chances are that some bearings will **not** receive adequate lubrication to prevent wiping.
>
> Wiping damage occurs quickly; thus, the bearings will be destroyed if wiping conditions exist for more than a few moments. …
>
> [emphasis in original]

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38 DCB 543 (2DBD 649).

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38 Mr McGurran refers to the Engine Manual under the heading of "Engine Warm-Up" to emphasise that time is needed for the lube oil pressure to be built up, for the engine to reach normal operating pressures and temperatures and for the lube oil to pass through the entire system before the engine can be switched on in full.[39] The Engine Manual states at p 1-7:

> Engine Warm-Up
>
> When engine is started, it takes a while to get oil film re-established between *shafts and bearings* and between pistons and liners. The most favourable clearances between moving parts are obtained only after all engine parts reach normal operating temperature.
>
> Allow engine to run at 800 RPM to 1000 RPM for 4 to 5 minutes before engaging the load. During the next 10 to 15 minutes, or until water temperature reaches 71 to 74 degrees C …, operate at approximately 75 percent of governed RPM.
>
> In most applications, engine idle speeds are 600 to 800 RPM; however, parasitic load may require a slightly higher speed setting to smooth out operation.
>
> [emphasis added]

39 The exact parts of the PME that were damaged on 31 January 2017 were the "*shafts and bearings*". This, according to Mr McGurran, resulted from a lack of priming when starting the engine.[40] The procedure of removing the electrical wire from the fuel pump solenoid valve during priming is necessary to stop fuel flow to the engine and prevent the start of the engine operating under fuel combustion (see [36]). I agree with Mr McGurran that it is important that the engine should not be started *before* the lube oil pressure is built up in the engine after an extended shutdown. The starter motor must first be used to gently rotate the crankshaft of the engine until it appears from checking the oil pressure gauge that sufficient oil pressure is built up.[41] Only after that is

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39 2PBA Tab 8 p 33 at para 123 and p 34 at para 125.

40 2PBA Tab 8 p 34 at para 124.

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achieved should the engine be started with fuel flow connected, enabling the engine to run under fuel combustion.

40 Exhibit D6 at p 10 explains how seizure can take place when there is a lack of lubrication:

> When lack of lubrication is more substantial or lasting for an appreciably longer time, bearing surface temperatures rise dramatically. Expansions and distortions of the bearings and the journal occur with increased temperatures. Clearances are closed up. The increased severity of the metal-to-metal contact along with the rising temperature burn away what lubricant is left in the journal so that temperatures are further elevated on a compounding basis. Seizure then takes place, tearing the bearing surface and/or spinning the bearing in the bore. In some instances, the bearings can be completely destroyed.

41 Mr McGurran opines that the fact that the PME had been shut off for 15 days and a complete lube oil change carried out meant that there would be no lube oil pressure in the engine unless the engine was first primed as required by the Engine Manual. Lube oil would not circulate immediately upon starting the PME.[42] Mr McGurran explains that when the engine is shut off, the lube oil pump stops generating lube oil pressure and the lube oil pressure starts to fall. Priming, according to Mr McGurran, is the process of restoring the lube oil pressure and ensuring that the entire lube oil system is filled with oil without pockets of air, after the pressure drops due to shutting off the engine. It is the lube oil pressure which forces the lube oil through the engine, which keeps the metal parts of the engine that come into contact from damage.[43] The Defendant had found no trace of lube oil at the crankshaft journal at the time of the damage inspection of the PME. Mr McGurran says this is significant as it shows that the

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41 2PBA Tab 8 p 35 at para 126.

42 2PBA Tab 8 p 32 at para 118.

43 2PBA Tab 8 p 33 at para 122.

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crankshaft was not receiving lubrication or sufficient lubrication, indicating strongly that insufficient lubrication was the cause of the PME damage.[44] Mr McGurran concludes that the lack of priming was clearly the cause of the PME damage.[45]

42 After considering all the evidence, I find on a balance of probabilities that the failure of the Defendant's technician to prime the PME prior to starting it for the post-overhaul free running test is the proximate cause of the damage to the PME on 31 January 2007 for the reasons stated by Mr McGurran. I do not accept the evidence of Mr Ryan that DW4 Mr Murali Arumugham ("Mr Arumugham") did not need to follow the Engine Manual's instructions and prime the engine because his 15 years' experience and specialist knowledge allowed him to assess if the procedure was required to be followed. Mr Arumugham has not provided any evidence of any technical assessment he made at that time allowing him to come to the conclusion that he could ignore the instructions given in the Engine Manual in relation to priming. Nor did Mr Arumugham say that he had attended any special training by the Defendant detailing the conditions under which priming need not be carried out, contrary to the Engine Manual. Neither has the Defendant produced any training materials for its technicians to show the conditions (if any) under which priming as required by the Engine Manual could be dispensed with.

43 I do not accept the bald statements of Mr Sivasothy and Mr Michael Drew that no priming is needed before starting an engine such as the PME even if it was shut off for months. The Defendant has produced no documentary evidence to support these claims. The Defendant's claim that its engines do not

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44 2PBA Tab 8 p 31 at para 112.

45 2PBA Tab 8 p 32 at para 118.

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need priming was made only in 2011, some four years after the damage to the PME occurred, even though the Plaintiff had accused the Defendant of not priming the PME soon after the PME's seizure.

44 The Defendant submits that since no damage was found on the SME, which had been similarly top-overhauled and allegedly started without priming for its post-overhaul free running test, the damage to the PME could therefore not have been caused by the non-priming. DW1 Matthias Manohar and DW2 Aung Soe testified that they did not pre-lubricate the SME before starting it for the free running test on 31 January 2007. The Defendant submits that this proves that the lack of priming could not have been the cause of the seizure of the main engine bearing of the PME.

45 The Plaintiff, however, disputes that the SME was not primed before the engine was started for its post-overhaul free running test. The Plaintiff relies on a contemporaneous Chief Engineer's statement[46] (admissible under s 32(1)(*j*)(i) of the Evidence Act (Cap 97, 1997 Rev Ed) as the Chief Engineer had passed away) to show that the SME was primed unlike the PME. Mr McGurran opines that it is likely that the SME was primed before the engine was restarted after the top overhaul.[47]

46 In any case, even if it were true that the SME was not primed, the mere fact that the SME did not seize up does not prove that a similar failure to prime the PME can never result in accidental damage to the PME. The Defendant may simply be lucky that the SME did not seize up and the *risk* of engine damage did not materialise (assuming that priming of the SME was in fact not carried

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46 PBD 129.

