The Bahamas Maritime Authority

Marine Safety Investigation Report

into the failure of a wire sling on board the Baltic Pearl with the loss of one life

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.

Date of Issue: 26 October 2022
Bahamas Maritime Authority
120 Old Broad Street
LONDON
EC2N 1AR
United Kingdom

Contents

1. Summary

Due to restrictions imposed as a result of the coronavirus pandemic, the BMA investigation team could not travel to the vessel to gather evidence and conduct interviews. Therefore, this investigation was conducted following the hierarchy of controls recognised by IMO Circular Letter No.4204/Add.16 establishing effective safety control measures and reducing the risk to personnel. The evidence, including the witness testimonies and images used for the purpose of this investigation, was provided by the Estonian Safety Investigation Bureau.

What happened

On 13 October 2021, the Baltic Pearl was alongside the shipyard quay undergoing its scheduled five yearly inspection and survey programme. As part of the scheduled work, two main engine cylinder liners were being exchanged for spare ones located in a storage compartment in the bow of the ship. A yard shore crane would be used to carry out the exchange. Whilst lifting the second liner from the engine room, a wire sling failed, resulting in the liner falling 18 meters to the engine room below and striking two service technicians who were working in the vicinity. One sustained a serious injury and the other was killed.

Why it happened

The wire sling failed due to the slipping of an eye splice. The sling's manufacture did not meet industry standards and it had not been subject to load testing or adequate inspection. Its recorded safe working load of 3 tonnes was less than the weight of the suspended load.

There was no lifting plan or task specific risk assessment for the handling of the liners and a lack of effective controls on movement of personnel meant that workers with no knowledge of the operation being conducted above them were exposed to risk.

What can we learn

When conducting lifting operations onboard it is vital that industry best practice is followed. Those responsible for the lifting operation should ensure that the lift is planned, conducted using certified lifting equipment with sufficient strength and that all elements are checked before the lift starts.

Personnel involved in the operation should be utilised to identify all the hazards associated with the particular task in order to establish meaningful safeguards and implement an effective communication plan.

2. Factual Information

Baltic Pearl

Vessel Type	Refrigerated Cargo	**Flag**	Bahamas
Owner	Daily Select Traders S.A.	**Manager**	Ost-West-Handel und Schiffahrt GmbH
Classification Society	Russian Maritime Register of Shipping	**Gross/Net Tonnage**	10,412 / 5,253
Built	1991	**Propulsion**	Six cylinder B&W diesel. Single screw

IMO No.	Callsign	Length overall	Breadth	Moulded Depth
9008732	C6OU9	142.13	22.50	13.20

Last BMA Inspection	Last PSC Inspection
St Petersburg, Russia, 16 February 2021. No deficiencies.	Ijmuiden, The Netherlands, 09 September 2021. No deficiencies.

Crew Details

Rank/Role on board	Chief engineer	First assistant engineer	Bosun
Qualification	Chief Engineer	Second Engineer	AB deck
Certification Authority	Russia	Russia	Latvia
Nationality	Russian	Russian	Latvian
Age	58	52	63
Time in rank	15 years	4 years 9 months	14 years
Time on board	6 months	6 months	6 months

Environmental Conditions

Wind Direction	Wind Force	Wave Height	Swell Height	Precipitation / Sky	Visibility Range	Light Conditions
SW	1	0.1m	0.1m	Overcast	Good	Daylight

Voyage Details

At the time of the casualty, Baltic Pearl was berthed at BLRT Grupp yard (Tallinn Shipyard OŰ) at Vene-Bati in Tallinn, Estonia.

Narrative

All times used in this report are UTC +3.

On the 13 October 2021, the Baltic Pearl was moored alongside at BLRT Grupp yard (Tallinn Shipyard OŰ) at Vene -Bati in Tallinn, Estonia, carrying out scheduled maintenance work during its planned lay-up period through September into late October. Part of the scheduled works was the five yearly removal and overhaul of two of the main engine cylinder liners. This work would involve members of the engineering department, as well as the use of the shore side crane.

The first of the two liners had already been removed ashore using a shoreside crane and preparation was underway to transfer the second liner. In order to position the liner at an accessible point for the shoreside crane, it had to be manoeuvred by the engine room gantry crane from deck 2 to deck 3 and then aft, directly beneath the hatch opening where it would be connected to the shore crane lifting beam hook with the use of a wire sling.

Lifting of the liner was via a lifting tool and collar clamp the total weight of the suspended load was 3314kg.

