



REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

STI WINNIE CASUALTY INVESTIGATION REPORT

Fatal Electrocution of the Electrician

Arabian Gulf | 2 May 2019

Official Number: 5511

IMO Number: 9696709



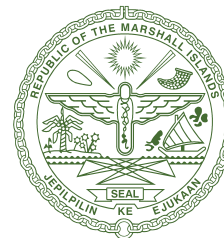
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AUTHORITY

An investigation under the authority of Republic of the Marshall Islands laws and regulations, including all international treaties, conventions and 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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PART 1: EXECUTIVE SUMMARY

On 2 May 2019, the Republic of the Marshall Islands-registered oil tanker STI WINNIE, managed by Scorpio Marine Management (India) Private Limited (the “Company”), was underway in the Arabian Gulf.

During maintenance on the inert gas (IG) scrubber pump starter panel, the Electrician was electrocuted. The Electrician, who had been working alone, was unresponsive when found by crewmembers. His head and hands were inside a local group starter panel (LGSP) cabinet. The Electrician was provided first aid, however, he was pronounced deceased.

What occurred immediately before the Electrician was fatally electrocuted cannot be determined exactly. Presumably he inadvertently touched the live 440 volt (V) power terminals in the cabinet’s lower section. He was probably attempting to retrieve a dropped contactor spring and cover locking pin.

The Republic of the Marshall Islands Maritime Administrator’s (the “Administrator’s”) marine safety investigation identified the following causal factors and an additional safety issue:

1. Causal factors that contributed to the fatal electrocution of the Electrician include:
 - (a) failure to de-energize the 440 V electrical input contained within the lower section of the LGSP cabinet before attempting to retrieve the contactor spring and cover locking pin;
 - (b) failure to comply with the requirements of the Company’s Safety Management System (SMS) with regards to work planning, pre-task hazard identification, and Permit to Work procedures;

- (c) no clear communication between the Electrician and First Assistant Engineer (1AE) regarding the commencement of the maintenance of the starter panel;
 - (d) ineffective onboard implementation of the Company's Stop Work Authority policy when the 1AE failed to ensure the Electrician complied with the requirements of the SMS before working on the IG scrubber pump starter contactor;
 - (e) lack of a physical barrier within the LGSP cabinet to separate the upper section (which contained the IG scrubber pump starter contactor) and the lower section (which contained the 440 V power terminals);
 - (f) lack of a fixed guard covering the exposed 440 V power terminals within the lower section of the LGSP cabinet; and
 - (g) lack of a warning label on the cover of the LGSP cabinet's lower section, which contained the 440 V power terminals.
2. An additional identified safety issue, not contributing to the electrocution, was the improper response to the suspected electrocution. The Trainee Marine Engineer (TME) immediately pulled the Electrician from the LGSP cabinet without ensuring that power was secured or that the Electrician's body was not energized.

PART 2: FINDINGS OF FACT

The following Findings of Fact are based on the information obtained during the Administrator's marine safety investigation.

1. Ship's particulars: *see* chart to right.
2. On 2 May 2019, STI WINNIE was underway in the Arabian Gulf, proceeding towards Ras Laffan, Qatar for loading.
3. Before starting work on the morning of 2 May 2019, the 1AE held a Toolbox Talk to discuss the work planned for that day. The Electrician mentioned that he might work on the IG scrubber pump starter panel, but did not specify the items to be completed, nor the timeframe for the work.

SHIP PARTICULARS

Ship Name
STI WINNIE

Registered Owner
STI WINNIE Shipping
Company Limited

ISM Ship Management
Scorpio Marine Management
(India) Private Limited

Flag State
Republic of the Marshall Islands

IMO No. 9696709	Official No. 5511	Call Sign V7EP8
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Length x Breadth x Depth
248.7 x 43.0 x 21.8 meters

Year of Build 2015	Gross Tonnage 64,677
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Net Tonnage 33,042	Deadweight Tonnage 109,999
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Ship Type
Oil Tanker

**Document of Compliance
Recognized Organization**
American Bureau of Shipping

**Safety Management Certificate
Recognized Organization**
American Bureau of Shipping

Classification Society
American Bureau of Shipping

Persons on Board
23

4. After the Toolbox Talk, the Electrician conducted a general round of the Engine Room. It was reported this was part of his normal daily routine. This included inspecting various electrical equipment throughout the machinery spaces.
5. At about 1130¹ on 2 May 2019, the TME spoke with the Electrician while on the Engine Room bottom platform. The Electrician told the TME that he would be working on the IG scrubber pump starter panel.