47 2PBA Tab 8 pp 39–40.

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out). If there can be no such *risk* of engine damage without priming, then it makes no sense for the Engine Manual to set out a priming procedure to be followed. It would be a complete waste of time for the technicians to carry out such a procedure.

47 The Defendant submits that since the fuel lines were empty after a top overhaul, the PME would not fire immediately upon pressing the start button. The evidence of the Defendant's service technicians was that the start button was pressed three to four times before the PME started. The Defendant contends that this would have caused the PME to be pre-lubricated before the engine fired.

48 Mr McGurran rightly disagrees that the instructions in Engine Manual can be ignored. He opines that the failure to prime the engine as required by the Engine Manual is courting an accident of engine damage.[48] The Foreword to the Engine Manual states, "This manual contains information for the correct operation and maintenance of your Cummins engine."[49] The Plaintiff submits and I have no reason to disagree that Mr Arumugham's omission of priming that day was a lazy and haphazard way to start the PME, done without regard to the potential risk of causing damage to the engine, and not attributable to some purported specialist skill on Mr Arumugham's part.

49 I find the explanation by Mr McGurran to be more technically logical as to why priming is needed prior to starting an engine that has been out of use for a long period of time and where there has been a complete change of lube oil. This is to avoid the *risk* of engine damage. The lube oil pressure takes time to

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48 2PBA Tab 9 at paras 9h–9l.

49 2PBA Tab 8 p 76.

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build up in order to fully lubricate the engine. If the engine is out of use for a long time and/or where there is a complete lube oil change, the lube oil drains out from the lube oil system especially in the *suction* or *intake portion* of the lube oil pump as it is sited above the lube oil level in the engine sump. This is all the more so when the lube oil has been changed.

50 When the engine starts, the crankshaft which is mechanically linked to the lube oil pump will turn the pump immediately. However, it takes time for the lube oil pump to suck out the air first on the *intake side* of the pump before it can suck the oil from the sump and begin to pump the oil under pressure past the oil filters to the rest of the oil channels in the engine to the various bearings that need the lubrication. Without priming, before there is time for the lube oil pressure to build up and push the lube oil to reach and lubricate the main bearings, the main bearings may burn and seize up if they are starved of lube oil. However, where there is priming prior to starting the engine, this will not happen. The priming ensures that all air is removed from the oil channels, that the lube oil fills up the entire lube oil system (including the oil filters, even if there has been a failure to pre-fill the new oil filters with lube oil prior to installation on the PME during the oil filter change), and that there is pressurised lube oil within the lube oil system prior to starting the engine with fuel. Upon starting the engine with fuel after priming, the pressurised lube oil will almost immediately circulate to lubricate all the moving parts of the main engine and in particular the main engine bearings. The *risk* of damage to the main and other bearings is minimised or removed. Hence, the Engine Manual requires priming to be carried out prior to starting with fuel when there has been a lube oil change or when an engine has been shut down for more than five days.

Defendant's theory that non-priming was not the cause of the engine

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damage

51 The Defendant submits that there would be lube oil flow *immediately upon starting* the engine without first having to pre-lubricate the engine because the oil pump was working and there was sufficient oil in the sump when the PME was started on 31 January 2007. Mr McGurran disagrees with this and has given his reasons why that would not be the case, and I agree with his expert opinion on this.

52 Further, there are too many unknowns and assumptions inherent in the Defendant's submission of an *immediate* lube oil flow to the journals and bearings upon starting the engine to make this a reliable submission of fact. It is, for instance, not known if the new oil filters were completely topped up with lube oil before they were attached to the PME. It is not known how much of the oil in the rest of the lube oil system had drained out after the complete lube oil change and after the engine had been idle for 15 days. The suction or intake portion of the lube oil pump would necessarily be drained of lube oil after the complete lube oil change. Obviously, the greater the amount of air in the lube oil system, the longer it will take for the lube oil pump to remove the air within the lube oil system, and a longer time will elapse before it can pump the lube oil to the required pressure for the lube oil to reach and lubricate all the critical parts of the engine, in particular the main engine bearings. If the lube oil flow expected at any of the critical engine bearings is delayed in the case of an engine that is started and running on fuel, the engine bearings that are starved of lube oil will heat up, burn and seize up. What is clear is that there is a very real *risk* of a lack of lubrication and hence engine bearing failure and engine seizure if the engine is not primed as required by the Engine Manual. That risk was especially high in this case, where there was a complete lube oil change, all oil

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filters had been replaced, and the PME had been idle for some 15 days. By starting the PME with fuel without priming on 31 January 2007 after the top overhaul, the Defendant's technicians were running a very real *risk* of engine seizure, and unfortunately for the Defendant, that *risk* in my view materialised within a few minutes of the engine running despite being on no load and under low rpm.

53 Mr Sivasothy advances the argument that if the lack of lube oil due to the absence of priming is the cause of the failure, then it is odd that there is no damage to the conrod bearings and small end bearings which are the last in the lube oil system to receive oil. Oil flows through the main bearings first.

54 I find that Mr Sivasothy's theory may perhaps be more applicable to a situation of an engine already running under full load condition and operating with full lube oil circulation before suddenly losing lube oil pressure and lube oil circulation. Exhibit D6 at pp 46–49 shows a lack of lubrication damage pattern purposely created by a lack of lubrication test in the laboratory, where an engine with new bearings was run and stabilised at rated power and speed (*ie*, maximum designed power and speed) and then the oil pan drain plug was removed. After about six minutes, the oil pressure began to fluctuate, indicating that the oil level had been lowered sufficiently to allow air to be drawn into the lube oil system. Immediately, the engine began to slow down and was stopped. The conrod bearings were found to be severely damaged but the main bearings were only wiped or slightly wiped, as in Fig. 25 and Fig. 26 of Exhibit D6 respectively. Whilst this may show that the conrod bearings would likely be the first to be damaged under this set of conditions, it must be pointed out that the engine during the test was operating under full load rated condition at maximum rated speed with full lubrication before loss of lubrication was induced.

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Understandably, with the engine running at full load, the "rod bearings are more heavily loaded and have less oil film thickness than the main bearings; therefore, rod bearings are first to sense loss of oil pressure" (Exhibit D6 at p 10).

