DSM 2023

Presented by:
Vasudev Ramachandra

Ignition Prevention

Guidelines and solutions for safe electrical connections

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Problem Description

LASH FIRE

Electrical fires – Reefers

- Two thirds of all fires in ro-ro spaces are electrically induced, mainly caused by refrigerated units connected to the ship.

- The aim is to develop better solutions and guidelines for safe electrical power connections of reefer units to eliminate electrically caused fires and to predict them beforehand to take timely corrective actions.

Problem Description

LASH FIRE

Safe charging of electric vehicles (EVs)

- The necessity to create a charging infrastructure for EVs on board is increasing but standards for the same are not set.

- The aim is to develop solutions and guidelines for safe electrical power connections of EV charging infrastructure to eliminate electrically caused fires and to predict them beforehand to take timely corrective actions.

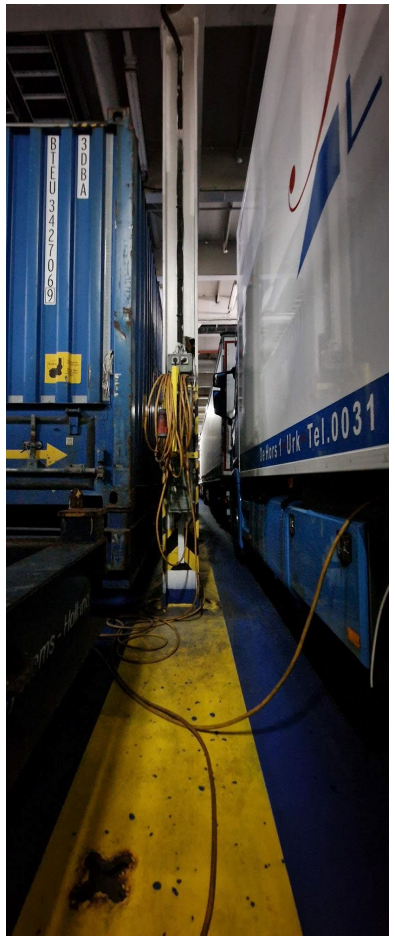
Problem Description

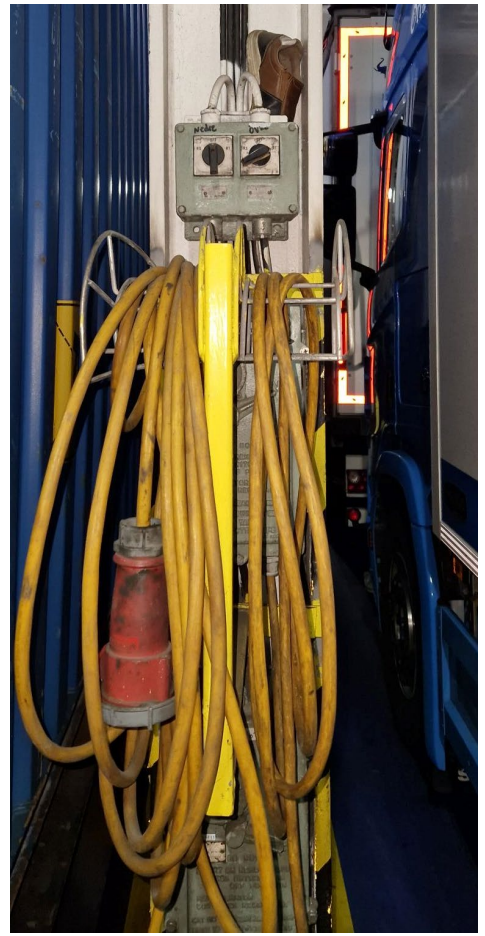
Incident Date Year	Size	Event	Incident Description/Fault	Investigation Report/ Firefighting Equipment Used
2015-01-09	3800	**Fire Risk**	**electrical cable heated**	AB discovered during his fire round patrol, one of the heated tank containers with a working temperature round 200 Celsius degree had its electrical cable connection coiled and was heated and smell burnt. The electrical cable coil from the ship was unrolled but the tank unit coil wasn't.
2014-07-06	5600	**Smoke**	**Fire Incident main deck**	Customer did an investigation; the reefer was not on fire but producing a lot of smoke. The coupling of the reefer was getting stuck, so the V belts were getting hot and produced the smoke.
	1900	**Smoke**	**- Fridge Drop - Sparks and Smoke**	Seaman plugged in refrigerated trailer once it was parked on deck 5. When ships power was turned on the bosun noticed that the fridge started to spark and smoke. The power was immediately turned off and the cable unplugged. A fire extinguisher was quickly collected in case it was required. Smoking reduced. The patch was called to remove the trailer. Email sent to port to inform them of the situation.
2019-09-01	3400	**Fire Risk**	**Near Miss with unsafe 220v/440v plug adaptor**	A rigid unit was p officer wisely dec itself required a s This "adaptor" al ships connection high risk of fire. T done an excellen checking it befor
2019-08-09	3400	**Smoke**	**Potential Fire Risk by Van Reefer Unit**	A driver of a box van requested a 5 Pin 440 V plug in off the Shore loader, and the Bosun was told this on deck 5. The box van was sent to deck 5 where he in fact needed a 3 pin 230 V plug in. The Bosun gave the Driver the ships cable for this, and the driver plugged the unit in himself to ships supply. The Bosun advised him to remain at his vehicle for at least 10 mins to ensure his