THE COMMONWEALTH OF THE BAHAMAS

"M.v. Black Watch"

IMO Number 7108930

Official Number 8000293

Report of the investigation into the Auxiliary Engine Room fire on the 01st July 2016 approximately 260nm off the coast of Funchal, Madeira

The Bahamas conducts marine safety or other investigations on ships flying the flag of the Commonwealth of the Bahamas in accordance with the obligations set forth in International Conventions to which The Bahamas is a Party. In accordance with the IMO Casualty Investigation Code, mandated by the International Convention for the Safety of Life at Sea (SOLAS) Regulation XI-1/6, investigations have the objective of preventing marine casualties and marine incidents in the future and do not seek to apportion blame or determine liability.

It should be noted that the Bahamas Merchant Shipping Act, Para 170 (2) requires officers of a ship involved in an accident to answer an Inspector's questions fully and truly. If the contents of a report were subsequently submitted as evidence in court proceedings relating to an accident this could offend the principle that individuals cannot be required to give evidence against themselves. The Bahamas Maritime Authority makes this report available to any interested individuals, organizations, agencies or States on the strict understanding that it will not be used as evidence in any legal proceedings anywhere in the world.

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Bahamas Maritime Authority
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1 GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AE	-	Auxiliary Engine
AER	-	Auxiliary engine room
AFFF	-	Aqueous film forming foam
AG	-	Auxiliary generator
ANI	-	Approved nautical inspector
ASI	-	Annual safety inspection
BA	-	Breathing apparatus
BAR	-	Metric unit of pressure
BMA	-	Bahamas Maritime Authority
°C	-	Celsius
CC	-	Condition of class
CCTV	-	Closed-circuit television
C/O	-	Chief Officer
CO_2	-	Carbon dioxide
CP	-	Controllable pitch
DNV-GL	-	Det Norske Veritas – Germanischer Lloyd
DOSC	-	Deputy on scene commander
DPA	-	Designated person ashore
ECR	-	Engine control room
EEBD	-	Emergency escape breathing device
EOOW	-	Engineer officer of the watch

FT	-	Fire team
GES	-	General emergency station
GMT	-	Greenwich mean time
HFO	-	Heavy fuel oil
HSSC	-	Harmonized system of survey and certification
IMO	-	International Maritime Organization
Knots	-	Nautical miles per hour
kW	-	Kilowatt
m	-	Metre
MCA	-	Maritime and Coastguard Agency
MLC	-	Maritime Labour Convention
MoU	-	Memorandum of understanding
MRCC	-	Maritime rescue co-ordination centre
MSC/Circ	-	Maritime Safety Committee circular
NM	-	Nautical mile
OOW	-	Officer of the watch
OSC	-	On scene commander
PA	-	Public address system
PMS	-	Planned maintenance system
PSC	-	Port State control
PSSC	-	Passenger ship safety certificate
SCBA	-	Self-contained breathing apparatus
SOLAS	-	International Convention for the Safety of Life at Sea
STCW	-	Standards of training, certification and watchkeeping
UHF	-	Ultra High Frequency

UK	-	United Kingdom
UTC	-	Universal co-ordinated time
VDR	-	Voyage Data Recording
WTD	-	Watertight door

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2 SUMMARY

2.1 The m.v Black Watch sailed from Ponta Delgada, Azores on the 30th June 2016 enroute to Funchal, Madeira with an estimated time of arrival of 1900(GMT+1) on the 02nd July.

2.2 At 0838(GMT+1) the Autronica fire alarm system sounded on the bridge indicating that a fire had established in the Auxiliary Engine Room. The Code Bravo was then announced on the public address (PA) system alerting all crew and passengers of the emergency in order to initiate the emergency response.

2.3 The exact location of the fire was confirmed by the 3rd Officer who was inside the Auxiliary Engine Room at the time the fire started and later reported to the bridge confirming that the fire started on the No.2 Auxiliary Engine (AE2) in vicinity of the on-engine fuel filters at the aft end of the generator.

2.4 There was significant damage to the entire starboard side of the auxiliary engine room including transformer room aft and all ancillary equipment located in vicinity of AE2. Outside the engine room heat had damaged adjacent compartments, and significant quantities of smoke in the Engine Control Room rendered it unattainable for two hours. The fire-fighting effort was severely hindered due to a failure of the voltage stabiliser on the emergency generator resulting in intermittent loss of power throughout the ship affecting fire pumps, bilge pumps, lighting, breathing apparatus (BA) compressor and communications.

2.5 Despite the loss of the emergency generator affecting essential firefighting systems the crew confirmed the fire in the auxiliary engine room had been extinguished by 1109(GMT+1). Further the Owners reported that no injuries had been sustained by any of the 1,061 passengers and crew onboard.

2.6 The vessel developed a 3° list to port due to water being used to extinguish the fire settling on the port side of the vessel with no ability to either remove or drain down the water. The vessel remained stable throughout and shore side support was provided to ensure the stability of the vessel was never in jeopardy. Further it was confirmed that no pollution occurred as a result of the firefighting effort.

2.7 The vessel managed to proceed to Funchal, Madeira under its own propulsion arriving on the 02nd July where upon the cruise was terminated and the passengers were repatriated back to their respective country of origin. The Bahamas Maritime Authority commenced the Marine Safety Investigation onboard on the 03rd July 2016.

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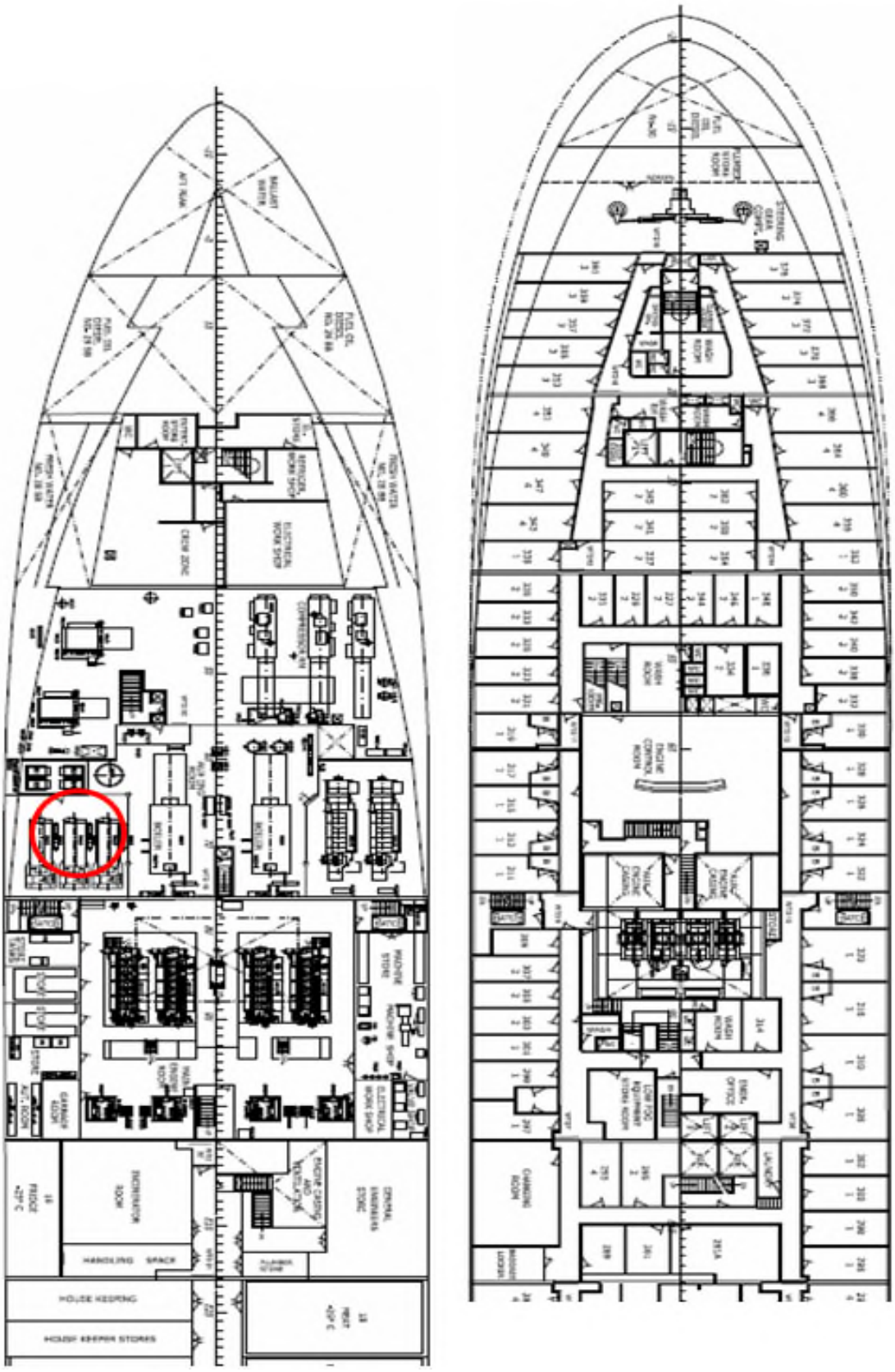

Figure 1: General Arrangement Plan indicating decks A (left) and B (right) (location of fire circled in red)

3 DETAILS OF INVOLVED VESSEL(s) AND OTHER MATTERS

3.1.1 The Black Watch is a purpose built passenger vessel owned by Black Watch Cruise Ltd and managed by Fred Olsen Cruise Lines of Ipswich, UK and registered in the port of Nassau, Bahamas. The principal details as at 1st July 2016 are as follows:

IMO Number	7108930
Keel Laid	1971
Builders	Oy Wartsila Ab Shipyard, Finland
Gross Tonnage	28,613 tonnes
Nett Tonnage	11,854 tonnes
Length (overall)	205.47 metres
Length (bpp)	175.10 metres
Breadth	28.20 metres
Draught	7.55 metres
Class Society	Det Norske Veritas (DNV-GL)
Class Notation	1A1 Passenger Ship (unrestricted sea-going service)
Propulsion	4 x MAN 7L32/40 diesel engines 2 x CP propellers
Auxiliary Generators	3 x Wartsila 824TS, 2 x MAN 8L21/31 1 x Wartsila 6R32 & 1 x Emergency Generator (1,700kW)
Shaft Power	14,000kW
Service Speed	18.5 kts

3.1.2 The vessel is designed and certified for the carriage of 804 passengers and 330 crew, at the time of the incident there were 365 crew and 696 passengers resulting in the vessel operating at 93% capacity.

3.1.3 The Black Watch has seven generators installed, five are located within the auxiliary engine room in deck 1, zone 4 (AG1 – 5), another located in pump room No.5 (AE7) deck 1, zone 3 and the emergency generator located in the

emergency generator room on deck 9 zone 4. AE6 was removed in 2005 during a vessel refit and never replaced.

3.2 Vessel Certification

3.2.1 At the time of the incident the vessel was classed with DNV-GL and all statutory certificates remained valid.

Primary Certificates:

Certificate of Class	issued	16 Nov 2015	expiry	30 Nov 2016
International Tonnage Certificate	issued	15 Jun 2005	expiry	-
International Load Line Certificate	issued	13 Jan 2013	expiry	30 Nov 2016
Passenger Ship Safety Certificate	issued	16 Nov 2015	expiry	31 Aug 2016
Safety Management Certificate	issued	10 Apr 2012	expiry	21 Apr 2017
Document of Compliance	issued	07 Nov 2014	expiry	19 Oct 2019
Maritime Labour Certificate	issued	05 Aug 2013	expiry	09 Jul 2018
Safe Manning Document	issued	01 Jul 2013	expiry	30 Jun 2018

3.3 Port State and Flag State Inspections

3.3.1 The vessel was inspected by Norwegian Maritime Authority Port State Control (Paris-MoU) on the 15th June 2016 in Alesund, Norway with no deficiencies recorded.

3.3.2 The Bahamas Annual Safety Inspection (ASI) was carried out on the 28th December 2015 in Las Palmas, Gran Canaries with no deficiencies recorded.

3.4 Duty Watchkeepers

3.4.1 The following watch team members were on watch in their respective locations between the hours of 0800 to 1200.

The Master (36 years of age) of the vessel held an unlimited Master Mariner Certificate at the management level (II/2)[1] required by the Standards of Training, Certification and Watchkeeping (STCW) issued by Finland on 02nd October 2012 and endorsed by the Commonwealth of the Bahamas on 13th June 2016, and was duly recognized in accordance with the provisions of Regulation I/10 of the STCW 1978 convention. At the time of the incident he was approaching the end of this contract having been on board for 2 months. The Master has been the Captain since May 2015 operating a two month on, two month off rotation. Prior to May 2015 he was the Chief Officer on board a sister vessel the m.v Boudicca.

[1] Specification of minimum standard of competence for Masters and Chief Mates on ships of 500 gross tonnage or more.

The Chief Officer (39 years of age) of the vessel held an unlimited Master Mariner Certificate at the management level (II/2) required by STCW issued by Finland on 22nd July 2010 and endorsed by the Commonwealth of the Bahamas on 30th September 2013 and duly recognized in accordance with the provisions of regulation I/10 of the STCW 1978 convention. The Chief Officer arrived on board at the same time as the Master in May 2016 for the start of his 6th contract period.

The Chief Engineer (51 years of age) held STCW III/2[2] Chief Engineering Officer qualification at the management level since 26th September 2014, endorsed by the Commonwealth of the Bahamas and duly recognized in accordance with the provisions of regulation I/10 of the STCW 1978 convention. He joined the vessel 5 days prior to the incident having been assigned to Black Watch since June 2015. He has been with Fred Olsen Cruise Line for 15 years serving on board all three sister vessels as Chief Engineer since 2008.

Bridge Watchkeepers

Senior Third Officer (OOW) – Joined Fred Olsen Cruise Lines as a deck cadet in 2009 and sailed on sister vessels Boudicca and Balmoral. Promoted to Officer in Charge of Navigation Watch upon obtaining his Certificate of Competency STCW II/1 in 2013, issued by the Maritime and Coastguard Agency (MCA) and started this contract 2.5 weeks prior to the incident having spent one year onboard.

Engineering Watchkeepers

The on-coming 3rd Engineer took over the engineering watch at 0800 having relieved the second 3rd Engineer with nothing significant to report. The Engineer Officer of the Watch (EOOW) joined the vessel at the end of May for his first contract with Fred Olsen Cruise Lines. He gained an Officer in Charge of an Engineering Watch Certificate (STCW III/1) in April 2015 issued by Norway.

3.5 Fatigue

3.5.1 The Fidelio Time and Attendance system used on board confirmed that prior to the emergency all crew were in compliance with the statutory hours of rest requirements[3]. At the point of the emergency the Master advised that the MLC compliance was suspended until the vessel was able to resume normal operations.

3.6 Substance Abuse

[2] Specification of minimum standard of competence for the Chief Engineer Officers and Second Engineer Officers on ships powered by main propulsion machinery of 3,000kW propulsion power or more.

[3] Required by the International Convention of Standards of Training, Certification and Watchkeeping for Seafarers. 1978 as amended (STCW) and the Maritime Labour Convention, 2006 (MLC 2006)

3.6.1 Although no alcohol testing was carried out following the incident, there was no evidence to suggest that substance abuse was a contributory factor.

3.7 Emergency Organisation – Code Bravo

3.7.1 Code Bravo is a code name used to indicate a fire on board. In the event of an engine room fire the engineer on duty and the motorman on duty are despatched to investigate the nature of the incident. Once the Code Bravo is confirmed, the following teams are mustered as per the Emergency Procedures Manual and assembled at their designated locations:

1	Central Command Team	Location: bridge
2	On Scene Command Team	Location: scene of incident
3	Area Control Team	Location: scene of incident
4	Rapid response Team	Location: scene of incident
5	Fire Teams	Location: various

3.8 Low Fog System

3.8.1 The fixed application system fitted on board is a Flexi-Fog Fire Extinguishing System manufactured by Heien-Larssen and fitted on board in December 1999. The system was inspected by service agents Autronica Fire and Security AS on the 15th June 2016. The manual spray system provides a network of nozzles throughout the auxiliary engine room. The nozzle houses a deflector plate causing water to spray out over a large area. The water is supplied initially from a tank pressurised by compressed nitrogen, once the tank pressure falls, as a nozzle issues water, a salt water pump cuts in automatically to maintain the water supply as long as is necessary.

3.9 Related Incident

3.9.1 On the 25th January 2015 the m.v Boudicca, a sister vessel within the Fred Olsen fleet suffered a similar auxiliary engine room fire while enroute to the Port of Arrecife, Lanzarote (Canary Islands). The exact location of the fire was found to be at the forward, starboard side, of the auxiliary engine No.1. Upon further investigation it was determined that the fire was initiated by fuel leaking from a broken fuel oil pressure gauge supply line, igniting on contact with a hot surface in the vicinity of the turbo charger, resulting in significant damage to auxiliary engines No.1, 2 and 3 and the surrounding space including cabling, deck head, fixtures and fittings.

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4 NARRATIVE OF EVENTS

4.1 All times noted in this report are given in the style of the standard 24-hour clock without additional annotations. The vessel time used on board at the time of the incident was Universal Coordinated Time (UTC) +1.

4.2 On the 30th June 2016 the vessel sailed from Ponta Delgada enroute to Funchal, Madeira arriving on the 02nd July for a scheduled port visit for this particular cruise. The vessel departed Ponta Delgada without incident and proceeded at 14kts with main engines 1 & 2 and auxiliary engines 2, 4 and 5 on load.

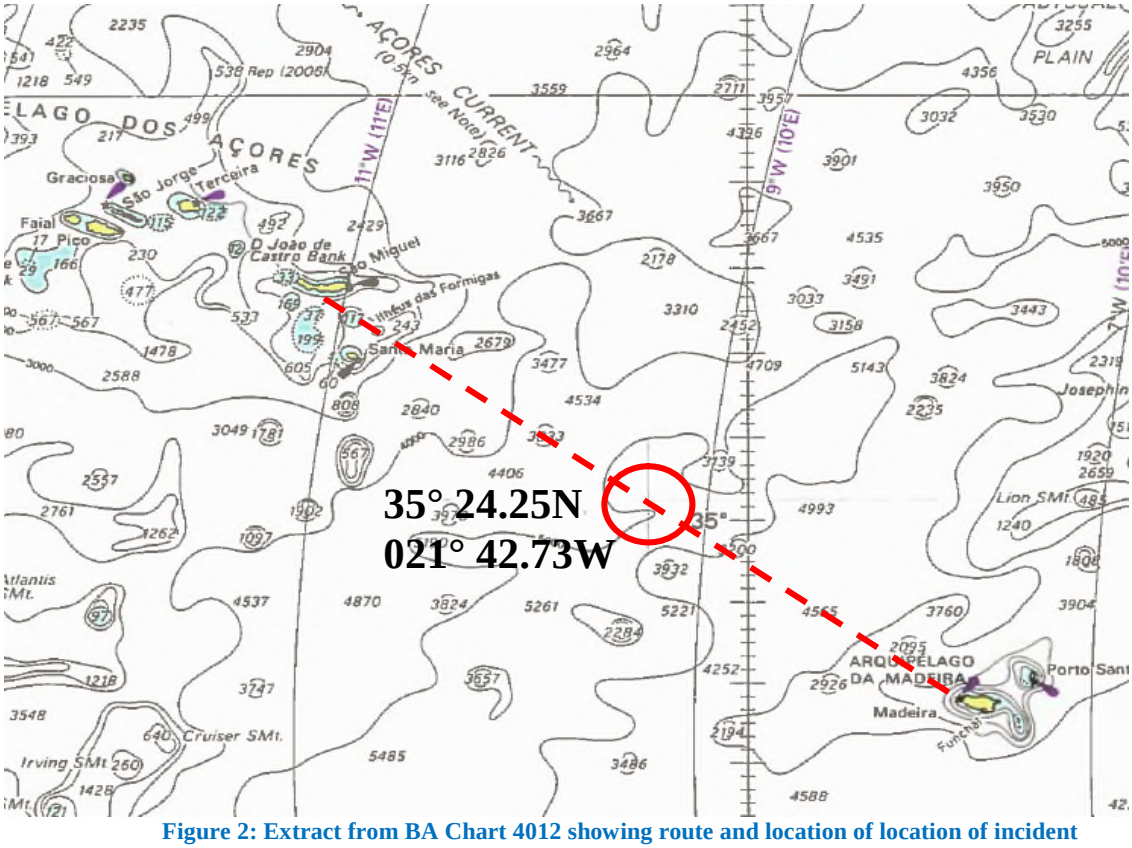


Figure 2: Extract from BA Chart 4012 showing route and location of location of incident between Ponta Delgada to Madeira

4.3 At 0800 the 3rd Officer (deck) and two contractors from Wilhelmsen Ship Services were inspecting and certifying fire extinguishers within the auxiliary engine room. At 0836 they were aft of the starboard boiler and approximately 10 meters from AE2.

