Marine Safety Investigation Unit

SAFETY INVESTIGATION REPORT

201901/010 REPORT NO.: 01/2020 January 2020

MV *Guroni*
Main engine failure
in position 57° 44.4’ N 010° 08.0’ E
08 January 2019

SUMMARY

MV *Guroni* was en route from the port of Klaksvik in the Faroe Islands, Denmark, to Rostock, Germany, in ballast. The vessel was scheduled to take bunkers off Skagen, Denmark.

On the morning of 08 January 2019, due to heavy weather, the speed of the main engine was reduced. About five hours later, an abnormal sound was heard, and the main engine stopped.

After unsuccessful attempts to restart the main engine, it was decided to have the vessel towed to a repair facility in Rotterdam, The Netherlands.

At the repair facility, it was found that the lubrication oil filter of the main engine had been improperly mounted. This resulted in inadequate lubrication of the main engine, leading to irreparable damage to the crankshaft.

The MSIU has issued one recommendation to the Company designed to ensure that the Company, addressing the critical use of the oil mist detector in the engine-room.

FACTUAL INFORMATION

Vessel

MV *Guroni* was a 6,190 gt oil/chemical tanker, built in China in 2010. She was owned by Avramit Shippng and Trading Ltd, and managed by Densa Tanker Isletmeciligi Ltd. Sti., Turkey.

The vessel had a length overall of 117.54 m, a moulded breadth of 19.01 m, a moulded depth of 10.0 m, and a summer draught of 7.51 m. At the time of the occurrence, the vessel was drawing a forward draught of 4.2 m and an aft draught of 5.8 m.

Propulsive power was provided by a 7-cylinder, four-stroke, single-acting, direct drive, SXD MAN-B&W marine diesel engine, producing 3,310 kW of power which enabled *Guroni* to reach an estimated speed of 14 knots.

Crew

The Minimum Safe Manning Certificate of the vessel stipulated a crew of 15. At the time of the accident, the complement of the vessel was in excess of these requirements. The crew members were nationals of Turkey and India.

The master had a total of 15 years of seagoing experience, 11.5 years of which were served in the rank of a master with STCW II/2 qualifications. He had joined *Guroni* on 30 December 2018, from the port of Grangemouth, U.K. Prior to the accident he had sailed on tankers for 7.5 years.

The chief engineer had a total of 18 years of seagoing experience, 15 years of which were served in the rank of a chief engineer with STCW III/2 qualifications. He, too, had joined *Guroni* on 30 December 2018, from the port of Grangemouth, U.K. Prior to the accident, he had sailed on tankers for eight years.

The second engineer had a total of 15 years of seagoing experience, of which, seven years were served in the rank of a second engineer with STCW III/2 qualifications. He had joined *Guroni* on 03 November 2018, from the port of Istanbul, Turkey. Prior to the accident he had sailed on tankers for 15 years.

The fourth engineer had a total of 11 months of seagoing experience, all of which were served on tankers, in the rank of a fourth engineer with STCW III/1 qualifications. He had joined *Guroni* on 20 October 2018, from the port of Istanbul, Turkey.

Environment

At the time of the accident, the vessel was experiencing heavy weather. The sky was overcast and the winds were blowing from a Northeasterly direction, Force 9 onto the port bow of the vessel. The sea was rough, with waves reaching heights of about 5.0 m.

Operating and maintenance instructions

It was reported that at the time of this occurrence, instruction manuals for the operation and maintenance of all machinery and equipment were available on board.

Pre-accident events

On 05 January 2019, the fourth engineer overhauled one of the lubricating oil filters of the main engine for routine cleaning. Once the task was completed, he re-mounted the filter.

During the evening of 07 January, an 'oil mist failure' alarm activated in the engine-room. On investigating, the crew members found that the air filter of the oil mist detector was dirty. It was therefore cleaned and re-installed. Thereafter, for the rest of that day, no further oil mist detector alarms were activated.