reefer was working correctly. The driver did this, told the Bosun he was satisfied and then went into the accommodation. A few mins later one of the loading crew noticed the vans reefer unit smoking and alerted the Bosun and bridge. The unit was immediately switched off and disconnected from the ships supply. The driver was also located and returned to the car deck. The unit continued to smoke, and as the loading was completed the box van could not be discharged ashore. Still smoking and the unit hot, 2 x fire Ext were discharged into the reefer. The smoking then stopped and there was a marked reduction in the reefer's temperature. With the unit cooled and not smoking, car deck fans were started to clear the small amount of smoke and fumes. A fire watch was the maintained on the unit for the rest of the passage, which passed without incident.
2019-01-27	5600	**Smoke**	**Near Miss - Running Fridge set off fire alarms**	Running fridge stowed on deck 5 not plugged in by driver. Fire alarm investigated deck 5 found smoke filled. Working party called and crew mustered at emergency stations. Thermal imaging camera revealed no fire but found running fridge. Fridge switched off and driver informed. Emergency stations stood down. Fans set to clear smoke.
2018-12-18	3400	**Smoke**	**Plug In Malfunction / Artic BH22ESB/1QEV-981**	The unit was loaded into B9 on deck 3 and plugged in to the ships power via the rear plug-in point on a trailer by the duty Motorman. The deck officer then proceeded to load the port wing and the lower hold. After about 15 minutes the deck officer noticed a strange smell on the car deck and went to investigate the source. On proceeding to the starboard side of the vessel she noticed smoke and arcing coming from the unit and immediately informed the bridge and the rest of the deck crew. The unit was immediately isolated from ships power and the deck officer proceeded to obtain a dry powder extinguisher. On returning to the unit with an extinguisher it was found that the smoking had stopped as the unit had been isolated. The rest of the deck crew immediately attended. Upon investigation the plug-in point on the trailer was found to be melted and blackened and plastic from the unit had dripped down onto the trailers bumper. See attached photographs. The plug-in cable was removed, the unit switched off, the driver called and informed and upon discussion with the Master it was decided that it would be safe to carry the unit with the fridge switched off.

Developed Solution

Operational aspects

- From a pure electrical perspective, connecting a reefer or an EV should involve checking the following.
  - Connection integrity, cable and socket condition, insulation integrity, electrical grounding and overcurrent protection.
- SoPs should be in place that cover connection, disconnection, handling, monitoring and emergency response.
- The connections are to be made by crew only.