4.4 At 0836 on the 01st July 2016 the Autronica alarm system sounded on the bridge indicating a possible fire in the auxiliary engine room, starboard side in vicinity of auxiliary generators 1, 2 and 3. At 0838 the Officer of the

Watch (OOW) initiated the emergency response by announcing *'Code Bravo auxiliary engine room, starboard side, 'B' deck, zone 4*' over the public address (PA) system three times in accordance with the emergency procedures manual.

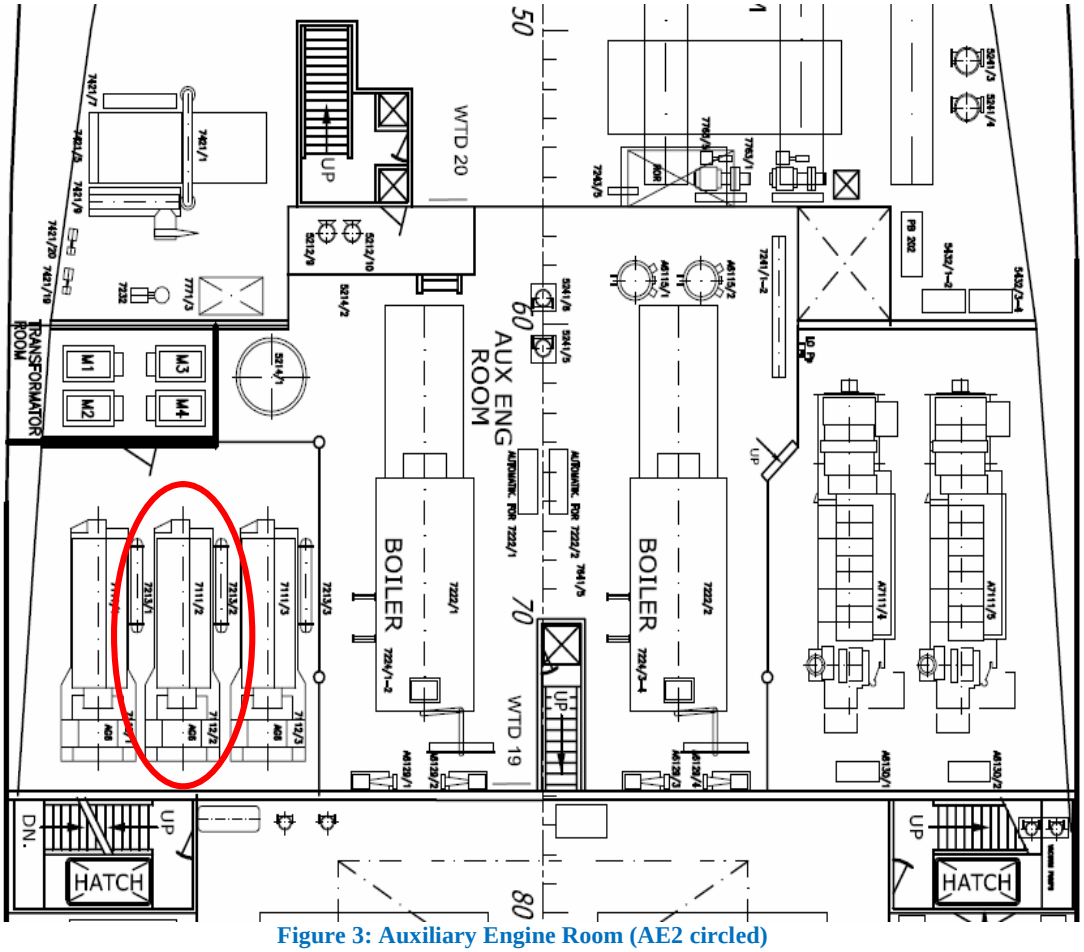


Figure 3: Auxiliary Engine Room (AE2 circled)

4.5 The two contractors and the 3rd Officer saw the fire engulf AE2 and immediately commenced attacking the fire by discharging one 12kg powder extinguisher. Due to the intensity of the smoke and heat all three individuals were beaten back and forced to evacuate the space through WTD 19 closing it behind them.

4.6 Emergency teams mustered in respective locations, the OOW requested permission to close watertight doors (WTD's) on 'A' deck in zone 4 and 5. Before approval was given the vessel lost power and blacked out as auxiliary engines 2, 4 and 5 stopped at this time. Immediately the emergency generator started and provided sufficient power to supply emergency systems. Simultaneous to this at 0842 the Master briefed all passengers and crew over the PA system of the situation and when to expect further updates. The Cruise Director assumed the responsibility of keeping the passengers

informed of the situation and did so every 5 minutes until 0940 followed by 10-minute intervals thereafter.

4.7 One minute later the Master called the Superintendent of Black Watch on the satellite phone providing a brief summary of the situation onboard. The Superintendent initiated emergency procedures ashore in order to provide maximum technical and operational support to the vessel, passengers and crew. Ipswich, UK and Oslo, Norway offices stood up emergency support teams.

4.8 At 0844 the first report from the scene was provided to the Master and Chief Officer located on the bridge by the 3rd Officer who was a witness to the fire while working in the Main Engine room. The Oiler also confirmed that he managed to activate the flexi-fog for zones 1 and 4 from the local release buttons located adjacent to WTD 19. At 0851 the two contractors from Wilhelmsen Ship Services arrived on the bridge to brief the Master. They confirmed the fire started at the aft end of AE2, spreading vertically and bouncing off the deck head above the generator. They also confirmed that prior to exiting the compartment through WTD 19 they managed to discharge one 12kg powder extinguisher on top of the generator. On exiting the compartment they met with the Oiler who was holding open WTD 19.

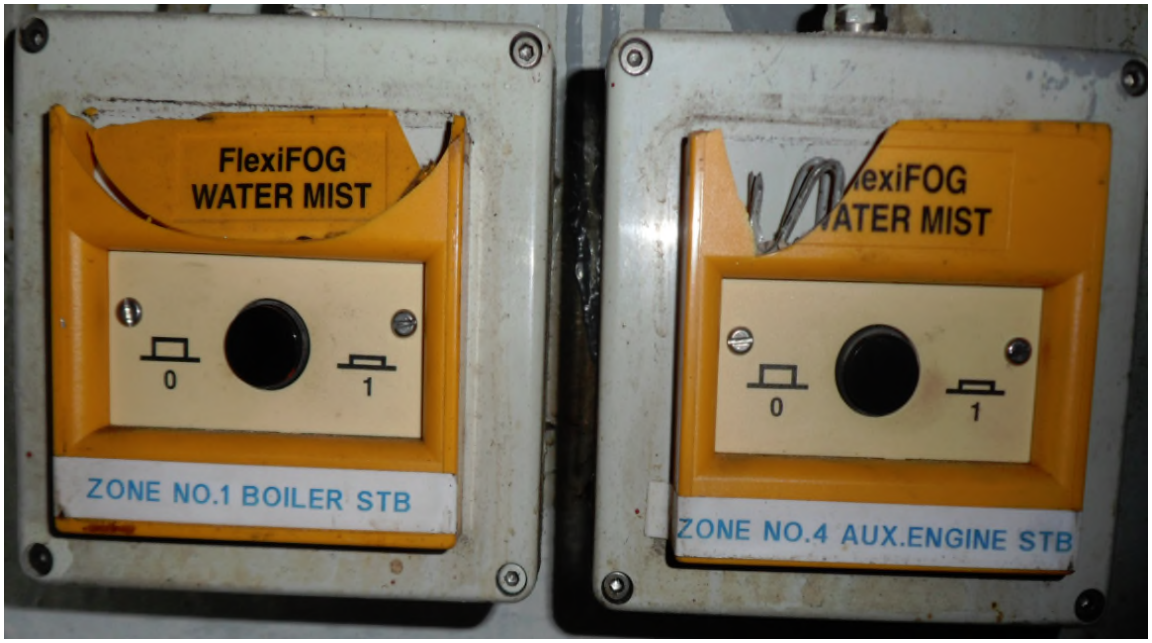


Figure 4: Flexi-Fog local release adjacent to WTD 19

4.9 At 0850 the Chief Officer received confirmation that flexi-fog had been released, however no update on whether the remaining items from the 'Fire at Sea' checklist had been completed, including whether or not the quick closing valves had been operated as required. It was confirmed within the Senior 1st Engineer written statement that the quick closing valves had been closed.

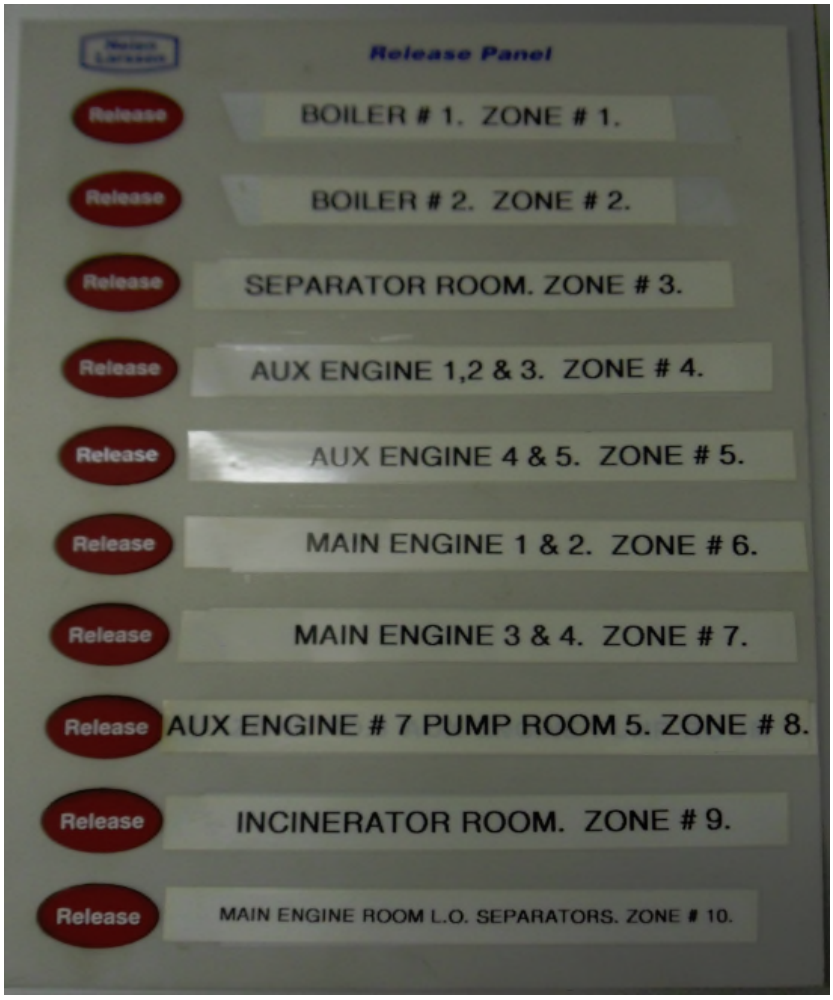


Figure 5: Flexi-Fog control panel within Engine Control Room

4.10 On Scene Command was established outside cabin 320, zone 4 deck 2 by 0843. At which point the fire teams had begun dressing and rigging hoses. FT 5[4] was ready by 0843 and commenced the first entry into the space as the start of a planned continuous aggressive attack followed shortly thereafter by FT 4, under the control of the Senior 1st Engineer in his capacity as On Scene Commander (OSC). Shortly thereafter FT 5 was relieved by FT 3 who commenced a re-entry in the space through the compressor room aft of WTD 20.

4.11 At 0901 a report was received by the Command Team from the Engine Control Room that the flexi-fog was no longer operating due to a loss of power to the emergency fire pump. At 0903 area control confirmed that power had been restored and that the flexi-fog system was now running.

[4] The reliability of the data regarding fire teams' exact activity cannot be fully verified due to several reasons. The communication from the OSC team to Central Command was at times disjointed due to loss of power affecting UHF communications. Secondly, as discussed within paragraph 5.7.7 the accuracy of the data is reliant on the record keeper's attention to detail and method of recording.

4.12 Over the course of the next five minutes, the vessel lost propulsion due to a loss of cooling capability to the main engines. In addition, the Engine Control Room was evacuated due to the presence of dense, black smoke that was filling the compartment from below making it unattainable to anyone not wearing breathing apparatus.

4.13 At 0911 WTD 19 was opened to allow access to the auxiliary engine room by the fire teams. At this point all WTD's to the auxiliary engine room were open. In addition, WTD 10 separating the Engine Control Room from the staging area and On Scene Command Team was reset on the bridge in order to operate manually.

4.14 The On Scene Command reported to all stations that the fire in the auxiliary engine room was under control. The Safety Officer also reported that there was a lot of smoke confined to decks 1 and 2 within fire zone 4.

4.15 At 0926 all crew were accounted for, one member of the crew was stuck in the forward elevator located in fire zone 1 but was evacuated from the elevator at 1104 with no injuries.

4.16 Due to the firefighting effort a port list started to develop which prompted the Command Team to consider restricting the use of flexi-fog and fire hoses to avoid potentially increasing the vessel's list.

4.17 At 0938, exactly one hour after the fire on AE2 was reported; multiple fire alarms started to activate in cabins on deck 2, port side above the auxiliary engine room. The Command Team requested cabins 322, 324, 326 and 328 be investigated for fire and or hot spots generated by the vertical transfer of heat. The deputy on scene commander (DOSC) at Area Control was unable to investigate due to the presence of smoke. At the same time, hot spots were identified outside cabin 319 directly above the seat of the fire. The Rapid Response Team was dispatched to rig fire hoses outside cabin 319 along with a fire team in order to determine if a fire was present inside the cabin.

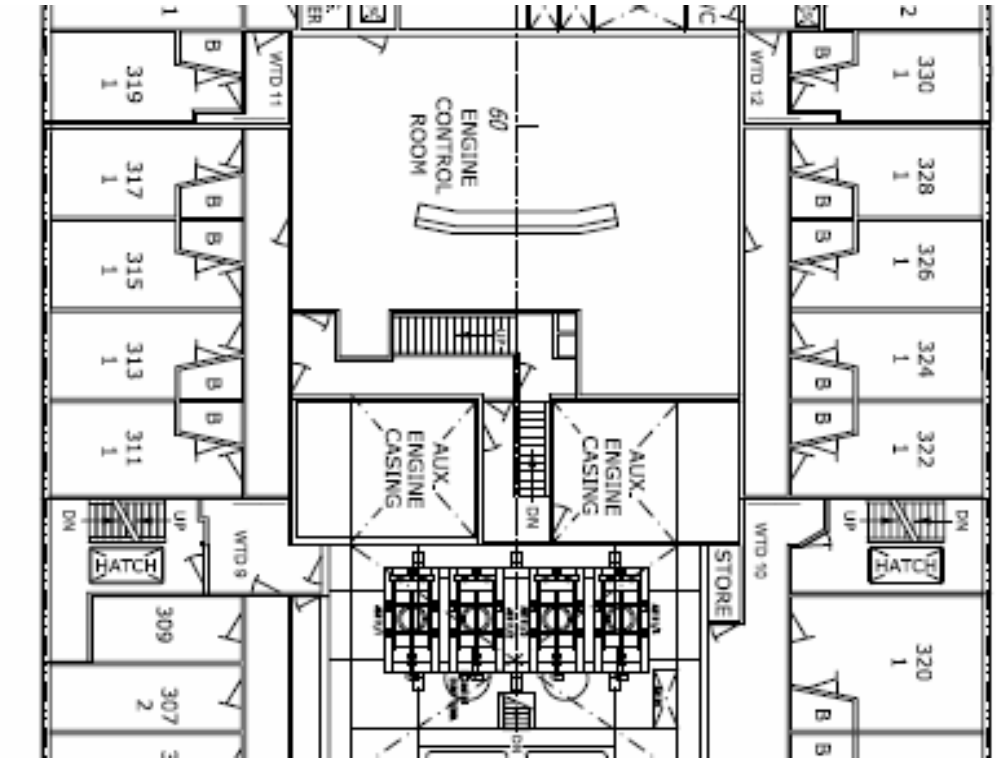


Figure 6: Cabins 322, 324, 326 and 328 investigated for damage

4.18 The emergency generator stopped working at 0938 resulting in the loss of emergency lighting, communications and electrical power required for powering essential firefighting system integral to support the firefighting effort.

4.19 All previous reports of smoke were confined to decks 1 and 2 within fire zone 4. At 0941 evidence of smoke migration was confirmed by the activation of a fire alarm on deck 3, zone 4 (crew staircase).

4.20 At 0944 Ultra High Frequency (UHF) internal communications failed, the command team maintained communication with the five dedicated emergency locations using runners delivering verbal and written messages to and from each location. At 0950 UHF communications were restored however over the course of the following 9 hours UHF communications operated intermittently and resulted in the use of runners continually. The public address system remained in operation and passengers continued to be briefed on the developing situation.

4.21 The Master at this point consulted with Fred Olsen Marine Services Technical Support (FOMS) who in turn liaised directly with DNV-GL Emergency Response Service (ERS)[5] regarding the vessel's stability based on draught and vessel loading at the point of departure to determine what effect the firefighting effort may have on the stability of the vessel.

[5] Service provided by DNV-GL; in the event of an emergency DNV Emergency Response Service provides technical expertise to assist the vessel with a particular emergency.

4.22 At 0955 the Chief Engineer briefed the Master on the progress of the fire-fighting effort and a situational report on vital systems. The Chief Engineer confirmed that there was no power available due to inoperable emergency generator and therefore as a consequence no fire main pressure. The Chief Engineer recommended to the Master that the priority should be to restore electrical power and utilize fire extinguishers to fight the fire.

4.23 Two minutes later a fire was confirmed on top of AE3, FT 4 used fire extinguishers to fight the fire. Within minutes FT 4 retreated from the space back to the staging area once all available fire extinguishers in the space were depleted.

4.24 At 1006 ventilation was confirmed stopped and acknowledged on the bridge. At this time the bridge also received an update from the Safety Officer stating smoke had migrated within the staircase up to deck 5 in zone 4, which was confirmed by the activation of smoke alarms in the vicinity.

4.25 Power was temporarily restored throughout the vessel as the emergency generator started at 1010. At 1019, the emergency generator shutdown and the Chief Electrician continued to investigate the fault.

4.26 Smoke continued to migrate vertically within zone 4 crew staircase C; at 1027 the smoke was reported on deck 7 however at 1029 the hotel manager informed the Command Team that *"no smoke or heat, everything okay in guest areas"*, the source of this report is not known and may well be a misinterpretation of the fact that smoke was present within crew staircase C on deck 7. At this point the DOSC discussed with the Master and the Chief Officer whether to release CO_2 into the auxiliary engine room. The DOSC briefed the Master on the available firefighting equipment and confirmed that the firefighting teams had a low number of BA bottles and extinguishers left onboard. The option was taken not to release CO_2 but instead attempt to restore power by fixing the emergency generator.

Figure 7: Smoke dispersing onto deck 10 starboard side at 1029

4.27 The Chief Engineer determined that the fault with the emergency generator was overheating; to improve ventilation he smashed one of the windows opposite the generator exhaust on deck 9 to increase the volume of cooler air to the generator intake.

4.28 At 1059, with intermittent power, fire main pressure and no breathing apparatus, the Chief Officer and Master discussed the use of CO_2 as the fire had not been extinguished.

4.29 At 1109 the On Scene Command reported to the Command Team that the fire in the auxiliary engine room had been extinguished however multiple hot spots remained in the vicinity. Shortly thereafter the Chief Engineer determined that the power demanded from the emergency generator was too great and therefore the focus should be to attempt to restart AG7 instead.

4.30 The Master discussed with the Chief Officer his concern regarding the vessel's stability. The result of this discussion prompted the Master to contact FOMS a further time in order to assist the Master in prioritising the emergency effort onboard.

4.31 At 1147 the Safety Officer contacted the Command Team to inform them that the fire in the auxiliary engine room had reignited, the deck in adjacent cabins on deck 2 had buckled and deformed through exposure to heat and hot spots were identified in cabins on deck 3 above.