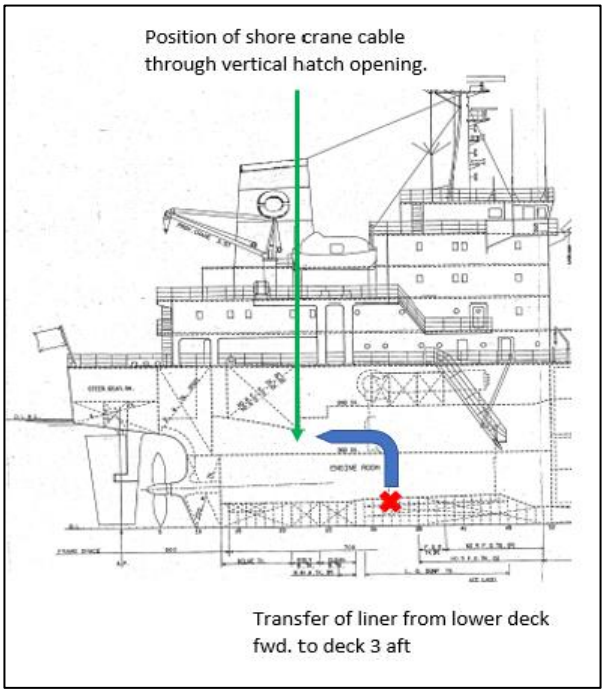


Figure 1. Relocation of cylinder liner

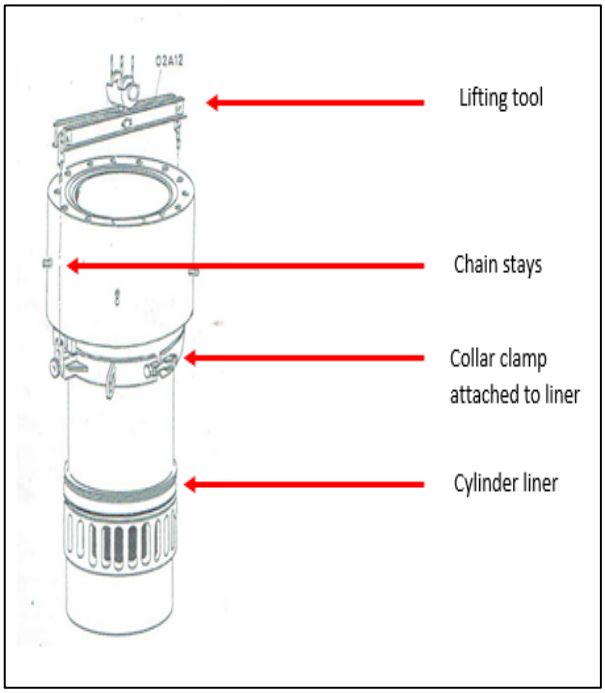


Figure 2. Complete rigging of cylinder liner

At 08:30, the chief engineer held a meeting in the engine control room with members of the engine department outlining the list of tasks scheduled for that day. As well as the removal of the cylinder liner, work included continuation of maintenance on the main engine and shaft. The removal of the cylinder liner was assigned to the first assistant engineer (1AE) to oversee.

Part of the preparation of the task involved referring to the company's safety management system, review of a cargo operation risk assessment and completion of cargo crane permit to work. Identified control measures included ensuring that no one was situated within four metres of where the item was suspended or being lifted from, a clear communication plan and the use of warning notices around the work areas.

Following the meeting, the 1AE briefed members of the removal party on the plan, the timings of when the shore crane would assist, as well as where each member of the team would be situated to oversee the safe removal of the cylinder liner to the agreed extraction point.

The shore crane's hook suspended from the lifting beam could only pass through the upper three deck openings due to the size of a permanently rigged lifting beam. It was decided that the ship would provide an 8m long wire sling to enable the lift, replicating the arrangement used for the removal of the first liner ashore and the loading of its replacement in to the engine room on 18 September 2021.

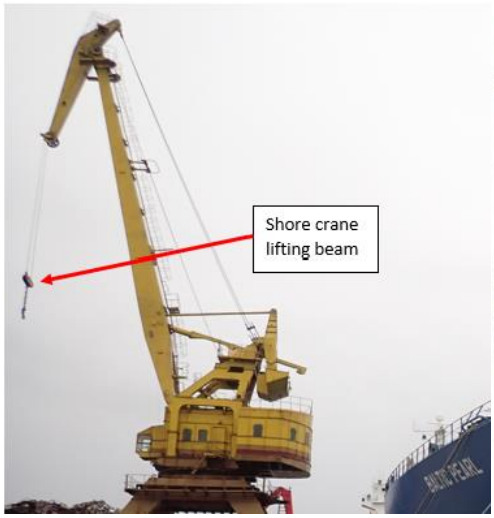


Figure 3. Shore crane

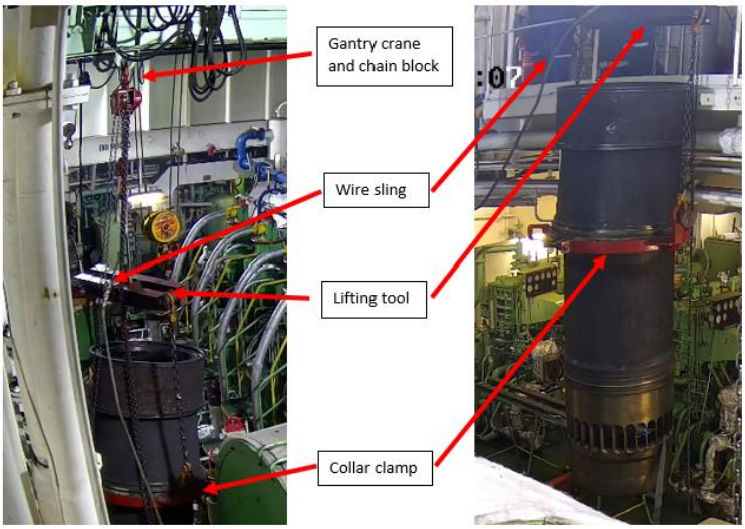


Figure 4. Liner rigged (L) and in position below hatch (R)

At the same time as preparation was being made to remove the cylinder liner, several shoreside contractors were also working in the engine room, including two engineers from Wärtsilä who were working on the shaft on deck two, aft of where the cylinder liner was being lifted to on deck three.

At 09.10 the 1AE along with two ratings rigged chain blocks to the engine room gantry crane, fastened them to the liner's lifting tool and hoisted it up to deck three. It was then repositioned aft, below the hatch opening in preparation for it to be lifted out by the shore crane. At this point the wire sling was passed up to the upper deck and connected to the shore crane hook.

A number of taglines were then rigged to the liner, to be held by the ratings positioned at various levels to prevent it from striking the ships structure as it was being lifted out.

Once the 1AE was satisfied that the liner was correctly positioned and attached to the wire sling, the taglines and crew were in their positions, the instruction was passed to the bosun situated at the upper deck opening to instruct the crane operator to take up the strain and lift gently so that the chain blocks hooks on the gantry crane could be removed.

At 09.15 the chain blocks were cleared and the order was given to the crane operator to commence lifting the liner out of the engine room. The 1AE along with the ratings and other personnel present cleared the scene and made their way to the upper decks to assist with the taglines.

At 09.17 the liner was approaching the upper deck opening when the wire sling failed. The cylinder liner fell approximately 18 metres to deck two, striking the two Wärtsilä engineers.

Approximately fifteen seconds after the sling failed, the 1AE and ratings made their way to deck two to inspect the area for damage. On arriving at the scene, the 1AE saw the two injured Wärtsilä engineers, and immediately called for assistance.

A call was made to the emergency services requesting immediate assistance.

Shortly after the call was made a team from the emergency services arrived on scene and made their way to the casualties. Five minutes later the second team arrived with a stretcher and first aid kit, followed shortly after by two further paramedics. The medical teams and paramedics removed one technician for treatment ashore but the other was declared dead.

