Report of Investigation into the electrocution of a fitter on board Hong Kong registered container ship "Maple Leaf 25" on 14 May 2015

The Hong Kong Special Administrative Region
Marine Department
Marine Accident Investigation Section

26 May 2016

Purpose of investigation

This incident is investigated in accordance with the Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (the Casualty Investigation Code) adopted by IMO Resolution MSC.255(84).

The purpose of this investigation conducted by the Marine Accident Investigation and Shipping Security Policy Branch (MAISSPB) of Marine Department, in pursuant to the Merchant Shipping Ordinance Cap. 281, the Merchant Shipping (Safety) Ordinance (Cap. 369), the Shipping and Port Control Ordinance (Cap. 313), or the Merchant Shipping (Local Vessels) Ordinance (Cap. 548), as appropriate, is to determine the circumstances and the causes of the incident with the aim of improving the safety of life at sea and avoiding similar incident in future.

The conclusions drawn in this report aim to identify the different factors contributing to the incident. They are not intended to apportion blame or liability towards any particular organization or individual except so far as necessary to achieve the said purpose.

The MAISSPB has no involvement in any prosecution or disciplinary action that may be taken by the Marine Department resulting from this incident.

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1. Summary

1.1 On 14 May 2015, the Hong Kong registered container ship "*Maple Leaf 25*" (*the vessel*) was at the anchorage in Shantou, Mainland China waiting for the delivery of a spare main engine turbocharger casing to *the vessel* by a launch for the emergency repair of the main engine prior to sailing. At about 0900, the crew had prepared the lifting appliances and tools so that they could start the work immediately once the delivery launch arrived.

1.2 When the launch berthed alongside *the vessel*, the crew used an electric hoist to lift the casing from the launch to the boat deck of *the vessel*. In addition to operating the electric hoist, a manual chain block was also used to shift the casing horizontally until it reached the boat deck aft zone. From there, the casing was lowered down into the engine room through a hatch opening, but it was stuck in the opening.

1.3 At 0930, when a fitter tried to shake the lifting chain of the electric hoist by his hands attempting to release the stuck of the casing in the hatch opening, he suffered from electric shock and lost his conscious.

1.4 The master called for medical assistance from shore. At about 1015, a rescue launch arrived and the fitter was sent to a hospital at shore. He was declared dead in the hospital on the same day.

1.5 At the time of the accident, the weather was fine with gentle breeze. The sea was calm with slight swell. The visibility was good. The ambient air temperature was about 32°C.

1.6 The investigation into the accident revealed the main contributory factors as follows:

a) a non-marine type electric hoist having an operating voltage lower than the ship's supply was used on board; in addition, it was not maintained properly and was not operated within operation limits recommended by the manufacturer during the lifting operation;

b) the risk assessment and supervision of the work were not carried out properly to ensure safety of crew;

c) electrical faults occurred in the electric hoist was due to rough handling of the equipment and there was no earth fault protection of the equipment; and

d) the pair of cotton gloves used by the deceased was wetted by sweat causing him electrocuted by electric current when he shook the lifting chain with his hands.

2. Description of the vessel

2.1 Particulars of M.V. *Maple Leaf 25*

Port of Registry	:	Hong Kong
IMO No.	:	9360348
Official No.	:	HK- 1556
Call Sign	:	VRBD8
Classification Society	:	China Classification Society
Type of Ship	:	Container Ship
Year of Built	:	2004
Ship Manager	:	Shenzhen Yong Chun International Shipping Management Co.Ltd.
Length	:	115.22 metres
Breadth	:	19.8 metres
Depth	:	8.8 metres
Gross Tonnage	:	6,249
Net Tonnage	:	2,257
Dead Weight	:	7661.2 tonnes
Engine Power	:	3,824 kW (Pielstick 8PCS-5L by Shanxi Diesel, China)
No. of Crew	:	21