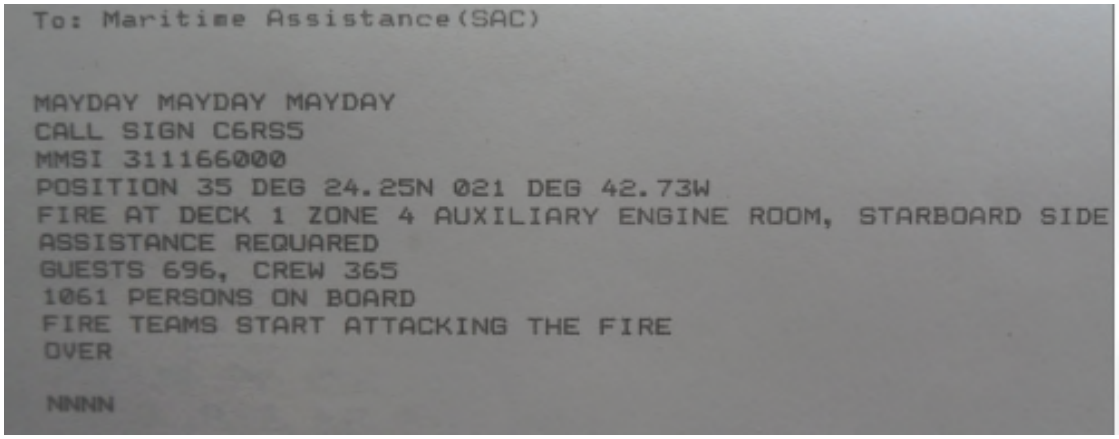
4.32 At 1154 the Chief Engineer called the bridge and confirmed that the Engine Control Room was now manned.

4.33 Over the course of the next 20 minutes boundary cooling continued using portable fire extinguishers in cabins on 2 deck within fire zone 4. It was reported from the ECR to the Command Team that the temperature reading

of 170°C continued to rise in the auxiliary engine room. The On Scene Commander provided the Command Team with a situation report stating: "*port side boiler okay, starboard boiler no good, generator 1, 2 and 3 gone, everything contained and fire teams standing by with fire extinguishers, flooring gone"*.

4.34 The Command Team instructed the DOSC that the emergency generator would be started for 5 minutes and *"we need to do whatever we can with this time"*. From 1233 the emergency fire pump was started and fire main pressure restored, activating the sprinklers in cabins 311 to 317 until 1246 thirteen minutes later. The Master at this point contacted MRCC Ponta Delgada located in the Azores to request assistance.

4.35 At 1331 a distress signal was sent from the Black Watch to all ships requesting maritime assistance in position 35° 24.25N 021° 42.73W. At 1338 the m.v Ocean Caesar, a Panamanian registered bulk carrier, responded with "*how is your situation"* from position 35° 33.50N 021° 15.50W approximately 26nm to the North of the Black Watch. The Black Watch responded with *"still fighting the fire, we need you to stay close"*.The Ocean Caesar replied, *"We are proceeding to the location but we cannot come close as we are chartering coals"*. The Ocean Caesar remained in close proximity until approximately 1730 at which point it was released by MRCC and continued on passage.


To: Maritime Assistance(SAC)

MAYDAY MAYDAY MAYDAY
CALL SIGN C6RS5
MMSI 311166000
POSITION 35 DEG 24.25N 021 DEG 42.73W
FIRE AT DECK 1 ZONE 4 AUXILIARY ENGINE ROOM, STARBOARD SIDE
ASSISTANCE REQUARED
GUESTS 696, CREW 365
1061 PERSONS ON BOARD
FIRE TEAMS START ATTACKING THE FIRE
OVER

NNNN

Figure 8: Distress message transmitted at 1331 (UTC+1)

4.36 By 1406 the AG7 was up and running providing sufficient power to operate emergency equipment, however due to the significant damage sustained to the auxiliary engine room, multiple systems were damaged beyond temporary repair.

4.37 Transfer of water in the bilge into holding tanks commenced at 1447. Shortly thereafter the Safety Officer reported to the Command Team that the temperature had reduced to 50°C in the auxiliary engine room and the removal of water was being achieved slowly.

4.38 At 1541 the Safety Officer was in contact with MRCC Delgada who reported that helicopters were 6 to 8 hours away, one tugboat enroute from Tenerife and the other from Ponta Delgada with an estimated time of arrival on the morning of 02nd July. A decision was then made by the Master that the helicopters were not required as the situation was under control and systems were being restored.

4.39 Restoration of systems continued and by 1920 main engines 1 and 3 were operational and the vessel was underway bound for Funchal, Madeira.

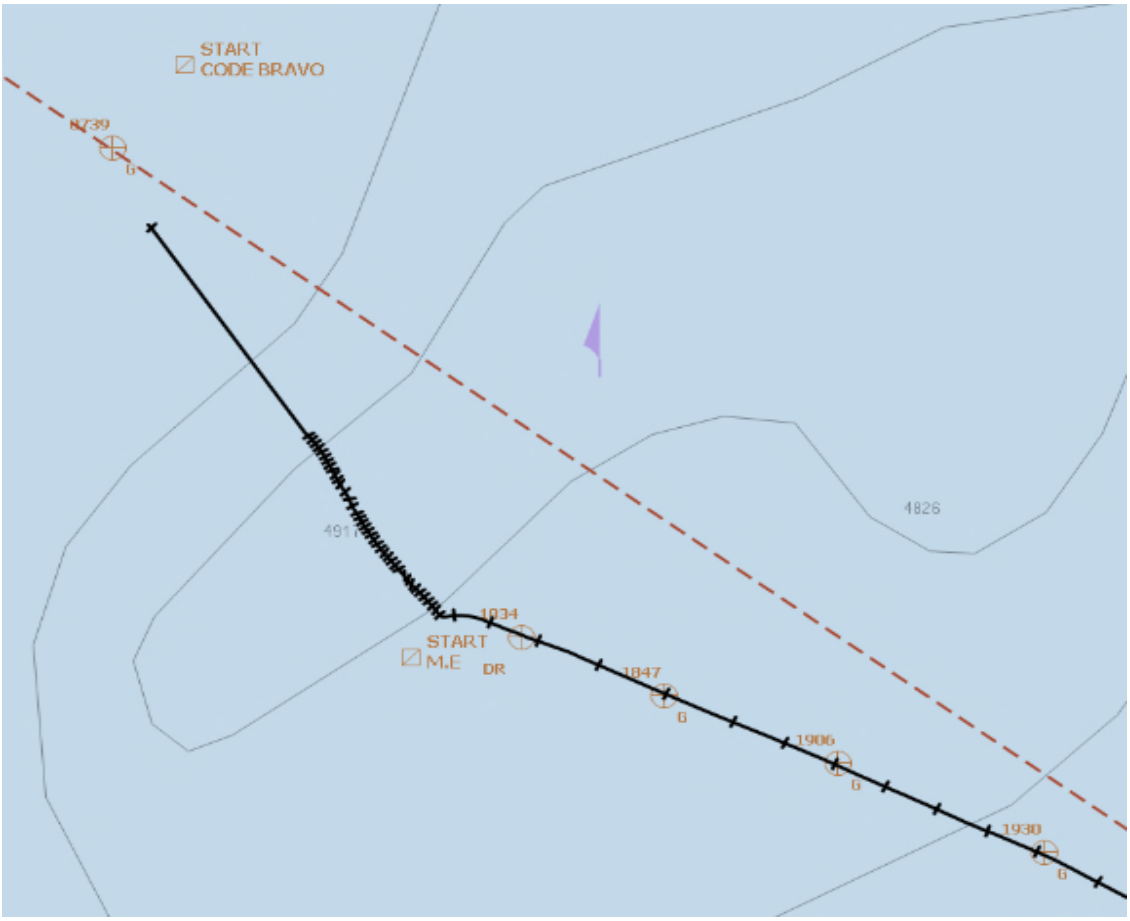


Figure 9: ECDIS screenshot of vessel during the course of the emergency

4.40 The vessel arrived alongside Funchal at 1700 on the 02nd July and commenced disembarking passengers to either local hotels or direct transportation to their country of residence.

4.41 The senior management from Fred Olsen departed Norway and UK respectively arriving in Funchal on the 02nd July in order to assist with the investigation and restoration of onboard systems.

4.42 The Bahamas Maritime Authority marine safety investigator arrived onboard on the 03rd July to commence the flag State marine safety investigation. By the time the investigation commenced all passengers had been disembarked and rectification work had commenced in the auxiliary engine room and surrounding spaces.

4.43 The vessel sailed from Funchal on the 08th July bound ultimately for Dover via Ferrol, Spain where permanent repairs took place prior to commencing the next cruise due to commence on the 17th July from Tilbury, UK. The Inspections and Surveys department of the Bahamas Maritime Authority in consultation with DNV-GL approved a single voyage without passengers from Funchal, Madeira to a port in Europe where repairs could take place prior to arrival in the UK. The vessel was issued with a Short Term Passenger Ship Safety Certificate (PSSC) by DNV-GL prior to arrival in Dover however the material condition of the vessel could not be verified prior to arriving in the UK, as the vessel was not attended by DNV-GL since departing Funchal, Madeira and prior to its arrival in the UK.

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5 ANALYSIS AND DISCUSSION

5.1 Aim

5.1.1 The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

5.2 Location of the fire

5.2.1 The cause of the fire cannot be fully determined due to the significant damage sustained on and around AE2. Witnesses recall seeing flames in vicinity of the upper, aft section of AE2, which from visual inspection after the fire shows a significant layer of carbon deposit in vicinity of the on-engine fuel filter. Further indication as a contributory factor was identified by a loose bolt, one of four securing the top of the filter to the base where the filter inside can be removed and exchanged. The on-engine fuel filter sits aft of the exhaust manifold which presents an unobstructed route for pressurised fuel to travel between the fuel filter and exhaust manifold. The typical operating pressure of the fuel filter is 7 bar; there is no record of the operating pressure moments prior to the fire in order to determine if a sudden drop in pressure occurred. The possible fuel leak at high pressure most probably ignited on any of the hot points on top of the engine and in vicinity of the fuel filter.

Figure 10: Auxiliary generator 2, aft end

Figure 11: Inboard side of auxiliary generator 2

5.2.2 The damage to the AE2 was predominantly concentrated to the top half of the engine; however heat damage was significant in vicinity of AE1 and AE3 and to the underside of AE2. The level of damage observed to the surrounding fixtures and fittings is consistent with a fire that generated a temperature in excess of 660°C as a number of engine parts constructed in aluminium had melted.

Figure 12: Aluminium rocker cover from auxiliary generator 2

5.2.3 Due to the significant damage sustained on AE2, the fixtures and fittings that remained in situ for the investigator to witness were so badly damaged that a full determination of cause could not be achieved. In the moments prior to the fire it was confirmed by eyewitnesses present that no explosion or unexpected noise was heard.

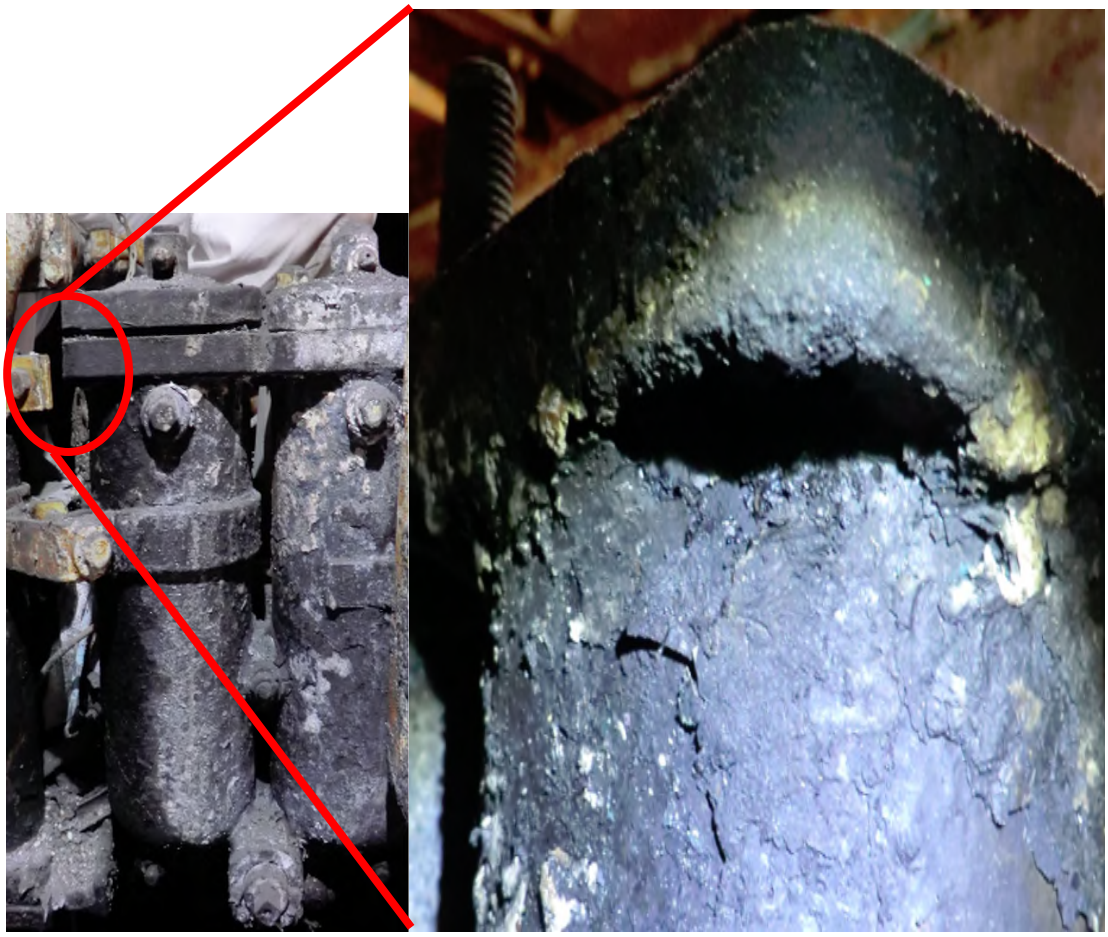


Figure 13: On-engine fuel filter

5.2.4 Between the 23rd and 25th September 2015 a thermal survey was conducted on all auxiliary engines by Thermo Protection Temperaturanalyse who highlighted six areas on AE2 that had a surface temperature in excess of 220°C, three of which found within the report were in the vicinity of the aft area of AE2 (see figures 14, 15 and 16), the approximate known location of the fire. The report was received in October 2015 and the Owners rectified the areas identified within the survey report, which was then verified and approved to the satisfaction of Class on the 16th November 2015 by issuance of the following statement: *"Immediate actions were taken by the engineer and the defective areas were repaired and upgraded satisfactorily".*

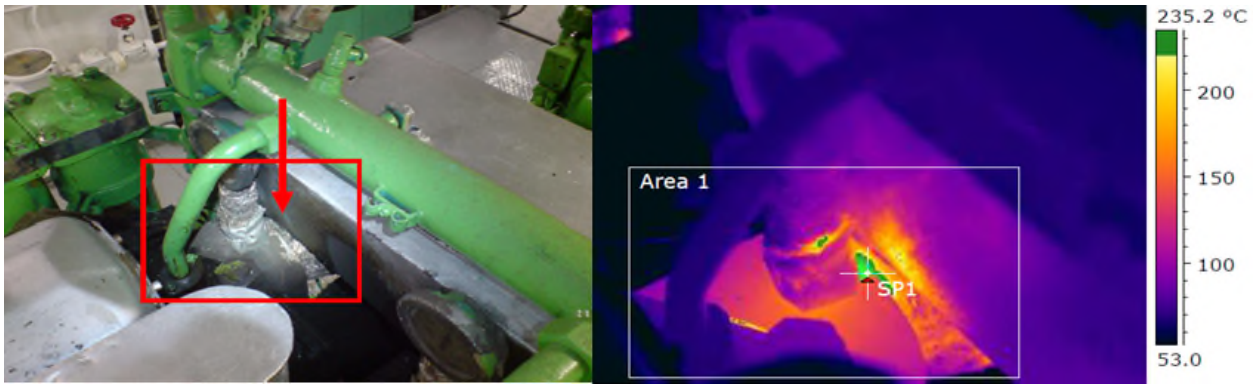


Figure 14: Temperature of 402.3°C in vicinity of exhaust thermostat (highlighted left) and SP 1 (right)

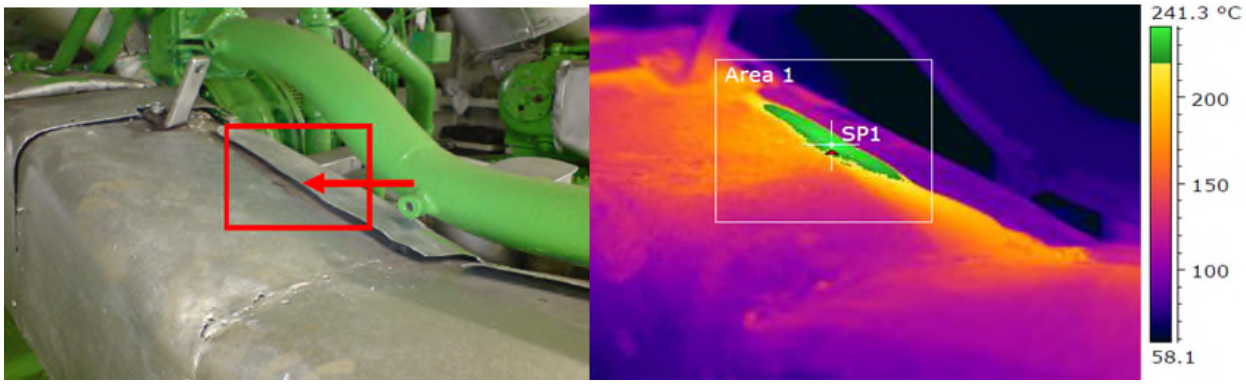


Figure 15: Temperature of 242.7°C in vicinity of exhaust manifold (highlighted left) and SP 1 (right)

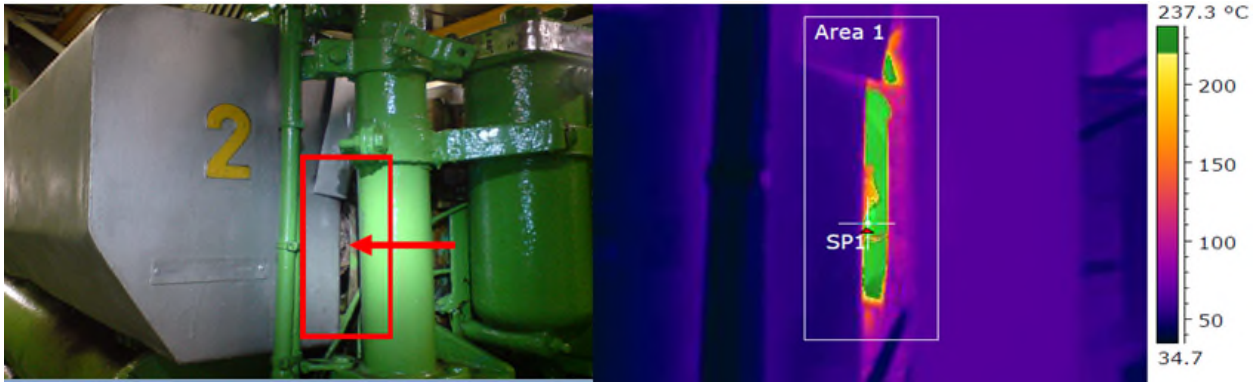


Figure 16: Temperature of 355.3°C in vicinity of exhaust manifold (highlighted left) and SP 1 (right)

5.3 Firefighting Effort

5.3.1 The fire quickly spread to the surrounding combustible material in vicinity of AE2. The extent of the damage was consistent with a fire, which was not immediately extinguished; this led to multiple secondary fires to become established within the space while the transfer of heat to adjacent compartments was evident both vertically and horizontally.

5.3.2 The control panel to the flexi-fog system located within the ECR indicated that the system was on; however it cannot be determined whether the flexi-fog system operated as designed once the release buttons were pressed by the Oiler on exiting the auxiliary engine room. By the time the first fire team entered the auxiliary engine room to fight the fire the smoke was so dense

they were unable to confirm whether flexi-fog was operating. What is known is that shortly before the fire team entered the space the fire pump lost power and was unable to supply water to the flexi-fog system. This was reset in the ECR prior to evacuating and the message was relayed to the bridge that flexi-fog was operating although no physical confirmation of the system operating could be achieved.