Inert Gas Scrubber Pump Starter Panel

6. The IG scrubber pump starter panel was inside a LGSP cabinet located on the Engine Room's bottom platform.
7. The LGSP cabinet has several sections. The upper parts are starter controls for various machinery and the lower part contains the 440 V power terminals (*see Figure 1*).

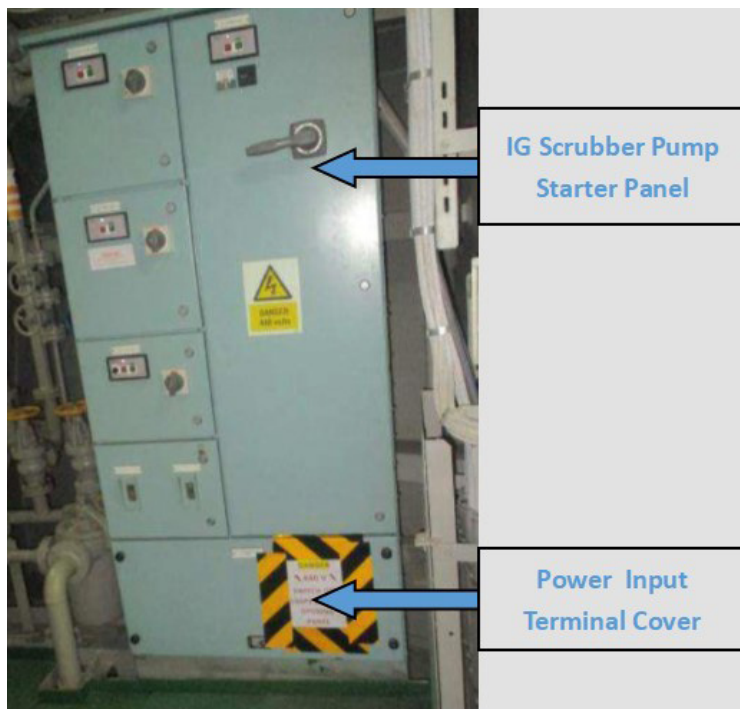


Figure 1: LGSP cabinet with all covers in place. The warning label on the lower panel was added after the incident.

8. The door covering the panel opens outward with hinges on the left side. The cover over the power terminals is fully removable (*see Figure 2*).

¹ Unless otherwise stated, all times are ship's local time (UTC + 4).

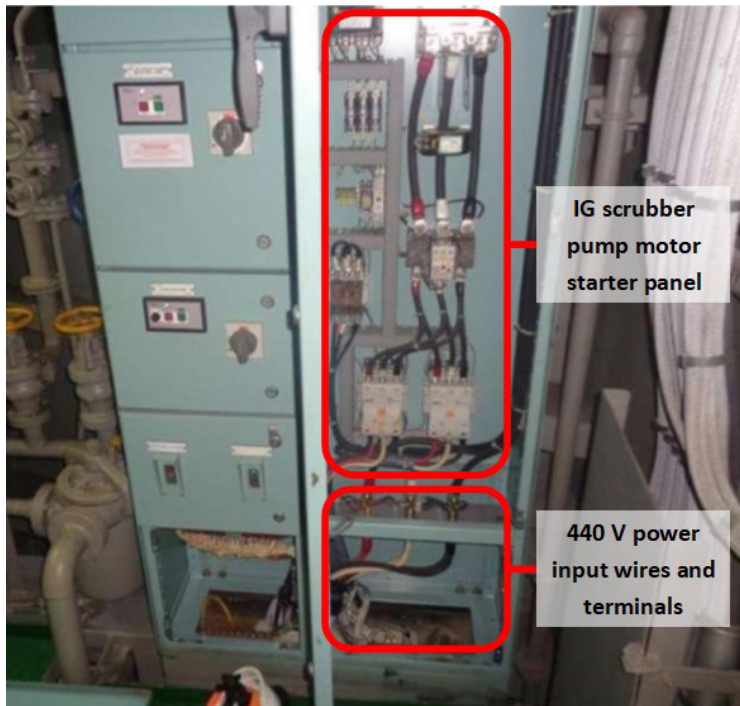


Figure 2: LGSP cabinet with IG scrubber pump starter panel open and power input terminal cover removed.

