WORKSHOP REPORT

Date: 04.08.2023
Time of workshop: 9:00 am to 4:00 pm CET
Location: DNV Office, Brooktorkai 18, 20457 Hamburg, Germany

1 WORKSHOP – REVIEW OF DRAFT DOCUMENT TO FUTURE INTERNATIONAL STANDARD IEC/IEEE 80005-3

Objective:

The objective of this workshop is to discuss and evaluate the technical aspects of the current draft document to the future IEC/IEEE 80005-3.

With focus on:

Low Voltage Shore Connection (LVSC), Data Analysis of Power Demands, Plug and Socket Connection, Voltage Levels, Power Delivery Systems (cable management system), and Special Considerations for Different Vessel Types as per IEC/IEEE 80005-3

2 AGENDA:

2.1 Welcome and Introduction

- Representatives from DNV, Port of Rotterdam, Port of Barcelona, Port of Hamburg (HPA), HAROPA ports and Hapag-Lloyd presented themselves.
- Jarl Schoemaker showed some slides representing the purpose of the project and showing how this project is a part of a grand project for port electrification and sustainability at the Port of Rotterdam. He also indicated that this study is instrumental for ports to position themselves towards the development of IEC/IEEE 80005-3 in terms of content and the procedure.

2.2 Case Study: Power Demand Analysis for Different Vessel Types (Amitava Kumar Ghosh, DNV; Group discussion)

- Quantitative analysis conducted for the world sea-going fleet power point presentation is shown. Low voltage and frequency data distribution for different vessel segments are shown and power demand at ports for these segments are also described. Vessel segments with different power demands at ports denoting which segments require load reduction as it may exceed 1 MVA at port.
- Share of vessel segments covered by IEC/IEEE 80005-1 HVSC is shown. Remarks were made on the fact that though vessels with HV systems are so low, 52% of world fleet is covered by the standard.
- The majority of onboard LV supply voltage is 440V. Only a small percentage has onboard supply voltage of 690V.
- The power demand analysis pointed out that some LV vessels will exceed the 1 MVA limit. It was discussed in the group that power reduction of LV vessels shall be avoided.
- The PowerPoint presentation is shared with the participants of the workshop.

2.3 LVSC and IEC/IEEE 80005-3 Standard (Thomas Hartmann, DNV; Group discussion)

- Overview of shore connection standard and description was provided. It is suggested to focus on Inland navigation and Sea-going vessels, leaving small crafts for the purpose of this discussion out of scope.
- It was discussed in the group the pros and cons of having the same infrastructure of shore connection for inland navigation vessels and Sea-going vessels. As per EU, there are different standards designated for inland navigation vessels and sea-going vessels which indicates the fact that shore connection for these two different segments should be separate. One of the key aspects of this differentiation is attributed to the fact that qualification of the personnel handling the shore connection for inland navigation vessels and sea-going vessels are different. For inland vessels, anyone can connect the vessel to shore power, whereas in case of sea-going vessels it needs to be a trained and certified personnel who handles the shore connection.
- Furthermore, it was discussed that the technical specification and requirements for Shore connection for Inland navigation vessels and Sea-going vessels differs significantly. Adaptation is only possible with additional installations on board.
- The available power of an Inland navigation Shore connection system will only suit relatively small seagoing vessels.
- In conclusion it was discussed in the group that separation of Shore connection for Inland navigation and Shore connection for Sea-going vessels seems advisable.