5.3.3 The fixed firefighting system onboard was inspected on the 11th June 2016 by Autronica Fire and Security AS. A certificate was issued to the Owners on the 15th June 2016 certifying that the water mist system and equipment was inspected and that the certificate was valid for a period of one year. Prior to the issuance of the certificate a number of deficiencies were required to be rectified, particular areas of concern were identified as follows:

a. *"Tested all the local protection areas in the engine spaces. Started to blow compressed air through the sections however it was not possible to complete this test due to the type of nozzles (Flexi-Fog type 30) which requires higher pressure to open completely (maximum compressed air onboard is 6 bar). Therefore it was only possible to make a visual of inspection of the nozzles and check their position.*"

Blowing compressed air through the nozzle can result in debris being deposited in vicinity of the mesh strainer located within the nozzle, potentially restricting the moving parts and possibly reducing or stopping water flow affecting the overall efficiency of the nozzle. MSC.1/Circ.1432[6] recommends '*blow dry compressed air or nitrogen through the discharge piping of dry pipe systems, or otherwise confirm the pipework and nozzles are clear of any obstructions. This may require the removal of nozzles, if applicable.*'

The annual inspection is required to ensure that the nozzles are maintained and working. In order to do this the system should be flushed through with either compressed air or water, neither of which occurred. Therefore the correct operation of the nozzles within the auxiliary engine room could not be ascertained. A visual inspection of the nozzles within the auxiliary engine room was conducted in lieu of water or compressed air with no deficiencies noted within the report. Figure 17 below was taken on the 17th July 2016 of a nozzle on the port side of the auxiliary engine room in vicinity of generators 4 and 5, as you can see this nozzle has been partially painted. Although there was no evidence of fresh paint in vicinity of this nozzle, it cannot be determined whether it had been painted before or after the inspection.

[6] Revised guidelines for the maintenance and inspection of fire protection systems and appliances

Figure 17: Damaged nozzle located in vicinity of auxiliary generators 4 and 5

b. *"Checked the batteries inside the main panel cabinet in ECR. Those are completely dead. There are no spares available onboard, the electrician already ordered new batteries. Those must be replaced as soon as possible in order to guarantee the functionality of the system."*

MSC.1/Circ.1432 lists the weekly testing and inspections to be carried out, one of which is to verify all fire detection and fire alarm control panel indicators are functional. It could be possible for the batteries to fail within the weekly testing and inspection schedule. It could also be an indication that the weekly testing and inspection schedule was not being conducted in accordance with MSC.1/Circ.1432.

c. *"The inside of the main panel cabinet in ECR is incredibly dirty…it is strongly recommended to find a solution."*

Observations *'b'* and *'c'* above provide the investigators with an indication that the material condition of the fire alarm control panel was not being maintained satisfactorily.

5.3.4 The supply and operation of the flexi-fog system was not fully understood by senior technical leadership on board. The system is a dry pipe, low-pressure system, which uses freshwater, stored within a feeder tank, pressurized by nitrogen in order to deliver water through the respective nozzles. It was determined through the course of an interview that one senior Officer was under the impression that it was a freshwater system and once the freshwater is depleted, the system stops operating. The flexi-fog system is freshwater up

to the point where the water level within the feed tank reaches a particular level, at which point the seawater pumps start and provide a ready supply of seawater.

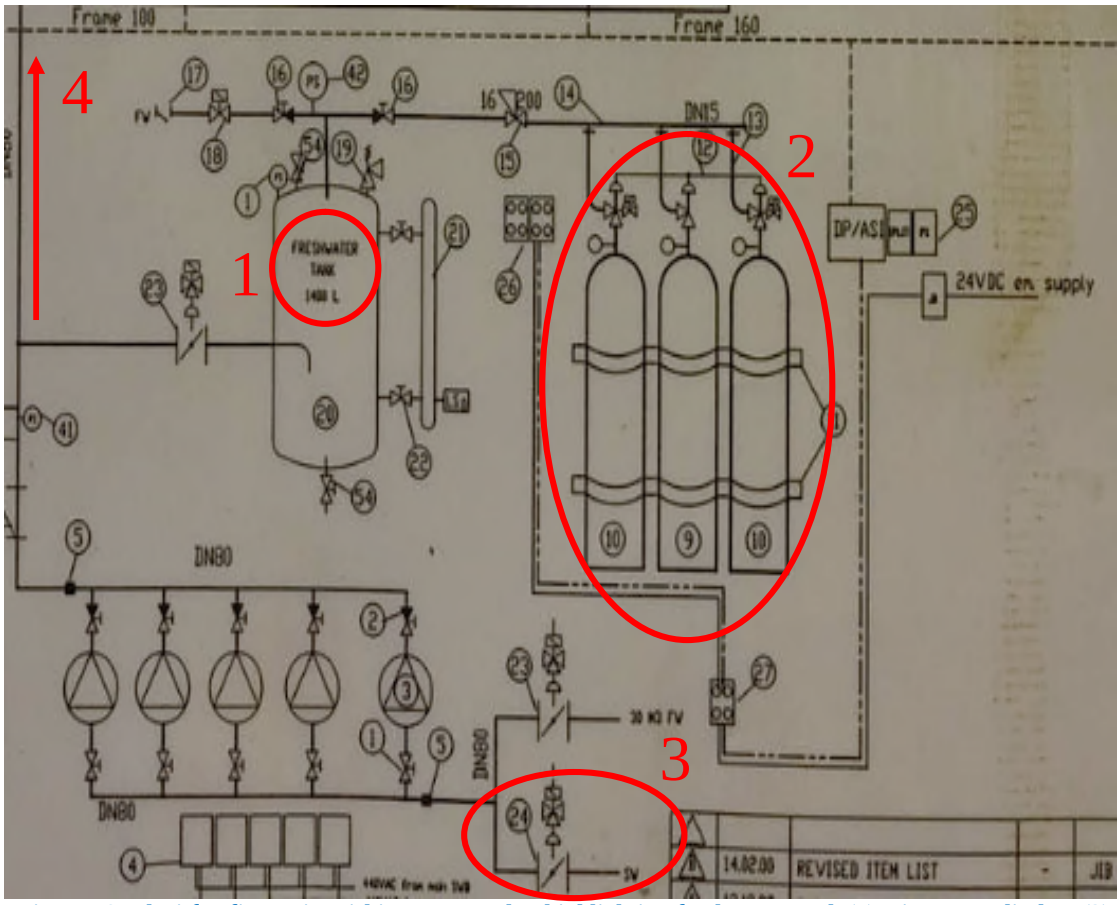


Figure 18: Flexi-fog fire extinguishing system plan highlighting freshwater tank (1), nitrogen cylinders (2) and seawater intake and valve (3) and route of water to zones (4)

5.3.5 It was also determined that the technical leadership did not fully understand the operation of the fixed foam application available on board. It was determined that portable eductors were available in each engine space but fixed foam application was not. As can be seen in figure 19, local fixed foam application was available within the machinery spaces. During an interview with the Oiler, a concern was raised regarding the quantity of oil and flammable liquid located within the bilge underneath auxiliary engines 1, 2 and 3, although this cannot be verified, had foam been used, even as a precautionary measure its fire suppression capabilities may have potentially been enough to reduce the ferocity of the fire or as a minimum aid the firefighting effort.

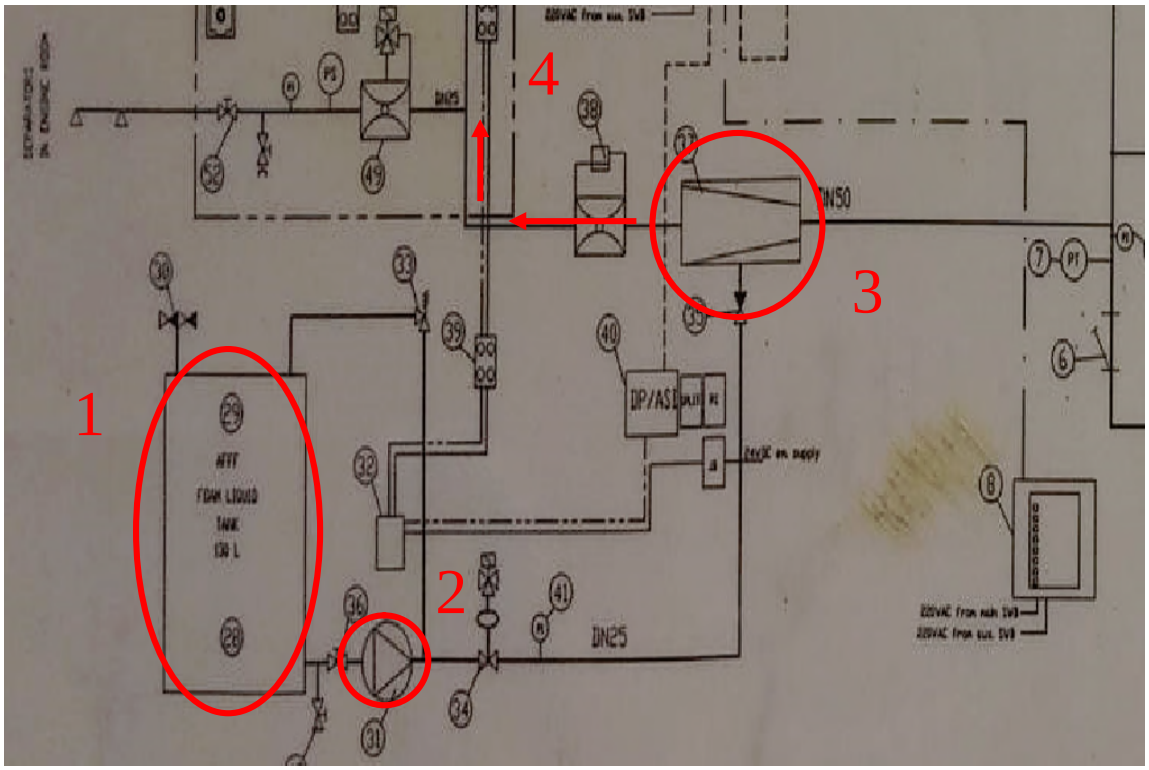


Figure 19: Flexi-fog fixed foam application system highlighting AFFF foam tank (1), centrifugal foam pump (2), automatic foam proportioner (3) and the route (4) of foam distribution to zones

5.3.6 During the course of the firefighting effort, at the point when BA stocks had depleted, FT 3 were required by the OSC to investigate a fire in a cabin on 2 deck. The fire alarm had been raised and it was suspected that a secondary fire had started. The fire team members decided to don Emergency Escape Breathing Devices (EEBD)[7] and proceed into the compartment to fight the fire. In accordance with MSC/Circ.849[8] *'EEBDs are not to be used for fighting fires, entering oxygen deficient voids or tanks, or worn by fire-fighters. In these events, a self-contained breathing apparatus, which is specifically suited for such situations should be used'.* This decision placed the crewmembers at significant and unnecessary risk.

5.3.7 CO_2 was reportedly used on multiple occasions for boundary cooling as well as to inert the area between the deck head and hanging ceiling. As CO_2 is a gas it's boundary cooling properties are short term and therefore water is considered best practice to achieve effective cooling of bulkheads. Given water is more effective at cooling than CO_2, had it been used in the first instance the likelihood of secondary fires establishing in adjacent compartments could be considered low, removing the requirement to send the fire team members into a compartment at great risk whilst wearing inadequate breathing apparatus.

[7] EEBDs are designed to provide a minimum of 10-minute supply of air to allow persons time to escape from compartments.

[8] Guidelines for the performance, location, use and care of emergency escape breathing devices (EEBDs) paragraph 2.2

5.3.8 The make and model of breathing apparatus on board was Drager PSS 5000 and was serviced between the 25th and 30th June 2016 by two Wilhelmsen contractors who were onboard servicing all firefighting equipment with the exception of the flexi-fog system. The BA sets were replaced for new sets in January 2016 and had a 12-month annual inspection cycle. The Owners wanted to keep all firefighting equipment on the same service and inspection cycle hence the 6 monthly service. The service agent confirmed that no defects were identified with any of the firefighting equipment.

The vessel carried 15 breathing apparatus sets; each set had 2 spare 200-litre bottles giving an approximate 'on air' time of 60[9] minutes per person. The working duration of a self-contained breathing apparatus will vary considerably from one wearer to another and will depend on the amount of effort being expended. As a rough guide, it can be assumed that a trained wearer in fit condition and working reasonably hard will consume about 40 litres of air per minute; and inexperienced person can easily double this rate of consumption.

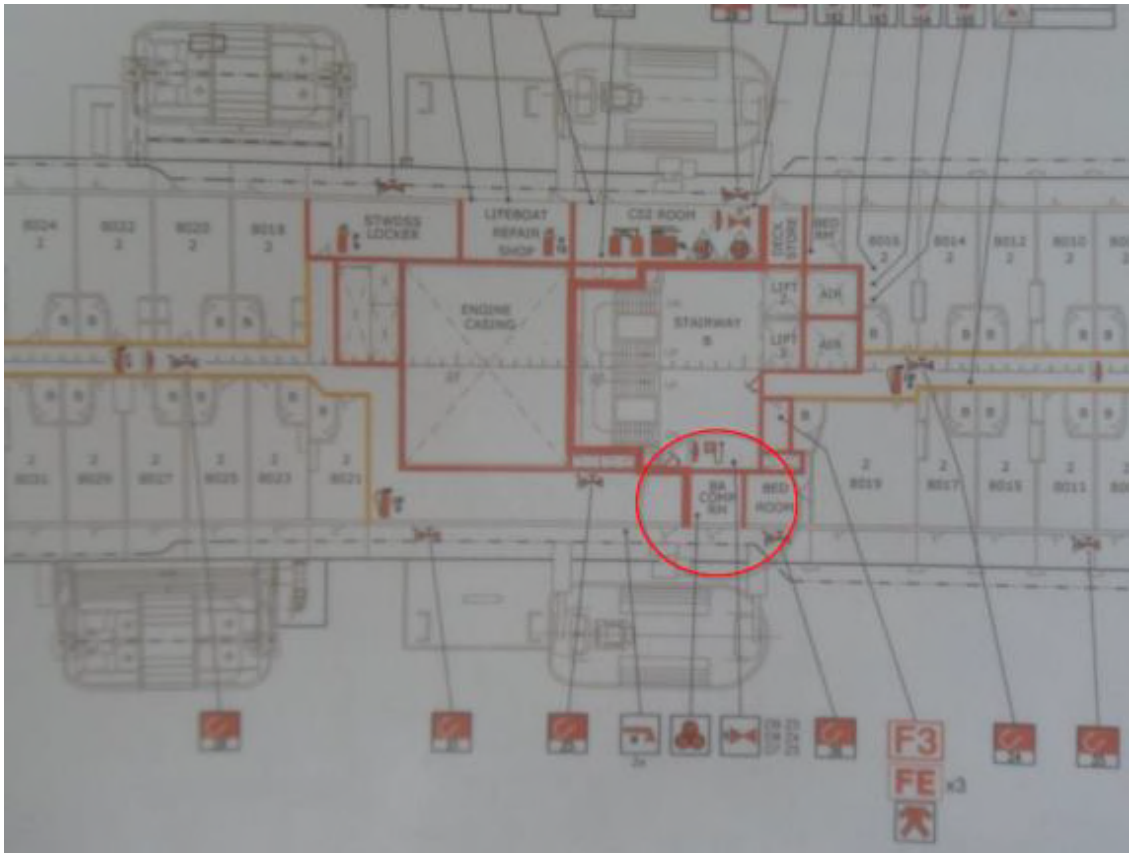


Figure 20: BA compressor located on deck 8 starboard side (indicated within red circle)

The BA sets were located in 5 lockers evenly spaced throughout the vessel. Each locker contained 3 BA sets, and each set had one 6-litre bottle rigged and 2 spare 6-litre bottles, the compressor room had an additional 10 spare charged bottles, equalling 55 bottles in total onboard.

[9] Figured obtained on the basis of a consumption of 40 litres/minute assuming the 6-litre cylinder is charged to 200 bar and a safety reserve of 10 minutes.

Figure 21: BA compressor cascade system and below 6-litre BA bottles

5.3.9 The bottles are capable of being recharged on board by means of an air compressor located on deck 8. Attached to the compressor the option exists to recharge via 4 x 50 litre stored pressure bottles in parallel known as a cascade system. To recharge one bottle with the air compressor would take approximately 15 minutes whereas by the cascade system would take approximately 13 minutes. Therefore in order to partially recharge one fire team by the cascade system would take 39 minutes. However, the Cascade bottles are charged to 200 bar, the same pressure required within the 6-litre cylinders. In order to achieve 200 bar each cylinder decanted from the Cascade system will need to be topped up by the air compressor in order to achieve 200 bar. The Cascade system must be used in conjunction with the air compressor to achieve a fully charged BA bottle.

Figure 22: BA air compressor located on deck 8

5.3.10 At 1143 all BA bottles had been used. With no electrical power to operate the BA compressor and the cascade bottles empty, the fire teams were unable to fight the fire wearing breathing apparatus. At the commencement of the firefighting effort, each team member had sufficient air to make 1 entry and 2 re-entries before expending the three available charged bottles. Based on a 20-minute consumption rate each team had the total capacity to remain on air for 220 minutes before expending all charged bottles onboard. The first on air time was recorded at 0843, 3 hours (180 minutes) before the BA was depleted without using the 10 spare bottles located in the compressor room. Based on these figures alone it could be considered that all fire teams went on air at approximately the same time and remained on air for the next 3 hours, without recharging any bottles by either method.

A number of theories could be drawn from the above analysis: The consumption rate was far higher than the average 20 minutes per bottle, all fire team members were on air at the same time, the distribution of BA sets was wider and used by other crew members not part of a fire team, the time that the BA was exhausted was not accurately recorded and/or the BA bottles were not charged to full capacity despite Company procedure on completion of any drill is to ensure BA bottles are fully charged prior to being stowed.

What is known is that the BA compressor was unavailable for the periods when there was no power onboard, without which used bottles could only be partially filled to the equivalent pressure remaining within the cascade bottles. This additional supply of air was used to partially recharge 4 bottles before all the cascade bottles were emptied.

5.3.11 The onboard maintenance and inspection routine of the flexi-fog system was confirmed as being conducted on a monthly basis. According to records the

system was flushed through monthly to ensure no leaks were observed and to ensure that no debris was present which may reduce or stop the flow of water when operated. During the course of the fire, one fire team, using the thermal imaging camera captured that the flex-fog pipe above AE2 had separated at the coupling. This was further confirmed by visual inspection once the fire had been extinguished (figure 23). It cannot be determined how or why the coupling failed. The coupling was not available for inspection by the investigator and therefore it cannot be determined whether the material the coupling was made from was in accordance with the principal requirements for the system as defined within MSC/Circ.1165[10] and approved to the satisfaction of the Administration. On the 17th July 2016, it was witnessed by the BMA ANI that the Owners were reinstating the flexi-fog system above the auxiliary generator using copper pipe and copper fittings (figure 24). Copper is not an approved material for use in fixed application systems as its structural integrity fails when subjected to intense heat.

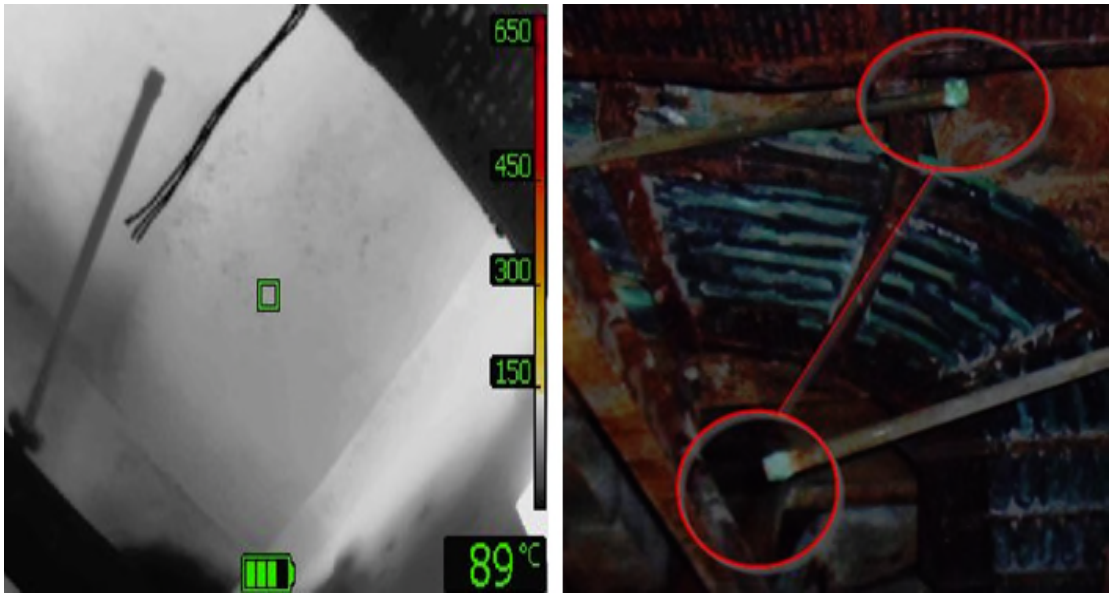


Figure 23: Flex-fog coupling separated above auxiliary generator 2

[10] Revised guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces and cargo pump rooms.