9. Inside the LGSP cabinet, there was no divider between the upper section, containing the contactors, and the lower section, with the 440 V power terminals. Inside the lower panel, the three power cable terminals did not have guarding.²

Incident

10. At 1144, the Engine Control Room (ECR) received a “Main Switch Board Abnormal” alarm, indicating “440 V Low Insulation”. At the time of the alarm, the 1AE, Third Assistant Engineer (3AE), and TME were in the ECR. The alarm was immediately acknowledged, and the cause investigated. The Engineers could not identify the cause of the alarm.³
11. At about 1150, the 1AE told the TME to tell the Electrician to investigate the alarm’s cause. The TME went to the Engine Room’s bottom platform, where he had last seen the Electrician.
12. On arriving at the LGSP cabinet, the TME saw the Electrician lying on the deck with his head and hands inside the lower section. He stated that he called the Electrician’s name and received no response (see Figure 3).

² All other starter cabinets installed on STI WINNIE had a horizontal divider to separate the contactors from 440 V power cables. Also, all other starter cabinets had covers over the power terminals to prevent accidental contact.

³ The Chief Engineer (C/E), 1AE, Second Assistant Engineer (2AE), and 3AE later stated that they were not aware at the time that the Electrician was working in the LGSP cabinet.



Figure 3: Location of the Electrician when found by the TME.

13. Then the TME removed the Electrician from the LGSP cabinet by pulling on his safety shoes. He reported that the Electrician was unconscious and remained unresponsive after being pulled away from the LGSP cabinet.
14. The TME went to the No. 4 generator, where the 2AE and Motorman were working. He told them of the incident and went to the ECR.
15. Immediately, the 2AE and Motorman went to the bottom platform and found the Electrician lying on the deck in front of the LGSP cabinet. They moved him further away from the open LGSP cabinet and found that he had no pulse. They started cardiopulmonary resuscitation (CPR).
16. At 1200, the 1AE reset the “440 V Low Insulation” alarm from the ECR. Shortly after resetting the alarm, the TME arrived at the ECR and told the 1AE and 3AE of the incident. The 3AE then called the C/E, who at the time was in his cabin completing paperwork.
17. The C/E notified the Master, who went to the Bridge and directed the Third Officer (3/O) to raise the general alarm. The 3/O did so and announced on the public address system that there was a medical emergency on the Engine Room bottom platform.
18. The Master and C/E both went to the bottom platform. At about the same time, other crewmembers began arriving at the Electrician’s location with emergency medical equipment. CPR continued, but the Electrician remained without a pulse.

19. After notifying the Company and local authorities, the ship was directed to divert to Khawr Fakkan, United Arab Emirates. At 1836 on 2 May 2019, the Electrician was transported ashore. He was subsequently pronounced deceased by the shoreside medical personnel.
20. A postmortem examination in the United Arab Emirates found that the Electrician had electrical burns to his hands and forehead. The cause of death was determined to be consistent with electrocution.

Incident Scene

21. When the Electrician was found, the door for the IG scrubber pump starter panel was fully open. Also, the lower panel (covering the 440 V power terminals) had been removed and placed to the left of the LGSP cabinet (*see Figure 3*).
22. The Electrician's tool bag, various tools, safety helmet, and rubber gloves were spread on the deck in front of the LGSP cabinet (*see Figure 4*).

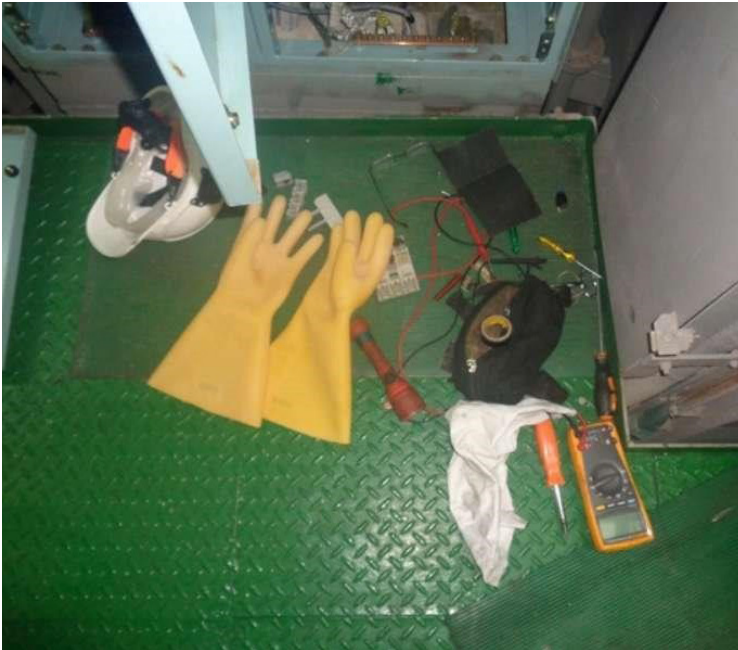


Figure 4: Tools and safety helmet, on deck, where Electrician was found.