55 However, the test situation mentioned above is entirely different from the situation that took place during the Defendant's post-overhaul free running test, where the PME was not placed on any load, run at very low speed and there was no full lubrication to begin with due to the lack of priming before starting the engine. That situation was far removed from the former, where the engine was running with full lubrication and at full load before lubrication starvation was deliberately induced.

56 To extrapolate the full load test situation to the Defendant's post-overhaul free running test when there was no full load does not appear to me to be sensible as the operating load conditions are so different. Just because the conrod bearings were not damaged first does not mean that the lack of priming could not have been the cause of the main bearing seizure in this case.

57 Mr Sivasothy's theory that the main bearings will be the last to be damaged in the event of oil starvation is to a certain extent contradicted by the Defendant's own Exhibit D6 at p 11, which appears to me to suggest that if there is a lack of lubrication and lube oil flow has not been established from the time of *starting* the engine, the damage to the main engine bearings is apparent even *before* failure is apparent in the smaller conrod bearings. See Fig. 27 at p 50 of Exhibit D6. I accept that the passage at p 11 is in the context of a cold start, when the temperature of the engine is below 1℃ and the lube oil is "extremely viscous". The real significance is that there is no lube oil flow to the bearings as the oil is "extremely viscous". The engine is *started* and run with "ether" instead

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of diesel fuel and at high speed immediately after starting, before lube oil flow has been established. The passage then states:

> During the high-speed operation, one, two, or three main bearings can be starved for oil and overheat to the point the bearing lining material melts. Since the condition occurs before lubricating oil flow is stabilized, usually one to three main bearings will be affected, although the rest of the bearings can show some degree of wiping. …
>
> Fig. 27 shows an example of this type [of] failure. In this instance, only one main bearing (No. 3 main) seized. The upper rod bearings show some wiping damage but otherwise no further distress appears. …

Other theories and possibilities raised by the Defendant

58 The Defendant raises many other theories and possibilities to explain why the engine seizure was not due its non-priming of the PME.

59 The Defendant submits that the engine protection system would kick in to stop the PME when insufficient lube oil pressure is detected. Since the engine protection system did not kick in to stop the PME, there must have been sufficient lube oil pressure in the PME throughout the period when the PME started running until the time the PME seized up. This of course assumes that there is an engine protection system in the first place and if so, that it was in fact working at that time. The Defendant did not produce any witness who had examined the PME on the vessel and who could testify that there was in fact a functioning engine protection system on board the vessel that would *automatically shut down* the PME if there was a failure of lube oil pressure in the PME. On the other hand, Mr McGurran had personally inspected the PME on board the vessel on 13 May 2012 and tested for the existence of such an engine protection system. He found none.[50] I accept his evidence on this. What

[50] 2PBA Tab 8 p 36 at para 132.

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is also known is that the lube oil pressure mechanical gauge and lube oil pressure switch on the PME were both faulty at the material time,[51] which therefore means that the engine protection system, even if there was one as the Defendant suggested, was not likely to be working as the alarm protection device against lube oil pressure failure would have to be activated by the lube oil pressure switch.[52]

60 The Defendant also submits that the PME and SME did not start immediately upon pressing the start button because the fuel systems were drained during their top overhauls and the engines would have to be cranked a few times in order for the fuel to flow from the respective fuel pumps through the empty fuel lines to the engine cylinders before the engines could fire. The start button of each engine would have to be pressed a few times before it finally fired up. Mr Arumugham testified that the PME started after about three tries on 31 January 2007.[53] The electrical cranking of the engine itself each time the start button is pressed would in turn operate the lube oil pump to pre-lubricate the PME before the eventual firing of the engine. The Defendant postulates that the fuel would only reach the pistons *after* the lube oil has lubricated the bearings. I do not know how that conclusion is arrived at. The Defendant is merely engaging in speculation. There are again too many unknowns to be able to tell whether the fuel will reach the engine cylinders first or the lube oil will fully lubricate the bearings first. For example, all the lube oil filters were changed but it is unclear how completely (if at all) all the new lube oil filters were pre-filled with lube oil before being installed on the engine in accordance with the Engine Manual. Not completely pre-filling these new oil filters with

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51 DCB 43 (1DBD 138).

52 1DBA Tab 10 p 17 at para 3.1.6.2.

53 NE 22 August 2016 p 137 lines 8–14.

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lube oil would have increased the volume of air in the lube oil system and extended the time needed for the lube oil to reach the bearings after starting the engines. Furthermore, as the fuel tanks are situated above the engines, there would be positive gravity feed of the fuel into the fuel lines. The Defendant assumes that the fuel lines had remained largely empty such that time was needed for the fuel to reach the engine cylinders upon starting the engine. When there is positive gravity feed of fuel into the fuel lines, I am inclined to believe that it is more likely that over a period of time, the fuel under pressure would fill up the fuel lines leading out from the fuel tank above the engine to the point where there is a non-leaking and non-faulty valve at the fuel pump to positively stop the fuel from reaching further down the fuel lines past the fuel pump to the engine.

61 Similarly, the Defendant's argument that there was sufficient lube oil pressure because the PME ran for five to seven minutes without failing does not establish that there must also have been lubrication for the critical first 15 seconds or so after the engine had fired. I am not surprised that, after wiping damage was caused to the bearings within the initial 15 seconds or so without lubrication, it took slightly longer for the engine to finally seize up after more damage was built up in the bearings during the running phase. Although lube oil might have begun to flow later, it might have been too late to save the already damaged bearings but in time to lubricate other bearings such as the conrod bearings, turbochargers and rocker lever arms, thus giving the appearance of full lube oil circulation and masking the fact that the initial critical phase might not have had full lube oil circulation. As can be seen, there are again too many unknowns implicit in the Defendant's argument and many speculative possibilities may be argued. The *risk* of engine damage if the engine runs for at least 15 seconds with engine lube oil pressure below 12 psi, based on the

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Defendant's Marine Application Bulletin on Controls, Gauges and Alarm Engine Protection,[54] does not mean that there will be an instantaneous catastrophic engine failure exactly at the end of those 15 seconds (which appears to be the logical basis of the Defendant's argument). The Defendant's literature, Exhibit D6 at p 7 (see [37]) explains that as many as 15 to 20 seconds may be required to establish sufficient oil flow. (In fact, I believe that estimate is premised on no new oil filters being changed during the shutdown, so the oil filters would remain full with lube oil even after the shutdown.) Consequently, if the engine were to be accelerated to high speeds within a few seconds after starting, some bearings would not receive adequate lubrication to prevent wiping. If some wiping of bearings had taken place, and if the engine were to continue to run, the damage would be exacerbated to the point of catastrophic failure as happened here after some five to seven minutes.

