



STATE COMMISSION ON MARITIME ACCIDENT INVESTIGATION

FINAL REPORT 26/13

Marine Incident

M/V POPRAD

Chief engineer's burn caused by electric arc
while repairing the control system of the G1 generator
on 9th September 2013 at the port of Rotterdam

September 2014

The examination of the incident was conducted under the State Commission on Maritime Accident Investigation Act of 31 August 2012 (The Journal of Law item 1068) as well as norms, standards and recommended procedures agreed within the International Maritime Organisation (IMO) and binding the Republic of Poland.

The objective of the investigation of a marine accident or incident under the above-mentioned Act is to ascertain its causes and circumstances to prevent future accidents and incidents and improve the state of marine safety.

The State Commission on Maritime Accident Investigation does not determine liability nor apportion blame to persons involved in the marine accident or incident.

This report shall be inadmissible in any judicial or other proceedings whose purpose is to attribute blame or liability for the accident referred to in the report (Art. 40.2 of the State Commission on Maritime Accident Investigation Act).

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1. Facts

On 9 September 2013 on board the Poprad mooring in the Werkhaven basin at the port of Rotterdam, at 21:30 local time (20:30 UTC), the chief engineer, when attempting to check and repair the control system in the G1 generator's area in the main switchboard, was burned by the electric arc. The attempted repair consisted in replacing faulty fuses protecting the synchronization circuits of the G1 generator.

Due to injuries, the chief engineer was transported to the hospital in Rotterdam. There were found surface burns to the skin of the face, neck and right arm, without signs of electric shock.

The next day, the PSC inspected the vessel. Inspectors found the faulty generator No 1 and no navigation light at the stern. Because of the inspection, the vessel was detained in Rotterdam.

The chief engineer was discharged from hospital on 11 September 2013. Further treatment of burns was carried on in Poland. Once the recommendations of the PSC had been fulfilled and reviewed by the classifier (PRS), on 12 September 2013 the vessel left the port of Rotterdam and went to England.

2. General Information

2.1. Ship Particulars

Vessel's name:	Poprad
Flag:	Polish
Ship owner:	Baltramp Shipping Sp. z o.o.
Operator:	as above
Classification society:	PRS
Vessel's type:	general cargo
Call signal:	SNBI
IMO number:	8509002
Gross tonnage (GT):	1567
Year of build:	1986
Power:	600 KM (Deutz SBA 8M 528)
Width:	11.30 m

Length overall:	81.07 m
Hull material:	steel
Minimum crew:	5 men
Type of the VDR recorder:	none



Photograph 1. General cargo vessel Poprad

2.2. Voyage Particulars

Ports en route:	Cowes, Rotterdam
Port of destination:	Plymouth
Type of navigation:	international, up to 200 nm from the port of refuge
Manning:	6 Poles

2.3. Marine Incident Information

Type:	marine incident
Date and time of the incident:	09.09.2013 at 19:30 LT (20:30 UTC)
Geographical area of the incident:	the port of Rotterdam - Werkhaven
Nature of the water region	internal waters, port's quay

Operational status of the vessel during the event:	while loading
Place of the incident on board:	engine room, switchboard – G1 generator’s steering area
Participation of human factor:	chief engineer
Consequences of the incident to people:	surface burn of the face, neck, and hand
Consequences of the incident to the vessel:	damaged parts of the main switchboard in the G1 generator’s area

2.4. Shore Services and Rescue Action Information

Medical aid was provided by the Burn Unit at the Maasstad hospital in Rotterdam.