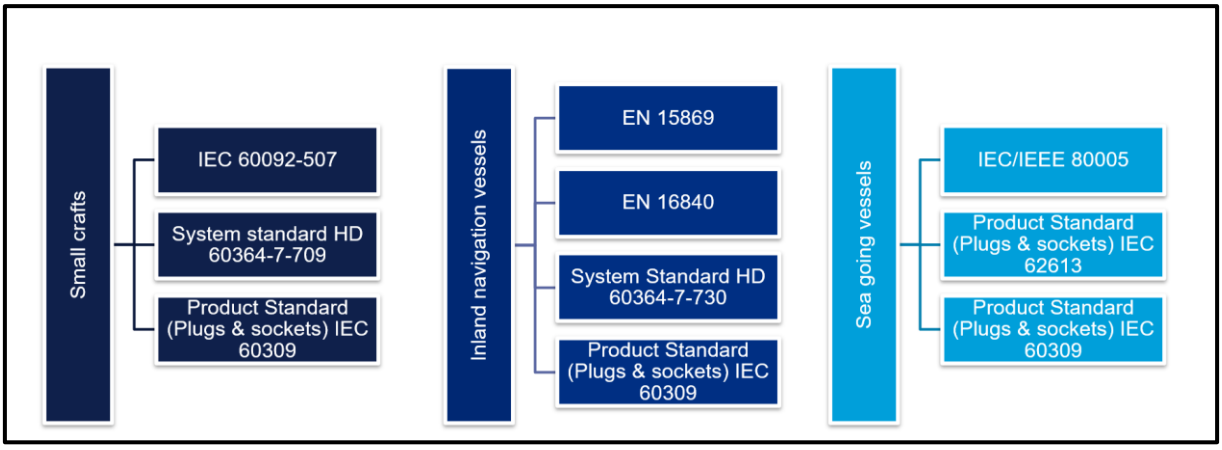


Figure 1: Relevant shore connection standards

- Roadmap and timeline for IEC/IEEE 80005-3 was shown and it was suggested that the ports reach out to their national committees for commenting on the “Committee draft for Vote” for suggestions. In figure 2, the timeline mentioned for workflow to FDIS to IEC/IEEE 80005-3 is an indication only.

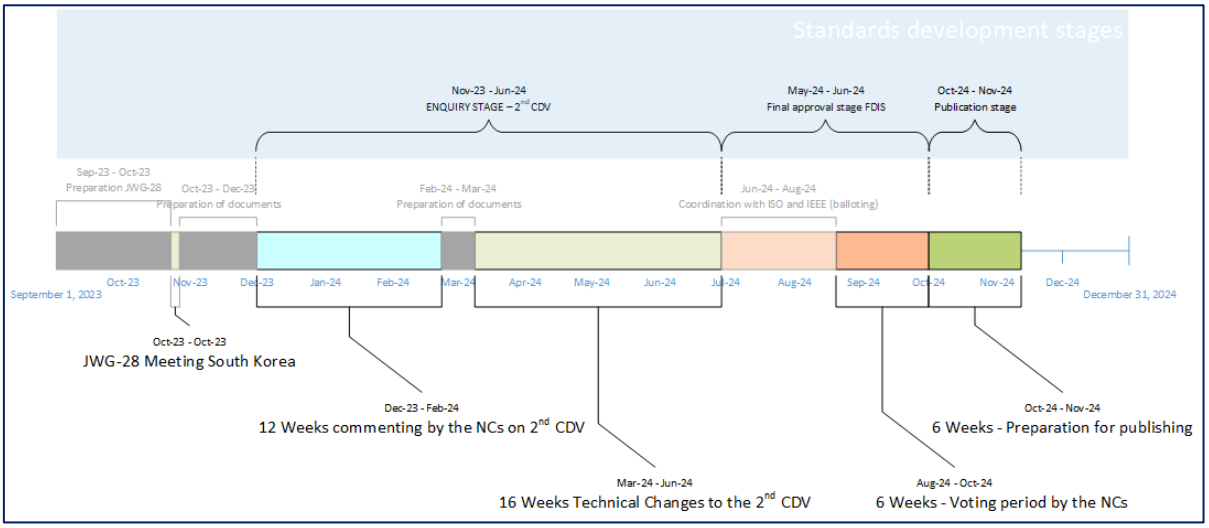
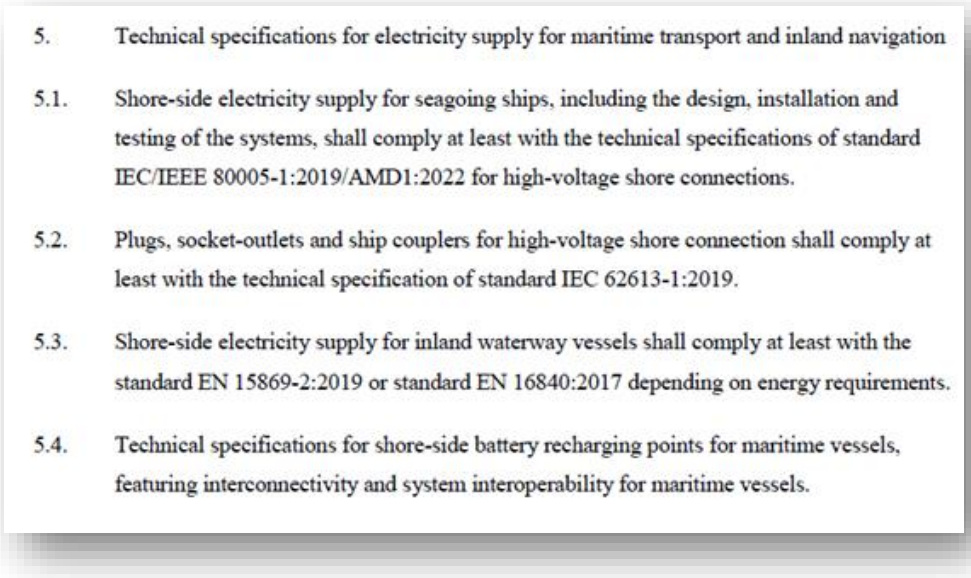