62 Another theory of the Defendant is that the fact that there was no damage to the pistons[55] and no sudden shock or sudden jolt[56] when the PME seized up during the free running test by the Defendant on 31 January 2007 means that the crankshaft must have already been damaged, *ie*, cracked and bent earlier due to vibration, and *not* damaged due to some sudden breakage or failure. I note that this theory contradicts the Defendant's earlier postulation that there must have been some "sudden impact" out at sea because the rotating port propeller had suddenly struck some object, as could be seen from the damaged propeller tips (see [9] to [13]). By the Defendant's theory, if there had been a sudden impactful force sufficient to bend and crack the very strong crankshaft, then the pistons must also have been damaged. Since there were no damaged pistons,

[54] Exhibit D7.

[55] Defendant's Closing Submissions at para 252.4.

[56] Defendant's Closing Submissions at para 248.

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there could not have been any sudden impactful force. The Defendant therefore mounts incompatible theories and this shows the unreliability and weakness of the Defendant's case theories.

63 Even if the Defendant now eschews the "sudden impact" theory in favour of the theory of vibration being the cause of the damage, it should be noted that the latter theory bears similarities to the Plaintiff's case. According to the Defendant, the mechanism by which the bearing failure is caused, leading to deformation of the crankshaft, is the disruption of the lube oil film[57] at the main bearings and crankshaft due to abnormal torsional vibration. The basic point still remains that it was lubrication failure resulting from vibration that eventually led to the crankshaft becoming bent and cracked, and the main bearings and journals severely wiped out and unevenly scored. The Plaintiff also grounds its case on the failure of lubrication caused by the Defendant's failure to prime the PME prior to starting it. Both sides rely on the failure of proper lubrication as the cause of the eventual damage. The only difference between the Plaintiff and the Defendant appears to be the reason for the failure of proper lubrication.

64 What remains very clear is that the catastrophic failure of the PME occurred *soon after* the Defendant's failure to prime the engine. The Defendant's vibration theory speculates that prolonged excessive vibration whilst the tugboat's engines were in use out at sea (a) disrupted the lube oil film and gradually caused the crankshaft to be bent and cracked;[58] and (b) caused the main bearings and journals to be badly wiped out due to prolonged intermittent metal to metal contact (wiping).[59] As a result, while the PME could still pass the

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57 Defendant's Closing Submissions at para 219.

58 Defendant's Closing Submissions at para 253.

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pre-overhaul free running test without problem on 16 January 2007, it had been brought just to the brink or verge of catastrophic failure by the Plaintiff and it was simply "bad luck" that the PME suddenly suffered catastrophic seizure only in the five to seven minutes of the Defendant's less stringent *post-overhaul* free running test on 31 January 2007. I find it hard to buy the Defendant's argument. The statistical probabilities do not favour the Defendant. If the crankshaft was already permanently deformed or bent and cracked, and the main bearings and journals were already badly wiped out through excessive vibration *before* the engine was turned over to the Defendant for top overhaul, it is most surprising that the PME could so easily pass the more stringent *pre-overhaul* free running test conducted by the Defendant on 16 January 2017 without seizing up. The whole purpose of the Defendant conducting the *pre-overhaul* free running test was to establish, for itself at least, that it was not taking over a seized up engine for top overhaul. The Defendant had the full opportunity to examine and test the PME *prior* to taking over. The Defendant surely would not want to take over a seized up engine merely for a top overhaul. A seized up engine would require a major and complete overhaul. The burden is on the Defendant to prove that the crankshaft was already severely bent and cracked and the bearings and journals badly wiped when it first took over the PME for top overhaul, despite the fact that the Defendant was satisfied with the PME's performance during the pre-overhaul free running test that it conducted. On the totality of the evidence, I find that the Defendant failed to discharge its burden.

Engine Test Report

65 The Defendant filed Summons No 2788 of 2016 ("the Summons") on 8 June 2016 to adduce further evidence of a test on whether the Defendant's *new*

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[59] Defendant's Closing Submissions at para 222.

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KTA 50-M2 engine, a similar model to the PME, would seize up and be damaged if it was started without priming after a top overhaul and an oil change, after having been shut down for 16 days.

66 I dismissed the Summons, not only on the basis that it was made very late in the day and in the midst of the ongoing trial after all the experts' affidavits had been filed and exchanged, but also on the basis that a test on a brand new engine of a similar model, even if admitted, would not assist me in determining whether the PME, an old engine, would fail without priming. After hearing further arguments and having considered the matter, my stand remains unchanged.

67 It is rather speculative to assume that the non-priming test on a new engine can be used to reliably predict the outcome for an old PME. A new engine with brand new bearings and journals cannot be compared with an old engine whose bearings and journals would have sustained a certain amount of wear after many hours of operation. Even if non-priming during the starting of a brand new engine causes no damage, it does not necessarily translate to the same result for an old engine. An old engine may not tolerate as much abuse through non-priming as a new engine. The lube oil pump of an old engine may not have the same efficiency as the lube oil pump of a new engine in removing the airlocks in the lube oil system, picking up suction, and then circulating the lube oil under pressure in the lube oil system. Exhibit D6 at p 8 states that bearings become more vulnerable to severe damage when lubricating clearances are expanded, causing loss of lubricant retention. At p 9, it states that where clearance has increased as a result of wear, the oil film requires a longer period of time to form at starting conditions. Hence, the degree of wear affects the clearances, which in turn affects the efficiency of lubrication and the ability of

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the bearings to quickly develop an effective hydrodynamic film for lubrication. Mr Ryan states that "lubrication of the journal bearings requires the creation of hydrodynamic lubrication when subjected to the operating pressures of the piston action" and engine failure during the operational period "implies the inability of the bearings to create an effective hydrodynamic film".[60] I would expect an old engine to have larger clearances due to wear and tear as compared with a brand new engine. It therefore cannot be assumed that the old PME has the same degree of lubrication efficiency as a new engine in terms of the ability of its bearings to quickly develop an effective hydrodynamic film for lubrication.