3. Circumstances of the Marine Incident

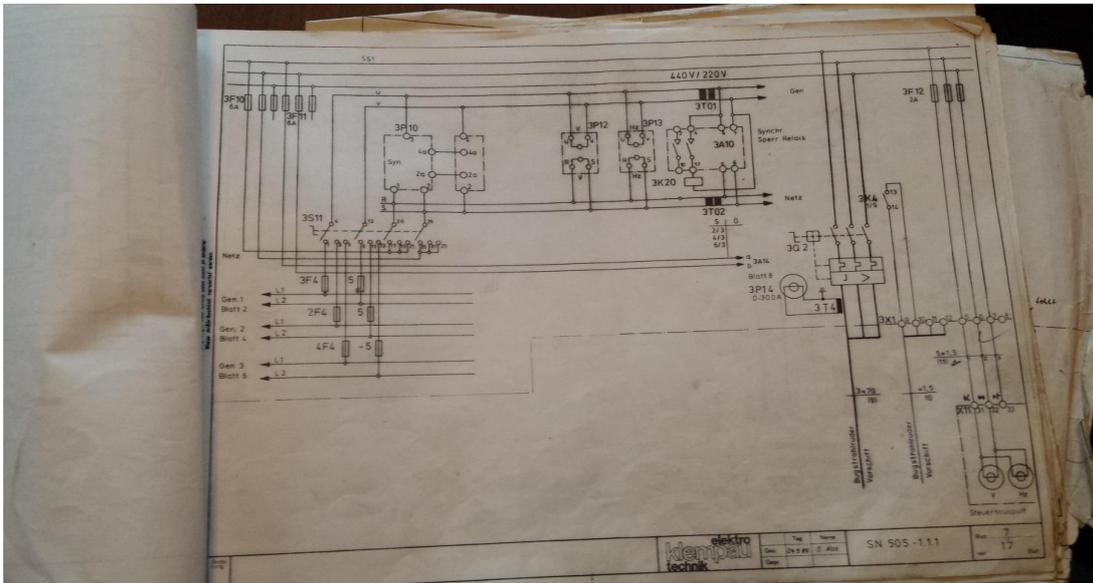
Before entering the port of Rotterdam, the chief engineer reported to the captain, and through the captain to a person responsible for the ship owner’s technical matters, the inefficiency consisting in the impossibility of switching on the G1 electric generator into the vessel’s electric network. The ship owner arranged for the vessel to be repaired at the port of Rotterdam. The ship docked on 7 September, 2013. After mooring, the electrician arrived on board and commenced the repair.

The control system of the G1 generator was repaired by replacing damaged “Start” and “Stop” buttons, among others. Next day the repair works were completed. The connection of the G1 generator into the network and its disconnection were tested once.



Photograph 2. Switchboard – G1, generator’s steering area

During a stopover in the port of Rotterdam, the vessel changed the berth twice. Following the second change of the quay and berthing in Werkhaven on 9 September, 2013 at ca. 20:15, the chief engineer could not disconnect from the network the G1 generator, which at the time of manoeuvring was required to power the thruster. Accordingly, following telephone consultations with the technician who had repaired the control system the previous day, the chief engineer was advised to remove the fuses in the control area of the G1 generator. He removed the fuses indicated by the technician causing disconnection of the G1 generator from the electric network of the vessel. Then, while making a visual inspection of the G1 generator's control area, he noticed two blown fuses - 3F4 and 3F5, protecting the synchronization circuitry. When replacing these fuses, the motor of the electric generator was running. The G1 generator was being induced and it was generating the nominal voltage of 3x440VAC.



Photograph 3. Electric diagram depicting connections of the damaged 3F4-5 fuse separator

The chief engineer replaced the 3F4 fuse with a new one of the rated current of 6A. The blown 3F5 fuse was replaced with the fuse of the same rated current of 16A as the damaged fuse had¹. After replacing the second fuse and switching on the fuse separator an arc shorting occurred. The chief engineer was burnt by the electric arc. The equipment and electrical wires were damaged as well as wires in the G1 generator's area. Because of injuries, the chief engineer was taken to hospital in Rotterdam.

¹ According to the electric diagram, the 3F5 fuse should have the rated current of 6A.



Photograph 4. Main switchboard – blown electric circuits in the G1 generator's area

4. Analysis and Comments about Factors Causing the Incident with regards to Examination Results and Expert Opinions

As a result of the investigation, the Commission determined that the use of fuse with the nominal value of 16A instead of 6A and the replacement of fuses while the generator was induced caused the marine incident. Then, the damaged electrical device was switched on (the fuse separator). When switching on, the damaged electrical device (while working under voltage and electric load) initiated arc shorting at the contacts on the side of the power supply from the G1 generator. Working G1 generator was inducing the arc shorting until the conductive elements in the fuse separator burnt out and the electric arc self-extinguished.

4.1. Mechanical Factors

According to the Commission, a mechanical factor that contributed to the incident was a damaged electrical device (fuse separator) 3F4-5, which caused problems with synchronization and switching on the G1 generator to the electric network of the vessel.

4.2. Human Factors (fault and neglect)

The Commission considered that the repair carried on by the chief engineer in the area of the G1 generator, despite his many years experience aboard vessels, was a serious mistake. Moreover, the chief engineer did not ascertain which fuse should have been used to protect the synchronization circuit of the G1 generator and he used the fuse of the rated current of 16A (which had been mistakenly inserted before) instead of 6A

4.3. Organizational Factors

The Commission recognized the lack of adequate procedures and instructions of the ship owner regarding safety at work while repairing main switchboard by the crew as a major organizational factor that caused the incident.