Fig. 1 - M.V. *Maple Leaf 25*

3. Sources of evidence

3.1 The master and the crew of *the vessel*

3.2 Information provided by the ship management of *the vessel*

3.3 Preliminary report from P&I Club of *the vessel*

3.4 Medical death certificate

4. Outline of events

(All times were local time GMT + 8 unless otherwise stated)

4.1 On 13 May 2015, after the Hong Kong registered container ship MV "*Maple Leaf 25*" *(the vessel)* finished cargo operation at the container terminal in Shantou, China, she prepared for departure at 1900 on the same day. However, it was found that cooling water was leaking out from the main engine turbocharger casing (the casing) and the defect would affect the normal operation of the engine. There was no spare casing for immediate replacement. The sailing schedule was postponed pending a new casing to be delivered on board *the vessel* for the replacement in the port.

4.2 *The vessel* left the terminal and was towed by tugs to drop anchor at the inner anchorage in the position of 23°21N and 116°43E at about 2045 on 13 May 2015. A risk assessment of the casing replacement work was carried out by the second engineer and was approved by the chief engineer.

4.3 On the morning of 14 May 2015, a work permit for the work was issued by the chief engineer. At about 0900, crew members prepared the lifting appliances including an electric hoist and other tools for the work.

4.4 In order to minimize delay of ship sailing, crew members had to complete the work as soon as possible. When a motor launch for delivery of the spare casing (about 550 kilogram in weight) berthed alongside the starboard after quarter of *the vessel* at about 0900 on 14 May 2015, the crew members immediately started to lift the spare casing up to the boat deck of *the vessel*. After that, it was shifted by means of the electric hoist and chain block to a position at the aft zone of the boat deck which was above the engine room store access hatch (the hatch). During shifting of the casing, the electric hoist was accidentally hit against the accommodation structures two times and some of the crew members, who had physical contact with the accessories of electric hoist (e.g. the chain and hook), felt slight electric shock. However, they ignored the electric shock hazard and continued the work.

4.5 Shortly afterwards, the electric hoist was secured to a pad eye located on the deck above the boat deck and it was about 5.2 metres above the hatch opening (Fig. 2). The casing was lifted from the boat deck and subsequently lowered downward. But it was stuck in the hatch opening.

4.6 It was a hot day, about 32°C. The crew members had been working for about 30 minutes and were sweaty. The pair of cotton gloves used by the fitter were wet. At about 0930, when the fitter shook the chain of the electric hoist by his hands

attempting to move the casing which had been stuck in the hatch opening, he suffered from electric shock and lost his conscious.

4.7 The fitter was then moved to a safe position. The chief engineer immediately applied oxygen resuscitation to the fitter. The master called for medical assistance from shore. At about 1015, a rescue launch arrived and the fitter was sent to a hospital at shore. He was later declared dead in the hospital on the same day.

