



REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

ANGEL 17 CASUALTY INVESTIGATION REPORT

Electrocution of Fitter

South Pacific Ocean | 15 October 2020

Official Number: 5932

IMO Number: 9208605



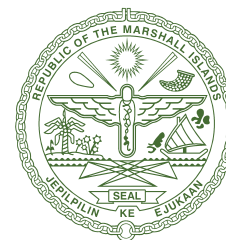
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AUTHORITY

An investigation, under the authority of the Republic of the Marshall Islands laws and regulations, including all international instruments to which the Republic of the Marshall Islands is a Party, was conducted to determine the cause of the casualty.



Maritime Administrator

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LIST OF ABBREVIATIONS

Fourth Engineer	4/E
Alternating Current	AC
American Welding Society	AWS
Chief Engineer	C/E
Coronavirus Disease	COVID-19
Cardiopulmonary Resuscitation	CPR
Direct Current	DC
International Safety Management Code	ISM Code
Maritime Labour Convention, 2006	MLC, 2006
Public Address System	PA system
Personal Protective Equipment	PPE
Safety Management System	SMS
Seafarers' Training, Certification and Watchkeeping Code	STCW Code



PART 1: EXECUTIVE SUMMARY

On 15 October 2020, the Republic of the Marshall Islands-registered oil tanker ANGEL 17, managed by Winson Shipping (Taiwan) Co., Ltd. (the “Company”), was underway in the South Pacific Ocean. The ship was bunkering fishing vessels operating in the region.

Shortly after starting the main engine, following a bunker transfer to a fishing vessel, a seawater leak was observed from the main engine cooling pump discharge seawater discharge pipe. As a result, the main engine cooling pump was isolated and the general service pump was used to supply seawater for main engine cooling. On inspection, it was found that the seawater discharge pipe of this pump was holed due to wastage. The C/E determined that the hole could be repaired by pad welding.

Following completion of a risk assessment and issuance of a Hot Work Permit, the Fitter prepared an electrical arc welder. About 40 minutes after he started welding, the Fitter was heard shouting by several nearby crewmembers. They found him lying motionless on the Engine Room tank top.

The welding leads were quickly disconnected and the power to the welder was secured. Crewmembers brought the Fitter up onto the deck plating and found that he did not have a pulse. CPR was immediately started; however, he was subsequently declared deceased by the Master.

The marine safety investigation conducted by the Republic of the Marshall Islands Maritime Administrator (the “Administrator”) identified the below factors.

1. Causal factors that may have contributed to this marine casualty:
 - (a) using an electric arc welder while standing or kneeling on a damp metal surface;
 - (b) welding while wearing damp clothing or insulating gloves, or both; and
 - (c) inadequate hazard identification and mitigation.

PART 2: FINDINGS OF FACT

The following Findings of Fact are based on the information obtained during the Administrator's marine safety investigation. Due to travel restrictions imposed in response to the COVID-19 pandemic, the Administrator was not able to arrange for onboard attendance as part of its marine safety investigation of this very serious marine casualty. All related information available to the Administrator was obtained remotely.

1. Ship particulars: *see* chart to right.
2. ANGEL 17 is an oil tanker primarily engaged in bunkering fishing vessels operating in remote areas of the Pacific Ocean.
3. On 15 October 2020, the ship was underway, about 115 nautical miles northeast of the Republic of Nauru, in the central Pacific Ocean. At 1050,¹ the main engine was stopped to allow bunkers to be supplied to a fishing vessel. The bunkering operation was completed at 1450 and the fishing vessel departed shortly after 1500.
4. At about 1520, the main engine was started. Shortly thereafter, a seawater leak was observed from the main engine cooling pump seawater discharge pipe. This pump supplies seawater from the sea chest to the main engine cooling system.
5. A general service pump was started and used to supply seawater to the main engine cooling system so that the leaking pump could be shut down without stopping the main engine. Once isolated from the system, the main engine cooling system was inspected by the crewmembers. A hole was found on the pipeline, located below the lower level deck plating of the Engine Room.
6. The C/E determined that the seawater discharge pipe could be repaired by pad welding over the corroded area. He informed the Fitter to begin preparing for welding.
7. Once secured, the main engine cooling pump, intake, and seawater discharge pipes were drained of water. Additionally, the standing water was removed from the tank top.

SMS Hot Work Requirements

8. As required by the ISM Code, the Company's SMS provided procedures for shipboard tasks such as repairing machinery, pre-task hazard identification and mitigation, issuing permits to work, and PPE use.

¹ Unless otherwise stated, all times are ship's local time (UTC +12).

SHIP PARTICULARS

Ship Name
ANGEL 17

Registered Owner
New Winstar S.A.

ISM Ship Management
Winson Shipping (Taiwan) Co., Ltd.