23. After the incident, the main circuit breaker supplying power to the pump starter was found in the off (open) position. This breaker is inside the IG scrubber pump starter panel.
24. The star contactor for the pump starter was missing a spring and cover locking pin when examined after the incident (*see Figure 5*).



Figure 5: IG scrubber pump starter contacts and the missing star contactor spring.

25. The missing star contactor spring was found on the LGSP cabinet's lower framing, resting against a ground buss bar. The star contactor cover locking pin was on the deck, under the buss bar (see Figure 6).

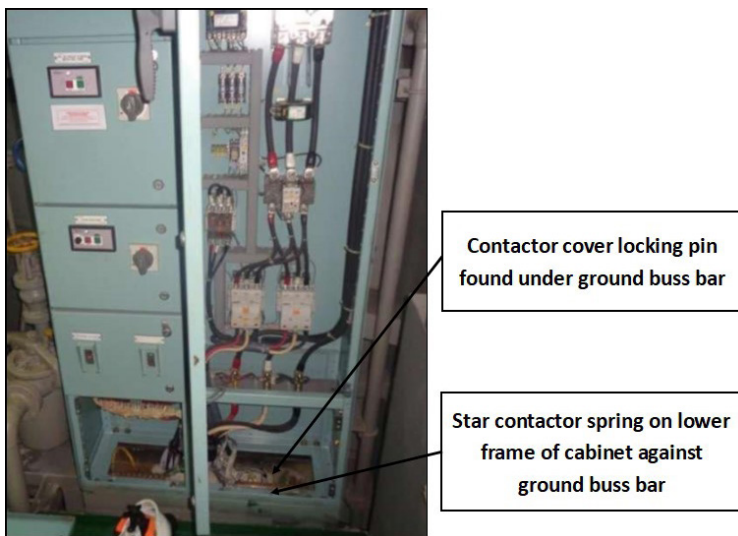


Figure 6: Location where the star contactor spring and contactor cover locking pin were found.

Safety Management System (SMS)

26. As required by the ISM Code⁴, the Company's SMS provided procedures for shipboard tasks. These included requirements for using personal protective equipment (PPE), conducting pre-task hazard assessments, pre-task briefings (also known as Toolbox Talks), and issuing a Permit to Work when maintaining and

⁴ The International Maritime Organization's (IMO's) International Management Code for the Safe Operation of Ships and for Pollution Prevention (International Safety Management (ISM) Code).

repairing electrical equipment. They also included a requirement that planned work be scheduled at least one day in advance to allow adequate time for completing the safety procedures required by the SMS.

27. The Company's SMS included a Permit to Work specific to systems of 450 V and below. Among other items, this permit required completing a risk assessment, the power supply be locked out and tagged out⁵, a second person assigned to be present during work, and completing a Toolbox Talk.
28. On 27 April 2019, the Electrician documented as completed the three-month planned maintenance for the IG scrubber pump starter panel. Before this work commenced, a Permit to Work was completed and a risk assessment conducted. The Electrician signed the Permit to Work as the "person carrying out the work" and the IAE completed the risk assessment.
29. The Company's SMS also included the requirement for all new crewmembers, on joining the ship, to complete familiarization training. This included familiarization with the Company's SMS and how to access the associated procedures. The training program included a specific requirement to discuss the importance of conducting Toolbox Talks and pre-task hazard assessments. The Electrician completed the Company's initial familiarization training program on 12 March 2019.
30. The PPE matrix in the Company's SMS required wearing a safety helmet, safety boots, coveralls, and gloves when doing electrical work. The SMS also required hearing protection when working in the machinery space.
31. The Company's SMS included a Stop Work Authority policy. This provided the authority to all crewmembers and required them to take positive action to intervene whenever unsafe acts or conditions were observed. The policy also included a process for submitting anonymous reports to the Company regarding unsafe actions and conditions.