68 For an experiment to be of any use for predictive purposes, the conditions should be made as similar as possible. There are too many unknowns when tests on a brand new engine are used to predict the results for an old engine. Another unknown factor is whether and to what extent the crew pre-filled the new oil filters with lube oil before they were installed on the PME. The non-priming test conducted on the new engine did not test whether there would be failure when new oil filters had not been completely pre-filled with lube oil before installation on the engine. The possibility that the new engine would have failed if the oil filters had not been pre-filled cannot therefore be eliminated. Whilst on this point, even if it is true that the Cummins KTA 50-M2 engine is used as standby generators for hospitals and data centres throughout the world and starting without priming has not been known to cause engine damage, it is quite clear that all the oil filters would be completely filled with lube oil, as the lube oil within the oil filters would not be drained off from the standby generators during prolonged non-operation of these generators whilst on standby, which is equivalent to a shutdown. The standby generators would

[60] 1DBA Tab 10 p 37 at para 3.2.2.3.

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certainly not have had empty lube oil filters prior to emergency starting without priming.

69 In fact, comparing the PME to a *brand new* engine is less probative than comparing the PME to the SME, which was likely of the same vintage. Even then, as I stated at [46] above, the mere fact that the SME did not seize up despite not having been primed (even if true) does not prove that accidental damage can never result to the PME from a similar failure to prime. Seeing as the comparison with the SME is not sufficiently convincing to refute the Plaintiff's case, the Engine Test Report would be even less so. Thus the Engine Test Report adds no further evidential value as far as I am concerned.

70 In any event, the Engine Test Report is far less compelling than the circumstances leading up to the PME seizing up, which strongly support the Plaintiff's case. The fact is that a working old engine that could pass the *pre-overhaul* free running test was handed over to the Defendant, but seized up in the hands of the Defendant after just five to seven minutes while undergoing the less stringent *post-overhaul* free running test. The Plaintiff points to a requirement in the Engine Manual that was not followed when the Defendant started the PME post-overhaul without priming. The Defendant chose to undertake a real risk of damage to a working old engine (*ie*, the PME) by not adopting a procedure mandated by its own Engine Manual. If there had been priming, even if the newly changed oil filters had not been completely pre-filled with lube oil and there was air within any part of the lube oil system (whether in the intake or output side of the lube oil pump), the priming process with battery operation only (without fuel) would have filled the entire lube oil system (including the lubricating channels) with lube oil, and thereafter the PME, an old engine, could be safely started and run with full fuel flow after the top

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overhaul. I find on a balance of probabilities that the *risk* of engine damage unfortunately materialised in the hands of the Defendant. The Defendant must therefore be held liable to the Plaintiff.

Conclusion on liability

71 On the totality of the evidence, I find on a balance of probabilities that the Defendant damaged the PME because its technicians failed to prime the engine before starting it on 31 January 2007, which led to the seizure of the main engine bearings.

Damages

72 In support of its claim, the Plaintiff itemised the damages in its closing submissions (at para 143) as follows:

Claim	Amount	Remarks
PME repair costs[61]	$139,805.08	This was the cost charged by the Defendant for repairing the PME.
Cost of replacement tugboat[62]	$168,000	As a result of the breakdown, the Plaintiff chartered a substitute tugboat, the *Marina Venus 2*, from 1 February 2007 to 23 April 2007 at the cost of $168,000.
Loss of use of tugboat[63]	$74,353.50	The amount was reduced from the original claim of $134,319.36.

61 1st AEIC of Lee Boon Wah, para 59 (1PBA Tab 1 p 17).

62 1st AEIC of Lee Boon Wah, para 62 (1PBA Tab 1 p 17).

63 6th AEIC of Lee Boon Wah, para 4 (3PBA Tab 14 p 2).

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		The Plaintiff could not charter a substitute vessel from 24 April 2007 to 23 May 2007, the date when the repairs to the PME were completed.
Services when the tugboat was laid up while the PME was being repaired[64]	$15,704 and $37,989	The services provided include the provision of staging, wharf space, *etc*.
Port Dues[65]	$210.90	Dues charged by the Maritime Port Authority of Singapore for a vessel's stay in port. Due to the damage to the PME, the Vessel had to stay in port for an extra period for the repairs.
ABS Class survey fees and expenses[66]	$3,843	The fees were incurred for the PME damage survey.
Survey Fees[67]	$11,250	
Bunkers consumed[68]	$10,935.93	While the tugboat was in port awaiting the completion of repairs to the PME, she had to consume fuel for her auxiliary engines.
Agency expenses[69]	$10,477.42	All ships operating in

64 1st AEIC of Lee Boon Wah, para 68 (1PBA Tab 1 p 20).

65 1st AEIC of Lee Boon Wah, para 69 (1PBA Tab 1 p 20).

66 1st AEIC of Lee Boon Wah, para 70 (1PBA Tab 1 p 20).

67 1st AEIC of Lee Boon Wah, para 71 (1PBA Tab 1 p 21).

68 1st AEIC of Lee Boon Wah, para 72 (1PBA Tab 1 p 21).

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		Singapore are required to have a ship's agent. These were the agency fees for the repair period.
Superintendent fees[70]	$11,100	The Plaintiff's superintendent attended to the tugboat because of the damage to the PME.
Total	**$483,668.83**	

73 The Defendant relies on a limitation of liability in its standard terms of sales which it says form part of its Quotation No 4002562 ("the Quotation") dated and sent on 24 January 2007[71] to the Plaintiff in relation to the top overhaul of both of the tugboat's main engines. The Quotation, which is labelled "QUOTATION (Service)", states the Plaintiff's order date as 24 January 2007 and the Plaintiff's reference number as "PU3202", which is the name of the Plaintiff's tugboat. Stipulated in fine print at the bottom of each and every page of the Quotation is the following:

> This quotation is subjected to the standard terms of sales. The said terms shall become terms of any contract that may result from this quotation unless they … have been limited[,] modified or excluded either expressly by this quotation or expressly [by] written agreement reached after delivery of this quotation but not otherwise. Standard terms of sales is available upon request. The rights and obligations of this contract are not transferable without prior consent of the seller.

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69 1st AEIC of Lee Boon Wah, paras 74–76 (1PBA Tab 1 pp 22–23).

70 1st AEIC of Lee Boon Wah, para 73 (1PBA Tab 1 p 22).

71 1DBD 151.