Flag State
Republic of the Marshall Islands

IMO No.	Official No.	Call Sign
9208605	5932	V7IF2

Year of Build	Gross Tonnage
1999	5,373

Net Tonnage	Deadweight Tonnage
2,589	8,816

Length x Breadth x Depth
108.5 x 18.2 x 9.6 meters

Ship Type
Oil Tanker

Document of Compliance
Recognized Organization
ClassNK

Safety Management Certificate
Recognized Organization
ClassNK

Classification Society
ClassNK

Persons on Board
14

9. The Company’s SMS requires that a risk assessment be completed during the work planning process and adequate controls put in place to reasonably mitigate the identified hazards. The C/E completed a risk assessment and the Master approved it before starting the hot work. This assessment identified the following risks associated with the planned welding work and the controls to be put in place to mitigate the hazards:

Identified Hazard	Control to Mitigate Hazard
Electric Shock	<ul style="list-style-type: none"> • All cables to be checked for continuity/ground • Work site to be inspected to ensure it is free of water
Personal Injury	<ul style="list-style-type: none"> • Proper illumination to be provided to avoid trips and falls • Proper PPE to be worn
Fire or Explosion	<ul style="list-style-type: none"> • Firefighting equipment to be kept on standby near the work site • Work site and surrounding area to be checked with a combustible gas detector • Combustible materials to be removed from the work site and the surrounding area • Fire watch to be posted during hot work

10. Additionally, the SMS requires issuing a Hot Work Permit before starting any work involving electric arc or gas welding, open flame torches, or any heat or spark generating tools. The Hot Work Permit must be approved by the Master and includes the following requirements specific to electric arc welding:

- (a) All welding equipment must be maintained according to the manufacturer’s instructions. Service and repair should only be carried out by a competent person.
- (b) Cables must be inspected before use. Any cables with damaged or degraded insulation must be taken out of service until repaired by a competent person.
- (c) Cable connectors must be fully insulated when connected to prevent inadvertent contact.
- (d) Electrode holders should be fully insulated so that no live part of the holder is exposed.
- (e) Gloves worn must be completely dry.
- (f) A suitably protected assistant must always be in attendance during welding operations.
- (g) The assistant must know the risks of electrical shock and how to cut off the power to the welding unit, raise the alarm, and apply first aid.
- (h) In no circumstances should a welder work while standing in water or with any body part immersed in water.

- (i) The electrode must be isolated from the supply before changing electrodes.
 - (j) The electrode must be removed when welding operations are completed or temporarily suspended.
11. The C/E completed, and the Master approved, a Hot Work Permit at about 1700 on 15 October 2020. This permit indicates that the C/E determined that the welding equipment (including cables and electrodes) was free of defects, the pump seawater discharge pipe was dry, the welder ground cable was connected directly to the pipe being welded, the required assistant was provided, and the required PPE was being worn.
12. The SMS requires a safety helmet, safety shoes, overalls, insulating gloves, and a welding helmet to be worn while welding.

Welding Equipment

13. An Osaka Denki Co. Ltd. 440-volt 300-amp AC arc welder was prepared.
14. The electrodes were AWS E6019 (mild carbon steel) type manufactured by Goodweld Corporation in September 2019. These are suitable for AC or DC welding with recommended amperages from 120 to 190, depending on the weld orientation.

Incident

15. Shortly after 1700, the Fitter began welding the holed seawater discharge pipe with an Oiler's assistance. The Fitter was reported to have been wearing the required PPE when he started welding, including insulating gloves. He was reportedly standing on the Engine Room tank top when he began.
16. At about 1740, the C/E, 4/E, and Oiler heard the Fitter suddenly shout loudly. At the time, the Oiler was positioned near the Fitter and the C/E and 4/E were in the vicinity on the lower level of the Engine Room; however, no one witnessed the incident. The C/E and 4/E quickly disconnected the welding leads from the welder while the Oiler ran to the Engine Room Workshop to switch off the power supply.
17. The Fitter was brought up from under the deck plating. He was not breathing and did not have a pulse. CPR was immediately started. He was reported to have been wearing the insulating gloves when brought up to the deck plating.
18. The Duty Officer was notified and an announcement was made over the ship's PA system. At about 1745 the remaining crewmembers carried the Fitter out onto deck using a stretcher.
19. At about 1900, CPR was stopped and the Fitter was pronounced deceased by the Master.
20. A certificate of death, issued by authorities in the Democratic Republic of Timor-Leste, indicated that the Fitter's cause of death was electrocution.
21. The welder and leads were inspected by the ship's crewmembers following the incident. No defects were noted. All insulation was intact and the welder operated properly.
22. Following the incident, the tank top was found to be free from standing water but still damp.

ANGEL 17 Crewmembers

23. ANGEL 17 had a complement of 14 crewmembers, one more than required by the Minimum Safe Manning Certificate issued by the Administrator.

24. Involved Crewmember Experience:

RANK	TIME ON BOARD ANGEL 17	TIME IN RANK	TIME WITH COMPANY	TOTAL TIME AT SEA
C/E	1 month	3.7 years	4.1 years	9.8
4/E	1 month	2.6 years	4.3 years	4.5
Fitter	4 months	0.9 years	3 years	3 years
Oiler	4 months	4.5 years	0.75 years	4.5 years

25. All involved seafarers held the appropriate Republic of the Marshall Islands-issued seafarer documentation for their positions.