Developed Solution

Technical implementation

- Measurement of crucial electrical parameters.
  - Insulation fault measurement, fault location, power consumption, voltages, currents
- Real time monitoring of measured values to scout for faults
- Remote disconnection of faulty units

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Undervoltage in phase 3 of reefer 2
Measured: 248.4 V
Deviation of: 16.6 V
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Frequency error in reefer 4
Measured: 59.95 Hz
Deviation of: 0.05 Hz
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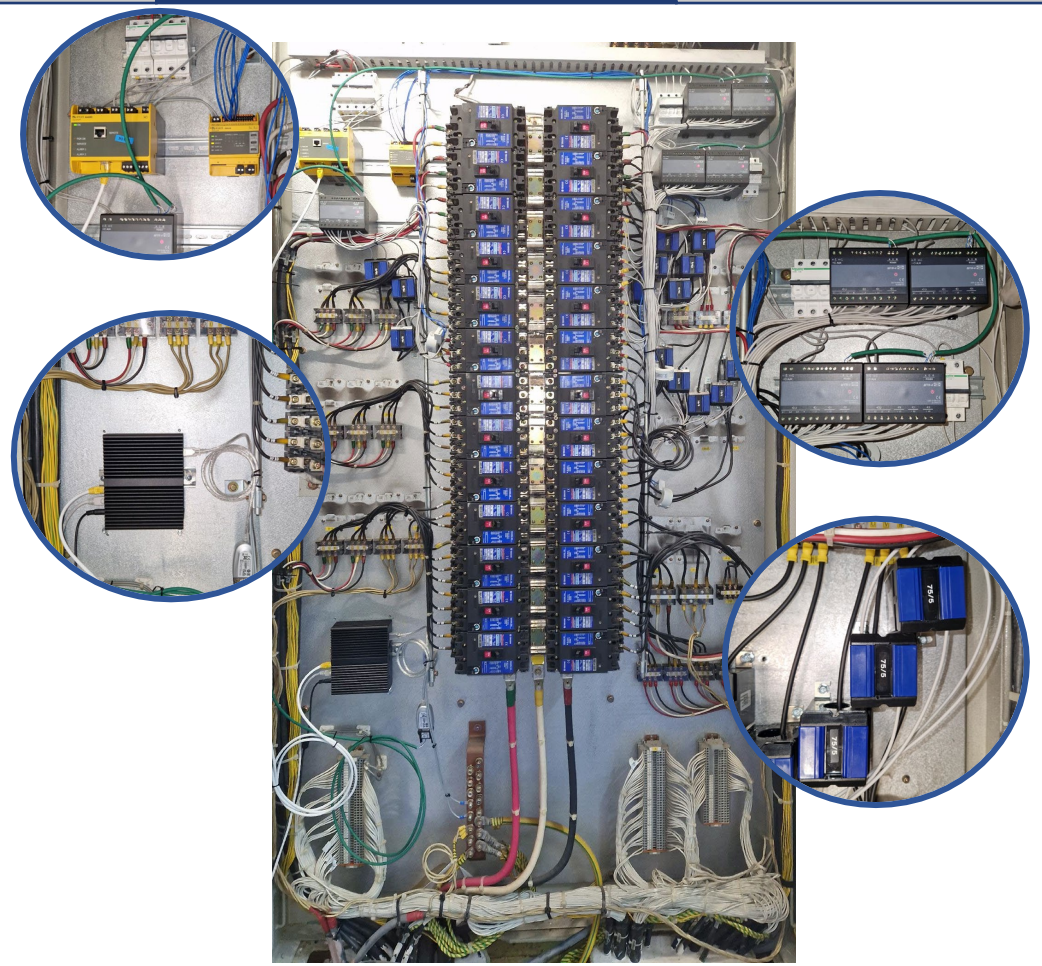
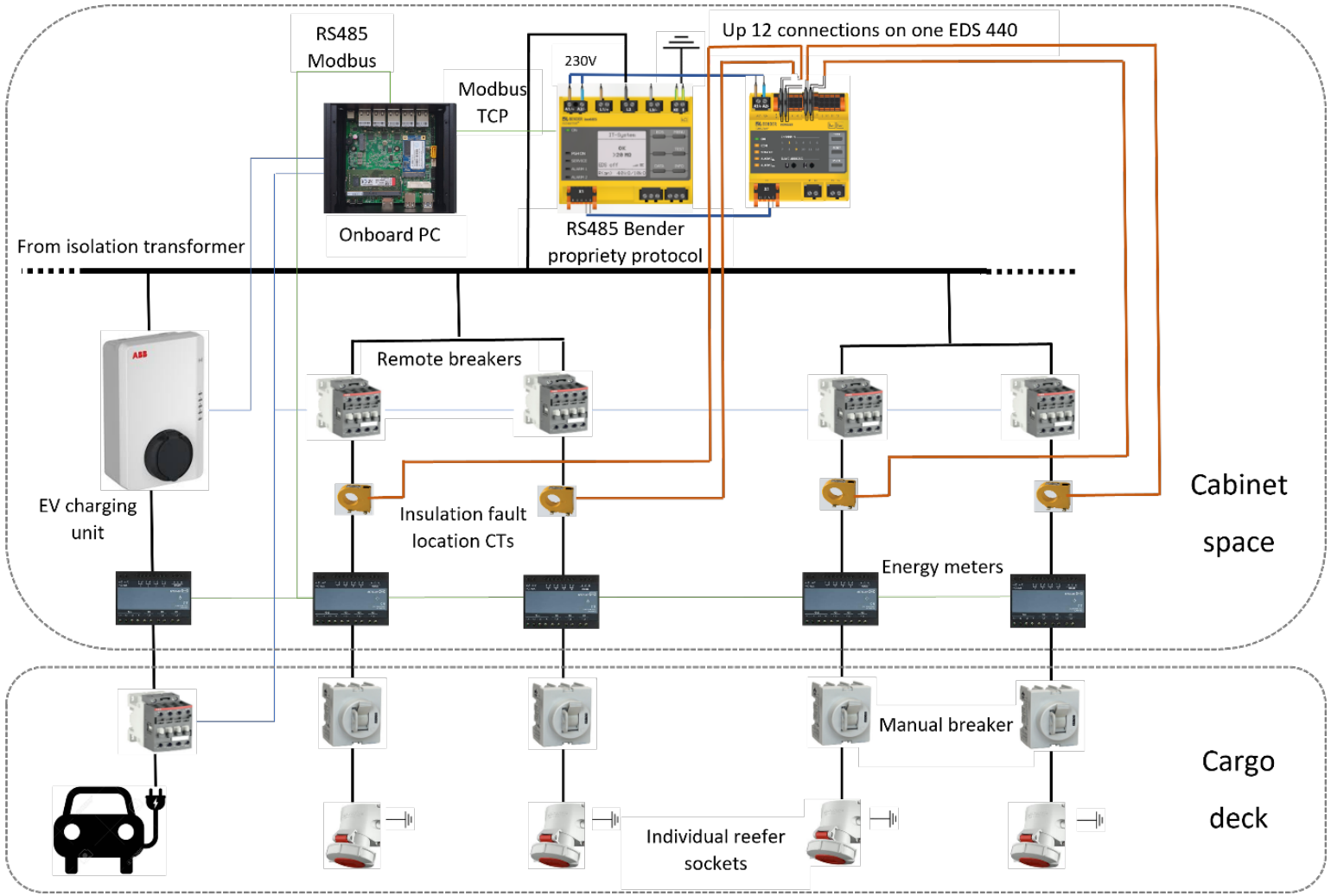


