



SAFETY INVESTIGATION REPORT

201110/003

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The Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011 prescribe that the sole objective of marine safety investigations carried out in accordance with the regulations, including analysis, conclusions, and recommendations, which either result from them or are part of the process thereof, shall be the prevention of future marine accidents and incidents through the ascertainment of causes, contributing factors and circumstances.

Moreover, it is not the purpose of marine safety investigations carried out in accordance with these regulations to apportion blame or determine civil and criminal liabilities.

NOTE

This report is not written with litigation in mind and pursuant to Regulation 13(7) of the Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011, shall be inadmissible in any judicial proceedings whose purpose or one of whose purposes is to attribute or apportion liability or blame, unless, under prescribed conditions, a Court determines otherwise.

The report may therefore be misleading if used for purposes other than the promulgation of safety lessons.

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MV BALKAN **Fire in engine-room** **In the port of Salerno** **04 October 2011**

SUMMARY

On 04 October 2011, container vessel *MV Balkan* was berthed at the port of Salerno, Italy. At 0044, no. 3 generator tripped due to low fuel pressure causing a power failure. The wiper, who at the time was cleaning the control room, went to check the generator room and on seeing smoke coming from the air gratings of the compartment, raised the fire alarm.

The engine-room was evacuated and isolated by the remote operation of the quick closing valves, engine-room ventilation motors, and electrical equipment. The crew succeeded in extinguishing the fire by the use of portable foam extinguishers.

Evidence indicated that a ruptured flexible armoured hose connected to the fuel gauge fitted on instrumentation panel of no. 3 generator leaked a continuous pressurised jet of gas oil onto an exposed hot surface of the running diesel engine. The fuel ignited and part of the prime mover caught fire.

Three recommendations have been made to the ship's managers, which are intended to raise awareness on the inspection of flexible hoses.



MV Balkan

FACTUAL INFORMATION

Vessel description, crew and external environment

Balkan, a 15633 GT container ship, was built by Shandong Province Weihai Shipyard, China in 2007 and is registered in Malta. She is owned by Balkan Shipping & Trading Company Ltd., managed by Agencia Maritime Artiach Zuazaga S L, Spain, and classed with Germanischer Lloyd. The vessel has an overall length of 161.09 m and a beam of 25.00 m. *Balkan* has four cargo holds with a capacity of 25,840.59 m³.

Balkan's main electrical power was supplied from three generator sets connected to the main switchboard. The generators were located in the generator compartment within the engine-room. Each of the three main generators were driven by a MAK 6M 20 trunk piston diesel engine, six cylinder, four stroke, turbocharged, rated at 1020 kW. Each alternator's output was 1200 kVA. The vessel was also provided with an emergency generator supplying 375 kVA.

Balkan operated on international trade. At the time of the accident, she had a crew of 18, with English being the working language on board.

At the time of the accident, it was night time and the air temperature was 22°C. Sea condition was calm inside the port and the wind was light airs.

Narrative¹

On 03 October 2011, *Balkan* berthed at the port of Salerno, Italy at 1550. By 0025 of 04 October, cargo operations were completed.

¹ Interviews with key crew members were conducted on 05 October 2011. Documentary evidence (including photographs of the accident site) was also collected.

The engine-room was put on UMS operation at 1700 on 03 October 2011. At 2000, the third engineer commenced his watch and together with the wiper conducted a general inspection of the engine-room and running machinery. The third engineer remained in the engine-room until 2040 and left the wiper to attend to his routine duties.

During the time that the third engineer remained in the engine-room, the watch alarm was put on attended operation. Before leaving the engine-room, the third engineer changed over the watch alarm to UMS on his cabin.

At 0044, on 04 October, the wiper was cleaning the engine-room control room when the engine-room alarm sounded. Soon after, a blackout occurred. The wiper proceeded to the generator compartment to investigate.

On reaching the entrance to the space, he observed smoke coming out from below the forward bulkhead air gratings of the generator compartment. He opened the door ajar and on seeing the room full of smoke, he shut the door and activated the manual fire alarm call point, which was adjacent to the generator compartment entrance.

Actions after the fire

The engine-room alarm also sounded in the third engineer's cabin. On his way to the engine-room, the third engineer met both the chief engineer and the wiper. The wiper informed them of the fire in the generator room. Meanwhile, the emergency generator started automatically, restoring light and emergency power on board.

The chief engineer and third engineer proceeded to the engine-room. On seeing the engine-room full of dense smoke, which impeded visibility, he closed the engine-room door. The chief engineer remotely switched off the engine-room ventilation, boiler, fuel pumps, and quick closing valves from the

control boxes located near the engine-room entrance.