Narrative[1]

On 08 January 2019, at 0742, while the vessel was navigating through Skagerrak, an oil mist detector alarm was observed in the engine-room, followed by a lubricating oil low pressure alarm[2]. Assuming that these were false alarms, the crew members reset the alarms.

At 1100, as the weather conditions worsened, the master decided to reduce the speed of the main engine. Following the reduction in the main engine's rpm, the speed of the vessel was observed to be around 4.5 knots.

The oil mist detector alarm sounded a couple of times more in the afternoon, but the system was again reset. At 1634, while taking a routine round in the steering gear room, the second engineer noticed an abnormal change in the sound of the main engine.

On entering the engine-room, he noticed that the main engine had stopped and there was significant smoke in the area. He also noticed sparks around some of the crankcase covers. A couple of minutes later, the chief engineer arrived and immediately started to investigate. He checked the crankcase covers and noticed that the temperatures of all the covers were normal. After concluding that the smoke was not emanating due to a fire, he opened the engine room skylight in order to vent out the smoke.

In the meantime, the master had ordered for the anchors to be prepared. At 1645, the chief engineer informed the master that he was unable to restart the main engine. As the master noticed that the vessel was drifting toward land, anchors were dropped at 1706.

[1] Unless specified otherwise, all times mentioned in this report are in Local Time (UTC +1).

[2] While the exact description of these alarms was not available to the safety investigation, print-outs of the vessel's alarm log indicated that these alarms were 'oil mist failure' and 'lub oil pressure engine inlet' alarms.

Post-accident events

Once the vessel was anchored, the crew removed all crankcase covers on the port side of the main engine to investigate further. They also noticed that the rocker arm valve adjusting bolts and nuts, of all cylinders, were loose and that some were missing. The crew members re-adjusted the valves and tried to re-start the main engine. The main engine did not start but only turned (freely) on starting air.

On removing the crankcase covers on the starboard side of the main engine, the following day, it was noticed that the big end bearing on cylinder no. 3 was damaged. Once the big end bearing was dismantled, the crew noticed that the big end bearings of cylinder nos. 1 and 2 were also damaged. Suspecting damages to the crankshaft, the Company was informed.

The Company arranged for a service technician to board the vessel, who, after the necessary inspections, advised that the crankshaft had to be replaced due to excessive hardness of the crankpin surfaces. It was decided to tow the vessel to a repair facility.

Findings at the repair facility

A visual inspection of the main engine's crankcase was carried out at the repair facility in Rotterdam. The main findings revealed that:

- the big end bearing shells of cylinder nos. 1, 2 and 3 were severely damaged (Figures 1, 2 and 3), and the bearing shells of three other cylinders had sustained minor damages;
- the crankshaft pins of cylinder nos. 1, 2 and 3 were damaged, while the pins of the other cylinders had sustained minor damages;

- all cylinder heads had sustained severe damages (Figures 4, 5 and 6);
- the piston crown of cylinder no. 3 was damaged;
- the connecting rods of cylinder nos. 1, 2 and 3 were damaged; and
- the lower portion of the liner of cylinder no. 2 was broken.

Figure 1: Big end bearing of cylinder no. 1 (scouring)

Figure 2: Big end bearing of cylinder no. 2 (scouring)

Figure 3: Big end bearing of cylinder no. 3 (scouring)

Figure 4: Cylinder head no. 1 (bent valves)

Figure 5: Cylinder head no. 3 (bent valves)

Figure 6: Cylinder head no. 6 (bent valves)

It was concluded that the crankshaft was damaged beyond repair and would require replacement. It was also noticed that the lubricating oil filter, which had been cleaned and re-mounted prior to the accident was improperly assembled.

Oil mist detector

The purpose of an oil mist detector is to protect an engine from severe damages which can be caused due to oil mist explosions due to overheating of various components of the engine (hot spots).