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74 The Defendant's position is that pursuant to Condition 24 of the Defendant's "CONDITIONS OF SALES", which it says is a part of the Defendant's standard terms of sales, its liability for damages is limited to merely the price of the Quotation for the various repair works that it had quoted, *ie*, $58,414.57 (excluding GST). Condition 24 reads as follows:[72]

> Under no circumstance shall the [Defendant] be liable for special or consequential damages for personal injury, loss or damage (including loss of profits or other economic loss) in connection with or arising out of the sale, supply, delivery, installation or use of any Merchandise. In any event, *liability shall in no case exceed the price of such Merchandise.*
>
> [emphasis added]

75 As a preliminary matter, the Plaintiff argues that the Defendant is not entitled to rely on Condition 24 to limit its liability because the Defendant failed to expressly plead that Condition 24 has been incorporated into the contract. I do not accept the Plaintiff's objection. In its Defence filed on 26 April 2011, the Defendant pleaded (at para 6) the incorporation of its standard terms of sales. The Defendant also pleaded (at para 20) that "under no circumstances shall the Defendants be liable for special or consequential damages (including loss of profits or other economic loss) in connection with or arising out of the Works, and that in any event, liability shall not exceed the price of the Works", which is essentially the language employed in Condition 24. Further, in its reply to the Plaintiff's request for further and better particulars dated 20 July 2011, the Defendant expressly stated (at para 10) that "Clause 24 of the Defendants' standard terms of sale", *ie*, Condition 24, is the term that provides for the limitation of liability pleaded at para 20 of the Defence. I find that the Defendant's pleadings were "sufficiently clear to allow [the Plaintiff] a fair opportunity to meet it": see *Bumi Geo Engineering Pte Ltd v Civil Tech Pte Ltd*

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72 DCB 542; 2DBD 563.

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[2015] 5 SLR 1322 at [46], quoting *Dare v Pulham* (1982) 148 CLR 658 at 664. The Plaintiff had sufficient notice of the Defendant's reliance on Condition 24 in order to respond to it.

76 The Defendant next submits that Condition 24 should apply to limit its liability to the price of the Quotation. According to the Defendant, the Quotation had been accepted via the oral instructions of the Plaintiff's Lim Mau Lin to "proceed with the repair, on the agreed parts that require to be replaced", which were documented in the email sent from the Defendant's S Saravanan to Lim Mau Lin on 26 January 2007 at 9.19am.[73]

77 The Plaintiff disagrees, submitting that the terms of the contract should instead reflect its own terms and conditions contained in Purchase Order No 11569 ("the Purchase Order") dated 24 January 2007. The Purchase Order states, *inter alia*, that:[74]

> This Purchase is governed by "Standard Terms and Conditions of PAN-UNITED SHIPPING PTE. LTD." … [A] copy will be provided upon request.

The Plaintiff argues that its own terms and conditions should prevail over the Defendant's standard terms of sales, so the Defendant's liability should not be limited to the price of the Quotation. According to the Plaintiff, the contract incorporated the Plaintiff's own terms and conditions rather than the Defendant's because the Purchase Order issued by the Plaintiff amounted to the "last shot" in a "battle of the forms" between the Plaintiff and the Defendant.

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73 DCB 65 (1DBD 161).

74 PBD 56.

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78 I pause at this juncture to first address the precise contents of the Purchase Order. At the close of trial, I realised that it remained unclear whether the columns titled "UNIT PRICE" and "TOTAL" in the Purchase Order were in fact blank, as exhibited by the Defendant in S Saravanan's Affidavit of Evidence in Chief ("AEIC") dated 16 April 2012 (at p 43),[75] or had in fact been filled up with the relevant prices when it was first sent by the Plaintiff to the Defendant, as shown in Lee Boon Wah's AEIC affirmed on 17 January 2013 (at p 45).[76] I thus sought clarification from the parties as to which copy shows the Purchase Order that was actually sent from the Plaintiff to the Defendant.

79 Having considered the further submissions tendered by both parties, I find that the blank Purchase Order exhibited by the Defendant is the copy that was in fact sent from the Plaintiff to the Defendant for the following two reasons. First, the Defendant's copy was exhibited as an attachment to an email sent from Lim Mau Lin to S Saravanan on 30 January 2007.[77] This shows that the Plaintiff had in fact issued the Purchase Order on 30 January 2007, but backdated it to 24 January 2007. Conversely, the Plaintiff's copy was not exhibited as an attachment to any email sent from the Plaintiff to the Defendant. Second, the Plaintiff itself also tellingly concedes in its further submissions to the court that the Defendant's copy of the Purchase Order is a genuine copy.[78] Insofar as the Plaintiff asserts that its copy of the Purchase Order is *also* a genuine copy, and that the Plaintiff's copy is simply an earlier copy reflecting the parties' agreed prices while the Defendant's copy is the later copy that was

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75 1DBA Tab 5 at p 43 (1DBD 175).

76 1PBA Tab 1 at p 45.

77 1DBA Tab 5 at p 42 (1DBD 174).

78 Plaintiff's Further Submissions dated 18 July 2017 at para 7(d); Plaintiff's Further Submissions 2 dated 21 July 2017 at para 3.

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sent with the prices covered up, I reject the Plaintiff's explanation. It was entirely speculative and unsubstantiated by the evidence adduced at trial.

80 Turning back to address the critical question of which party's standard terms applied to govern the contract, I find on a balance of probabilities that the terms of the contract are governed entirely by the Defendant's standard terms of sale referred to in the Quotation, including Condition 24, and do not include any of the Plaintiff's standard terms and conditions. In my judgment, the Plaintiff had accepted the Quotation via its oral instructions issued at some time prior to 9.19am on 26 January 2007. If those oral instructions to proceed had not been issued to the Defendant, I find it hard to believe that the Defendant would have proceeded to perform and complete the top overhaul of both of the main engines on the Plaintiff's tugboat.

81 The Plaintiff objects to a finding that it orally accepted the Quotation on the basis that this was not what the Defendant pleaded. To this end, the Plaintiff refers to para 5 of the Defence, where it was pleaded that:

> By a contract contained in or evidenced in writing by the Defendants' quotation no 4002562 dated 24th January 2007, and *accepted by the Plaintiffs' purchase order of even date*, the Plaintiffs engaged the Defendants to perform a top overhaul on the engines more fully described in the Defendants' quotation ("the Works") upon the terms set out therein in relation to the port and starboard main engines of the Tugboat.
>
> [emphasis added]

In my view, this contention does not take the Plaintiff very far; the most that can be said is that the Defendant has failed to prove that the Plaintiff specifically accepted the Quotation by issuing the Purchase Order. The first line of para 5 of the Defence clearly shows that the Defendant's case has always been that the contract was made subject to the terms in the Quotation. It is accordingly open

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to the court to make a finding of fact regarding how a contract on such terms was arrived at. The court, in finding that the Plaintiff had orally accepted the Quotation, would not be deciding on an issue that goes beyond the boundaries delineated by the parties' pleadings.