The police were later called to attend and arrived on scene five minutes later.

3. Analysis

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

Wire sling

The wire rope sling that failed was listed as part of the ship's equipment dating to when the ship was delivered into technical management of Ost-West-Handel und Schiffahrt GmbH in 2017.

The sling had no identifiable marks, stamps or tags confirming that it had undergone a load test, nor were there any accompanying certificates of origin. The only certificate held onboard confirmed that the sling was manufactured from 18mm wire rope supplied by Daiwa Wire Rope Co. Ltd on 22 December 2015 (see Appendix 4).

As part of the planned maintenance checks, the wire slings were inspected by an onboard "commission" comprising the Chief Officer, Second Officer and Bosun. Inspection was last carried out on 28 August 2021 and all items were approved for use (full document in appendix 3).

Item	Inventory	Quantity (pcs)	Load, t	Result
1.	Wire ropes D=12 mm, L=3 m	2 (two)	1.5	Approved for using
2.	Wire ropes D=18 mm, L=5 m	2 (two)	3.0	Approved for using
3.	Wire rope D=18 mm, L=8 m	1 (one)	3.0	Approved for using

Figure 5. Extract from wire rope inspection report 28 August 2021

The wire rope was specifically kept for the purpose of exchanging main engine cylinder liners from the engine room with spare ones awaiting ashore. Prior to the casualty, the wire sling was last used on 18 September 2021 for the removal and replacement of cylinder liner 1.

Following the casualty, the wire sling could not be accounted for. Divers attended the yard where they recovered it from the water. Once recovered it was sent to a steel wire rope supplier and lifting specialist, Certex, to determine the cause of failure. (see Appendix 5)

The wire sling was inspected against the requirements of EN 13414-1:2003+A2:2008. *(Steel wire rope slings - Safety - Part 1: Slings for general lifting service)*. The inspection included the measurement of the diameter and construction of the wire rope and assessment of the wire rope, handmade eye splice and free end.

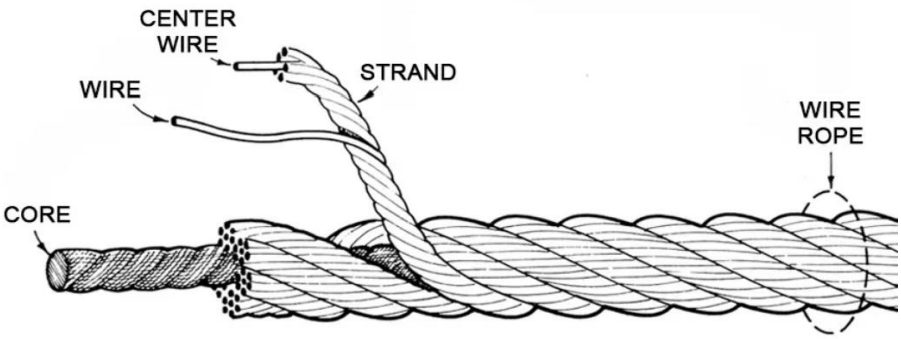


Figure 6. Composition of standard wire rope Figure

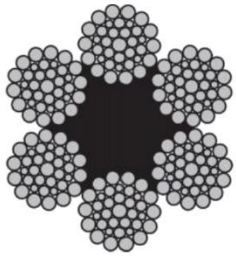


Figure 7. Sling's cross section

The wire rope was 18mm diameter with 6 x 36 construction and a fibre rope core. Whilst deformed in places (in line with use in a U-type and basket type lifts), the wire rope was found undamaged and free of breaks.

Figure 8. Recovered failed sling

The EN standard specifies the number of tucks required in a splice. For each strand, the splice shall have five load carrying tucks. At least three of the load carrying tucks shall be made with the whole strand, remainder should be made with strands comprising at least 50% of the wires. The wire rope examined did not meet any of the specified requirements:

- The splice examined comprised of 3 partial tucks and measured 20cm (figure 6). The standard minimum length for a splice with 5 tucks is 30cm (figure 7).
- All load carrying tucks inspected were made under one strand. Typically load carrying tucks are made under several strands

Some of the spliced strands' tail ends did not protrude from the splice, which indicated that the splice had begun to slip under load.

Figure 9. Correctly spliced wire with 5 tucks

Figure 10. Sling's splice with 3 tucks

For the free end, the strands diverged approximately 110cm from the bitter end, the length of the strands were equal and were free of breaks. The fibre core was removed at the point where the diverged strands met. On the basis of these observations, it was determined that the spice had pulled out under load. Certex estimated that when spliced, the sling would have a length of 7.5m – in line with shipboard records.

Figure 11. Diverged strands

Risk assessment and planning

The risk assessment covering the lifting operation was generated from Risk Assessment form Cargo-003 (see Appendix 1). It was task specific and covered actions for undertaking general cargo works and actions to be taken in the event of a person or persons falling from height.

Описание опасности Hazard Description	Последствия Failure Effects	Значение риска Risk Rating			Первоначальная категория риска Initial Risk Category	Дополнительные меры контроля Control measures to be taken	Значение риска Risk Rating			Конечный фактор риска Final Risk Category
		F	I	R			F	I	R	
1	2	3	4	5	6	7	8	9	10	11
Падение с высоты в МО, падение предметов с высоты. Нарушение правил эксплуатации грузовых устройств. Fall into a ER from a height, fall objects down from a height. Violations of regulations for cargo equipment operation.	Травмирование, повреждение судовых конструкций и оборудования. Injury, damage to ship's constructions and equipment.	3	3	9	Средний Medium	Вводный инструктаж по безопасности, использование СИЗ, выполнение правил ТБ. Грузовые работы выполняются под контролем ответственного члена экипажа согласно установленным инструкциям. Регулярно согласно планам-графикам выполняются осмотры ранцоутов, тросов, цепей, гаков, работы по их ТО. При падении человека с высоты выполняются спасательные операции, при легких повреждениях оказывается первая медицинская помощь, при тяжелых – выполняются действия по эвакуации пострадавшего с судна. При повреждении судовых конструкций и оборудования выполняется ремонт силами экипажа или береговой станции ТО. Initial safety briefing, using of individual protection means, compliance of accident prevention rules. Cargo works are performed under control of responsible officer as per established instruction. Inspections, TM, repair and replacement of spars, ropes, chains, and appliances are performed regularly according to plan-schedule. In case of man's falling from the high crew members give first aid to a casualty if he has a minor injury or take actions to evacuate a casualty from the ship if he has a severe injury. After damage to the ship's constructions and equipment repair works to be performed by crew members or a shore based repair enterprise.	1	3	3	Низкий Low

It did not consider specific detailed tasks for lifting operations. The control measures identified did not address the requirement to verify that the area was safe and free from personnel, nor was there a system of verification to ensure that the equipment was certified for use.