Figure 24: Copper pipe used to rectify flexi-fog piping after the fire

5.4 Inspection and Maintenance

5.4.1 The vessel was provided with a Passenger Ship Safety Certificate on the 10th November 2015 by the vessel's classification society DNV-GL in accordance with IMO Assembly resolution A.1104(29)[11]. An approved nautical inspector from the Bahamas Maritime Authority visited the vessel along with a surveyor from the MCA on the 17th July 2016 while alongside in Dover, UK and identified a number of deficiencies which were not as a result of damage sustained or repaired post incident. The first identified deficiency was the condition of the watertight bulkheads within the auxiliary engine room. As seen within figure 25 the subdivision does not meet the standard required under SOLAS Chapter II-1 Regulation 13.2.1 which specifically states: *'where pipes, scuppers, electric cables, etc. are carried through watertight bulkheads, arrangements shall be made to ensure the watertight integrity of the bulkheads.'*

[11] Survey guidelines under the harmonized system of survey and certification (HSSC), 2015 for Passenger Ship Safety Certicate.

Figure 25: Condition of watertight bulkheads within auxiliary engine room

Assembly resolution A.1104(29) requires examining the collision and other watertight bulkheads required for the ship's subdivision to be conducted. Due to complications surrounding the testing of bulkheads when the vessel is in service by the hose test method, SOLAS Chapter II-1 Regulation 11.1 provides an alternative method of careful visual examination. SOLAS Chapter II-1 Regulation 13.1.1 requires *'the number of openings in watertight subdivisions to be kept to a minimum compatible with the design and proper working of the ship. Where penetrations of watertight bulkheads and internal decks are necessary for access, piping, ventilation, electrical cables, etc., arrangements are to be made to maintain the watertight integrity.'* The vessel records did not reveal any maintenance-taking place that may have affected the integrity of the watertight subdivision within the auxiliary engine room between November 2015 and the 17th July 2016. It can therefore be determined that both internal and external inspection routines failed in this instance to identify deficiencies effecting the integrity of watertight subdivision.

The consequence of not being able to adequately contain smoke within the machinery space resulted in the evacuation of the ECR and the free migration of smoke throughout decks 1, 2 and 3. The Master's last line of defence to extinguish a fire within a category A[12] machinery space is CO_2, had the CO_2 system been activated, its effectiveness may have been severely diminished whilst placing the crew at significant risk.

5.4.2 The PSSC renewal survey conducted on the 18th December 2015 consisted of testing all electrical and pneumatic fire dampers for accommodation and engine room spaces in remote and local operation. A small number were

[12] SOLAS Chapter II/2 Regulation 3.31: Machinery spaces of category A requirements.

found with deficiencies resulting in the issuance of a condition of Class (CC). The deficiencies concerned external fire dampers and air intakes, which were found in a corroded, holed or wasted condition. The seven identified deficiencies were rectified and the CC was later deleted with the following statement: *"effective repairs carried out satisfactorily"*.

The Owners are ultimately responsible for the condition and operation of fire dampers. Regular on board inspections should be conducted to ensure the fire dampers structural integrity is not compromised by verifying their condition and operation to ensure in the event of a fire the engine space can be contained.

On the 17th July 2016 the condition of the fire dampers in ventilation ducts suppling the auxiliary engine room was also verified. Figure 26 below is provided to demonstrate the condition of the fire dampers during the visual inspection. It can be seen that the physical condition of the fire dampers inspected are degraded to such an extent that the Owners were required to replace prior to sailing.

Figure 26: Auxiliary engine room fire dampers

During the renewal survey the fire dampers are required to be inspected for correct operation in accordance with A.1104(29), paragraph 5.2.2.68 which states: '*examining the special arrangements in the machinery spaces and*

confirming, as far as practicable and as appropriate, the operation of the remote means of control provided for the opening and closing of the skylights, the release of smoke, the closure of the funnel and ventilation openings…' and under the Class survey requirements the survey *'shall cover examination of fire doors and fire dampers in ventilation ducts'.*

In addition to the requirements and standards set by Class, assembly resolution A.1052(27)[13] stipulates when fire dampers cannot comply with the SOLAS convention due to absence, non-compliance or substantial deterioration the condition may warrant the consideration of Port State Control to detain the vessel. The Norwegian Maritime Authority Port State Control (Paris-MoU) conducted an inspection on the 15th June 2016 in Alesund, Norway and did not identify any deficiency with the fire dampers located in or associated with auxiliary engine room ventilation.

In addition to the PSSC renewal survey, the vessel also underwent an annual flag State inspection by an Approved Nautical Inspector (ANI) on the 28th December 2015. In accordance with the Bahamas Inspection Checklist the ANI is to *'check the condition of, and if applicable, verify the following are operational – Watertight doors, port holes, ventilator closures, fire flaps, other closing devices, sounding pipes and air/vent pipes'.* No deficiencies were identified by the ANI in regard to the above systems. However the ANI is not conducting a survey but instead an inspection on the general condition of the vessel utilizing the checklist as an aide memoir. This one-day 'snap shot' of the vessel does not allow for a more detailed inspection of all safety related appliances and fixtures.

It can be determined with a certain degree of certainty that the degraded condition of the fire dampers shown in figure 26 was not a result of fire damage from the auxiliary engine room fire on the 1st July 2016. Further it can also be determined with a degree of certainty that the condition of fire dampers did not deteriorate to such an extent that the Owners or PSC inspections would not have had sufficient opportunity to potentially identify their condition.

5.4.3 The 'A' class insulation on the deck head of the auxiliary engine room provided adequate structural fire protection sufficient to contain the heat from transferring for approximately 60 minutes. As the fire continued to burn in excess of one hour the fire protection insulation degraded allowing the transfer of heat to adjacent compartments, this resulted in secondary fires to establish themselves in the crew cabins located above the seat of the fire. Damage sustained to these compartments can be seen within figure 27 below.

5.4.4 Due to the loss of power and emergency fire pumps no fixed application system operated within cabins affected by the transfer of heat. Boundary cooling was initiated but not until 0940, by which time the extreme heat generated by the fire had transferred through the bulkheads affecting the integrity and habitability of adjacent compartments (see figure 27). If

[13] Procedures for Port State Control, Appendix 2 – Guidelines for the detention of ships

boundary cooling had been initiated immediately, in accordance with onboard firefighting procedures, the transfer of heat would have been reduced and the likelihood of such damage occurring may have been significantly lower.

Figure 27: Heat damage sustained in cabin 311 above the seat of the fire

5.4.5 Auxiliary Generator 2 underwent a major overhaul in February 2010 at 58,295 hours. The Wartsila maintenance guide recommends '*After every 48,000 hours running, to give the engine a complete overhaul. The engine should be entirely dismounted and substantially overhauled into the same condition as a new one'*. At the time of the fire the running hours on AE2 was 67,069, therefore in the last 6.5 years the generator had amassed 8,774 hours. In March 2016 the engine had passed 8000 running hours', a point in the generators lifecycle where a comprehensive service should take place consisting of 22 items requiring inspection, testing and/or checked. A comparison between the manufacturer's maintenance manual and the vessel's planned maintenance system (PMS) was conducted to determine when the maintenance required at 8000 hours had been conducted. Of the 22 items required to be inspected, tested and/or checked, according to PMS records only 8 were completed between March and June 2016. It can be determined that the 8000 running hour manufacturer recommended maintenance was not conducted on AE2 and therefore the mechanical condition of AE2 could not be verified.

5.5 Training

5.5.1 This marine safety investigation looked into the drill history on board over the course of the last 6 months in order to determine the frequency and effectiveness of training when dealing with a machinery space fire. It was determined through records provided by the Designated Person Ashore

(DPA) that the crew had not conducted a Code Bravo drill in either the auxiliary engine room or the main engine room in this period.

5.5.2 One drill had been conducted in May within Pump Room 5, zone 3, within which auxiliary AG7 is located. The drill was coordinated by the Safety Officer, the same Safety Officer who was on board for the fire on AE2 on the 01st July. The drill scenario and reporting form (SAF 02.1k) aims to test and activate all safety and equipment functions with the exception of the emergency generator. The objectives of the drill were to test the effectiveness of the hose, foam and inline eductor preparation, hose handling and entry to compartment using proper firefighting techniques. Medical team to exercise casualty handling and a full CO_2 muster was to be achieved. All starboard side lifeboats to be prepared to the embarkation deck and sent away with their operating crews. The drill report also provides a section for drill evaluation. In summary, the evaluation report stated the following: "*improper search procedure when searching for casualties and that the starboard lifeboat team were disorganized and required further training*."

5.5.3 When comparing the actual fire and the drill conducted there are two distinct differences. The emergency generator was not routinely operated during drills, it was tested weekly for no more than one hour at a time but it was rarely used on-load for a period greater than one hour. Secondly, the boats were not prepared to the embarkation deck on the 01st July in the event the Master decided to abandon ship.

5.5.4 The senior positions on board rotate with their opposite numbers approximately every 2-3 months. The senior Officers present at the time of the drill conducted in May within pump room number 5 were the same senior Officers present during the fire on the 01st July, with the exception of the Chief Engineer. Therefore, despite this being the only machinery based Code Bravo drill in the previous six months; the senior Officers on board on the 01st July could be considered the most current.

5.5.5 Despite not conducting a drill within either auxiliary or main machinery spaces, a drill was conducted within pump room 5, which could be considered a mechanical space given the location of AG7. Form SAF 02.1k report form is not detailed enough to determine the overall effectiveness of the drill in accordance with emergency response procedures. Key emergency response procedures are not included on the form, which is used not only to provide instruction and guidance on the objectives to be achieved but also to critique the drill in order to identify areas for the crew to improve on.

5.6 System Redundancy

5.6.1 Within four minutes of the Code Bravo announcement engines 2, 4 and 5 had been shut down. At this point the emergency generator started immediately and restored power to essential equipment in order to fight the fire. The emergency generator ran without fault for 56 minutes until the Chief Electrician shut it down locally due to failure of the voltage stabilisation unit. A decision which should have been made by the Master given Central

Command had overall responsibility for the control and coordination of the firefighting effort. Once shut down the vessel lost all fixed system firefighting and breathing apparatus charging capability. Central Command were not informed of the fact that the emergency generator had been shut down, instead, they were under the impression it had shut down automatically due to overheating. The firefighting effort continued utilizing all available means including fire extinguishers and to some extent ice for boundary cooling taken from ice stores located around the vessel.

Figure 28: Emergency generator

5.6.2 It was not possible to start auxiliary engines 4, 5 and 7 as neither generator was connected to the emergency switchboard. In order to start an alternative engine from the emergency switchboard, supplied by the emergency generator, fabrication of a hard wire connection was required. This was achieved by the Chief Electrician who had to don BA to enter the main

engine room where a connection could be made to the booster pump and cooling pump of AG7.

Figure 29: Auxiliary generator 7

5.6.3 The fault with the emergency generator was not known prior to the incident. The emergency generator had been run weekly in accordance with SOLAS Chapter II-1 Regulation 43[14] and witnessed by PSC, Class and a Bahamas Approved Nautical Inspector. However it cannot be recalled when it was last operated for more than 60 minutes at greater than 60% load. A service engineer from AAE Technicians was called on the 3rd July while the vessel was alongside in Funchal to assess the generator and determine the fault. The report identified that unstable voltage manifested after 30 minutes of operation due to a defective diode on the bridge control unit and a faulty voltage regulator. Both units were replaced and the emergency generator tested for 20 hours on full load without fault.

5.6.4 The vessel maintenance record for the emergency generator indicates that the generator was tested weekly for one hour. The PMS work order does not stipulate what load the generator should be under when tested. Therefore it can be determined that prior to the incident the generator had not been operated in a condition in which it was expected to fulfil in the event of an emergency.

[14] Regulation 43.7: *"Provision shall be made for the periodic testing of the complete emergency system and shall include the testing of automatic starting arrangements."*

5.7 Emergency Procedures

5.7.1 The overall coordination and communication effort on board moments prior to the Code Bravo up until the fire had been confirmed as extinguished proved disjointed. By definition the Central Command serves as the vessel's command, control and information centre. In order for this to be fulfilled information from the emergency teams located throughout the vessel should feed information to the Command in order to allow overall coordination of the firefighting effort to be achieved. It was determined throughout the course of the investigation that key decisions were made without the knowledge or approval of the Command Team located on the bridge.

5.7.2 The establishment of the staging area outside cabin 320 was not in accordance with the pre-planned response for a fire within the auxiliary engine room (see figure 30, fire attack plan). Once the ECR was evacuated and WTD 10 was allowed to remain open, there was no physical boundary between a smoke filled compartment and an area deemed, at the time to be suitable for controlling and coordinating fire teams entry and exit. In drills the crew train to incorporate a two-door separation between a smoke filled compartment and fresh air however this is not a Company policy. This was not achieved in practice and instead of re-establishing the staging area to a location further forward in fresh air, the staging area remained outside cabin 320 subjecting the staging team to smoke which had migrated from the ECR through the open WTD 10. Further, a smoke boundary could not be maintained due to the movement of personnel to and from the smoke filled staging area; this allowed smoke to migrate freely.

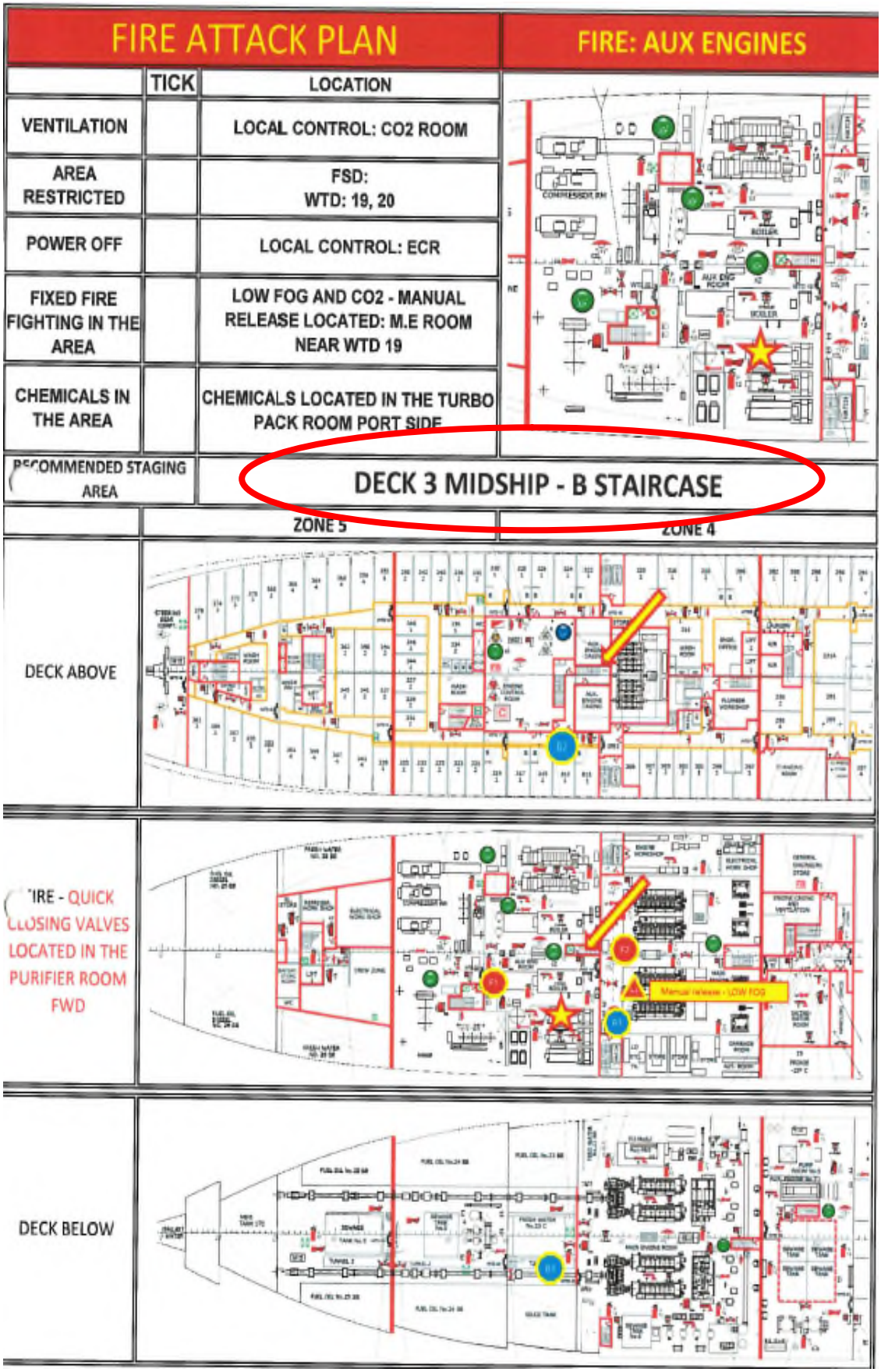


Figure 30: Fire Attack Plan and highlighted (circled) recommended staging area

5.7.3 The Master and the Safety Officer discussed going to General Emergency Stations (GES) as it would speed up the process of abandonment should the emergency not be recoverable. On the back of this discussion the Safety Officer and the Master decided that if smoke migrates beyond deck 3 zone 4 then the vessel would go to GES. By 1006 smoke had migrated up to deck 5 within crew staircase C (zone 4) however the vessel did not go to GES. The Navigation policy and procedures (NAV 07.01) check off sheet does recommend consideration is given to sounding the GES alarm.

5.7.4 There were a number of occasions when the Chief Officer was requesting information from various sources but not being provided with timely updates as to the firefighting effort or equipment availability. Had the Chief Officer had a better understanding of the damage control effort, key decisions may have been made from Central Command and not by individual team members. At one stage the emergency generator was being used to provide power to start AE7 without the knowledge of the Chief Officer who at the time, was under the impression power was being provided to fire pumps in order to generate sufficient water pressure to fight the fire.

5.7.5 The emergency organization manual requires the Safety Officer to report to the '*scene of the incident and establish communication with Central Command and proceed as directed'*. The emergency organization manual does not go further in detailing the role and responsibility of the Safety Officer. The Safety Officer saw his role as a coordinator of the firefighting effort having overall responsibility of the fire teams, liaising with the OSC whilst roving throughout the vessel. The role of the On-Scene Commander is defined within the emergency organization manual as follows: *'direct the fire teams in attacking the fire after discussing with his/her team'*.To avoid any misunderstanding the fire teams responsibility is also defined by the following statement: *'follow orders from the On-Scene Command'*.

The role of the Safety Officer is defined but unless direction is provided by Central Command, any action taken to assist the firefighting effort is done so not in accordance with procedure but through local routines implemented and practised during pre-planned drills. The Safety Officer acted under his own initiative as he had done so on all previous Code Bravo occasions. The Safety Officer did not maintain regular communication with the Command Team due to the quantity of assigned roles delegated to himself. At one point the Safety Officer had proceeded into the compressor room aft of the auxiliary engine without BA, prior to the Fire Teams arrival whilst WTD 20 was in the open position. This placed the Safety Officer in significant danger displaying disregard for his own health and safety. Ultimately it could have led to a search and rescue effort being required using up vital resources at considerable risk.