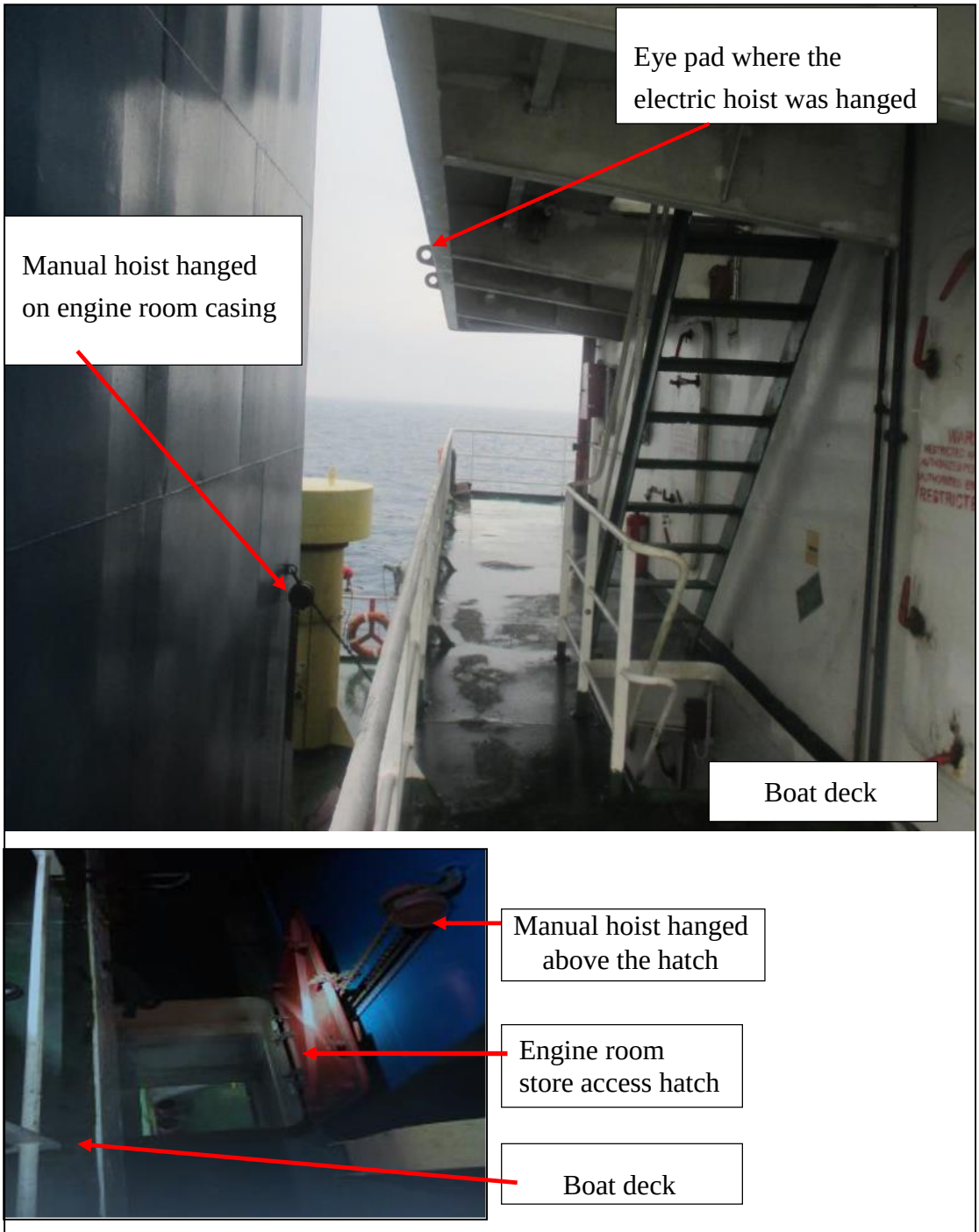

Fig.2 – Boat deck after zone and engine room store access hatch

5. Analysis

Manning of *the vessel*

5.1 *The vessel* was manned by a total of 21 mainland Chinese crew. The Minimum Safe Manning Certificate of *the vessel* required a minimum of 17 crew numbers.

5.2 The master had served as a shipmaster for more than four years. He possessed a Certificate of Competency as a master on ship issued by the People's Republic of China (PRC) valid until 6 December 2015, and a Class 1 License (Deck Officer) issued by the Hong Kong Marine Department (HKMD) on 19 August 2011. He signed on *the vessel* as a master about five months before the accident.

5.3 The chief engineer had served as a chief engineer for about two years. He possessed a Certificate of Competency as a chief engineer on ship issued by the PRC valid until 10 August 2016, and a Class 1 License (Engineer Officer) issued by the HKMD on 9 February 2015. He signed on *the vessel* as a chief engineer about four months before the accident.

5.4 The second engineer had served as a second engineer for more than 2 years. He possessed a Certificate of Competency to work as a chief engineer on ship issued by the PRC valid until 31 December 2016, and a Class 1 License (Engineer Officer) issued by the HKMD on 22 April 2015. It was his first ship serving for the Company. He signed on *the vessel* as a second engineer about one month before the accident.

