|  |  |  |
| --- | --- | --- |
|  | | |
| H&M FINAL Survey Report | |
| MV “VESSEL NAME” | |
| **INSERT PICTURE OF VESSEL / DAMAGE** | |
| **Occurrence:**  **Date/year - Fire in the engine room** | **NHC Claim Reference: xxxxxx/20xx/H&M** |
| **Our Reference.: xxxxxxxxx** |

**contents**

1 INTRODUCTION / SCOPE OF WORK 3

2 Occurrence 3

3 Attending representatives 3

4 VESSEL’S PARTICULARS 3

5 VESSEL’S MOVEMENTS & events 4

6 AVAILABLE INFORMATION 4

7 BRIEF TECHNICAL DESCRIPTION 5

8 BACKGROUND 5

9 DAMAGE DESCRIPTION 6

10 REPAIRS 7

11 OTHER MATTERS OF RELEVANCE 7

12 Cause CONSIDERATION 8

12.1 Discussion 8

12.2 Conclusion 8

13 Repair Cost 9

14 DRY DOCKING AND TIME FOR REPAIRS 9

15 TEMPORARY REPAIRS 9

16 EXTRA EXPENSES INCURRED TO REDUCE DELAY 9

17 GENERAL EXPENSES 9

18 WORK NOT CONCERNING AVERAGE 10

19 SUMMARY OF TIME FOR REPAIRS 10

20 SUMMARY OF COST 11

# INTRODUCTION / SCOPE OF WORK

At the request of Norwegian Hull Club Bergen, Norway, being the Leading Hull & Machinery Underwriters of the above-mentioned vessel, the undersigned has on [*date, month, year*] and subsequent days surveyed [*Vessel Name*] whilst lying at the premises of [Name, Place].

# Occurrence

Survey was held in order to ascertain the nature and extent of damage sustained on the following occasion:

|  |  |  |
| --- | --- | --- |
| **Occurrence No. 1** | |  |
|  | |  |
| **Date, month, year** | **On laden (or ballast) voyage from Port A to Port B.**  **Fire in the engine room.** | |

# Attending representatives

The following persons were present during the survey / meetings:

|  |  |  |
| --- | --- | --- |
| ***Name*** | ***Company*** | ***Function*** |
| Name | Company | Vessel Manager |
| Name | Company | Chief Engineer |
| Name | Class | Class surveyor |
| Name | Company | Senior Service Engineer |
| Further name(s) | Further companies | Further |

# VESSEL’S PARTICULARS

|  |  |  |
| --- | --- | --- |
| IMO Number | : | 123456 |
| Type |  | Ro-ro vessel |
| GT / DWT | : | xx.xxx / xx.xxx |
| Flag / Home port | : | Name / Port |
| Built | : | Shipyard / Country / Year |
| Owners | : | Name |
| Managers | : | Name |
| Class / Notation | : | DNV / 1A1 ICE-C SF COMF-V(3)C(3) |
|  |  |  |
| Certificates |  | All certificates valid at time of occurrence |
| DOC details | : | Issued xx March 20xx, valid till yy February 20yy |
| ISM SMC details | : | Issued xx March 20xx, valid till yy February 20yy |
| Casualty ISM reported? | : | Yes |
| Prior related ISM reports? | : | Yes |

# VESSEL’S MOVEMENTS & events

|  |  |
| --- | --- |
| ***Event*** | ***Date*** |
| Fire occurred. | Date, Year |
| Fire extinguished. | Date, Year |
| Vessel arrived at *Arriving Port*. | Date, Year |
| Inspection and commencement of repair. | Date, Year |
| Shifting to a nearby shipyard commenced by using harbor tugs. | Date, Year |
| The vessel arrived at the shipyard. | Date, Year |
| The vessel dry docked. | Date, Year |
| The vessel undocked. | Date, Year |
| Sea trials after repair. | Date, Year |
| Repairs completed. | Date, Year |
| The vessel sailed. | Date, Year |

# AVAILABLE INFORMATION

|  |  |
| --- | --- |
| ***Document*** | ***Enclosed / Available*** |
| *General Information:* |  |
| Ship particulars | Available on request |
| DOC | Available on request |
| SMC | Available on request |
|  |  |
| *Logbooks:* |  |
| Copy of bridge logbook | Relevant pages enclosed |
| Copy of engine logbook | Relevant pages enclosed |
|  |  |
| *Incident reports:* |  |
| Master’s initial report | Enclosed |
| Master’s statement of facts | Enclosed |
| Class report and recommendation for repairs | Enclosed |
| Owner’s Incident Report | Enclosed |
|  |  |
| *Repair planning and execution of repairs:* |  |
| Repair Plan | Available on request |
| Repair offer from Cable Renewal Company | Available on request |
| Quotation from Cleaning Company | Available on request |
| Quoted unit prices from Electric Motor Overhaul Company | Available on request |
|  |  |
| *Final technical reports:* |  |
| Damage Control Company’s report of chloride spread and extent | Available on request |
| Class report after completion of repairs | Available on request |
| Final report from Cable Renewal Company | Available on request |

# BRIEF TECHNICAL DESCRIPTION

The vessel is a Ro-Ro ferry of xx xxx gross tons, built in 1985. The two main engines are of make MAN B&W, type 8L45GB, two stroke diesel engine with 8 cylinders in line, rated to   
16 965 bhp. Each cylinder has a separate fuel pump. The engines are normally running on heavy fuel oil.