Figure 2: Workflow to FDIS to IEC/IEEE 80005-3

- Shore power requirements in accordance with FuelEU Maritime is highlighted.
  - From 1st January 2030 - container and passenger ships not using zero-emission technologies must connect to shore power while at berth in TEN-T ports for more than 2 hours. And from 1st January 2035 - container and passenger ships in all ports where shore power is available.
  - FuelEU Maritime draws the technical requirements for OPS from Alternative Fuel Infrastructure Regulation (AFIR) which does not mention any low voltage requirement yet. The regulations can be seen in figure 4:



5. Technical specifications for electricity supply for maritime transport and inland navigation

5.1. Shore-side electricity supply for seagoing ships, including the design, installation and testing of the systems, shall comply at least with the technical specifications of standard IEC/IEEE 80005-1:2019/AMD1:2022 for high-voltage shore connections.

5.2. Plugs, socket-outlets and ship couplers for high-voltage shore connection shall comply at least with the technical specification of standard IEC 62613-1:2019.

5.3. Shore-side electricity supply for inland waterway vessels shall comply at least with the standard EN 15869-2:2019 or standard EN 16840:2017 depending on energy requirements.

5.4. Technical specifications for shore-side battery recharging points for maritime vessels, featuring interconnectivity and system interoperability for maritime vessels.

Figure 3: Technical requirements for OPS defined in AFIR

  - From the above-mentioned regulations, it is quite clear that EU regulations provides separate standards for sea-going and inland navigation vessels.

- Discussion conducted on whether to consider defining standards in IEC/IEEE 80005-3 as per different ship types or not. In IEC/IEEE 80005-1, the decision for considering different ship types was driven by technical aspects pertaining to different vessel segments placed by interest groups at the time of drafting its standards. Although the decision in Part 1 to follow ship types is technical reasonable, it is impossible to maintain this in Part 3 where have a high diversification of different ship types with different low voltage requirement and power demand at port which is described in section 2.2 “Power demand analysis for different ship types”.

- Issue with two-sided cable management system discussed:

  - Issue with two-sided cable management system, i.e., whether the cable should be installed on the ship or should be located at the shore side was discussed. Different vessel segments have different systems, such as containerships which have cable installed onboard ship whereas for cruise and RoPax, it is installed at shore. For LVSC IEC/IEEE 80005-3, the cable system should be either on the shore side or on the ship side. Preference was given having the cable system at shore side as the OPS system structure is port dependant. However, further details with respect to the location of the cable management system needs to be agreed between the different stakeholders.

  - Issue of having cable management system at shore side was discussed as it may cause obstruction to the cargo operation, especially for containerships which was also discussed by the port authorities and ship owner company. Need to find a common ground for this problem.

  - Location of the cable system was discussed and is suggested that it is quite port specific.

  - Length of the cable is another problem. Constraint on the cable length and position implies the fact that the cable management system should be on the shore side.

- Though LV system has lower installation cost and is a familiar system, limitation of LV to 1 MVA is essential in order to prevent no. of plugs and size of the unit.

2.3.1 Plug and Socket Connection

- Different power ranges (kVA) with respect to different standards were discussed in order to understand the plug and socket requirements.

  - Discussion specifically was conducted for IEC/IEEE 80005-3 standard (light plugs) category which indicates towards a guideline developed by the Norwegian committee for having 250A maximum rated current, now being included in the IEC 80005-3 standard.