5.5 The rating who assisted the engineers in the maintenance and repair of electrical equipment had served on board for about three years. He held a Certificate of Proficiency certifying him as an engine room watch rating issued by the PRC on 9 December 2014. He signed on *the vessel* for about one month before the accident.

5.6 The deceased fitter had about three years of seagoing experience. *The vessel* was his first ship serving for the Company on which he was promoted to the rank of a fitter. He joined *the vessel* about five months before the accident. He held a Certificate of Proficiency certifying him as an engine room watch rating issued by the PRC on 7 April 2015.

Working hours and Alcohol Abuse

5.7 No evidence showed that the fitter was suffered from either fatigue at work or abused of alcohol and drug.

Weather and Sea Condition

5.8 At the time of the accident, the weather was fine with gentle breeze. The sea was calm with slight swell. The visibility was good. The ambient air temperature was about 32°C.

The electric hoist

5.9 The particulars of the electric hoist (Fig.3) used in the incident were as follow : -

Maker	: Shanghai Tie Ying Co., Limited
Type	: DHS Electric Chain Hoist
Model	: YHPE
SWL	: 2 tonnes
Power Source	: 380 V/ 50Hz
Year of Manufacture	: 2013
Application	: Onshore industries

Fig.3 - the electric hoist

5.10 The electric hoist was not designed for marine use. It was not suitable for use on ship as the equipment would expose to wet and humid environment and saline atmosphere.

5.11 According to the Code of Safe Working Practice for Merchant Seafarers, electric tools used on deck should be operated from low voltage supplies, i.e. no more than 55 volts AC with maximum of 30 volts to earth or 50 volts DC. When it is not practicable to use low voltage power supplies, other precautions such as a local isolating transformer supplying one power tool only or a high-sensitivity earth leakage circuit breaker (also known as a residual current device) should be used.

5.12 The electric hoist in question was designed to operate under a power supply of 380V 50Hz. Noting that the power source on board *the vessel* was 450V 60Hz, the motor of the electric hoist would turn at a higher speed that easily led to overheating of the equipment, short circuit and earth fault.

5.13 The insulating sheathing of the electrical power cable (black colour) and the control cable (yellow colour) of the electric hoist were in damaged or deteriorated condition but were just repaired by electrical tape. The extension electrical power cable

supplying power from ship's main was connected to the electric hoist by means of a non-water-proof type circuit breaker (Fig.4), which was not suitable for use on open deck. Besides, there was no earth fault protection for the equipment.