The safety management system required permit to work OWH 3-15-ISM to be completed for works with cargo cranes (see Appendix 2). The checklist included the requirement to ensure that a technical and operational inspection was carried out on equipment being used, that a communication system was adopted to co-ordinate and control activities, as well as the presence of an emergency plan, including the displaying of warning notices informing personnel of the planned activity.

Regardless of the hazard control measures identified in the risk assessment and contents of the checklist, there was no effective control of the area, no lifting plan, no identification of the weight on the hook, or check that all elements were of sufficient strength for the lift and no pre-use inspection of equipment.

Management of non-ship personnel

The engineering department were not aware of the presence of the Wärtsilä engineers. The engineers had been onboard the previous day, to carry out work to the main engine shaft and alignment, which included attending to the shaft bearings as part of the process, but due to unfinished work, returned early on the morning of the casualty to make up lost time and complete the works on schedule.

All movements, including the scheduling of contractors between ship and shore was carried out by the yard manager. The yard manager was responsible for the safe movement and access and egress from vessels docked at the yard. The ships personnel were not made aware of who and how many could be on board the vessel at any given time.

Due to the lack of communication from the yard manager to the ship's officers, as to the movement of contractors on and off the vessel, an opportunity was missed to effectively manage and control those contractors, prior to the lifting taking place. Ineffective communication with the ship was most likely a factor in the engineers being unaware that Wärtsilä engineers were working in an area directly below where lifting operations were taking place.

Notwithstanding the above, the team assigned to oversee lifting operation made no attempt to check beyond the immediate area of the lift prior to lifting operations commencing.

Failure to preserve evidence

Shortly after the casualty, when the shore emergency services and on scene investigators were working on board the vessel, it was noted that the sling was missing. Following several hours of searching, divers were called in and it was located in the dock bottom and retrieved onboard.

It is imperative that equipment that has failed should be left in its present state and not be removed or relocated, as understanding the mode or reason for its failure is vitally important for the industry as a whole to learn from, in order to prevent further occurrences or casualties. Appreciating the need to preserve the scene and the evidence is vital in determining the exact cause of failure.

CCTV footage recovered from Tallinn Shipyard OŰ in Vene-Bati was examined, and at 09.43 on the day of the casualty, identified something thrown into the water on the aft port side of the vessel. This was on the opposite side of where the shore side crane was operating, and directly above where divers later recovered the wire sling.

Those interviewed denied any knowledge of the wire sling being thrown into the water, it is evidential that the wire sling was purposefully removed from the scene and disposed of in an inappropriate manner .

The recovered wire sling had been tampered with to such an extent that it proved difficult to determine the exact length that was originally used for the eye splice or at what point the working end of the wire was intersected with the dead ends of the wire strands.

4. Conclusions

- A shore based service technician died and another was seriously injured when they were struck by a dropped main engine cylinder liner when a lifting wire sling failed.
- The wire sling failed because the eye splice comprised of 3 partial tucks and not the full 5 tucks as required by the standard. It was also noted that the load carrying tucks were made under one strand, and not under several strands
- The shipboard risk assessment and permit to work did not cover all hazards associated with the task but, that notwithstanding, there was no effective control of the area, no lifting plan, no identification of the weight on the hook or check that all elements were of sufficient strength for the lift and no pre-use inspection of equipment.
- The interrelation between the deck and engineering department was ineffective as work activities, record keeping and systems were not adequately synchronised as logbook entries and timings on CCTV equipment did not correspond nor were they checked or verified against actual local times.
- Control of personnel was ineffective, as the vessels crew were unaware of exactly who and how many shore side personnel were on board and where they were operating.
- The crew's deliberate disposal of the wire sling as physical evidence, rather than preserving it, resulted in it being severely compromised when recovered, prior to being sent for inspection.

5. Lessons to be learned

- When conducting lifting operations onboard it is vital that industry best practice is followed.
- Personnel involved in the operation should be utilised to identify all the hazards associated with the particular task in order to establish meaningful safeguards and implement an effective communication plan. This plan should extend to all parties including shore side operators, contractors and those responsible for oversight on board.
- All lifting equipment should be inspected prior to use, as the use of non-certificated, untested lifting equipment can prove fatal.
- In any incident where an item of machinery or component has failed, it is essential that the item is preserved, and made available for testing in order to best understand the failure so that ships crews and the industry can learn from what happened.

6. Actions taken

Wärtsilä has:

- Implemented changes to its procedures around communications during simultaneous works taking place on site

Ost-West-Handel und Schifffahrt GmbH has:

- Carried out a thorough inspection of all lifting arrangements, loose gear and slings was on board their managed vessels, and where required, those items not meeting the industry standard were removed and replaced with industry approved certified ones.
- Conducted a comprehensive review of hazardous work activities on board managed vessels, and all crew members were informed and familiarised on the new changes.
- Developed and implemented a new Risk Assessment for Safety of Sub-contractors and incorporated changes into the SMS to reflect this. All crew have been familiarised on how to use the risk assessment as part of the planning when undertaking high risk operations, that involve crew and other personnel operating within a hazardous work area.

7. Recommendations

Ost-West-Handel und Schifffahrt GmbH are recommended to:

- Implement a system to ensure that only strops and wire slings that are load tested and certificated are carried onboard.

Russian Maritime Register of Shipping are recommended to:

- Ensure that the register of all lifting equipment on board is maintained, and that it complies with their respective certification and testing during scheduled classification inspections.