The rest of the crew had already gathered at the mustering station and the main fire party was ordered by the Master to investigate the fire. The fire team met the engineers outside the engine-room. The chief mate reported to the Master that the chief engineer had already activated the shut downs. All engine-room ventilation flaps were then closed.

Fire party no. 1, under the leadership of the chief mate, was hindered from entering the generator compartment from the electrical workshop due to the dense smoke. Instead, access was gained from the steering gear compartment. The chief mate reported to the Master that no. 3 generator was on fire.

After consulting the Master, and with the assistance of the back-up party and other crew members who brought portable fire fighting equipment, fire party no. 1 managed to extinguish the fire using nine portable foam extinguishers.

At 0105 on 04 October, the local fire brigade arrived on the scene and instructed the Master to evacuate all the crew members ashore. The firemen were told that the fire had been suppressed by the crew. The fire fighters donned their fire fighting suits and breathing apparatus and went down to the generator room. They surveyed the situation and confirmed to the Master that the fire was extinguished but the engine-room was still engulfed in smoke.

On the fire fighters advice, the ventilation for the engine-room was restarted using no. 4 ventilator fan supplied from the emergency switchboard. The fire brigade left the vessel at 0210 after ensuring that the situation on board was under control. The crew were again allowed on board.

As a result of the fire, no. 3 generator was inoperative. The fire had also damaged electrical cables, which affected several equipment such as the oil-fired boiler, exhaust boiler feed pumps, air starting compressor starters, engine-room lighting, and the smoke and heat detection system.

Nos. 1 and 2 generators were tested with satisfactory results and by 0408, main power was restored. Auxiliary equipment was also checked, and the main engine was tested at 0700.

Pilot boarded at 0645 and at 0710 with the engine's own power and the assistance of two tugs, forward and aft, the vessel started to shift berth and was made fast at a lay-by berth at 0750.

ANALYSIS

Source of fire

A detailed inspection of the generator room revealed that the fire was localised, on and around no. 3 generator prime mover. It could not be established when the fire had commenced or for how long it had been burning before it was discovered. However, the inspection of the fire scene indicated that the fire duration was short. This was so because by the time it was extinguished, the damage sustained to the generator and equipment was not extensive (Figures 1 and 2).



Figure 1: Localised damage restricted to turbocharger and intercooler area



Figure 2: Extent of fire damage did not reach the prime mover units

When the engine-room alarm sounded, followed by the black out at 0044, the fire in the generator compartment had already started. The fire was eventually suppressed in approximately 20 minutes, reducing the severity of the damage to the generator and the generator room.

The investigation came to the conclusion that the cause of the fire was the ruptured flexible armoured rubber hose connected to the fuel gauge fitted on no. 3 generator instrumentation panel (Figure 3). After the fire, the chief engineer was requested to open the fuel delivery valve to no. 3 generator and oil could be seen leaking from the damaged flexible hose attached to the fuel gauge of no. 3 generator (Figure 4).

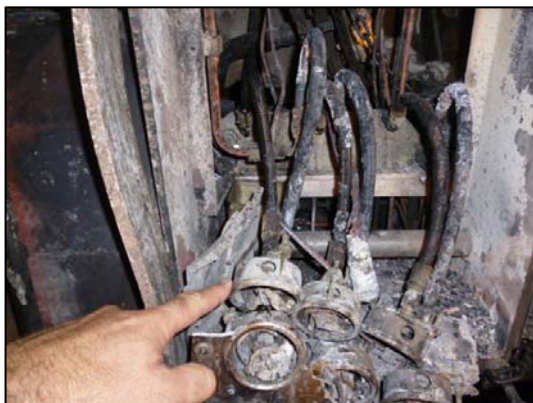


Figure 3: Close up of the burnt instrumentation panel showing finger pointing at the fuel gauge



Figure 4: Leaking armoured flexible rubber hose fitted to the fuel gauge of no. 3 generator

No. 3 generator, which was the only generator working at the time of the fire, operated at a fuel oil pressure of between 4 and 5 bar. The flexible hose was directly connected from the main fuel supply line to the fuel gauge, although there was an isolation shut-off cock in between. The arrangement was also the same for nos. 1 and 2 generators.

The flexible hose fitted to the gauge was not physically visible (Figure 5). It was enclosed inside the instrumentation panel and only accessible if the panel front face is unscrewed and removed. Frequent visual inspections of the flexible hoses' condition were not possible². The instrumentation panel was adjacent to the turbocharger air filter (Figure 6).

The support brackets of the turbocharger turbine side were not insulated and the temperature of the brackets exceeded 220°C when the generator was in operation. This was identified during the safety investigation, when the temperature readings of nos. 1 and 2 turbochargers' support brackets were taken³.