Oil mist may form when any oil is sprayed through a narrow crack, or when oil, leaking down a high temperature surface, vaporizes, comes into contact with low air temperatures, and then condenses. The crankcase of an engine would contain a large amount of oil droplets suspended in warm air.

When a moving part of an engine fails, it will overheat and vaporize these oil droplets, which would tend to travel away from the high temperature spots and condense into smaller droplets, *i.e.* oil mist. Once the oil mist reaches the lower explosion level, it becomes ignitable and, at high temperatures common within an engine, the oil mist could trigger an explosion. Surfaces that generate oil mist within an engine include the crankshaft bearings (main and big end bearings), pistons, camshaft bearings and cams, gear boxes, *etc*.

The type of oil mist detector fitted on board *Guroni* indicated the detection of high oil mist level, in general, and was typically positioned at mid-length of the main engine as shown in Figure 7.

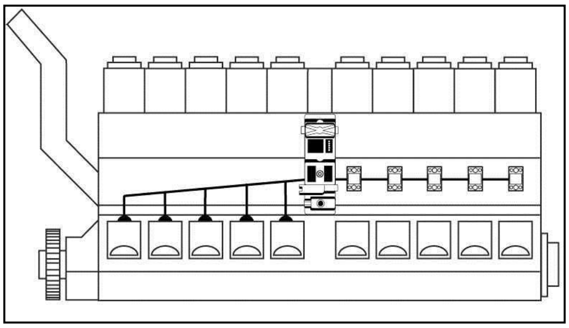

Figure 7: Position of the oil mist detector

This detector was designed to continuously and simultaneously sample the atmosphere from each crankcase compartment between two main bearings. As indicated in Figure 8, the sample mixture is then passed through an optical turbid channel, within the detector, and the turbidity of the crankcase atmosphere would be measured by optical absorption.

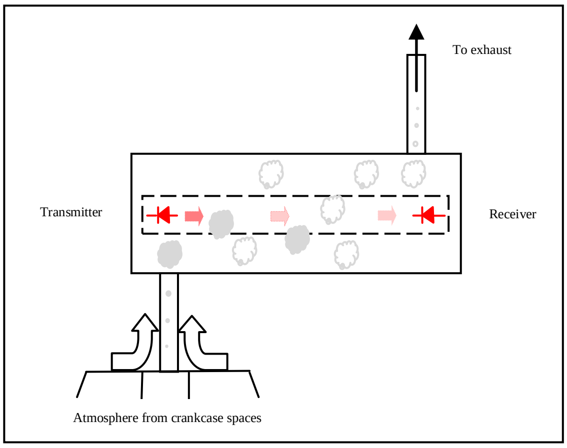

Figure 8: Working of the oil mist detector

The measuring path consisted of two infrared diodes – one working as a transmitter, while the other as a receiver.

Oil mist passing between these diodes would absorb some of the infrared light, thereby reducing the amount of light that could reach the receiver. Depending on the amount of light absorbed by the oil mist, an alarm would be triggered.

The oil mist detector manufacturer's operating instructions[3] stated that false alarms can be generated by the detector in the event of a fire with smoke development – due to which, smoke may pass into the measuring path and induce an opacity, or in very warm or cold climates, when the humidity in the crankcase falls below the dew point – due to which water droplets may pass the measuring path.

The lubricating oil filter

The lubricating oil filter was a system integrated filter for protecting an engine, by retaining all residues which may cause harm to the engine. These residues could be removed from the mesh of the filter by automatic back-flushing, manual cleaning, or changing the filter cartridge.

The lubricating oil treatment system for the main engine of *Guroni* consisted of three filters – an automatic lubricating oil filter designed for intermittent back-flushing of the filter elements, installed close to the main engine, with arrangements for a manual by-pass of this filter; a filter installed on the suction line of the lubricating oil pump; and a filter installed at the pump outlet before the engine block (Figures 9 and 10). The filter installed at the lubricating oil pump outlet was the one found to be improperly re-mounted. Figure 11 shows the filter cartridge, after being dismounted at the repair facility.