Tallinn Shipyard OŰ are recommended to:

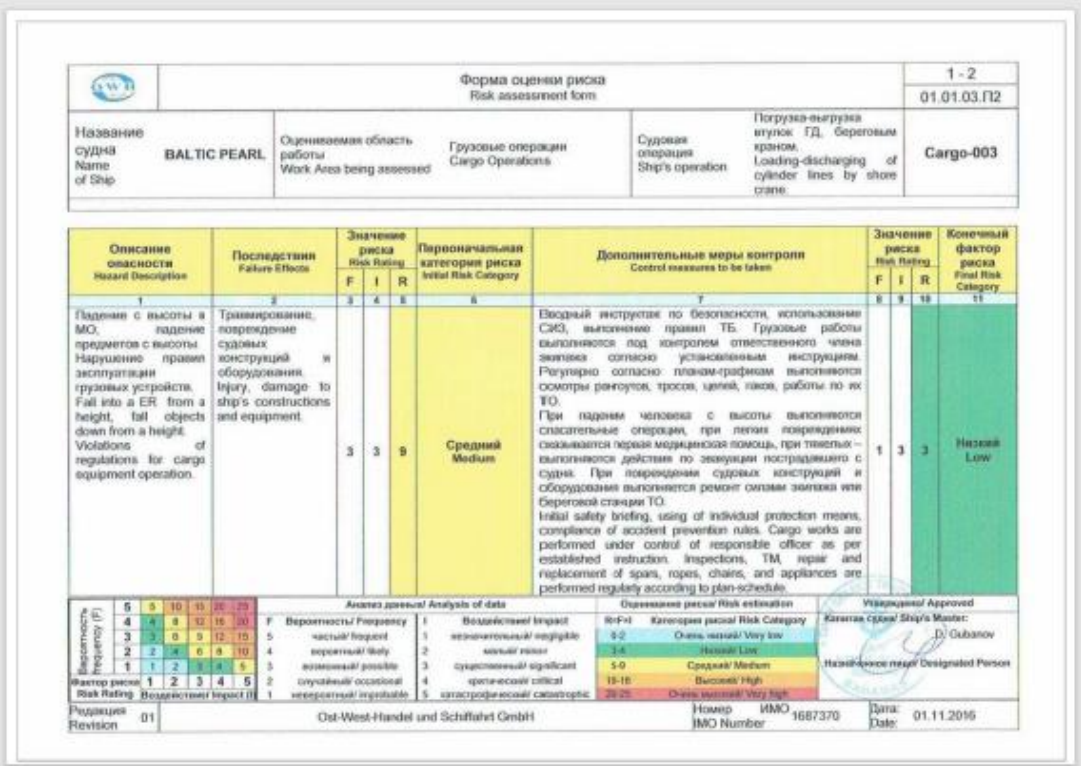
- Implement a programme to control the access and egress of non-ship personnel when vessels are berthed at the dock, as well as ensuring that a clear line of communication is established and maintained with the ship's officers regards those non-ship personnel scheduled to attend the vessel.

8. Glossary and Definitions

1AE	First assistant engineer (rank below chief engineer)
Aft	The rear of a ship, at the direction of a ship's stern
CCTV	Closed Circuit Television
Eye-splice	A splice where the working end is spliced into the working part of the wire forming a loop
Fibre core	Its primary function is to support the wire strands of the rope, maintaining them in their correct relative positions during the operating life of the rope.
Fwd	Forward on a ship means toward the direction of the bow
Kg	Kilogram
PTW	Permit to Work
RA	Risk Assessment
Tagline	A line attached to a suspended load to provide control / minimise movement of the object during lifting operations.
Tuck	A full tuck is made by inserting a dead end strand under and rotating it 360 degrees Turn around another strand in the body of the wire rope. The tucked strand is set or locked tightly. Each subsequent full turn of the dead end around a live end strand constitutes a full tuck.

Appendices

Appendix 1 Cargo Operations RA



Форма оценки риска
Risk assessment form

1 - 2
01.01.03.П2

Название судна Name of Ship	BALTIC PEARL	Оцениваемая область работы Work Area being assessed	Грузовые операции Cargo Operations	Судовая операция Ship's operation	Погрузка-выгрузка втулок ГД, береговым краном. Loading-discharging of cylinder lines by shore crane.	Cargo-003

Описание опасности Hazard Description	Последствия Failure Effects	Значение риска Risk Rating F	I	R	Первоначальная категория риска Initial Risk Category	Дополнительные меры контроля Control measures to be taken	Значение риска Risk Rating F	I	R	Конечный фактор риска Final Risk Category
1	2	3	4	5	6	7	8	9	10	11
Падение с высоты в МО, падение предметов с высоты. Нарушение правил эксплуатации грузовых устройств. Fall into a ER from a height, fall objects down from a height. Violations of regulations for cargo equipment operation.	Травмирование, повреждение судовых конструкций и оборудования. Injury, damage to ship's constructions and equipment.	3	3	9	Средний Medium	Вводный инструктаж по безопасности, использование СИЗ, выполнение правил ТБ. Грузовые работы выполняются под контролем ответственного члена экипажа согласно установленным инструкциям. Регулярно согласно планам-графикам выполняются осмотры ранцоутов, тросов, цепей, гаков, работы по их ТО. При падении человека с высоты выполняются спасательные операции, при легких повреждениях оказываются первая медицинская помощь, при тяжелых – выполняются действия по эвакуации пострадавшего с судна. При повреждении судовых конструкций и оборудования выполняется ремонт силами экипажа или Береговой станции ТО. Initial safety briefing, using of individual protection means, compliance of accident prevention rules. Cargo works are performed under control of responsible officer as per established instruction. Inspections, TM, repair and replacement of spars, ropes, chains, and appliances are performed regularly according to plan-schedule.	1	3	3	Низкий Low

Анализ данных/ Analysis of data

F	Вероятность/ Frequency	I	Воздействие/ Impact
5	частый/ frequent	1	незначительный/ negligible
4	вероятный/ likely	2	малый/ minor
3	возможный/ possible	3	существенный/ significant
2	случайный/ occasional	4	критический/ critical
1	невероятный/ improbable	5	катастрофический/ catastrophic