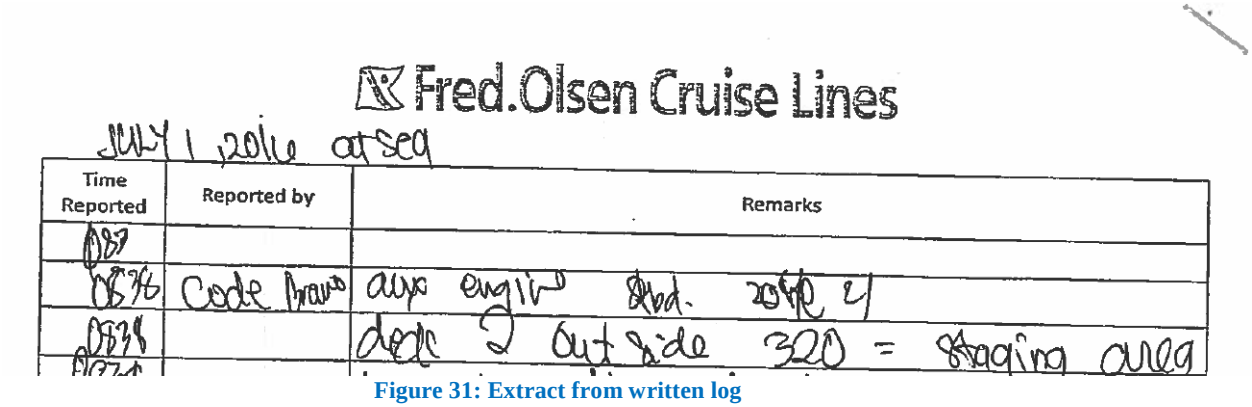
5.7.6 On the 01st July the Boat Deck Commander Team and Lifeboat Team mustered on the boat deck in accordance with Code Bravo procedures. The Lifeboat Team has a standing order to lower the boats to embarkation level as soon as the Code Bravo is sounded; the team is then required to report to the Boat Deck member that they are ready to receive passengers. This did not

happen; the lifeboats remained in the stowed and secured position on the boat deck.

In accordance with the emergency organisation manual the Boat Deck Commander Team shall monitor the preparation and lowering of rescue boats, lifeboats and life rafts. A recent drill was conducted on the 29th May 2016 and in the drill evaluation notes on SAF 02.1k form state that *"all the lifeboats should be lowered to the embarkation deck once the general emergency alarm is sounded"*, this evaluation, written by the Safety Officer and witnessed by the Master was in contradiction to the emergency procedures required within the emergency organization manual. The evaluation report goes on to state that *"but there is a conflict with Company policy which is not allowing the deck commander to lower the lifeboats without a Senior Officer present"*. The emergency organization manual makes no reference to a Senior Officer required to be present in order to lower lifeboats, it states clearly that when a Code Bravo is sounded, *the Lifeboat Team are to lower the boats to the embarkation level*. The emergency procedures were not followed or adequately understood by the higher authority on board resulting in no action being taken to rectify this misunderstanding identified during training.

5.7.7 The Command Team consists of various members, one of which is the Record Keeper whose responsibility it is to assist Central Command in maintaining a written log of events taking place. The evidence provided to the investigator included a hand written copy of the log. The first page is written on a formatted sheet with columns to assist the writer in recording the correct information but also to aid the reader after the event in determining what had occurred, by who and in what order.

Unfortunately there was only one formatted page available leaving the remainder of the incident being recorded on blank A4 paper. This resulted in the standard format not being used. The VDR audio recording on the bridge was, in general, invaluable to the investigator in order to piece the incident back together with the aid of the written log. However when validating the evidence multiple discrepancies existed that could not be clarified due to the quality of the audio recording and the format used to log specific events.


Fred.Olsen Cruise Lines

JULY 1 2016 at sea

Time Reported	Reported by	Remarks
0837		
0836	Code Bravo	aux engine stbd. 2040 4/
0838		deck 2 outside 320 = staging area

Figure 31: Extract from written log

***

6 CONCLUSIONS

6.1 The fire broke out at 0838 on the 01st July 2016 in vicinity of the on-engine fuel filter located at the aft end of AE2. The ignition source cannot be identified post incident due to the significant damage sustained to AE2. The fire continued to burn generating temperatures in excess of 660°C within the auxiliary engine room, destroying the majority of evidence and preventing investigators from determining actual cause.

6.2 The firefighting effort was severely hampered through a combination of material, system and human element factors, at times, resulting in crewmembers acting independently to achieve a positive outcome often deviating from Company policy and procedures.

6.3 The lessons learned from the related incident that occurred on board the m.v Boudicca on the 25th January 2015 were clearly well understood by the Command Team on board the Black Watch. The Command Team were conscious of the use and duration of the flexi-fog system in order to avoid a potential list which developed on the Boudicca due to the fixed application high-fog system remaining in operation after the fire had been extinguished.

6.4 Local release buttons were activated in accordance with Company procedures; however a continuous supply of water through the nozzles could not be achieved as designed due to a loss of power, regardless of the unknown condition of the nozzles. The verification process in combination with the testing and inspection procedures coupled with the onboard system knowledge is likely to have impacted the operation of the fixed application system.

6.5 A lack of adequate containment resulted in smoke and heat being able to migrate to adjacent compartments and beyond. The degraded structural integrity of fire dampers enabled smoke to escape from the space enabling fresh air to enter the compartment, effectively feeding the fire. Penetrations within watertight bulkheads were not adequately sealed resulting in smoke passing through the subdivision into adjacent compartments, resulting in fire teams being forced on air in advance of reaching the auxiliary engine room, effectively wasting fresh air in transit. Control of WTD's from the staging area to the scene of the fire was not coordinated or controlled as required in accordance with Company procedures. The procedure for separation between the affected space and staging area was not adhered to through a lack of understanding of basic firefighting principles.

6.6 The option to use CO_2 was discussed once primary firefighting techniques had been exhausted and prior to smoke reaching public areas of the ship. It was agreed that if smoke reaches the public areas above deck 3 then the option to use CO_2 would be reconsidered. By the time this occurred the fire

within the auxiliary engine room had been extinguished. However the fire continued to burn within the transformer room aft of AE2 but its severity did not warrant the use of CO_2.

6.7 The continued requirement to investigate whether a fire was present within adjacent compartments after BA stocks had been depleted resulted in crewmembers being placed at risk by entering compartments whilst wearing EEBD's without knowing the danger that existed.

6.8 Regular Code Bravo drills were conducted, recorded and evaluated by senior Officers on board however no drill was conducted in the auxiliary engine room in the preceding 12 months. The auxiliary engine room is considered a compartment of significant importance, not only because of the equipment operated within but also because of its central location beneath the ECR. The consequence of the fire escalating outside the auxiliary engine room to the point where adjacent compartments were rendered unattainable affected propulsion machinery, power generation, domestic services and primary control of all mechanical systems.

6.9 A minority of senior Officers demonstrated throughout the course of the incident insufficient knowledge of systems, firefighting techniques and command and control methods resulting in these individuals using their own experience to determine the best course of action, without approval or consultation with Command. The Command team attempted to remain in control but without up-to-date information on equipment availability or the severity of the fire(s) they were not in a position to best prioritise responses effectively. This ultimately resulted in some emergency systems not being made available to the On Scene Commander leaving fire teams exposed at critical times throughout the incident.

6.10 The vessel was not adequately prepared in the event the fire escalated to a point where abandonment was deemed by Command as the last resort to preserving safety of life. The lifeboats were not lowered to the embarkation deck allowing ready access by passengers and crew. Despite a recent drill identifying a discrepancy in the onboard procedures, no action was taken to clarify the procedures and rectify the deficiency.

6.11 Due to the power output of auxiliary generators 1, 2 and 3 they were used primarily as reserve providers of power when either demand was high or any combination of generators 4, 5 or 7 were unavailable. Although regular maintenance was conducted on generators 1, 2 and 3, AE2 had not been maintained in accordance with the manufacturer's recommended service cycle.

***

7 RECOMMENDATIONS

Recommendations for the operator:

7.1 Consider reviewing the procedure for allocating the location of drills onboard to ensure realistic training occurs regularly within all engine rooms.

7.2 Review the requirement of periodic testing of emergency generators and consider implementing a mechanism whereby their condition is tested to ensure they are capable of operating in a condition in which they are expected to fulfil on all Fred Olsen vessels.

7.3 Recommend refresher training for all senior Officer's within Fred Olsen on advance firefighting techniques.

7.4 Consider a review of the roles and responsibilities of team leaders detailed within the emergency organization manual.

7.5 Consider implementing a vessel system familiarisation-training package to ensure all team leaders understand the limitations and capabilities of emergency systems.

7.6 Consider increasing the level of fire protection within engine rooms on board all Fred Olsen vessels.

***

8 ACTIONS TAKEN

8.1 Owners will arrange a meeting with Autronica to review their inspection and reporting systems and to discuss the necessity to review system/layout in view of applicable rules and regulations and make changes as deemed appropriate.

8.2 The Owners have implemented a method to use AMOS as a means to coordinate, and record drill deficiencies.

8.3 The Owners are working on a change to the Emergency Organisation Manual to ensure it accurately reflects the routine for adequately preparing crew and guests in the event of a Code Bravo incident. A new crew alert stage or inclusion of more crew at Code Bravo is being considered, which incorporates an additional stage between Code Bravo and GES, whereby crew will muster and prepare for GES ahead of mustering passengers.

8.4 The Owners will continue to review planned maintenance system to allocate the location of drills on an annual schedule.

8.5 The Owners have implemented a routine to ensure emergency generators are tested on 80% load for 1 hour every 7weeks.

8.6 The Owners will continue to review of the training of the BA team and operation of the BA compressor including appropriate use of the cascade system.

8.7 The Owners will continue to improve the on board familiarisation process as part of their continuous improvement programme.

8.8 The Owners have inspected and secured all bulkhead penetrations. The use of the bulkhead penetration checklist contained in the Safety Quality Manual (SQM) has been reiterated to all relevant crew to emphasise the importance of correctly recording alterations.

8.9 The Owners have modified auxiliary engines 5, 6 and 7 to ensure they are now capable of being started with the emergency generator powering auxiliary support components.

8.10 The Owners have implemented a new system of accounting for crew entering or leaving an engine space. The system forms part of the CO2 muster process to ensure any crew within the engine room can be accounted for at the muster.

8.11 The Owners have ordered two new BA compressor and in addition increased the system redundancy with the addition of a second compressor installed in a separate location and connected to the emergency generator.

LIST OF APPENDICES

I. Autronica Fire and Security AS Flexi-Fog Service Report

II. Black Watch General Arrangement Plan

III. 8000 Hour Maintenance Requirement

IV. Additional Pictures

V. MSF1601A Form from MCA (PSC Paris MoU) Deficiencies Found and Follow Up Actions (17th July 2016)

VI. Engine Room Fire Checklist

***

Appendix I: Autronica Fire and Security AS Flexi-Fog Service Report

Autronica Fire and Security AS
Haakon VIIs gt. 4, 7041 Trondheim, Norway

Telephone: **+47 915 09753**
Technical Support: afs.support@autronicafire.no
Warranty/Claims: claim.maritime@autronicafire.no
Order Service: service.maritime@autronicafire.no

CERTIFIED BY DNV·GL MARITIME
Approval of Service supplier
Certificate No. SFJ-13-5075

AUTRONICA

Job no. :	S-136-016
Document ID :	20/2016 AAR
IMO # :	7108930

Date :	15.06.2016
Service eng. :	[redacted]
Service eng. :	[redacted]

☒Service Report ☐Commissioning Report

		Equipment:	Equipment:
Vessel:	M/S Black Watch	☐ Omicron Systems	☒ FlexiFog LP
Customer:	Fred. Olsen Marine Service A/S	☐ Moss Gass	☐ FlexiFog TF
Customer ref.:	Chief Engineer	☐ AutroPrime	☐ FlexiFoam
Ref. no.:		☐ AutroSafe	☐ FM200
Location:	Alesund	☐ BS100	☐ CO2
Comment:	FlexiFog Accommodation	☒ Others (specify in comment)	☐ Novec
			☐ Argonite

Parts supplied:

Qty.:	Article:	Description:

Time Sheet:

Date:	From hour:	GMT	To hour:	GMT	Action taken:	Work / travel hours: Norm. time / Wait. time 08:00-16:00	Over time / Wait. time 16:00-08:00	Travel time
9.06.2016	12:00	+2	20:00	+2	Travel time Bodo-Bergen			8x2
10.06.2016	8:00	+2	17:00	+2	Went onboard, visual inspection, started sprinkler test	7,5x2	1x2	0,5x2
11.06.2016	8:00	+2	18:00	+2	Finished the sprinkler test, started the high risk areas tests		10x2	
12.06.2016	8:00	+1	17:00	+1	Continued with tests. Found problems on sirens alarms, investigated it		10x2	
13.06.2016	8:00	+2	17:00	+2	Tested all the flow switches and flushed the system	8x2	1x2	
14.06.2016	8:00	+2	16:00	+2	Prepared documents and took measurements for jockey pump installation and FDS refit + waiting time	4x2 / 4x2		
15.06.2016	8:00	+2	24:00	+2	Signed the documents. Travel back to Italy	4x2		12x2
Regarding return travel, adjustments might be made after the travel is completed.					**Sum:**	47 / 8	44	41

SIGNATURES:

AFS Service Engineer:		Yard/Owners rep:
[redacted]	Date: 15.06.2016	[redacted]
Block letters: [redacted]	Place: Alesund, Norway	Block letters: [redacted]

Chief Engineer M/V BLACK WATCH

Protecting life, environment and property.

Page 1 of 5

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Approval of Service supplier
Certificate No. SFJ-13-6075

AUTRONICA

Job no. :	S-136-016
Document ID :	20/2016 AAR
IMO # :	7108930

Date :	15.06.2016
Service eng. :	[redacted]
Service eng. :	[redacted]

Detailed Service report:

09.06.2016

Travelled from Bødo to Bergen.
Travelled from Bergen airport to hotel.

10.06.2016

Travelled from hotel to the vessel.

Spoke with Chief Engineer and Hotel Engineer and overviewed the system.

Prepared the plan for the tests to perform.

Put all the pumps in manual mode and disconnected the nitrogen to avoid any accidental release.

Started the tests form the accommodation side performing the sprinkler test according to the IMO regulations (2 sprinkler heads in each zone, for 10 zones).

Tested one sprinkler in each zone for 10 zones with a stand-by pressure of 11 bar (the other 10 sprinklers in the same zones will be tested the next day, this job procedure has been decided in order to make the job easier for us and for the crew). All the nozzles worked properly and no one failed the test. Took 10 samples of water from the broken sprinklers (one for each zone). These samples will be sent to our office for analysis.

Replaced all the broken nozzles with new ones, re-pressurized all the tested zones and set the system back in normal operation for the night.

SIGNATURES:

AFS Service Engineer:		Yard/Owners rep:
[redacted]	Date: 15.06.2016	[redacted]
Block letters: [redacted]	Place: Alesund, Norway	Block letters: [redacted]

Chief Engineer M/V BLACK WATCH

Autronica Fire and Security AS
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AUTRONICA

Job no. :	S-136-016
Document ID :	20/2016 AAR
IMO # :	7108930

Date :	15.06.2016
Service eng. :	[redacted]
Service eng. :	[redacted]

11.06.2016

Finished the sprinkler test breaking the last 10 nozzles. Only one failed. The system passed the sprinkler test. Attached the list. All the tested nozzles will be sent to our office for analysis.

Replaced all the broken nozzles with new ones and re-pressurized all the tested zones.

Tested all the local protection areas in engine spaces. Started to blow compressed air through the sections. It was not possible to complete this test due to the type of nozzles (Flexi-Fog type 30) which requires higher pressure to open completely (compressed air onboard is maximum 6 bar). Because of this, it has been possible only to make a visual inspection of the nozzles and check their position (all the lines have been flushed last year with water).

Released all the local protection zones from the panel in ECR and the local push buttons. Checked the correct description of the released area on the display, the correct functionality of the valves, pressure switches and the sirens/lights.

Found the actuator valve of the zone "Aux. Engines 3&4" not working. Opened it and cleaned it. Now is working as it should.

Found the actuator valve of the zone "Boiler N.2" not working. Opened it and discovered that rod of the valve is bended. Unscrewed a little bit the valve in order to make it work. Now is working but **must be replaced as soon as possible** in order to guarantee the functionality of the system.

Found 3 pressure gauges broken. The plumbers onboard already replaced them.

Checked the batteries inside the main panel cabinet in ECR. Those are completely dead. There are no spares available onboard, the electrician already ordered new batteries. Those **must be replaced as soon as possible** in order to guarantee the functionality of the system.

The inside of the main panel cabinet in ECR is incredibly dirty. Probably is due to the cooling fan which has no filters and suck all the dust inside. **Is strongly suggested to find a solution.**

SIGNATURES:

AFS Service Engineer:		**Yard/Owners rep:**
[redacted]	**Date: 15.06.2016**	[redacted]
Block letters: [redacted]	**Place: Alesund, Norway**	**Block letters:** [redacted]

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AUTRONICA

Job no. :	S-136-016
Document ID :	20/2016 AAR
IMO # :	7108930

Date :	15.06.2016
Service eng. :	[redacted]
Service eng. :	[redacted]

12/06/2016

The plumbers informed us that the defective solenoid valve for the local protection zone "Boiler N.2" was leaking water and they tightened to avoid the draining of the main collector. **The valve at the moment works only if manually operated.** The electrician already ordered a new solenoid valve.

Tested the sequence of the pumps (including foam pump). Everything ok.

Tested the switch-over of SW and FW valves simulating a low level in the FW tank. Everything ok.

Tested the releasing of the nitrogen. Everything ok.

Checked all the three bottles of nitrogen. Those are in good condition (pressure 200 bar each).

During these tests, a malfunction of the sirens/bells alarms has been discovered. All of them activates at the same time during any system release (even accommodation zones).

Inspected the problem checking the software of the PLC and the hardware (ASi-Nodes).

It seems that all the sirens/bells are connected to the "System release" relay inside the main control cabinet.

This doesn't affect the functionality and the reliability of the system but it would be better to have separate alarm for each high risk zone.

13/06/2016

Tested all the flow switches. All of them are working perfectly except the one mounted for the zone "Deck 7 Zone 1", it remains open after activation and needs to be hit to return in normal position. It has been opened and the spring has been cut in order to make it work properly (it was loose). Tested it again, now everything is ok.

Flushed all the system in order to blow out all the air. The water is very clean (the crew performs the flushing of the system every month).

Made the analysis for the foam. Everything ok.

SIGNATURES:

AFS Service Engineer:		Yard/Owners rep:
[redacted]	Date: 15.06.2016	[redacted]
Block letters: [redacted]	Place: Alesund, Norway	Block letters: [redacted]

Chief Engineer MY BLACK WATCH

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Haakon VIIs gt. 4, 7041 Trondheim, Norway

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AUTRONICA

Job no. :	S-136-016
Document ID :	20/2016 AAR
IMO # :	7108930

Date :	15.06.2016
Service eng. :	[redacted]
Service eng. :	[redacted]

14/06/2016

Prepared the service report, certification and check list.

Attached new inspection labels.

Took all the measurements for the future installation of the jockey pump.

Took all the measurements for the next refit of the fire detection system cabinet.

Waiting time to arrive in Alesund.

15/06/2016

Signed the report and all the documentation.

Desemabrked at 12:00.

Travelled from the vessel to the airport.

Travelled from Alesund to Venice.

Travelled from Venice to Trieste.

REMARKS:

The system certificate will be valid ONLY when the following problems will be solved:

- **The batteries of the cabinet in ECR must be replaced.**
- **The solenoid valve for the high risk zone "Boiler N. 2" must be replaced.**

SIGNATURES:

AFS Service Engineer:		**Yard/Owners rep:**
[redacted]	Date: 15.06.2016	[redacted]
Block letters [redacted]	**Place: Alesund, Norway**	**Block letters** [redacted]

Chief Engineer

AUTRONICA
A UTC Fire & Security Company

Vessel: M/S Black Watch

Foam analysis **Date:** 13/06/16

Standard

%	0	3	6	9
Fraction	0,1	2,5	4,5	6,2

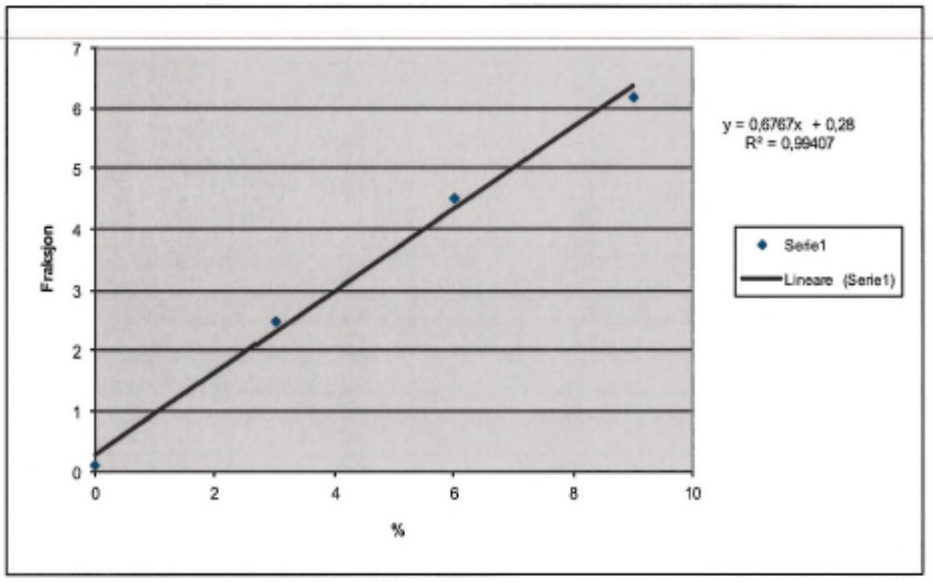
Foam sample

%	3,1
Fraction	2,6

Specification

Service eng.: [redacted] Result: Approved

Concentrate: Sthamex AFFF 3% System: FlexiFog



Description of test: The measurements / liquid tests are done by using a digital refractometer, type PAL-1 from Atago. The index used is Brix. The first test is done on the water, then we mix water foam 3%, 6% and 9% at our test facilities. These ideal mixes are made by mixing water and pure foam from the ship. The ideal mixes are used to make an ideal graph for foam extinguishing system delivered. Then it is taken tests of the mix sample taken on site at the nozzles. This value is then compared against the ideal graph. If the nozzle-mix from site is at the graph 1% or close, the foam system is accepted.