Lubricating oil enters the filter and passes through the filter cartridge, which absorbs any residues that may be present, thus allowing filtered lubricating oil to pass through the main engine. If the filter cartridge is improperly mounted, there is a possibility of inadequate filtration of the lubricating oil passing into main engine, as well as an obstruction to the oil flow to the main engine.

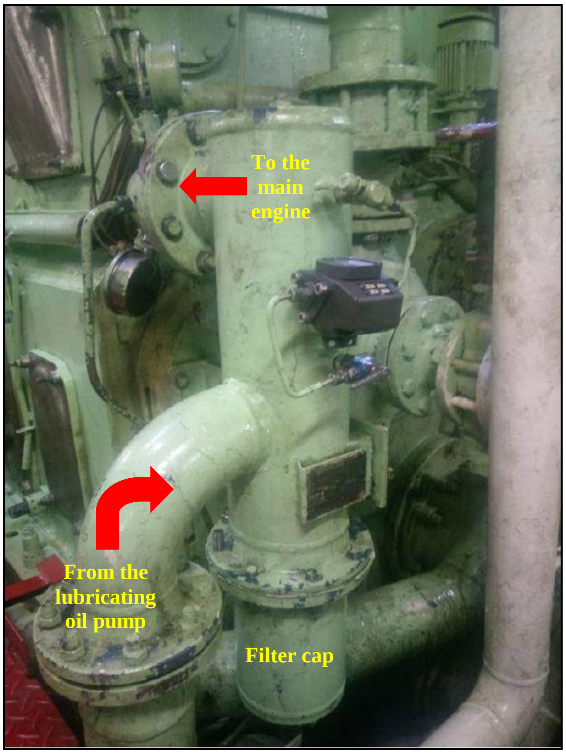

Figure 9: Lubricating oil filter at the pump outlet

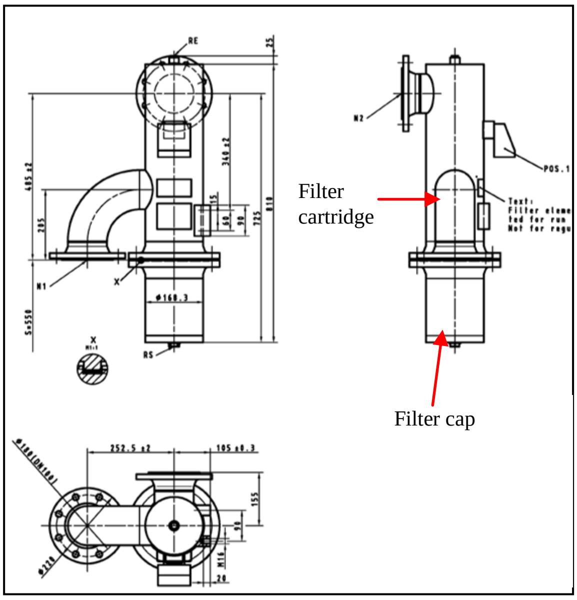

Figure 10: Drawing of the lubricating oil filter

[3] https://schaller-automation.com/en/wp-content/uploads/sites/2/2018/10/Manual-VN87EMC-English-1.pdf

Figure 11: Lubricating oil filter cartridge

ANALYSIS

Aim

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, and to prevent further marine casualties or incidents from occurring in the future.

Re-mounting of the lubricating oil filter, following maintenance

According to the vessel's planned maintenance system, the filter of the lubricating oil treatment system was dismantled three days before the accident occurred for routine maintenance. In order to clean or replace the filter cartridge, one would have to dismantle the filter cap (Figure 9), extract the cartridge from the bottom (Figure 12), and replace the cleaned/new cartridge in the same manner, before re-mounting the filter cap.