5. Description of Examination Findings Including the Identification of Safety Issues and Conclusions

The inspection and repair of the control system of the G1 generator by a technician-electrician, the day before the accident had not removed all the defects of the system causing its failure. The investigation showed that neither the 3F4-5 fuse separator had been exchanged nor the inserted fuse-links checked for compliance of their rated current against the wiring diagram of the main switchboard.

Information obtained from the crew differs significantly from what was stated by the service technician making the repair. According to the technician, he was not involved in the repair work within the area of the main switchboard, and the steering and control systems of all generators were working properly. Whereas, according to the crew, the scope of repair included the installation of additional wiring due to observed discrepancies inside the main switchboard and existing electrical connections. In addition, the technician adjusted and repaired the regulator of the G2 generator (that is why the repair works lasted from 20:00 of 7 September 2013 until 05:00 the next day). Lack of the repair report and documentation make it impossible for the Commission to verify the scope of service works. The Commission also found no entries about the malfunction of the G1 generator in the engineer's and ship's logbooks.

The chief engineer should replace fuse-links in the main switchboard only after switching off the voltage in the circuit or checking that the circuit was not loaded as well as after checking the nominal value of rated current of fuse-links compatible with currents specified in the wiring diagram.²

Injuries sustained in an accident by the chief engineer showed that personal protective equipment used while working in the main switchboard was insufficient and ineffective. Safety glasses protected the eyes, but not the face and neck. The engineer did not use sufficiently resistant to high temperature of the electric arc gloves. Because of the injuries, the chief engineer had a sick leave for 28 days.

The operator has arranged neither for a post-accident team nor it specified the reasons behind the marine incident, nor have they implemented appropriate steps to prevent future incidents of similar nature while making repairs in the main switchboard by the crew.

In view of the PSC recommendations from Ghent of 29 July, 2013 and Rotterdam of 10 September, 2013, the operator made an internal audit of the Safety Management System of the vessel. The auditor checked the implementation of the PSC recommendations and confirmed that they have been executed.

6. Safety Recommendations

The State Commission on Marine Accident Investigation has considered reasonable referring to the ship's operator the following safety guidelines that form a proposal of measures that may contribute to prevention of similar incidents in the future.

The State Commission on Marine Accident Investigation has recommended:

- 1) developing a procedure and instructions regarding safety at work while repairing electric equipment and installations, in particular in the main switchboard, by the crew devoid of a qualified electrician, which should be published in the Safety Management Book, Chapter P-08 "Emergency and Breakdown Actions";
- 2) observing the P-03 procedure contained in the Safety Management Book ("Reporting, and Discrepancy Analysis of Accidents and Emergency Situations") regarding the appointment of a post-accident team to determine causes of the accident and to suggest preventive actions;

² The safety matters in the course of works with electrical devices are defined in the Order of the Minister of Economy of 28 March 2013 on safety at work with energy-related devices (Journal of Laws item 492.)

- 3) requiring from persons engaged in the technical service of the vessel (service technicians) to prepare and submit to the operator and the vessel detailed reports documenting commissioned and performed service works;
- 4) equipping the vessel with adequate and effective personal protective gear for work with electrical equipment, including face shields protecting from electric arc;
- 5) convincing the captain and chief engineer to make entries in the ship's and engineer's log books related to the incidents or cases of equipment malfunction having a significant impact on the safety and operating condition of the vessel.

7. Participation of Substantially Interested States

The Dutch commission for investigating accidents (Dutch Safety Board) on hearing the information about the incident on board the Poprad, from the Netherlands Shipping Inspectorate, informed the State Commission on Maritime Accident Investigation and desisted from further investigation.

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9. Glossary and Abbreviations

G1 – Power generator No 1

PRS – Polish Register of Shipping

PSC – Port State Control

VAC – voltage in alternating current

UTC – Coordinated Universal Time

10. Information Sources

Notification of the incident

PSC report from Rotterdam

Documents of the vessel

Report and checklist from the audit by ISM on board

Documents of the course of treatment of the chief engineer

Expert opinion by Tomasz Gelert, M. Eng. – ship's electro-automatic engineer

11. Composition of the Incident Investigative Team

The team conducting the investigation was composed of:

the Team Leader: Marek Szymankiewicz – a Secretary of the State Commission on Maritime Accident Investigation

the Team Member: Tadeusz Gontarek – a member of the State Commission on Maritime Accident Investigation