Crew Experience and Rest Hours

32. The IAE had over three years of shipboard experience, with almost two years in rank. He had sailed with the Company for two years and had been on board STI WINNIE for less than one month.
33. The Electrician had been sailing on merchant ships since 2013 and was on his third contract on sister ships with the Company. Before this, the Electrician served as an Electrician in the Indian Navy for 27 years. He had been on board STI WINNIE for about two months.
34. The Administrator found no indications that any crewmembers involved with this incident had failed to get the amount of rest mandated by the IMO's Seafarers Training, Certification and Watchkeeping (STCW) Code, Section A-VIII/1, paragraphs 2 and 3 and the International Labour Organization's Maritime Labour Convention, 2006 (MLC, 2006), Regulation 2.3.
35. Following the incident, all involved crewmembers were tested for drugs and alcohol; neither substance was detected. Postmortem drug and alcohol testing did not indicate their use by the Electrician at the time of the incident.

⁵ The Company's Lock Out/Tag Out procedures required that all potentially harmful energy in and around the work area be de-energized, locked in the off position, and tagged with a warning before starting work.

PART 3: ANALYSIS

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

After the incident, the star contactor for the IG scrubber pump starter was missing a spring. This contactor is in the upper part of the LGSP cabinet. The missing spring was found resting on a ground buss bar in the cabinet's lower section.

The cover locking pin for the star contactor was found on the deck, behind the ground buss bar (within the cabinet's lower section). This indicates that the Electrician was likely working on the star contactor before the incident. While attempting to retrieve the spring and cover locking pin, it is likely he removed the lower panel's cover, which covered the 440 V power terminals.

Although what occurred immediately before his electrocution cannot be determined since there were no witnesses, it is presumed that the Electrician inadvertently touched the energized power terminals while retrieving the star contactor spring or cover locking pin.

IG scrubber pump starter panel maintenance was scheduled for completion every three months. The last maintenance was on 27 April 2019, when the contactors were reported as checked and cleaned. It is not known why the Electrician determined that it was necessary to work on the same contactors only six days after the last maintenance. After the incident, an examination indicated that the star contactor may not have been overhauled on 27 April 2019, as indicated by maintenance records.

Power Isolation

The main power breaker for the IG scrubber pump starter was in the off (open) position after the incident. This de-energized the electrical equipment in the pump starter panel. By design, the pump starter panel door can only be opened after turning the power lever to the off position. However, the 440 V power cables and terminals in the cabinet's lower section were still energized when the Electrician was found.

Electrical Equipment Protection

The LGSP cabinet was divided into two sections. The upper has various contactors and the lower encloses the 440 V power terminals. The design of the LGSP cabinet that the Electrician was working in did not have a physical barrier between the two sections, nor was one installed at the time of the incident.

All other starter cabinets in STI WINNIE's Engine Room have a physical divider between the contactor and power sections. Other electrical cabinets in the Engine Room also had guarding installed over any exposed terminals to prevent inadvertent contact.

A divider between the upper and lower parts of the cabinet might have prevented the star contactor spring and cover locking pin from falling into the lower section. This would have avoided the need for the Electrician to remove the cover for the cabinet's lower section.

Safe Work Practices

The Company's SMS required completing a formal risk assessment before work of this nature. No crewmember completed a risk assessment before work began on the pump panel. Completing this might have identified the hazards of working in the cabinet which included the 440 V power cables and terminals.

The SMS required the C/E to complete and approve a Permit to Work before work began on electrical equipment. A key condition for issuing a permit included implementing Lock Out/Tag Out procedures. These required de-energizing circuits and equipment in and around the work area. It is presumed that the Electrician secured power to the IG scrubber pump starter panel, but he failed to secure the 440 V power input to the cabinet before trying to recover the dropped spring and cover locking pin.

The SMS required completing a Toolbox Talk after issuing a Permit to Work, but before work begins. This was not done before the Electrician worked in the cabinet. After the incident, the engineering officers reported they were not aware that the Electrician was completing this work and thus, had not completed a Toolbox Talk with him.

The SMS and Permit to Work required a second crewmember to be present when working on electrical equipment. The Electrician was working alone when the incident occurred and had not requested another crewmember's assistance.