On dismantling the lubricating oil filter at the repair facility, it was reported that the upper end of the filter cartridge was damaged, as it was pressed up against the opening of the inlet pipe of the filter (Figure 13). This indicated that the cartridge had slipped to an angle before the filter cap was tightened in position when the filter was being re-assembled, as simulated in Figure 14. This would have restricted the flow of lubricating oil to the main engine.

Figure 12: Extraction of the filter cartridge

Figure 13: Position where the upper end of the filter cartridge was pressed

Figure 14: Simulation showing the angle at which the filter cartridge was found mounted

It was reported that none of the senior engineer officers had supervised this task, although the replacement of a filter cartridge would not be normally supervised, unless abnormal issues are encountered during the process.

Fatigue and consumption of drugs and alcohol

The vessel's records indicated that the rest hours of all crew members on board *Guroni* were in compliance with the relevant requirements of the Standards of Training, Certification and Watchkeeping (as amended) and the Maritime Labour Convention, 2006 (as amended).

The vessel was, however, experiencing heavy weather and available information suggested that that the crew members were tired and stressed because of the bad weather, which was compromising the quality of rest. This, in turn, would have compromised the effective monitoring of the situation in the engine-room.

The Company had a zero alcohol policy, and there was no evidence which suggested that any of the crew members were under the influence of drugs or alcohol. Therefore, drugs and alcohol were not considered as contributing factors to this occurrence.

The assumption on false alarms

During the evening of the previous day, when the oil mist detector alarm activated, the crew members found that the detector's air filter was dirty. After cleaning and re-installing the filter, no alarm was noticed until the following morning.

On the next morning, as well as in the afternoon, when the oil mist detector alarm was triggered again, the crew members assumed that the alarms were false, and simply reset the system. The reason why the alarms were assumed to be false was attributed to the motions of the vessel (heavy pitching) due the prevailing heavy weather. Moreover, once the system was reset, the alarms were not heard again, immediately, which probably allowed the crew members to safely assume that they were false alarms.

However, the operating instructions of the oil mist detector manufacturer, did not suggest that the motions of a vessel in a seaway could be a reason for a false alarm being generated.

Probable cause of the oil mist alarm

The damages sustained by the main engine's running gear seem to indicate that these components were subjected to extensive friction. The cylinder pistons, liners and crank pin bearing journals of the crankshaft showed similar signs of friction (Figures 13 to 18).

The friction between the components of the engine would have probably resulted in the generation of high temperatures within the crankcase spaces of the engine due to micro-welding, as a result of restricted lubrication. These high temperatures (hot spots), in turn, would have led to the vaporisation of oil, building up an oil mist, as already explained. This would have triggered the oil mist detector alarm.