Оценивание риска/ Risk estimation

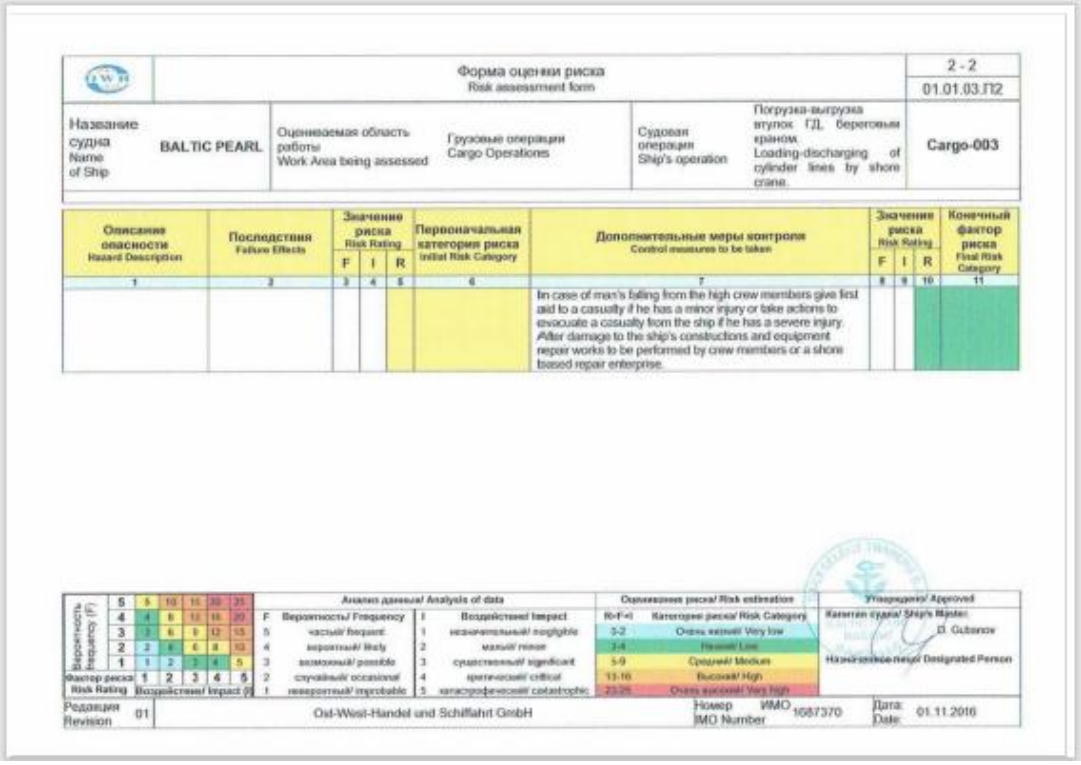
R=F×I	Категория риска/ Risk Category
1-2	Очень малый/ Very low
3-4	Низкий/ Low
5-9	Средний/ Medium
10-16	Высокий/ High
20-25	Очень высокий/ Very high

Утверждено/ Approved
Капитан судна/ Ship's Master:
D. Gubanov
Назначенное лицо/ Designated Person

Вероятность/ Frequency (F) | Фактор риска/ Risk Rating | Воздействие/ Impact (I)

5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	1	2	3	4	5

Редакция Revision	01	Ost-West-Handel und Schiffahrt GmbH	Номер ИМО IMO Number	1687370	Дата: Date:	01.11.2016



Форма оценки риска
Risk assessment form

2 - 2
01.01.03.П2

Название судна Name of Ship	BALTIC PEARL	Оцениваемая область работы Work Area being assessed	Грузовые операции Cargo Operations	Судовая операция Ship's operation	Погрузка-выгрузка втулок ГД, береговым краном. Loading-discharging of cylinder lines by shore crane.	Cargo-003

Описание опасности Hazard Description	Последствия Failure Effects	Значение риска Risk Rating F	I	R	Первоначальная категория риска Initial Risk Category	Дополнительные меры контроля Control measures to be taken	Значение риска Risk Rating F	I	R	Конечный фактор риска Final Risk Category
1	2	3	4	5	6	7	8	9	10	11
						In case of man's falling from the high crew members give first aid to a casualty if he has a minor injury or take actions to evacuate a casualty from the ship if he has a severe injury. After damage to the ship's constructions and equipment repair works to be performed by crew members or a shore based repair enterprise.				

Анализ данных/ Analysis of data

F	Вероятность/ Frequency	I	Воздействие/ Impact
5	частый/ frequent	1	незначительный/ negligible
4	вероятный/ likely	2	малый/ minor
3	возможный/ possible	3	существенный/ significant
2	случайный/ occasional	4	критический/ critical
1	невероятный/ improbable	5	катастрофический/ catastrophic

Оценивание риска/ Risk estimation

R=F×I	Категория риска/ Risk Category
1-2	Очень малый/ Very low
3-4	Низкий/ Low
5-9	Средний/ Medium
10-16	Высокий/ High
20-25	Очень высокий/ Very high