26. The Administrator found no indications that any crewmembers involved with this incident failed to receive the amount of rest mandated by the STCW Code, Section A-VIII/1, paragraphs 2 and 3, and the MLC, 2006, Regulation 2.3.

27. With the exception of the Fitter, the remaining crewmembers submitted to alcohol testing after the incident. Alcohol was not detected in any tested crewmembers.

PART 3: ANALYSIS

The following Analysis is based on the above Findings of Fact.

Electrocution

At the time of his electrocution, the Fitter was pad welding a holed section of seawater discharge pipe that was below the deck plating of the Engine Room’s lower level. To access the seawater discharge pipe, the Fitter was standing on the Engine Room tank top. The Oiler, who was the assigned assistant, stood by with a fire extinguisher. He was on the lower deck plating above the Fitter. The C/E and 4/E were also on the Engine Room’s lower level deck plate. Although crewmembers were nearby, no one witnessed the Fitter’s electrocution.

The crewmembers were first alerted to the incident when the Fitter shouted. Hearing this, they immediately took action to assist him. Before going down to the tank top, they ensured that the welding leads were disconnected and power to the welder was secured.

Work Area

The seawater discharge pipe being welded was located below the Engine Room lower level deck plating. This required the Fitter to stand on the tank top, an area that can frequently become wet or damp. On the day of the incident, the seawater discharge pipe had leaked onto the tank top. The standing water was removed from the areas around the leaking seawater discharge pipe in preparing for welding. However, the area was still found to be damp following the incident.

PPE

The Company's SMS required a safety helmet, safety shoes, overalls, insulating gloves, and a welding helmet be worn while welding. Crewmembers stated that the Fitter was seen wearing the required PPE when he started. After the incident and before being moved to the deck plating the Fitter was still wearing the required PPE, including insulating gloves on both hands. Lack of PPE is not considered a causal factor of this incident.

Cause of Electrocutation

The cause of the Fitter's electrocution is not known since it was not witnessed. He had been welding for about 40 minutes before the incident.

It is possible the electrocution occurred while the Fitter was changing an electrode.

Following the incident, the immediate work area was still damp from the water that leaked from the holed seawater discharge pipe. This may have caused his insulating gloves or overalls, or both, to become damp while standing or kneeling on the tank top. If his damp clothing contacted the grounded work piece while he touched the electrode with a damp glove, electrical current could have travelled through his body from the electrode to the grounded metal.

The arc welder and leads were inspected by the C/E following the incident. Both were found in good condition with no signs of insulation deterioration. It is not likely that the electrocution resulted from direct contact with a welding lead. Additionally, the Fitter was still wearing insulating gloves when crewmembers removed him from the tank top. This indicates that contact with the electrode or electrode holder with his bare hand was not likely either.

Hazard Identification and Mitigation

Before starting the work, a risk assessment was conducted and a Hot Work Permit was issued. The permit required that the work area be free of standing water and that no body part should be submersed in water while using an electrical welder.

All standing water was removed from the tank top around the holed seawater discharge pipe before issuing the Hot Work Permit. However, the area was still damp when the welding started. This created an electrocution hazard that was likely not recognized by the involved crewmembers. To mitigate this hazard, the area could have been allowed to dry fully before starting or insulating matting could have been used to isolate the Fitter from the damp metal surfaces.

PART 4: CONCLUSIONS

The following Conclusions are based on the above Findings of Fact and Analysis and shall in no way create a presumption of blame or apportion liability.

1. Causal factors that may have contributed to this marine casualty include:
 - (a) using an electric arc welder while standing or kneeling on a damp metal surface;
 - (b) welding while wearing damp clothing or insulating gloves, or both; and
 - (c) inadequate hazard identification and mitigation.

PART 5: PREVENTIVE ACTIONS

In response to this very serious marine casualty, the Company has taken the following Preventive Actions:

1. Insulating mats have been procured and provided to all ships in the Company's managed fleet.
2. The Company's SMS has been amended to require using insulating mats for any electrical welding in wet or damp areas. The Hot Work Permit has also been updated to include this requirement.
3. The risk assessment relevant to hot work contained within the Company's SMS was reviewed and amended to include additional hazards associated with welding in damp areas.
4. A circular was sent to all ships in the Company's managed fleet to share the lessons learned from this incident.

PART 6: RECOMMENDATION

The following Recommendation is based on the above Conclusions and in consideration of the Preventive Actions taken.

1. It is recommended that the Company's SMS requirements pertaining to the periodic inspection of machinery and associated piping be reviewed and amended, as necessary, to ensure they are adequate to identify signs of deterioration before failure.

The Administrator's marine safety investigation is closed. It will be reopened if additional information is received that would warrant further review.