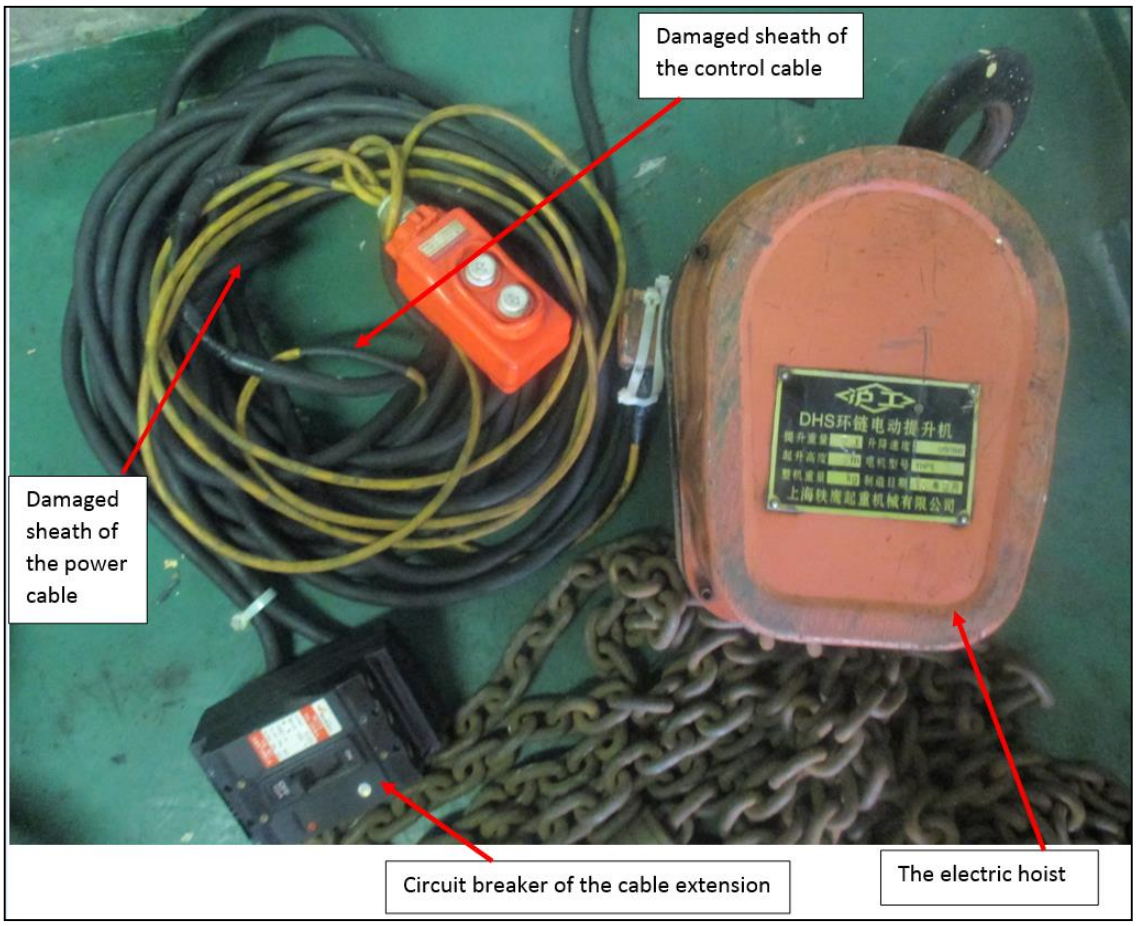

Fig.4 - Poor maintenance of the electric hoist

Operating of the electric hoist

5.14 The electric hoist was used to lift the spare turbocharger casing vertically from the launch to the boat deck. The electric hoist was rigged again at different positions to shift the casing horizontally until it reached the aft zone of the boat deck. Finally, it was used to lower the casing through the hatch opening into engine room.

5.15 According to the maker's recommendation, the electric hoist should not be used to lift a load at an angle of more than 3.5° from the vertical. Thus, the electric hoist should not be used for shifting the casing horizontally. When the casing was lowering down to the hatch opening for the engine room, the angle of the force applied to the electric hoist was about 7° from vertical.

5.16 The electric hoist was weighed about 40 kg. During handling and rigging of the equipment by the crew, the hoist struck accidentally against accommodation structures

two times. It was probably that the crew members rushed to complete the work or the equipment was too heavy to be handled by them. Rough handling of any portable electrical equipment could cause electrical faults to the equipment.

Risk assessment and supervision of work

5.17 The risk assessment and supervision of the work were not carried out properly to ensure safety of crew engaged in the work as described below : -

a) the electric hoist should not be accepted to be used on board as it was neither designed for 450V power supply of *the vessel* nor for marine use;

b) while the electric hoist was being used, the electrical power connection to the equipment was not properly arranged and the insulation of the electric cables of the hoist was not maintained in a satisfactory conditions; and

c) the electric hoist was handled roughly during work and it was operated beyond manufacturer's limits with respect to electrical power supply voltage and lifting angles.

Probable cause of the accident

5.18 Before the accident happened, some of the crew members had already noticed the abnormality that they felt minor electric shock, while they were handling the electric hoist. But they did not report to the chief engineer.