82 Even if I am wrong in that regard, I also reject the Plaintiff's submission that its standard terms reflected in the Purchase Order were incorporated into the contract. First, I agree with the Defendant that the Purchase Order was at best a written confirmation of the Plaintiff's earlier oral acceptance of the Quotation because the Purchase Order was issued *well after* the Plaintiff's oral instructions to the Defendant to proceed with the repair and also *after* the actual completion of the top overhaul on 30 January 2007.

83 Second, contrary to the Plaintiff's contention, the Purchase Order could not possibly be characterised as the "last shot" in a "battle of the forms" between the parties. In a classic "battle of the forms" scenario, the "last shot" must be a *counter-offer*, so that it can destroy the original offer and constitute the terms on which any agreement is formed: see *The Law of Contract in Singapore* (Andrew Phang Boon Leong, gen ed) (Academy Publishing, 2012) at para 03.107; see also *Butler Machine Tool Co Ltd v Ex-Cell-O Corporation (England) Ltd* [1979] 1 WLR 401. In this case, the Plaintiff has consistently painted the Purchase Order as an *acceptance* of the Quotation. Also, it has earlier been established that the Purchase Order does not provide any *price* for the repair works (see [78]–[79] above). Hence, even on the Plaintiff's own case, the terms and conditions reflected in the Purchase Order cannot be treated as constituting the terms of the contract because the Purchase Order was merely intended to signify the Plaintiff's *acceptance* (and not *replacement*) of the terms reflected in the Quotation.

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84 Third, the Purchase Order did not constitute a subsequent written agreement to vary the terms of the concluded contract bearing the standard terms and conditions reflected in the Quotation. As stated above, the Defendant's standard terms of sale may only be limited, modified or excluded expressly by written agreement (see [73] above). The Plaintiff's unilateral issuance of the Purchase Order was thus not sufficient to vary the terms of the concluded contract to reflect its own standard terms and conditions.

85 Having established that Condition 24 applies to possibly limit the Defendant's liability, I turn now to consider the ambit of the limitation of liability provided for under the second sentence of Condition 24, which the Defendant relies on (see [74] above). In my judgment, the term "liability", as reflected in the second sentence of Condition 24, should be construed to only encompass the Defendant's liability for "special or consequential damages", which is referred to in the preceding sentence of Condition 24. While it may be argued that "liability" in the second sentence of Condition 24 could be construed to encompass *all* liability (including liability for direct losses), I am of the view that any such ambiguity ought to be construed strictly *against* the Defendant. This reading tellingly finds support in the Defendant's express concession in its closing submissions that Condition 24 "only covers losses falling within the 2nd limb of the test for remoteness of damage set out in *Hadley v Baxendale* (1854) 9 Exch 341".[79] In other words, the Defendant impliedly admits that losses falling within the first limb of the *Hadley v Baxendale* test do not fall within the limitation set out in Condition 24.

86 I shall now examine the nature of the Plaintiff's losses. I find that all the items of loss claimed by the Plaintiff are losses flowing directly, naturally and

[79] Defendant's Closing Submissions at para 348.

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in the ordinary course of events from the Defendant's breach without other intervening causes and independently of special circumstances: see *Singapore Telecommunications Ltd v Starhub Cable Vision Ltd* [2006] 2 SLR(R) 195 at [59] and [60]. They are therefore direct losses that fall within the first limb of the *Hadley v Baxendale* test for remoteness of damage, and do not amount to "special or consequential" losses capped by Condition 24. Hence, Condition 24 does not apply to limit the direct losses claimed by the Plaintiff.

87 The Plaintiff has also provided sufficient supporting evidence to prove the quantum of all its direct losses (except for the two items below, namely the "cost of replacement tug" and the "loss of use of tug", for which I have adjusted the quantum to be allowed).

Cost of replacement tugboat

88 The Plaintiff hired a replacement tugboat, the *Marina Venus 2*, on a time charter dated 15 January 2007.[80] That was during the time when the Plaintiff decided that the tugboat was to be dry docked in Singapore and repaired. This initial time charter had nothing to do with the damage to the PME that occurred much later on 31 January 2007.

89 Under the time charter, the *Marina Venus 2* was to be delivered on 17 January 2007 to the Plaintiff and there was a minimum of 15 days of hire at $2,000 per day with an option to extend. Seven days' notice had to be given for early termination. At the earliest, the charter of the *Marina Venus 2* could only end on 1 February 2007. Before the damage to the PME occurred, the Plaintiff already committed the *Marina Venus 2* on a second voyage from Thathong to Bin Tri commencing on 28 January 2007 and ending on 7 February 2007

[80] DCB 41.

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("second voyage").[81] The expected date of the post-overhaul free running test on the PME was 31 January 2007.

90 I note that even if the PME did not sustain any damage on 31 January 2007 during the post-overhaul free running test, time would be needed for the tugboat to sail to Thailand to take over the next voyage on 8 February 2007 from the *Marina Venus 2*. Given the seven days' notice requirement for termination, I do not see how the charter for the *Marina Venus 2* could have been terminated earlier than 7 February 2007.

91 Accordingly, I would allow the claim based on the *Marina Venus 2* as the replacement tugboat to commence only from the earliest date that the charter for the *Marina Venus 2* could be legally terminated if the PME had not seized up on 31 January 2007. I find that the date would likely be **8 February 2007**. It was therefore not unreasonable for the Plaintiff to continue with the charter of the *Marina Venus 2* at $2,000 per day from 8 February 2007 as it was clear by 31 January 2007 that its tugboat could no longer be used to replace the *Marina Venus 2* upon completion of its second voyage.

92 As the Defendant had advised the Plaintiff that the PME would be ready by 30 April 2007 and the sea trial by 5 May 2007,[82] the Plaintiff returned the *Marina Venus 2* to her owners in anticipation of this. Accordingly, the *Marina Venus 2* was scheduled to go off-hire and be returned to the owners on **25 April 2007**. When the Defendant could not complete the repair work on the PME on the dates as advised to the Plaintiff, the Plaintiff tried to re-charter the *Marina Venus 2* for a further period, but the owners did not agree. The Plaintiff could

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81 DCB 557–558.