Autronica Fire and Security AS

Inspector [redacted]

[redacted]

Chief Engineer M/V BLACK

AUTRONICA	Maritim, System Inspection Certficate	Dokument ID:	AFS-11780
		Revisjon nr.:	01
		Endret dato	12.11.15

Vessel Name: M/S BLACK WATCH		IMO no.	: 7108930	Date : 15.06.2016
Yard	: ALESUND	Flag	: BAHAMAS	Inspector's name: [redacted]
Hull no.	:	Class	: DNV - GL	Inspector's ID: [redacted]

We hereby certify that the following systems and equipment have been inspected according to requirements set by flag – port state authorities and the classification society:

Water Mist System

- **Local Protection Dry Pipe System 10 Zones**
- **Accommodation Wet Pipe System 40 Zones**

This Certificate is only valid when accompanied by validated service report (020/2016 AAR) and when signed and stamped by an Authorized AFS Engineer.

This CERTIFICATE has been issued for a period of **1 Year**, an extension of up to 3 months is possible only with the agreement of the Classification society

For Autronica Fire and Security AS
Authorized Engineer

Autronica Fire and Security AS
(AFS Stamp)
[redacted]

For Vessel / Plant
Authorized Signature
[redacted]
(Customer Stamp)
M/V BLACK WATCH Chief Engineer

Utarbeidet av:	Per Steinar Hanssen	Utarbeidet dato:	12.11.15
Godkjent av:	Runar Hassel	Side:	1 av 1

AUTRONICA A UTC Fire & Security Company	Maritim, Water System Check List	Dokument ID:	AFS-11761
		Revisjon nr.:	01
		Endret dato	30.10.08

Vessel/Plant: M/S BLACK WATCH	Owner :FRED. OLSEN AS	Date : 15.06.2016
Yard : ALESUND	IMO no. : 7108930	Technician [redacted]
Hull no:	Project no:	Flag/ Class : BAHAMAS/DNV-GL

Area(s) protected:
Water Mist: No. 10 Local Protection areas, No. 40 Accommodation areas

The following items are inspected / tested / checked

Item	Description	Pass	Fail	Not Applicable
1	Checked Documentation, Current, Correct, Available	X		
2	Visual Inspection	X		
3	Check Display Panel Bridge (During Testing Also)	X		
4	Check Pump Starter Cabinet LED Lamps	X		
5	Check Nitrogen Cylinder Clamps	X		
6	Check Nitrogen Cylinder Pressure	X		
7	Check condition of tank	X		
8	Check Level of Water in Tank	X		
9	Check Foam Tank	X		
10	Check Level of Foam Concentrate	X		
11	Check Foam Pump Function / Pressure	X		
12	Check Position of all valves	X		
13	Function Test Back-up Pump	X		
14	Function Test Pump Starter Sequence	X		
15	Function Test High Risk Zone Release All Zones	X		
16	Function Test Wet Zone Release All Zones	X		
17	Function Test Total Flooding Release	X		
18	Function Test Deluge Release All Zones			X
19	Check All flow switches Reset	X		
20	Check Fresh Water and Salt Water Supply & Valve	X		
21	Check foam inductor	X		
22	Check alarms and shutdown	X		
23	Check All Fault Indications	X		
24	Reset System & Release System	X		
25	Check Spare Parts	X		
26	Attach new inspection labels:	X		
27	Issue New Certificate / Report	X		
28	Instructed onboard personnel:	X		
29	Check all manual release buttons	X		
30				
32				
33				
34				
35				
36				

All items are to be marked accordingly, any failure except those marked with a * will prevent a certificate being issued. Refer to Service Manuals for further information. All actions, repairs, test must be reported separately on the Service Report 020/2016 AAR.

Utarbeidet av: Per Steinar Hanssen
Godkjent av: Runar Hasser

Utarbeidet dato: 30.10.08
Side: 1 av 1

Autronica Fire and Security AS
Inspector [redacted]

MV BLACK WATCH Chief [redacted]

[redacted]

Nozzle sampling sheet

Project nr.	xxxxxxxxx	Tested by:	[redacted]
Vessel	M/S Black Watch	Test date:	11/06/16
Class society:	DNV	Minimum working pressure:	11 bar

Nozzle testing								Observations
Sample number	Section	Nozzle location	Nozzle type (installed)	Nozzle type (project)	Quick coupling	Test pressure [bar]	Nozzle activation	
1	D1 Z1	Garbage Room near WTD 17	FlexiFog 10	FlexiFog 10	N	11	Y	
2		Garbage Room near elevator	FlexiFog 10	FlexiFog 10	N	12	Y	Water sample taken
3	D2 Z1	In front of cabin 205	FlexiFog 9	FlexiFog 9	N	12	Y	Water sample taken
4		in front of cabin 204	FlexiFog 9	FlexiFog 9	N	11	Y	
5	D3 Z1	Crew Galley in front of FSD75	FlexiFog 9	FlexiFog 9	N	12	Y	Water sample taken
6		crew Galley in front of FSD52	FlexiFog 10	FlexiFog 10	N	11	Y	
7	D4 Z1	Crew Corridor beside cabin 4000	FlexiFog 9	FlexiFog 9	N	11	Y	
8		Crew Corridor in front of cabin 4001	FlexiFog 9	FlexiFog 9	N	12	Y	Water sample taken
9	D5 Z5	Crew Corridor in front of FSD 29	FlexiFog 9	FlexiFog 9	N	12	Y	Water sample taken
10		Crew Corridor in front of FSD 28	FlexiFog 9	FlexiFog 9	N	11	N	Sprinkler failure
11	D6 Z1	Main Galley near garbage locker	FlexiFog 10	FlexiFog 10	N	12	Y	Water sample taken
12		Main Galley in front of fridge 80	FlexiFog 10	FlexiFog 10	N	11	Y	
13	D7 Z1	Flower shop port side	K15S	K15S	N	11	Y	
14		Flower shop starbord side	K15S	K15S	N	12	Y	Water sample taken
15	D8 Z1	Officer mess pantry in front of elevator	FlexiFog 20	FlexiFog 20	N	12	Y	Water sample taken
16		Officer mess pantry in front of mess door	FlexiFog 10	FlexiFog 10	N	11	Y	
17	D9 Z1	Observatory bar pantry in front of fridge 13	K15S	K15S	N	11	Y	
18		Observatory bar pantry in front of elevator	K15S	K15S	N	12	Y	Water sample taken
19	D10 Z2	Comm. Room corridor fwd	FlexiFog 10	FlexiFog 10	N	11	Y	
20		Comm. Room corridor aft	FlexiFog 10	FlexiFog 10	N	12	Y	Water sample taken

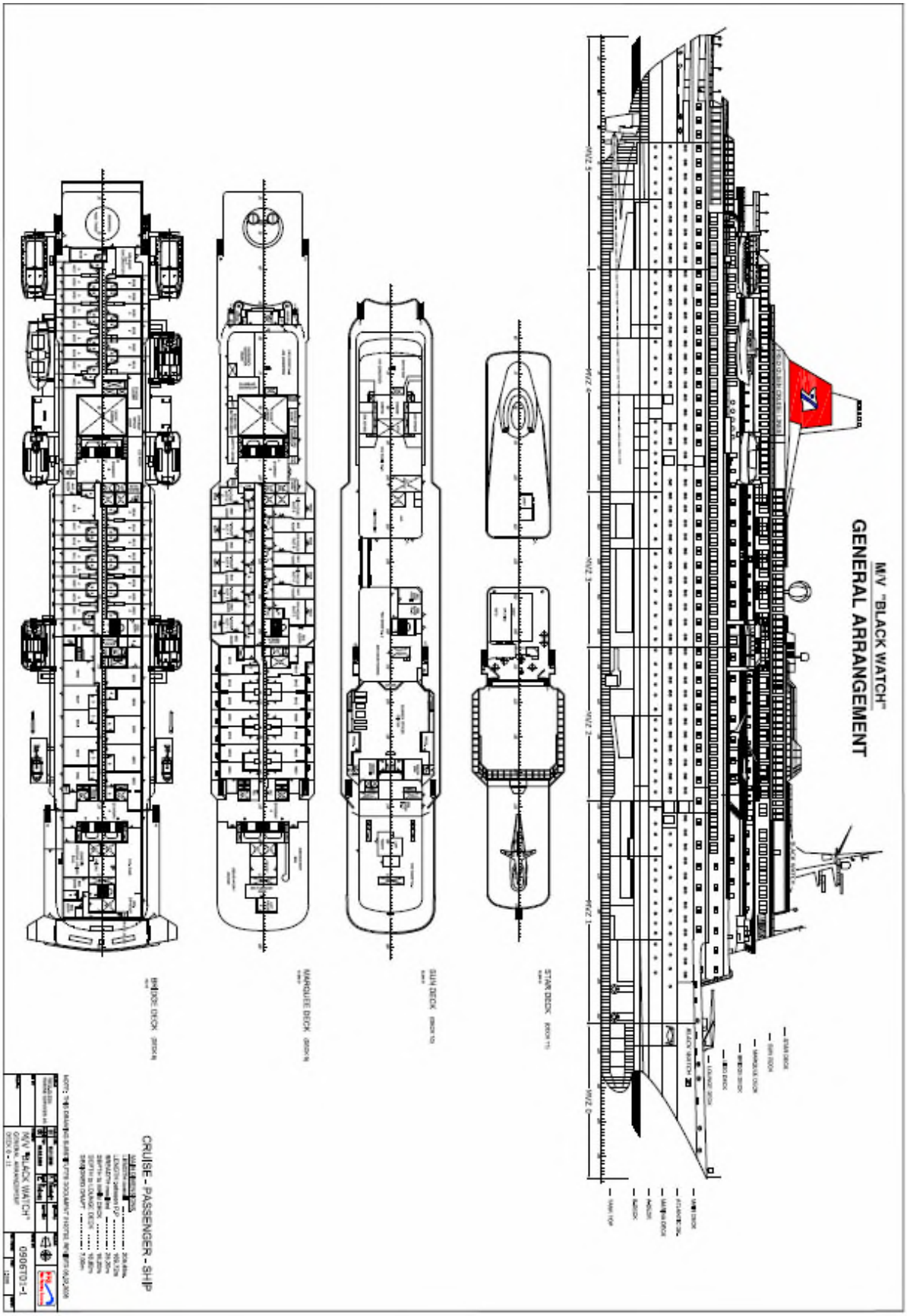
Autronica Fire and Security AS

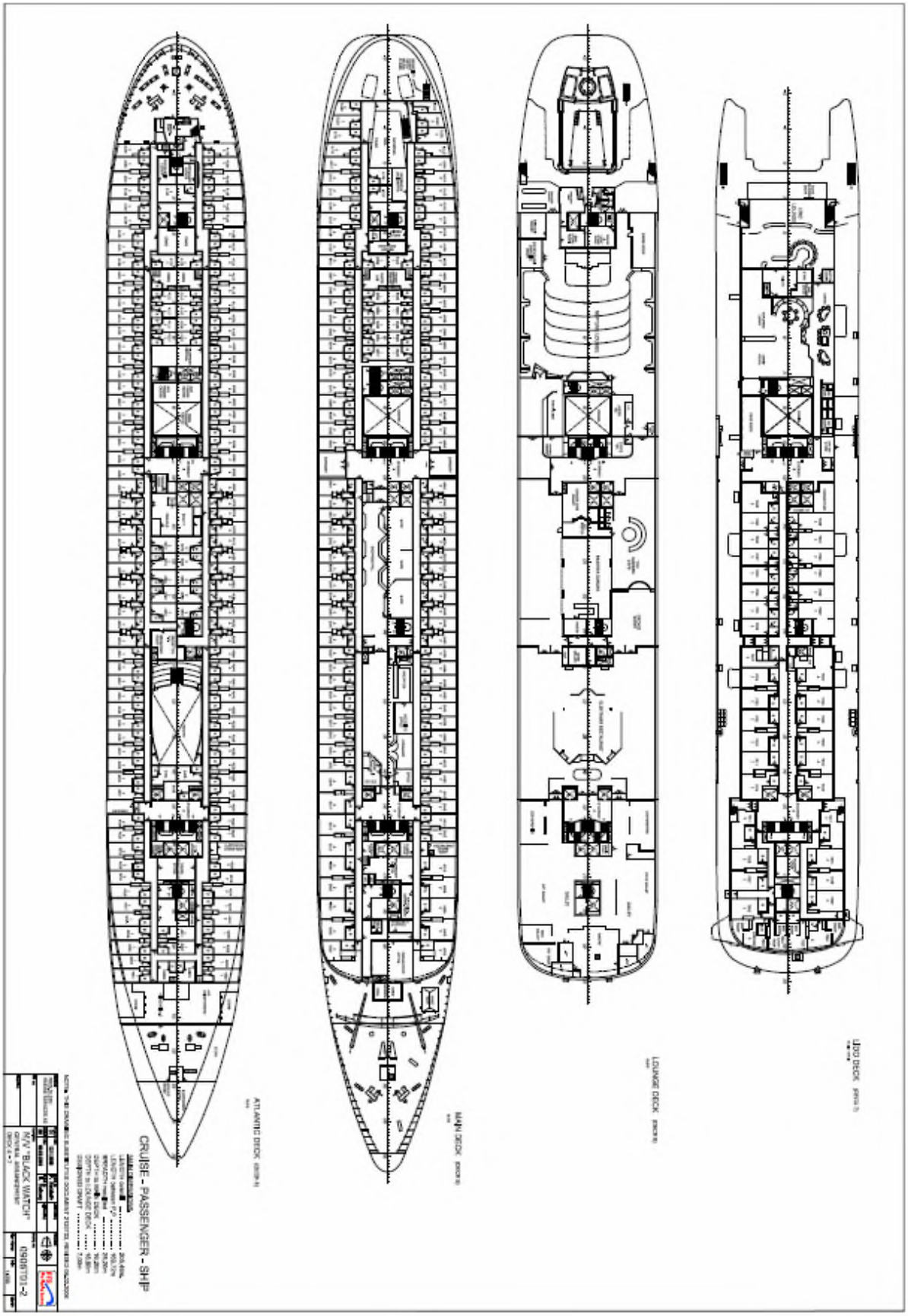
[redacted]

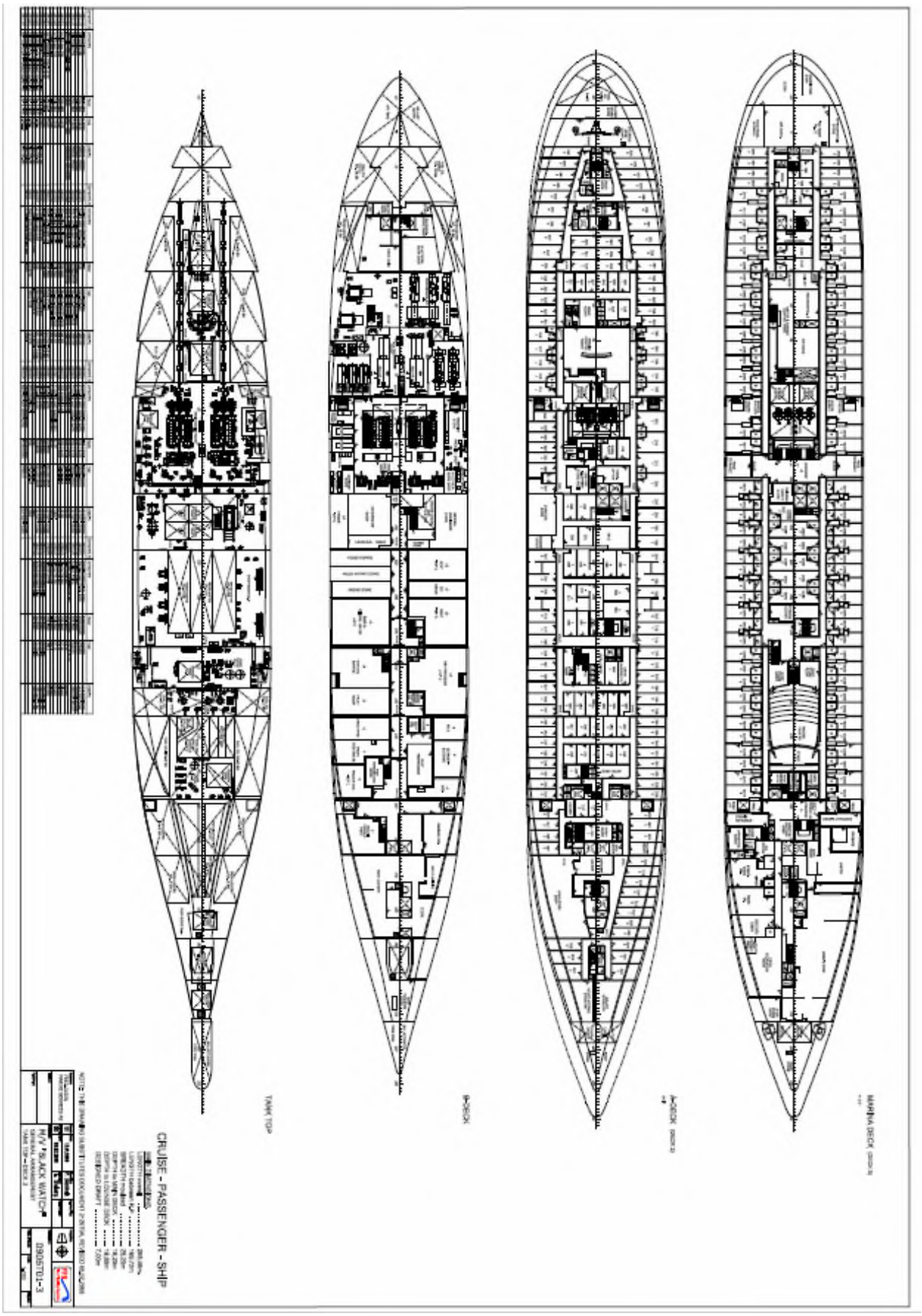
MV BLACK WATCH Chief Engineer

[redacted]

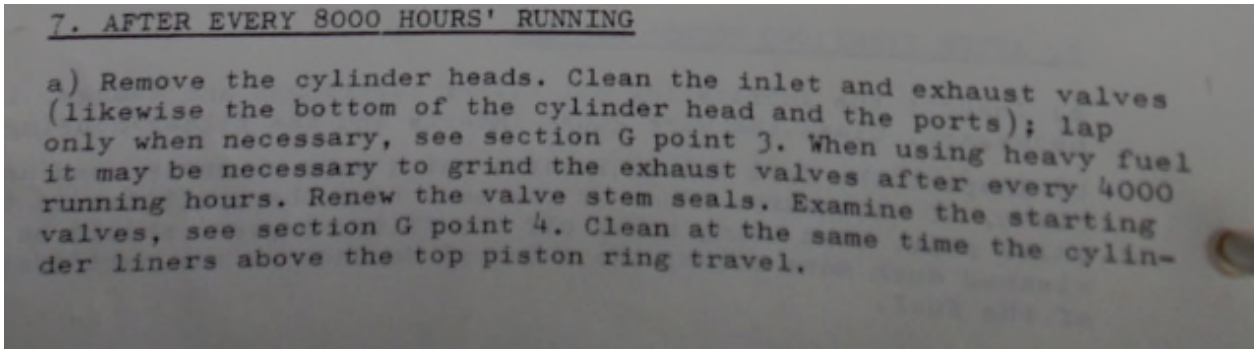
Appendix II: Black Watch General Arrangement Plan




