



Performing a combined AC + DC arc flash simulation on an entire yacht

Arc flash simulation performed on

22

AC distribution boards

Arc flash simulation performed on

8

DC distribution boards

10

days project lead time

A major electrical developer for the yacht industry reached out to HyTEPS with a very specific request – to perform arc flash studies on their newest ship. However, there was a twist! The on-board electrical installation was a hybrid of AC and DC power supplies. Out of 30 distribution boards, eight were designed for a DC system, with batteries and rectifiers. Arc flash studies for AC power electrical systems are well documented, but DC networks require a different approach...

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HyTEPS is an expert in
arc flashes and simulations

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The Challenge

Arc flash studies have proven to be valuable in ensuring the safety of electrical installations and the operators working on them. An arc flash study helps identify where operations can be carried out safely (with appropriate personal protective equipment) as well as unsafe locations.

However, standards and guidelines to be followed for an arc flash study depend on the type of electrical installation. The most common standards are based on AC power and require short circuit studies to calculate the limits of large currents which would flow into the network in the event of a short circuit. Although there are defined standards for AC arc flash studies, none exist currently for DC networks.



ARC FLASH STUDIES
DIRECT AND ALTERNATING
CURRENT

ENSURE COMPLIANCE WITH
STANDARDS AND
GUIDELINES

SOLUTION ADVICE

ARC FLASH LABELS
FOR SAFETY

Objective

- Perform **arc flash studies** on both AC and DC parts of the electrical network of the ship.
- Ensure arc flash analysis complies with **standards, recommendations and guidelines**.
- Ensure customers are **well informed** of the solution as well as the methodology used to achieve these results.
- Provide **arc flash labels** at the relevant distribution boards.

Solution

“Challenges associated with performing arc flash studies on a DC network, along with the additional complexity of carrying out arc flash studies on a ship, made this an interesting project for HyTEPS,” explains Lead Engineer Arnau Sans. “The electrical system design was thoroughly studied in order to perform arc flash studies on the DC part of the installation. Key electrical components were highlighted, and essential data required for the calculations carefully selected. With the help of the customer, all required information was collected, and a simulation methodology was decided upon.

Owing to the lack of a complete standard for DC arc flash studies, calculations were performed using recommendations suggested by Lloyds Register. A DC arc flash calculation method with the most conservative results was adopted, identifying the worst possible situations in case of an arc flash.”

“Most power system software packages do not support arc flash simulation studies for DC networks. Therefore, to perform the required DC arc flash study, we developed tools to fill in the gaps and reach beyond the power system software’s capabilities. In addition, arc flash studies were also performed on the installation’s AC network. Adjustments were also made to the standard arc flash calculations

to accommodate different standards applicable for short circuit calculations on ships.”

Results

HyTEPS performed the arc flash simulations in line with the customer’s requirements. By obtaining a complete overview of the electrical installation, HyTEPS and the customer were able to identify possibly unsafe locations and discuss solutions to improve arc flash safety at these. Labels were printed for the AC and DC distribution boards following discussion and approval of the results. The DC arc flash stickers are informational, while the AC arc flash stickers indicate exact parameters and information based on the standard. After the initial time taken for research, an arc flash calculation for an entire ship should take about 10 days, including an arc flash report.

“We are proud to have matched required technical knowledge with know-how of the standards and methodologies involved,” adds Arnau. “However, we also had to perform several calculations, in addition to the power system analysis software used. Customer feedback on the analysis provided was highly positive. By allowing HyTEPS to perform the arc flash calculation studies, the customer was able to focus on their area of expertise. Research, knowledge and a deep interest in finding the best solution for our customer helped our engineers transform a challenge into a solution.”

As electrical DC networks become more common, HyTEPS is ahead of the curve, gaining expertise beyond the available tools. In the future, hybrid networks are expected to become the norm. HyTEPS Power Competence Center engineers help the customer improve their protection system and prevent possible catastrophic situations at sea! In addition, the customer can market itself as a company that ensures a strong safety standard for customers.

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- Arnau Sans, Lead Engineer HyTEPS



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