During the IG scrubber pump starter panel maintenance on 27 April 2019, a risk assessment was completed and a Permit to Work was issued before work commenced. The 1AE completed the risk assessment and the Electrician signed the Permit as the Responsible Officer. This indicates that both crewmembers were aware of the SMS requirements regarding electrical work.

Actions to Prevent Unsafe Acts

On the morning of the incident during the planning meeting, the Electrician mentioned to the 1AE that he might work on the starter panel at some point during the day. The Company's SMS required that all scheduled work be planned at least one day in advance to allow adequate time for completing the required safety procedures. However, the 1AE did not question the Electrician, nor did he act to prevent him from doing this work, which had not been previously planned.

Before working, the Electrician told the TME that he was preparing to work in the starter panel. The TME did not question the Electrician about the work, nor did he tell any other engineering officer.

The Company had developed and implemented a Stop Work Authority policy, which required that all crewmembers take action to prevent unsafe acts or conditions when observed. The 1AE and TME failed to act to prevent the Electrician from working without complying with the requirements in the Company's SMS.

Hazard Communication

The panel's upper door had a warning sign about the 440 V shock hazard. The lower panel cover had no attached notice warning of the exposed 440 V power terminals. A warning label on the lower panel cover may have prevented the Electrician from opening the cabinet without de-energizing the power.

Risk Perception

The Electrician had served in that capacity for over 32 years at the time of the incident. It is likely that he did not perceive the work as high risk, due to the job's routine nature—it was scheduled to be completed every three months.

Electrocution Response

When the TME found the Electrician lying on the deck with his hands and head inside the LGSP cabinet, he immediately pulled him out by grabbing his boots. However, he did not ensure that the power was secured or that the Electrician's body was not energized due to contact with the live terminals. In this specific incident, the TME did not receive an electrical shock when removing the Electrician, however, there was a potential that he could have also been electrocuted while pulling him out of the cabinet.

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 contributed to the fatal electrocution of the Electrician include:
 - (a) failure to de-energize the 440 V electrical input in the LGSP cabinet's lower section, before attempting retrieval of the contactor spring and cover locking pin;
 - (b) failure to comply with the Company's SMS requirements with regards to work planning, pre-task hazard identification, and Permit to Work procedures;
 - (c) no clear communication between the Electrician and 1AE regarding the commencement of the maintenance of the starter panel;
 - (d) ineffective onboard implementation of the Company's Stop Work Authority policy when the 1AE failed to ensure the Electrician complied with the SMS requirements before working on the pump starter contactor;
 - (e) no physical barrier within the LGSP cabinet to separate the upper section (which contained the IG scrubber pump starter contactor) and the lower section (which contained the 440 V power terminals);
 - (f) no fixed guard covering the exposed 440 V power terminals, within the lower section of the LGSP cabinet; and
 - (f) no warning label on the cover of the LGSP cabinet's lower section, containing the 440 V power terminals.

2. An additional identified issue, which did not contribute to the fatal electrocution, was the improper response to the suspected electrocution when the TME immediately pulled the Electrician from the LPSG cabinet, without ensuring that power was secured or that the body was not energized.

PART 5: PREVENTIVE ACTIONS

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

1. A safety bulletin was immediately sent to all ships within the Company's managed fleet which detailed the circumstances of the incident.
2. All high-voltage electrical panels installed on all Company-managed ships, were inspected to ensure that adequate warnings were posted. Also, all electrical cabinets were inspected to ensure that adequate physical barriers and guarding were in place.
3. A system for preventing access to high voltage panels without proper authorization is being implemented for all ships in the Company's managed fleet.
4. An internal ISM audit of STI WINNIE was arranged by the Company to ensure that the procedures contained in the SMS were properly implemented onboard.
5. SMS procedures relating to unplanned work, pre-task risk assessments, Permit to Work, and crew training matrix were updated to include additional requirements for Electricians.
6. The Company has amended their procedures to ensure that Electricians are included in shoreside crew training seminars.
7. The Company conducted a review of the maintenance intervals for all starters to ensure they accurately reflected the needs based on frequency of use and power drawn.
8. The Master, C/E, and IAE will be briefed on the results of the Company's investigation before assignment to their next ships.
9. The lessons learned from this incident were shared with all ships in the Company's managed fleet and other interested parties.
10. The lessons learned will be reviewed during future crew training seminars, safety officer training courses, and pre-joining briefings.

PART 6: RECOMMENDATIONS

Having considered the Preventive Actions taken by the Company, the Administrator has no further Recommendations.

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