5.19 It was not sure whether the deceased fitter had the same feeling of minor electric shock before the accident happened. The pair of cotton gloves used by him was wetted by sweat while he was working under hot and humid weather, making him vulnerable to electrocution.

5.20 It was deduced that the most probable cause of the accident was due to electrical faults occurred in the electric motor of the electric hoist during operation. As there was no earth fault protection of the equipment, the cover and lifting chain of the hoist became live. When the fitter came into contact with the chain by his hands wearing wetted cotton groves, electrical current passed through his body down to ship's hull. The level of electrical current was high enough to kill him by electric shock.

5.21 Working under time pressure may have contributed to crew's reduction in alertness to electrical safety. While they were working in a hurry, the portable electric hoist was accidentally banged against accommodation structures during handling and rigging of the equipment (paragraph 5.16) and the crew ignored reporting their feeling of minor

electric shock during handling of the equipment (paragraph 5.18).

The death certificate

5.22 The death certificate issued by the hospital revealed that the fitter died from a sudden death but without specific reason. The electrocution was deduced to be the cause of the death.

6. Conclusion

6.1 On 14 May 2015, the Hong Kong registered container ship "Maple Leaf 25" (*the vessel*) was at the anchorage in Shantou, Mainland China waiting for the delivery of a spare main engine turbocharger casing to *the vessel* by a launch for the emergency repair of the main engine prior to sailing. At about 0900, the crew had prepared the lifting appliances and tools so that they could start the work immediately once the delivery launch arrived.

6.2 When the launch berthed alongside *the vessel*, the crew used an electric hoist to lift the casing from the launch to the boat deck of *the vessel*. In addition to operating the electric hoist, a manual chain block was also used to shift the casing horizontally until it reached the boat deck aft zone. From there, the casing was lowered down into the engine room through a hatch opening, but it was stuck in the opening.

6.3 At 0930, when a fitter tried to shake the lifting chain of the electric hoist by his hands attempting to release the stuck of the casing in the hatch opening, he suffered from electric shock and lost his conscious.

6.4 The master called for medical assistance from shore. At about 1015, a rescue launch arrived and the fitter was sent to a hospital at shore. He was declared dead in the hospital on the same day.

6.5 At the time of the accident, the weather was fine with gentle breeze. The sea was calm with slight swell. The visibility was good. The ambient air temperature was about 32°C.

6.6 The investigation into the accident revealed the main contributory factors as follows:

a) a non-marine type electric hoist having an operating voltage lower than the ship's supply was used on board; in addition, it was not maintained properly and was not operated within operation limits recommended by the manufacturer during the lifting operation;

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d) the pair of cotton gloves used by the deceased was wetted by sweat causing him electrocuted by electric current when he shook the lifting chain with his hands .

6.7 The safety factor was identified as follows : -

- crew worked under time pressure may have contributed to reduction in alertness to electrical safety.

7. Recommendation

7.1 The shipowners and ship management company of *the vessel* should issue safety circular to inform all masters, officers and crew on board ships of the findings of this accident.

7.2 The shipowners, the ship management company and masters of *the vessel* should take appropriate measures to ensure that-

a) electrical equipment provided on board must be suitable for marine use and cope with the supply voltage;

b) risk assessment before commencement of work must be carried out thoroughly, including the assessment of the suitability of equipment to be used, their working condition and arrangement; and

c) execution of work must be carefully planned and closely supervised to avoid damaging of equipment during work and to ensure safety of crew.

7.3 A Merchant Shipping Information Note (MSIN) should be issued to promulgate the lessons learnt from this accident.

8. Submission

8.1 In the event that the conduct of any person or organization is commented in an accident investigation report, it is the policy of the Marine Department to send a copy of the draft report, either in part or in its entirety, to that person or organization for their comments.

8.2 The draft report was sent to the shipowner/ship management company and master of *the vessel* for their comments.

8.3 No submission was received from the above mentioned parties.