Hi-Fog water mist extinguishing system is fitted in the engine room and in the machinery spaces.

# BACKGROUND

On the above date, at 15:34:30 hrs, whilst the vessel was approaching the entrance to   
[*Arrival Port*], the fire alarm was activated in the engine room. Concurrently an oil squirt from the top of the No. 1 main engine was observed on the video monitor in the engine control room. Reportedly, the oil splashed into the ceiling plates of the deck above.

Within the next 50 seconds the following sequence of events has been reported:

* 15:34:40 hrs. The bridge was contacted, and the No. 1 main engine was requested to be stopped.
* 15:34:45 hrs. Two engineers entered the engine room. They discovered a fire was starting and tried to extinguish with local fire extinguishers.
* 15:34:51 hrs. The No. 1 main engine was stopped.
* 15:34:55 hrs. The 2nd engineer arrived in the engine room but was met by an explosive fire development.
* Bridge was notified that a fire was at stake.
* 15:35:10 hrs. The fixed Hi-Fog fire extinguishing plant for No. 1 main engine was released from a panel in the engine control room.
* 15:35:30 hrs. No. 3 fire team (engine room team) commenced dressing up. Chief Engineer arrived in the engine control room.

At 15:38 hrs, the fuel to the No. 1 main engine was shut off by activating the quick closing valves.

Three fire teams, including one cooling team were now ready and the engine room team entered into the engine room and reported that the fire had been extinguished. Further checking was carried out to confirm that the fire would not re-ignite before the engine room was eventually ventilated.

In the meantime, the Owners had been informed at 15:46 hrs. and the No. 2 main engine had been stopped at 15:50 hrs. after the anchor had been dropped.

After thorough checking of the fire area it was decided that the vessel could sail to port by using the No. 2 main engine and she resumed her voyage towards [*Arrival Port*], where she arrived at 17:30 hrs.

# DAMAGE DESCRIPTION

Upon survey at [*Arrival Port*] and at the shipyard we noted damages as follows:

* The No. 1 main engine and the adjacent areas, including equipment in way, were covered with a layer of fuel oil.
* The ceiling and bulkhead structures adjacent to No. 1 main engine, including pipes, cables, the engine room crane above No. 1 main engine, lighting armatures, fire detectors, video surveillance cameras, electric equipment, etc. were covered with soot and variously melted, discoloured and deformed.
* Water leaks were noted from cooling water piping on the engine.
* The instrumentation on the No. 1 main engine was variously melted, discoloured, covered by soot and deformed, involving sensors, wiring, and control/monitoring system.
* Electric cables in the area around No. 1 main engine were melted, discoloured, covered by soot and deformed.
* From the specialist company, Messrs. Cleaning Company it was reported that except for the areas close to the fire, the chloride measurements in the engine room revealed relative low concentrations.

|  |
| --- |
| **Insert relevant photo** |
| Photo 1: [*Text*] |

|  |  |
| --- | --- |
| **Insert relevant photo** | **Insert relevant photo** |
| Photo 2: [*Text*] | Photo 3: [*Text*] |

# REPAIRS

The permanent repairs were carried out by Ship Yard Ltd. with Cleaning Company Ltd., Cable Renewal Company, MAN B&W, ABB and Kongsberg Maritime as subcontractors and included as follows:

* Thorough cleaning of all affected surfaces, machinery, equipment etc. for oil, soot and chlorides as applicable.
* Renewal of, in total 3300 meters of electric cables of various sizes and types, including cable trays as necessary.
* Dismounting, cleaning and control of all affected piping, valves, pumps etc. fitted to the engine.
* Removing the cylinder covers of cylinders nos. 2, 3, 4 and 5 for inspection. The inspection result revealed that the engine was not internally affected by the fire, and no further opening of the engine was required.
* Check of both turbochargers of No. 1 and 2 main engines. The air filter mats of the silencers of all (4) turbochargers were contaminated with fuel oil mist to such an extent that satisfactory cleaning was not possible, and consequently the silencers had to be renewed.
* Renewal of the automation system fitted to the engine (sensors, wiring, control- and monitoring system).
* Renewal of the emergency engine telegraphs system. This system was only partly damaged, however, as the manufacturer did not exist anymore, spare parts were not available and therefore the entire system had to be renewed.
* Cleaning and overhaul/renewal as necessary of various electric and mechanical equipment/components.

The repair involved dry docking for cropping an access hole for transport of debris out of the engine room and for transport of equipment/parts out and in.

On completion of the individual repairs, testing was carried out by the relevant contractors as necessary and required, and a thorough system test, including sea trials, was carried out according to the Class’ requirement prior putting the vessel into service on “*Date 20xx”*.