Developed Solution

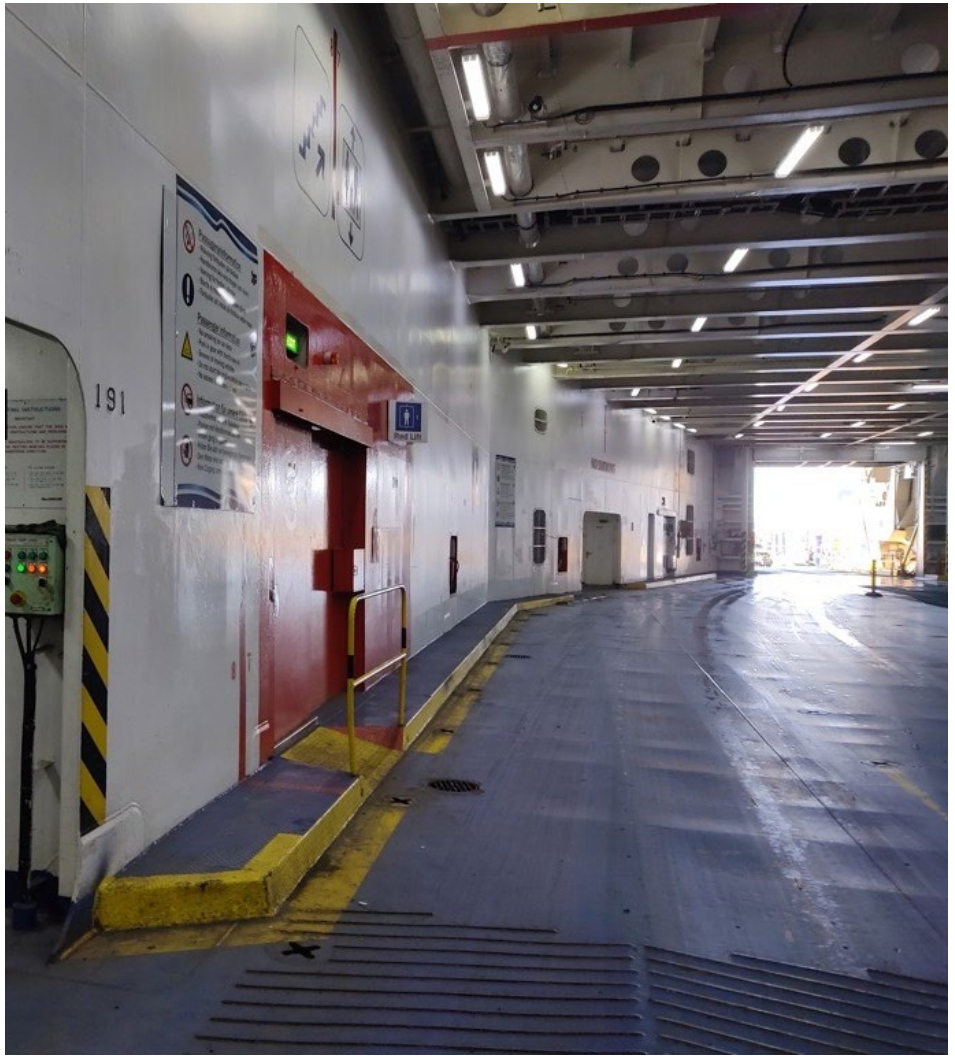


The Way Forward

- More diverse test data to analyse trends
- Integration with onboard safety system
- Evaluate continued need for insulation measurement

Risk Reduction

- Reduction of incidents
  - Reduced potential electrical faults
  - Fires caused by electrical faults
- Safety to personnel
- Lesser loss of cargo



More Information

D08.5 Development and validation of safe electrical systems, equipment and routines

D08.6 Guidelines for electrical systems, equipment and routines, providing safe electrical connection of reefers and electrical vehicles in ro-ro spaces

https://lashfire.eu/deliverables/

Vasudev Ramachandra

Engineer, Maritime Operations

Dept. Safety and Transport, RISE

+46 73 054 1975

vasudev.ramachandra@ri.se