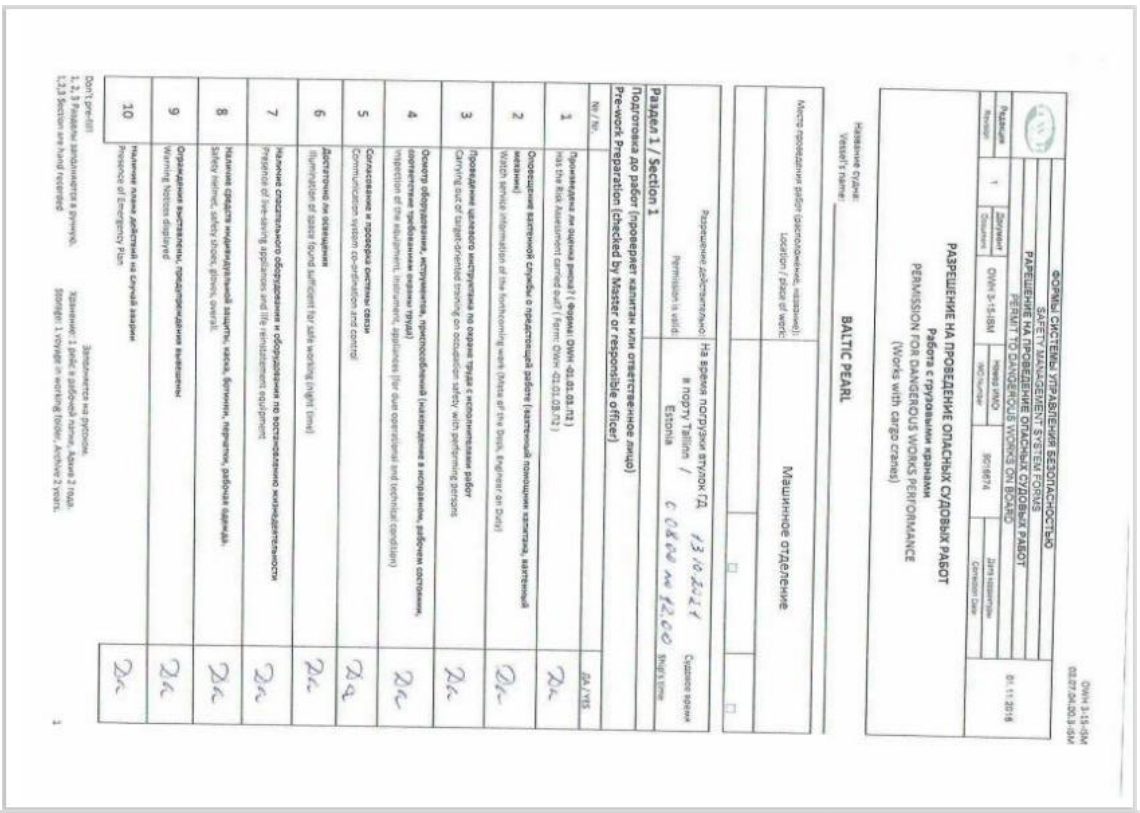
Утверждено/ Approved
Капитан судна/ Ship's Master:
D. Gubanov
Назначенное лицо/ Designated Person

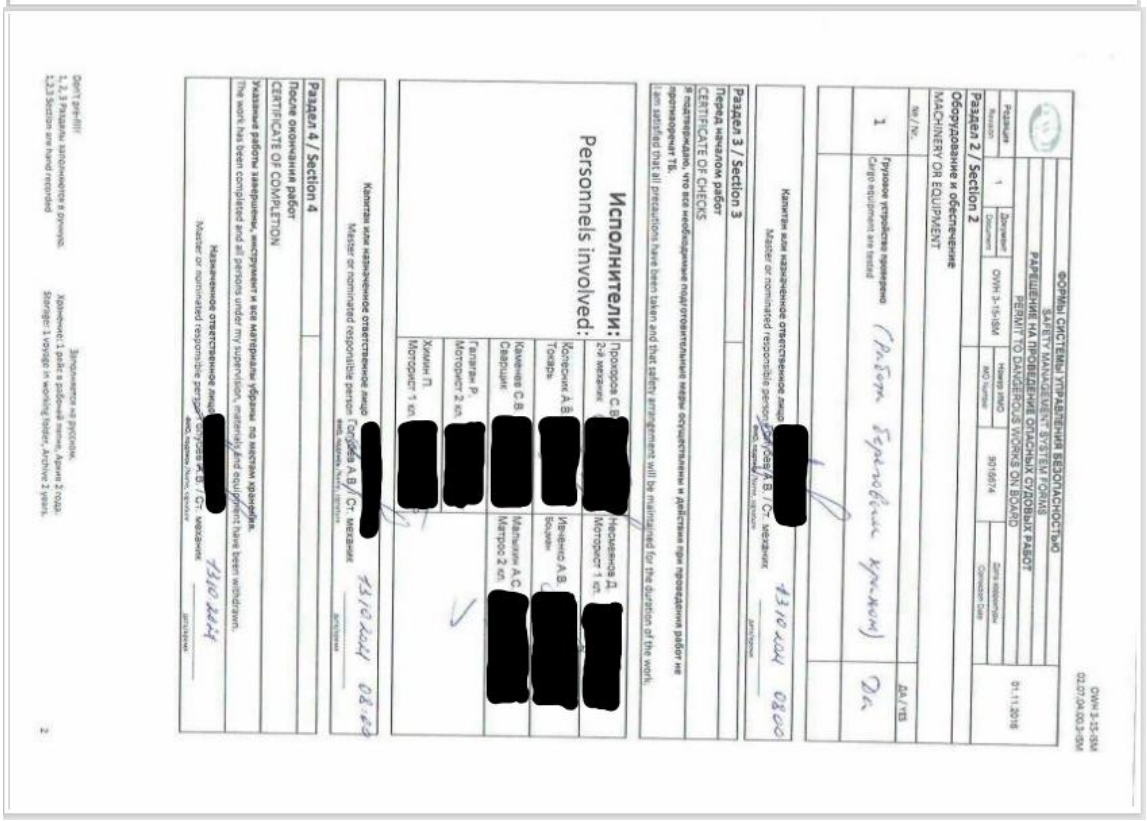
Вероятность/ Frequency (F) | Фактор риска/ Risk Rating | Воздействие/ Impact (I)

5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	1	2	3	4	5

Редакция Revision	01	Ost-West-Handel und Schiffahrt GmbH	Номер ИМО IMO Number	1687370	Дата: Date:	01.11.2016

Appendix 2 PTW for Dangerous Work





Appendix 3 Wire rope inspection report

=APPROVED=

Master of the m/v "Baltic Pearl"

[redacted]

28th August 2021

WIRE ROPES INSPECTION REPORT

This is to certify that wire ropes have been inspected by Safety Commission on the 28th of August 2021, and have been found in good condition and approved for using.

Item	Inventory	Quantity (pcs)	Load, t	Result
1.	Wire ropes D=12 mm, L=3 m	2 (two)	1,5	Approved for using
2.	Wire ropes D=18 mm, L=5 m	2 (two)	3,0	Approved for using
3.	Wire rope D=18 mm, L=8 m	1 (one)	3,0	Approved for using

The Safety Commission:

Chief mate:- [redacted]

NASSAU M/V BALTIC PEARL CHIEF OFFICER

Second mate: - [redacted]

Boatswain: - [redacted]

Appendix 4 Cert. of test and examination of wire rope

大和工業株式会社
Daiwa Wire Rope Co., Ltd
OSAKA JAPAN

2015年12月22日

御中

ワイヤロープ試験成績証明書
Certificate of Test and Examination of Wire Rope

塩化ビニール被覆ワイヤロープ
Poly Vinyl Chloride

製品番号 Mfg.No.	150828	鋼種 Material	SWRH 62A
ロープの構成 Const.of Rope	G/O 6X24	色彩 Color	青透明
公称ロープ径 Nom.Dia.of Rope	内径(mm) 16 — 外径(mm) 18		
ロープの長さ Length of Rope	500 M		
規格切断荷重 Spec. B.S.	126 KN	実際切断荷重 Actual B.S.	128 KN

以上試験した結果相違ないことを証明します。

This is to Certify that the above particulars are correct.