82 1DBD 316.

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not secure another substitute vessel to take over from the *Marina Venus 2* from 26 April 2007. This is understandable as the further hire period required was a relatively short one until the completion of the repairs to the PME.

93 I therefore allow the claim for the extension of the charter of the *Marina Venus 2* from **8 February 2007 to 25 April 2007** (a total of **77 days** for which the Plaintiff would have paid **$154,000** for this portion of the time charter at **$2,000 per day**). For the above reasons, the Plaintiff's claim of a loss of $168,000 (paid for the charter of 84 days from 1 February 2017 to 25 April 2007 at $2,000 per day) for the "cost of replacement tug" namely the *Marina Venus 2* is reduced to **$154,000 (based instead on 77 days of hire from 8 February 2007 to 25 April 2007 at $2,000 per day)**.

Loss of use of tugboat

94 The Plaintiff initially claimed "loss of use of tug" of $74,353.50[83] for the period from 23 April 2007[84] to the date the repairs to the PME were actually completed on 23 May 2007 (a total of 31 days), at $2,398.50 per day.[85]

95 The Plaintiff later realised that there was a mistake in this claim and addressed this in the seventh AEIC of Lee Boon Wah, affirmed on 14 March 2017. The claim for "loss of use of tug" is now amended to **$67,158[86]** for the period from **26 April 2007** to the date the repairs to the PME were completed on **23 May 2007** (**a total of 28 days**) at **$2,398.50 per day.**

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83 See 6th AEIC of Lee Boon Wah at para 4 (3PBA Tab 14 p 2).

84 There is an error in the table provided at para 143 of the Plaintiff's Closing Submissions, which state the period to be from 24 April 2007 to 23 May 2007 (30 days of hire). See 7th AEIC of Lee Boon Wah affirmed on 14 March 2017 at para 5.

85 See 6th AEIC of Lee Boon Wah at para 4 (3PBA Tab 14 p 2).

86 See 7th AEIC of Lee Boon Wah affirmed on 14 March 2017 at para 12.

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96 This claim for "loss of use of tug" is based essentially on what the tugboat could have earned in gross net profit for the Plaintiff had it been operational during the period of 28 days with no damage to the PME by the Defendant. The Plaintiff is claiming loss of profits during the time it was deprived of the use of its own tugboat.

97 I am satisfied with the reasonableness of the calculations in the table at p 4 of the 6th affidavit of Lee Booh Wah affirmed on 9 March 2017 showing how the amount of loss of use per day of **$2,398.50** is derived. The Plaintiff used the actual operational data captured in its computerised records to compute its gross profit margin when it was hiring the *Marina Venus 2*. These figures are used as a proxy to compute the gross profit margin when operating its tugboat PU3202 (*ie*, the tugboat with the damaged PME).

98 The table shows a total gross revenue of $967,434.89 for a total of 117 days of voyage. After deducting all the variable operating costs for fuel ($315,762.96), cleaning allowance ($1,341.43), loading port expenses ($46,849.50), discharging port expenses ($38,702.43), towing allowance ($3,300) and fresh water ($216.10), the gross profit margin is $561,262.47. When divided by 117 days of voyage, the gross profit margin per day is $4,797.11. As this gross profit margin per day is earned by **two** income-producing assets, namely the *Marina Venus 2* and the barge PU3303 under tow, and as the total bareboat charter cost for each of these income-producing assets is about the same (or more specifically 47.15%[87] for the tugboat and 52.85% for the barge), the Plaintiff attributes *half* of the gross profit margin per day of

[87] The bareboat charter cost of the tugboat PU3202 in the table at p 4 of the 6th AEIC of Lee Booh Wah affirmed on 9 March 2017 shows a total of $90,355.27. The bareboat charter of the barge PU3303 shows a total of $101,260.22 for the same period. Accordingly, the ratio of the bareboat charter cost of the tugboat to the barge is 47.15%: 52.85%.

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$4,797.11, *ie*, **$2,398.50** of gross profit margin to the tugboat in computing its claim for "loss of use of tug".

99 If I were to be more accurate and base the attribution on the figures produced by the Plaintiff that the bareboat charter cost of the tugboat alone is only 47.15% of the total bareboat charter cost of **both** the tugboat and the barge, then the total gross profit margin for the tugboat should be 47.15% of $4,797.11, which is **$2,261.84** per day of loss of use of the tugboat. I shall use this figure as the best estimate of the loss of use of the tugboat given the available data from the Plaintiff's records.

100 I am satisfied from the evidence that the Plaintiff's other tugboats were fully deployed at the material time. The Plaintiff has produced sufficient evidence to allow me to infer that it would have had no difficulty obtaining charters for the tugboat for the further period from **26 April 2007** to **23 May 2007** (**a total of 28 days**) that would have enabled it to earn a gross profit margin of about **$2,261.84** per day had the tugboat not suffered any damage to the PME. I therefore reduce the claim for "loss of use of tug" from $74,353.50 to **$63,331.52** (*ie*, $2,261.84 × 28 = $63,331.52).

Reduction in damages

101 As I am allowing all the other items of direct loss claimed by the Plaintiff in full, the total claim of $483,668.83 is therefore reduced by a total sum of $25,021.98 on account of the reduction in both the amounts claimed for the "cost of replacement tug" and the "loss of use of tug". This works out to be **$458,646.85**.

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Conclusion

102 The Plaintiff shall have judgment for the total sum of $458,646.85 with interest at 5.33% per annum from the date of writ to the date of this judgment (less two years) and costs to be taxed unless agreed by the parties. In my view, the Plaintiff has caused unreasonable delay of some two years in its prosecution of its claim. I agree with the Defendant's submission[88] that the six-year-long Suit could have been disposed of in much less time. I exercise my discretion to deny the Plaintiff interest on the judgment sum for two years.

103 If parties do not wish to be heard on costs, I will order costs to be taxed by the Registrar if not agreed.

Chan Seng Onn
Judge

Tay Twan Lip Philip and Yip Li Ming (Rajah & Tann Singapore LLP) for the plaintiff;
Campos Conrad Melville and Charis Toh Si Ying (RHTLaw Taylor Wessing LLP) for the defendant.

88 Defendant's Reply Submissions dated 3 May 2017 at para 124.

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