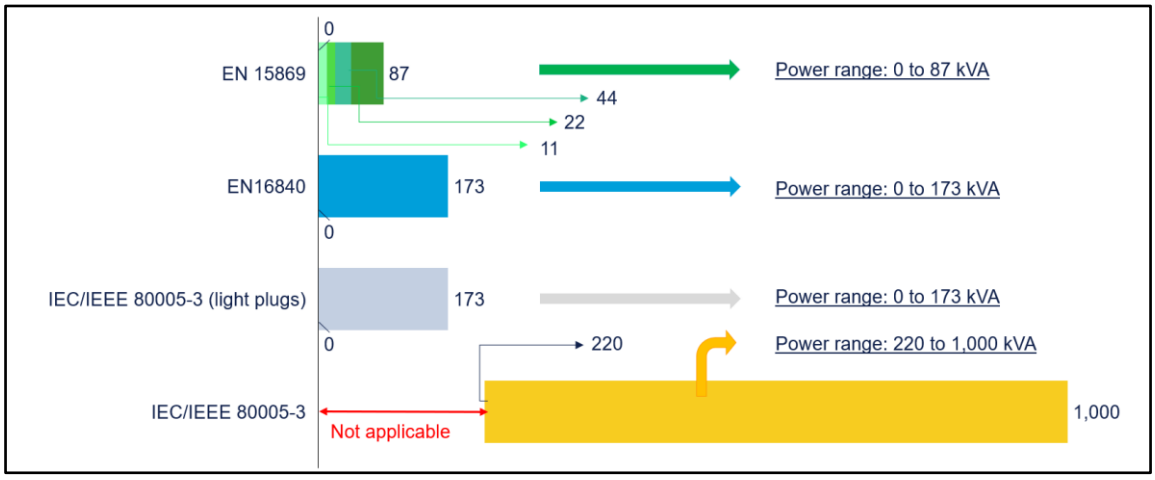


Figure 4: Power ranges with respect to different standards

- During the discussion on different plug and socket connections, implementation of the lighter plug version (with maximum rate current at 250A) in the European ports came into the picture, mainly pointing towards the fact that whether it will be beneficial to all ports or not. This lighter plug version of the supply system is already being implemented for Norwegian local fleet.

2.3.2 Voltage Levels and Delivery Systems

- Discussion on different voltage system for vessels are conducted as well as the suitable voltage for LVSC. The following points were discussed.

  - Voltage levels

	Transmission voltage level:		
Number of parallel cable connection with a plug and sockets rated 350 A	400 V	440V	690V
1	242 kVA	267 kVA	418 kVA
2	485 kVA	533 kVA	837 kVA
3	727 kVA	800 kVA	1000 kVA[1)]
4	970 kVA	1000 kVA[1)]	
5	1000 kVA[1)]		
Note:	[1)]The calculated power rating of the connection is higher, but the scope of the standard is limited ≤ 1000 kVA		

  - From above table, as a rule of thumb, lower the voltage, cables and plug numbers will increase.
  - It was discussed in the group that providing different voltages (400V, 440V and 690V) will benefit the installation on board the vessel but increasing the complexity of the Shore side installation. Changing Voltage level and Frequency in shore installation utilizing frequency converter is simple to implement.
  - Protocols and procedures need to ensure that the correct voltage and frequency is delivered to the vessel.

- The majority of the vessels have an onboard voltage of 440V/60Hz but the default transmission voltage is currently 690V/60Hz.

2.4 Special Considerations for Different Vessel Types (Group discussion)

- Technical feasibility of LVSC for LNG vessels were discussed, specifically how to manage boil-off gas along with shore power.
  - Parallel connections of the ship system and shore connection may be allowed in case of critical cases defined as per safety requirements.
- Feeder vessels may have an issue with HVSC as many times the berth for large containerships are occupied by these feeders. If the berth has HVSC, and the feeders do not need such high power, and therefore it is required to be provided with LVSC. A berth having multiple shore connection type can be issue two independent system with independent connections at terminal will be a challenge. One of the solutions discussed by the group is to have a step-down transformer onboard the ship but there may be challenges on the vessel on its own.

3 LVSC SYSTEM DESIGN CONSIDERATIONS (Group discussion)

The last topic of the workshop was a group discussion of other LV design considerations. The group was entertaining the idea to keep ship generators running in parallel with the Shore connection in order to prevent power reduction on the vessel side or to support the local grid with power. It was concluded that:

- Technically possible, but depends on the grid provider, as they may not want the ship powering the grid because of the possible negative impact on the grid. Utility companies have very specific requirements in respect to co-generation, i.e., supplying power to the grid.
- Power metering, fiscal issues, billing, and related taxations need to be addressed between the different parties.
- Safety issues such as protection relaying, and short circuit withstand ratings needs to be co-ordinated.
- The group agreed that this is a very interesting future prospective towards a smart grid infrastructure but at this point to focus on the development on a future international standard for LV Shore connection.