Daiwa Wire Rope Co.,Ltd.
No.730 Mitsumatsu,Kaizuka,597-0105,Japan
Tel.(072)-446-1137

大和工業株式会社
〒597－0105大阪府貝塚市三ッ松730番地
電話 (072)－446－1137

Signed by :
品質責任者
Manager of Inspection Branch

Appendix 5 Certex Wire rope inspection report

CERTEX
Tõste- ja koormakinnitusvahendid

Majandus- ja
Kommunikatsiooni-
Ministeerium
Ohutusjuurdluse keskus
Suur-Ameerika 1
10122 Tallinn

22.12.2021

Evaluation

According to the agreement between us, we give an assessment for the steel wire rope sling used for lifting on board of the M/V Baltic Pearl.

During the inspection, we assessed the condition and properties of the steel wire rope sling used for lifting. Thereby we performed the neccessary measurements in terms of the diameter of the steel wire rope sling and the number of wires in strands and tucks in splice

Standard requirements for steel wire rope slings:
Steel wire rope sling standard: EN 13414-1:2003+A2:2008. *Steel wire rope slings - Safety - Part 1: Slings for general lifting service CONSOLIDATED TEXT**
* - https://www.evs.ee/en/evs-en-13414-1-2003%2Ba2-2008

The characteristics of steel wire rope sling with hand spliced eyes are:
Used steel wire rope: Ø18mm construction 6x36WS+FC, according to standard EN 12385-4:2003+A1:2008 *Steel wire ropes- Safety- Part4: Stranded ropes for general lifting applications CONSOLIDATED TEXT**
*- https://www.evs.ee/en/evs-en-12385-4-2003+a1-2008

Construction 6x36WS+FC explanation:
6-number of strands
36-number of wires in each strand
WS- Warrington-Seal type strand
FC- Fiber-core
Wire rope cross section picture:

CERTEX
Tõste- ja koormakinnitusvahendid

Rope grade: 1960 N/mm²
Working load limit: WLL 3,4t / U-type lift SWL 6,8t
Rope grade: 1770 N/mm²
Working load limit: WLL 3,1t / U-type lift SWL 6,2t

It is not known from which rope grade was current steel wire rope made. If sling is with illegible markings we should assume according to the standard that rope grade is 1770 N/mm². Due to the further findings this is not relevant
Safety factor – SF 5:1

Hand splicing is covered by the standard: *EVS-EN 13411-2:2002+A1:2008 Terminations for steel wire ropes – Safety- Part2: Splicing of eyes for wire rope slings CONSOLIDATED TEXT**
*- https://www.evs.ee/en/evs-en-13411-2-2002+a1-2008

Standard specify in chapter *5.2 Number of tucks required*. For each strand, the splice shall have five series of load carrying tucks. At least three of the load carrying tucks shall be made with the whole strand, remained should be made with strands comprising at least 50% of the wires.

For lifting purposes are allowed to use slings only with proper markings.

With number of tucks corresponding to requirements Ø16mm wire rope sling example below.
The lenght of the spliced part of Ø16mm wire rope sling ca 30 cm (see photo 1)

Photo 1

CERTEX
Tõste- ja koormakinnitusvahendid

Assessment of the wire rope sling used for lifting on board the M/V Baltic Pearl

Diameter: 18mm
Construction: 6 x 36 WS+FC
Sling does not have any markings or load label tag.
At distance of 3,85m from sling eye is a U-shaped deformation, which indicates that the sling has been used for the U-type lift. Sling have four minor deformations which indicates that the sling is used on a basket type lift (see photo 2). But wire rope strands and wires were undamaged on deformed areas . Such kind of deformations occur during normal use of sling and are not relevant in this case.

Photo 2

CERTEX
Tõste- ja koormakinnitusvahendid

One end hand spliced soft eye. (see photo 3).

Photo 3

Spliced eye examination:
In spliced part from six strands only one strand with three load carrying tucks, three strands with two load carrying tucks, two strands with one load carrying tucks. Spliced part total lenght is ca 20cm.
If splicing would be made according to the norms then for Ø 18mm six strand rope customary spliced part lenght is approximately 35cm.
All load carrying tucks are made under one strand. Typically load carrying tucks are made under several strands.
Some of the spliced strands tail ends do not protrude from splice, which means that splice has begun to slip under load.

CERTEX
Tõste- ja koormakinnitusvahendid

Other end examination:
On the other end strands are diverged with lenght of 105-115cm (see photo 4).
Photo 4

Fiber core was removed away from the place where diverged strands meet. Wires lenght in strands is equal. These two facts indicate that this end has also been with hand spliced eye. When wire rope is breaking under the load, wires would be with different lenghts.
It is not possible to estimate splice lenght, neither load carrying tucks quantity, because strands are intentionally diverged or by splice slipping unwinded so that rope in eye part did not stay winded.

Wire rope sling estimated lenght when it was new and soft eyes in free state, before brakedown approximately 7,5m.
Wire rope condition between splices is without damages and there are no visible wire breaks.

Summary

Steel wire rope sling does not meet above mentioned standard, common practise of wire rope splicing method and it misses identification tag.

After examining the evidence, we conclude that the reason of the load falling was wire rope sling eye splicing slipping over. Wire rope sling eye splice slipping reason is unproperly made hand splicing, there were not enough load carrying tucks. A smaller number of load carrying tucks does not provide sufficent frictional resistance against slipping over under tension.

As the both eyes were not correctly spliced and wire rope condition between splices is undamaged , it is expedient to perform additional metallographic analyzes of the rope, which does not give any extra information for assessment of the reasons of the broken wire rope sling.

[redacted]