Completion work of flushing/washing and painting of affected areas in the engine room continued without affecting the vessel’s sailing schedule until about mid of “*Date” 20xx*”

# OTHER MATTERS OF RELEVANCE

The Owners used the opportunity to commence Class’ special survey during the dry docking of the vessel.

# Cause CONSIDERATION

## Discussion

During inspections in the fire affected engine room, we could see clear indications that there had been an oil squirt from the top of the No. 1 main engine that hit the underside of the deck above (the ceiling).

Further investigation revealed that the source of the escaped oil was at the top cover of the fuel pump of the No. 4 cylinder, in which one nut was missing due to a fractured stud bolt, which left a hole into the high-pressure section of the pump.

The fractured bolt and the disappeared nut allowed the high-pressure oil to escape upwards and splash over the engine and the adjacent areas.

It was reported that last time when work was performed, which involved the fuel pump, was during a yard stay at Messrs. *Machinery Shipyard* in the period from *xx* to *yy* *January 20xx*.   
The contractor states that the relevant nut was not touched at that occasion.

The stud bolt was sent to Det Norske Veritas AS, Section for Materials Technology for investigation of the cause of breakage.

The conclusion of the investigation is that the bolt had fractured as a result of fatigue, with the initiation area in the second thread root from the top, which is indicating that the bolt and nut may have been subject to an assembly irregularity.

As the investigation report does not state anything about the time frame of the fatigue, it is not possible to conclude about when a potential assembly irregularity may have taken place.

## Conclusion

In our opinion the cause of the fire is related to a sudden oil leak from the top of the No. 4 cylinder fuel pump of No. 1 main engine, which allowed fuel oil to escape and spray over hot surfaces and consequently ignite.

Further it is our opinion that the root cause of the leakage is the mentioned stud bolt, which had been exposed to improper tightening, consequent development of fatigue, which eventually led to fracture.

The cause investigation has not succeeded to reveal unambiguously when or by whom improper tightening was carried out.

# Repair Cost

The above damages have been permanently repaired, and the full specification of the work and the cost listed in the Owners’ general claims account are presented in the enclosed Repair Cost Account, which forms an integrated part of this Final Survey Report.

The summary of the repair cost, based on the repair scope as described in section 10 above – but excluding general expenses is as follows:

USD 2 735 468.

# DRY DOCKING AND TIME FOR REPAIRS

The vessel was in dry dock for a total of 11 days.

If carried out separately the repair work would have required a total of 45 days,   
including 11 days in dry dock to be completed.

# TEMPORARY REPAIRS

The repair account includes USD 38 500 for temporary repairs to the engine room crane above the No. 1 main engine (ref. item xx in the Repair Cost Account), which required   
2 days to be completed.

Temporary repairs were carried out to save time as it was impossible to carry out permanent repairs to the No. 1 main engine without the crane in working condition and waiting for permanent repair of the crane would have detained the vessel a further   
1 – 2 weeks.

No particular cost was involved for removal of temporary repairs.

# EXTRA EXPENSES INCURRED TO REDUCE DELAY

In connection with this occurrence, extra expenses have been incurred by working   
overtime for an amount of USD 20 250.

By incurring extra expenses, 3 days in dry dock have been saved and the total repair time has been reduced by 3 days.

# GENERAL EXPENSES

General Expenses have been listed in detail in the enclosed Repair Cost Column with the amount of:

USD 173 664

# WORK NOT CONCERNING AVERAGE

Concurrently with the average repairs, maintenance work was carried out at the yard to an amount of:

USD 396 378.

The work included as follows:

* Scheduled dry docking
* Commencement of Special Survey
* Aux engines overhaul
* Renewal of 8 tons of bottom plating
* Repair of Electric system

If carried out separately the above work would have required a total of 17 days,   
including 9 days in dry dock to be completed.

# SUMMARY OF TIME FOR REPAIRS

The total time for repair at [*Place*] from Month Day 20xx till Month Day 20xx – 45 days.

If carried out separately the work involved would have required the following time:

|  |  |  |  |
| --- | --- | --- | --- |
|  | In dry dock | Afloat | Total |
| Occurrence No. 1 | 11 days | 34 days | 45 days |
| Work not concerning average | 09 days | 08 days | 17 days |

# SUMMARY OF COST

|  |  |  |
| --- | --- | --- |
| Repair Cost – Occurrence No. 1 | USD | 2 735 468,00 |
| General Expenses | USD | 173 664,00 |
| Sum | USD | 2 909 132,00 |
| Work Not Concerning Average | USD | 396 378,00 |
| Total Amount of Owners’ General Account | USD | 3 305 510,00 |

Subject to the rights of the Underwriters according to  
the relevant insurance conditions and policy.

Place, day, month, year

|  |
| --- |
| Yours faithfully |
| For *[Name of the survey company]*  *Signature*  H&M Surveyor  [*name of surveyor]*  *Please include your written name in addition to the signature* |