CRUISE - PASSENGER - SHIP
M/V "BLACK WATCH"
GENERAL ARRANGEMENT
ATLANTIC DECK
MAIN DECK
LOUNGE DECK
UPPER DECK

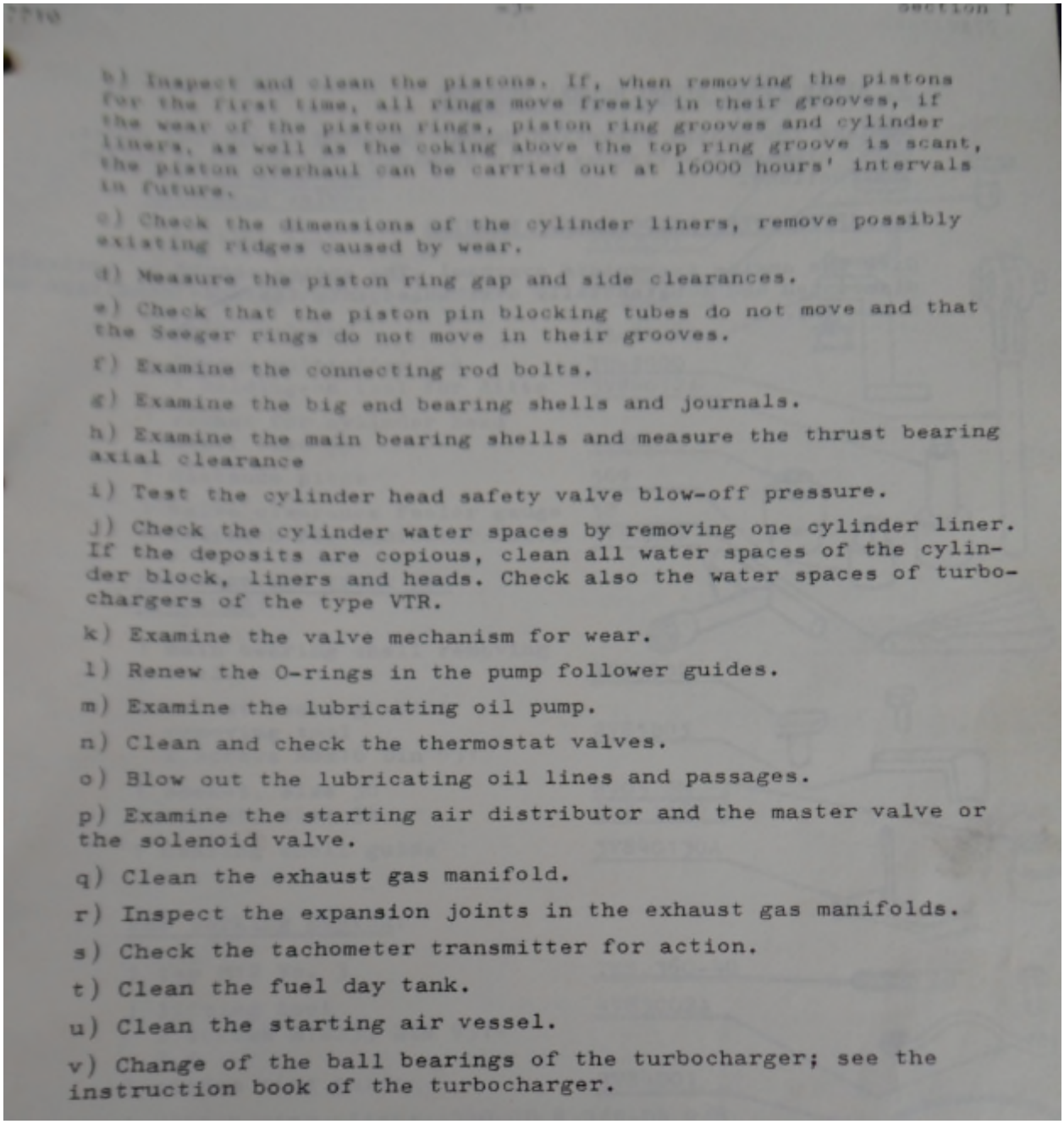

CRUISE - PASSENGER - SHIP
TANK TOP
R/V "BLACK WATCH"
D905TDI-3

Appendix III: 8000 Hour Maintenance Requirement



7. AFTER EVERY 8000 HOURS' RUNNING

a) Remove the cylinder heads. Clean the inlet and exhaust valves (likewise the bottom of the cylinder head and the ports); lap only when necessary, see section G point 3. When using heavy fuel it may be necessary to grind the exhaust valves after every 4000 running hours. Renew the valve stem seals. Examine the starting valves, see section G point 4. Clean at the same time the cylinder liners above the top piston ring travel.



b) Inspect and clean the pistons. If, when removing the pistons for the first time, all rings move freely in their grooves, if the wear of the piston rings, piston ring grooves and cylinder liners, as well as the coking above the top ring groove is scant, the piston overhaul can be carried out at 16000 hours' intervals in future.

c) Check the dimensions of the cylinder liners, remove possibly existing ridges caused by wear.

d) Measure the piston ring gap and side clearances.

e) Check that the piston pin blocking tubes do not move and that the Seeger rings do not move in their grooves.

f) Examine the connecting rod bolts.

g) Examine the big end bearing shells and journals.

h) Examine the main bearing shells and measure the thrust bearing axial clearance

i) Test the cylinder head safety valve blow-off pressure.

j) Check the cylinder water spaces by removing one cylinder liner. If the deposits are copious, clean all water spaces of the cylinder block, liners and heads. Check also the water spaces of turbochargers of the type VTR.

k) Examine the valve mechanism for wear.

l) Renew the O-rings in the pump follower guides.

m) Examine the lubricating oil pump.

n) Clean and check the thermostat valves.

o) Blow out the lubricating oil lines and passages.

p) Examine the starting air distributor and the master valve or the solenoid valve.

q) Clean the exhaust gas manifold.

r) Inspect the expansion joints in the exhaust gas manifolds.

s) Check the tachometer transmitter for action.

t) Clean the fuel day tank.

u) Clean the starting air vessel.

v) Change of the ball bearings of the turbocharger; see the instruction book of the turbocharger.

Appendix IV: Additional Pictures

Figure 32: Starboard Side shell plating in vicinity of Auxiliary Engine Room

Figure 33: On-engine fuel filter

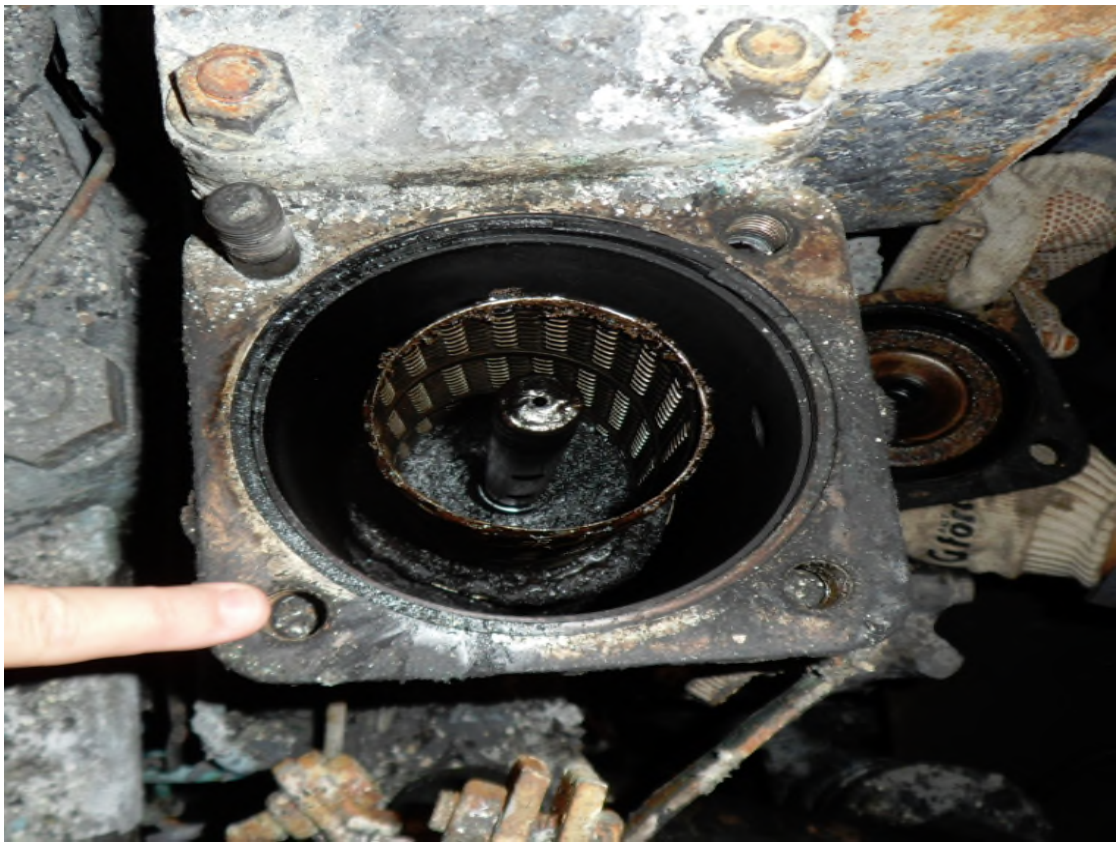


Figure 34: On-engine fuel filter with lid removed, identifying location of loose bolt

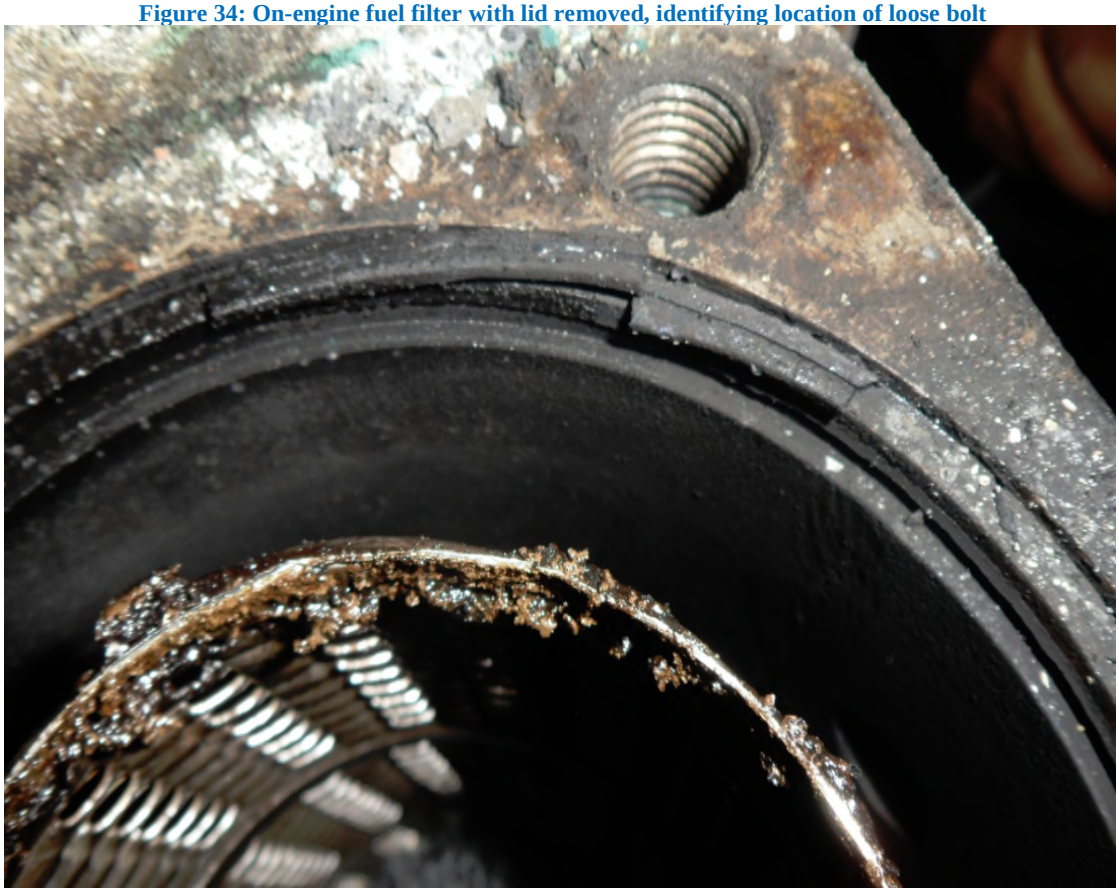
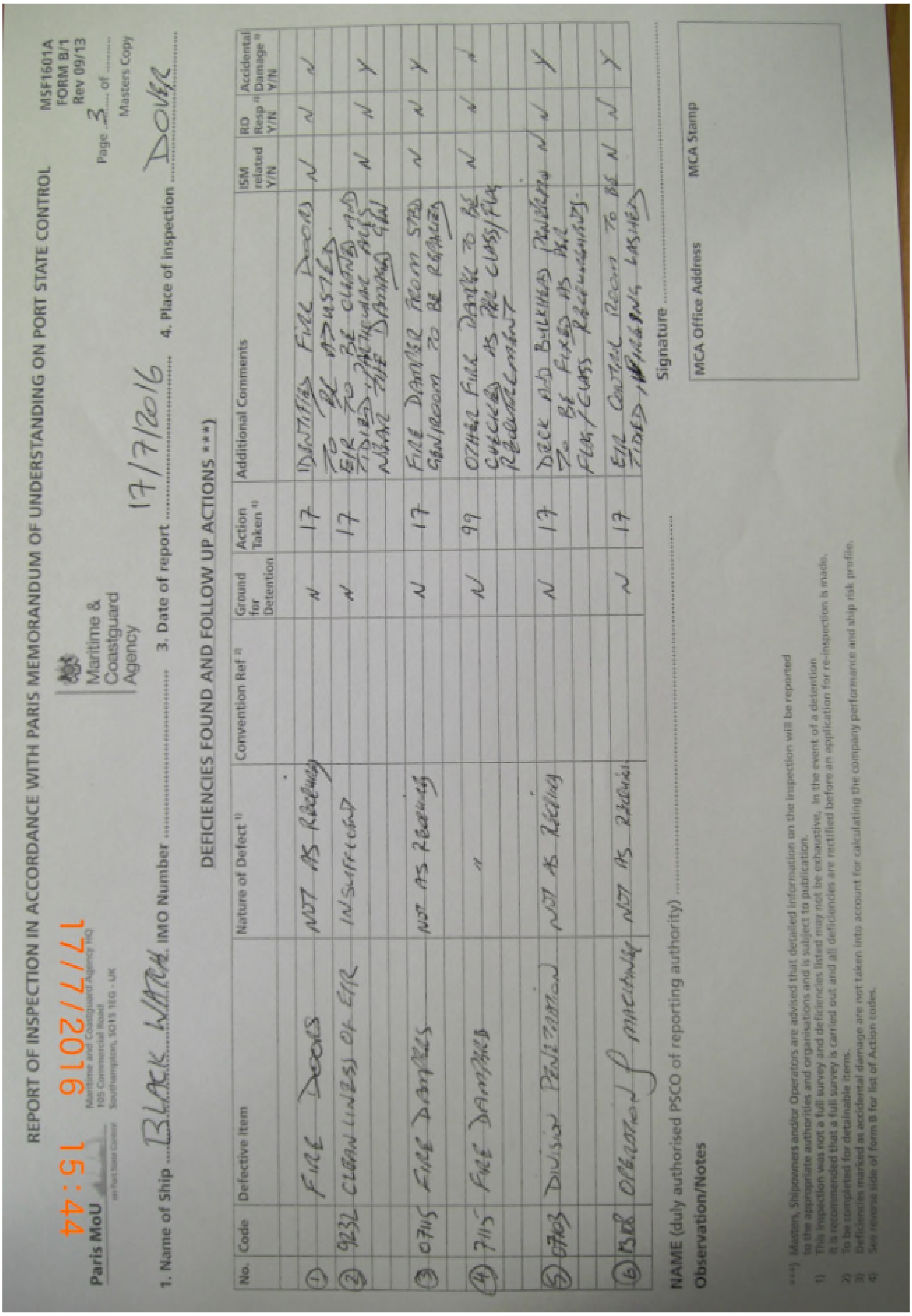


Figure 35: On-engine fuel filter damaged seal with lid removed

Appendix V: MSF1601A Form from MCA (PSC Paris MoU) Deficiencies Found and Follow Up Actions (17th July 2016)



REPORT OF INSPECTION IN ACCORDANCE WITH PARIS MEMORANDUM OF UNDERSTANDING ON PORT STATE CONTROL

MSF1601A
FORM B/1
Rev 09/13

15:44 17/7/2016

Paris MoU on Port State Control

Maritime and Coastguard Agency HQ
105 Commercial Road
Southampton, SO15 1EG - UK

Maritime & Coastguard Agency

Page 3 of ....

Masters Copy

1. Name of Ship BLACK WATCH IMO Number .... 3. Date of report 17/7/2016 4. Place of inspection DOVER

DEFICIENCIES FOUND AND FOLLOW UP ACTIONS ***)

No.	Code	Defective item	Nature of Defect [1]	Convention Ref [2]	Ground for Detention	Action Taken [4]	Additional Comments	ISM related Y/N	RO Resp [3] Y/N	Accidental Damage [3] Y/N
1		FIRE DOORS	NOT AS REQUIRED		N	17	IDENTIFIED FIRE DOORS TO BE ADJUSTED.	N	N	N
2	9232	CLEANLINESS OF E/R	INSUFFICIENT		N	17	E/R TO BE CLEANED AND TIDIED, PARTICULAR AREAS NEAR THE DAMAGED GEN	N	N	Y
3	07115	FIRE DAMPERS	NOT AS REQUIRED		N	17	FIRE DAMPER FROM STBD GEN/ROOM TO BE REPAIRED	N	N	Y
4	7115	FIRE DAMPERS	"		N	99	OTHER FIRE DAMPER TO BE CHECKED AS PER CLASS/FLAG REQUIREMENT	N	N	N
5	07103	DIVISION PENETRATION	NOT AS REQUIRED		N	17	DECK AND BULKHEAD PENETRATIONS TO BE FIXED AS PER FLAG/CLASS REQUIREMENTS.	N	N	Y
6	13108	OPERATION of MACHINERY	NOT AS REQUIRED		N	17	E/R CONTROL ROOM TO BE TIDIED, WIRING LASHED	N	N	Y

Signature ....

NAME (duly authorised PSCO of reporting authority) ....

Observation/Notes

MCA Office Address

MCA Stamp

***) Masters, Shipowners and/or Operators are advised that detailed information on the inspection will be reported to the appropriate authorities and organisations and is subject to publication.
1) This inspection was not a full survey and deficiencies listed may not be exhaustive. In the event of a detention it is recommended that a full survey is carried out and all deficiencies are rectified before an application for re-inspection is made.
2) To be completed for detainable items.
3) Deficiencies marked as accidental damage are not taken into account for calculating the company performance and ship risk profile.
4) See reverse side of form B for list of Action codes.

Appendix VI: Engine Room Fire Checklist

ENGINE ROOM FIRE CHECKLIST

Date and Place: _____

OPERATIONS	Confirm
1. Confirm location of fire	
2. Activate Low Fog system	
3. Isolate area/compartment/component - evacuate and close WTD	
4. Confirm to the Bridge "Fire in Engine Room"	
5. Call Technical Team in ECR	
6. Activate Quick Closing Valve(s)	
7. Stop Ventilation to Engine Room	
8. Isolate Electrical Power	
9. Account for Technical Team known to be in ER	
10. Inform Bridge "Ventilation and Electrical power isolated, Quick Closing valves closed and Technical support manned"	
11. If fire cannot be contained consider CO2 release	
12. CO2 Room informed to sound CO2 Alarm	
13. ECR evacuated and "Engine Room Visitor Log" is taken to CO2 Assembly Station	
14. CO2 Assembly Station (ALL Staff Accounted for)	
15. Chief Engineer requested Captains permission for CO2 release	
16. On Masters Approval - Release CO2 for Engine Room Spaces	
Notes:	

Engine Watchkeeping Officer

Name and Sign _____

Chief Engineer

Name and Sign _____