Figure 13: Piston of cylinder no. 2

Figure 14: Piston of cylinder no. 5

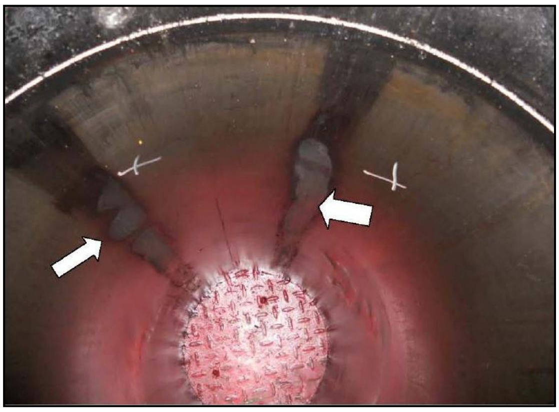

Figure 15: Liner of cylinder no. 6

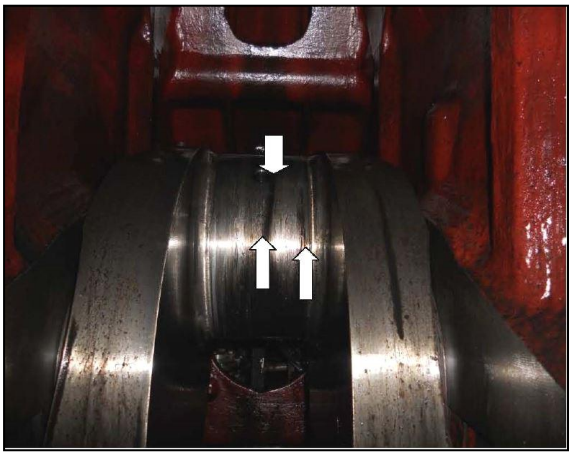

Figure 16: Crankpin journal no. 1

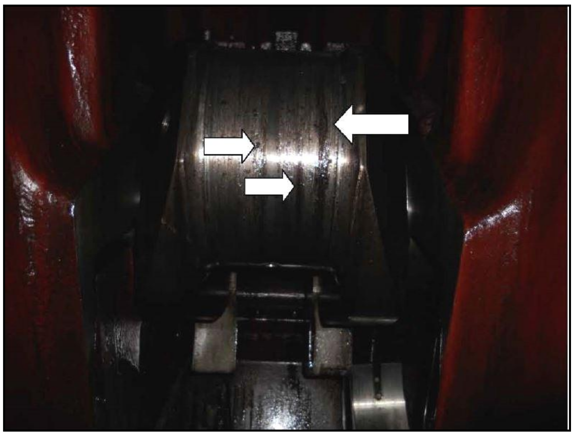

Figure 17: Crankpin journal no. 2

Figure 18: Crankpin journal no. 2

CONCLUSIONS

1. The lubricating oil filter was re-assembled incorrectly, restricting the flow of lubricating oil to the main engine.
2. The restricted oil flow compromised lubrication of the main engine's running gear, leading to the overheating of these components.
3. The oil mist detector alarm was triggered a number of times, probably due to generation of oil mist caused by the overheating of the engine's components.
4. These alarms were erroneously assumed to be false and consequently, accepted by the crew members.
5. The unfavourable weather conditions could have adversely affected the quality of rest of the crew members, which in turn would have affected their ability to effectively monitor the situation in the engine-room.
6. The occurrence resulted in severe damages to the components of the main engine and a complete failure of the main engine.

RECOMMENDATIONS[4]

Densa Tanker Isletmeciligi Ltd. Sti. is recommended to:

01/2020_R1 ensure that the safety management system manual addresses the critical importance of the oil mist detector and lists down the procedures to be followed in case of an alarm.

[4] **Safety recommendations shall not create a presumption of blame and / or liability.**

SHIP PARTICULARS	
Vessel Name:	*Guroni*
Flag:	Malta
Classification Society:	Bureau Veritas
IMO Number / Official Number:	9438248
Type:	Oil/Chemical Tanker
Registered Owner:	Avramit Shipping and Trading Ltd.
Managers:	Densa Tanker Isletmeciligi Ltd. Sti
Construction:	Steel
Length Overall:	117.54 m
Registered Length:	109.9 m
Gross Tonnage:	6,190
Minimum Safe Manning:	15
Authorised Cargo:	Oil and chemicals in bulk
VOYAGE PARTICULARS	
Port of Departure:	Klaksvik, Denmark
Port of Arrival:	Rostock, Germany
Type of Voyage:	International
Cargo Information:	In ballast
Manning:	20
MARINE OCCURRENCE INFORMATION	
Date and Time:	08 January 2019 at 1636 (LT)
Classification of Occurrence:	Serious Marine Casualty
Location of Occurrence:	57° 44.4’ N 010° 08.0’ E
Place on Board	Engine-room
Injuries / Fatalities:	None
Damage / Environmental Impact:	Damages to the main engine / None
Ship Operation:	Underway
Voyage Segment:	In transit
External & Internal Environment:	Weather: Overcast. Visibility: 6 miles. Wind: Northeasterly - Beaufort Force 9. Sea State: Rough. Swell: 5 m.
Persons on board:	20