² Reference is made to IMO document MSC.1/Circ.1321 on guidelines for measures to prevent fires in engine-rooms and cargo pump-rooms. The document highlights the importance of accessibility for inspection and maintenance.

³ An infrared heat tracer was used to measure the surface of the hot brackets.

Moreover, whilst the brackets were not insulated as prescribed in SOLAS regulation II-2/4.2.2.6.1, the unshielded brackets temperature readings were in excess of 220°C, bordering on the auto-ignition temperature of the gas oil.



Figure 5: Instrumentation panel on one of the other intact generators



Figure 6: Location of generator instrumentation panel

The failure of the armoured flexible hose caused a continuous fuel spray to be pumped onto the hot surfaces of the turbo charger casing support brackets, which eventually gave rise to the fire. The fire, which spread to the immediate surrounding area, was assisted by the forced air from the ventilation fan situated aft and above no. 3 generator.

Fire fighting

The fire alarm was manually activated by the wiper who went to check the generator room after the black out occurred. There

was no evidence to show that one of the smoke or heat detectors inside the generator room triggered the fire alarm system in advance before the wiper pressed the manual call point.

However, this was not taken to mean that the fire detection system was faulty. In fact, during the investigation and after the damaged smoke detecting sensors in the generator compartment were disconnected, all the fire alarm loops were tested by checking random detector heads from each loop. All loops worked satisfactory.

After the fire alarm sounded, the chief engineer operated the emergency stops and quick closing valves. The timely intervention of the ship's fire party to enter the generator compartment and suppress the fire certainly reduced the severity of the damage in the generator compartment.

Planned maintenance

The flexible hose to the fuel pressure gauge was not included in the planned maintenance of the ship. Moreover, it should be noted that it was also not listed in the spare parts manual of the MAK engine. No periodical schedule of inspection was mentioned in the maintenance programme of the engine or in the safety management system of the vessel⁴.

No spare flexible hoses of the type used on the fuel gauge were available on board. Moreover, a record of inspection and maintenance of the flexible hoses for the instrumentation panel of the generators was not available.

⁴ It has to be specified, however, that there were no class requirements on the maintenance of flexible hoses.

CONCLUSIONS

- The fire was initiated by the rupture of the flexible armoured hose pipe on the fuel gauge of no. 3 generator instrumentation panel.
- The un-lagged turbocharger support brackets served as a hot spot to ignite the leaking fuel.
- The inspection and maintenance of the pressurised fuel oil system was hindered by the way the flexible hose was hidden behind the instrumentation panel.
- The timely intervention by the crew reduced the severity of the fire and equipment damage.

RECOMMENDATIONS

Agencia Maritima Artiach Zuazaga SL is recommended to:

15/2012_01 revise the SMS, in order to take into consideration not only the manufacturer's periodical inspections and maintenance, but also incorporate guidelines from other recognised maritime bodies or institutes such as IMO circulars and Classification Societies technical papers on fires similar to the one on board *Balkan*.

15/2012_02 ensure that crew members, especially officers, are provided with enhanced risk assessment training and skills to identify critical equipment / fittings, the failure of which may have the potential to cause a hazardous situation or accident.

15/2012_03 ensure that thermal surfaces exceeding 220°C and which may be impinged as a result of a fuel system failure are properly insulated.

SHIP PARTICULARS

Vessel Name:	<i>Balkan</i>
Flag:	Malta
Classification Society:	Germanischer Lloyd
IMO Number:	9358890
Type:	Container
Registered Owner:	Balkan Shipping & Trading Company Ltd
Managers:	Agencia Maritima Artiach Zuazaga S L
Construction:	Steel
Length Overall:	161.09 m
Registered Length:	151.35 m
Gross Tonnage:	15633
Minimum Safe Manning:	15
Authorised Cargo:	Containerised

VOYAGE PARTICULARS

Port of Departure:	Genoa, Italy
Port of Arrival:	Salerno, Italy
Type of Voyage:	Coastal
Cargo Information:	Loaded
Manning:	18

MARINE OCCURRENCE INFORMATION

Date and Time:	0044 on 04 October 2011
Classification of Occurrence:	Less Serious Marine Casualty
Location of occurrence:	Salerno, Italy
Place on board	Engine-room
Injuries / fatalities:	None
Damage/environmental impact:	None
Ship Operation:	Alongside
Voyage Segment:	Arrival
External & Internal Environment:	It was night time, the air temperature was 22°C. Sea condition was calm inside the port and the wind was light airs. The machinery's state inside the engine-room was normal. The engine-room was UMS but an engine-room rating was in the control room.
Persons on board:	18