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A new international Standard for utility connections in port

Geoff Cronshaw, Chief Engineer at the IET, explains a new international Standard that is likely to be introduced for connecting ships to shore supplies in ports.

Introduction

The IET and BSI jointly publish BS 8450:2006 Code of Practice for Installation of Electrical and Electronic Equipment in Ships and the IET provide the secretariat for the national committee JPEL/18 (electrical installations of ships and of mobile and fixed offshore units).

The UK participates in both International and European standards work. An area of development within international standards is the requirements for high and low voltage shore connections to ships whilst in port.

Shore power, also known as 'cold ironing', enables ships to turn off their electricity generators and connect to local electric power that is supplied to the ship from the utility at the dock. Cold ironing is a shipping industry term that first came into use when ships started to be fitted with steam engines and ancillary machinery. When a ship was tied up at port there was no need to continue to fire the boilers and the machinery would literally cool down, eventually going completely cold, which gives the term 'cold ironing'.

In larger ships fitted with high voltage systems the shore-ship power connection requires a sophisticated system of transformers, frequency changers for 50/60 Hz connections, switchgear, special cables, circuit breakers and control systems. Smaller ships fitted with low voltage systems can 'plug in' to relatively simple shore supply outlets provided at sea ports, inland navigation ports and river wharfs. Shore-based electricity then runs all onboard services while the ship is secured on a shore berth.

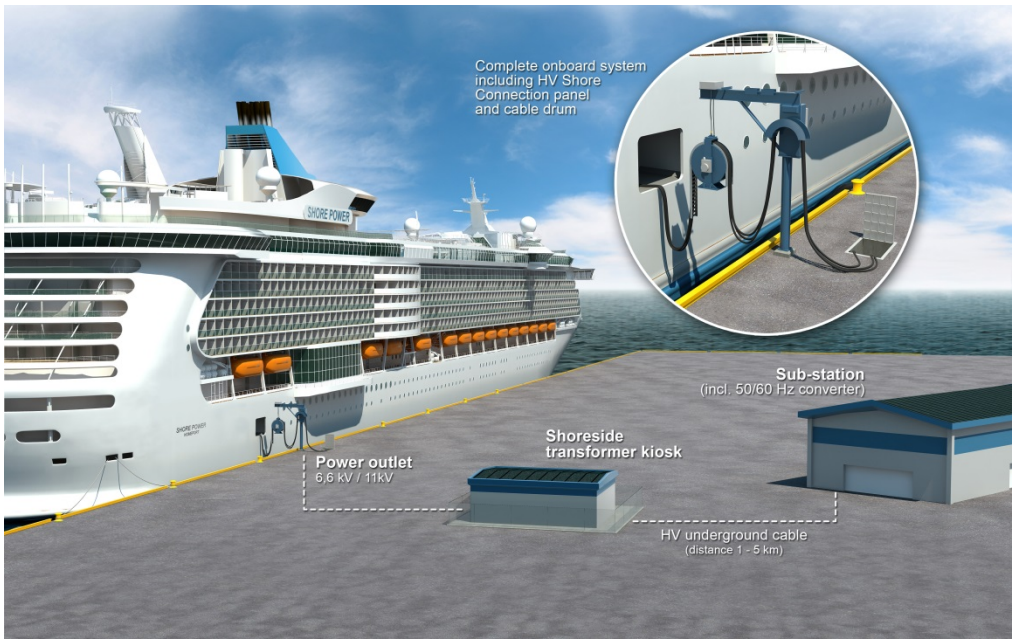

Image courtesy of ABB: http://www.abb.com/

The rationale for utility connections in port

The rationale for supplying ships with electrical power from the shore utility supply while the ship is in port is to reduce pollution in the port area. Environmental considerations are becoming increasingly more important and the propulsion and electrical generation machinery of ocean-going vessels contribute to global air pollution by their exhaust gas emissions. These emissions are particularly significant for cruise ships when berthed in ports because of their constant need for ancillary power to meet domestic loads of lighting and heating, ventilation and air conditioning requirements. Smaller ships fitted with low voltage electrical installations often navigate between smaller ports and on inland waterways and the noise of their generators when berthed has been found to be intrusive to local inhabitants as well as emitting exhaust gases.

The challenges

There are a number of challenges in considering high and low voltage shore connections. This is a complex issue as the problems to overcome are both technical and operational. For example:

- load requirements vary from ship to ship. Power requirements for some cruise ships may be 20 MVA compared to only 300 KVA for some ferries or small cargo ships.
- voltage and frequency requirements on board the ship may differ from the shore supply utility; some ships operate at 50 Hz and some operate at 60 Hz.
- shore supplies vary from 50 Hz, for example, in Europe to 60 Hz, for example, in America.
- some ships operate at low voltage (for example, 400 V) and some ships operate at high voltage (for example, 1,1000 V).
- some ships may regularly discharge and load in the same berths, whereas cruise ships may only call at a particular port occasionally.
- there needs to be compatibility between ship and shore connection equipment including plugs, socket-outlets and ships couplers.
- when a ship is laid-up for inspection, maintenance and repairs a shore supply is often essential for work on board to continue.

The Standard for shore connections

The utility shore connection Standard IEC/ISO/IEEE is being developed in three parts:

- Part 1 gives requirements for high voltage shore connection systems, which, as mentioned above, have complex systems.
- Part 2 provides the communication requirements for monitoring and control.
- Part 3, the draft low voltage Standard, covers the general requirements for an low voltage shore connection (LVSC) system, shore supply system requirements, the shore side installation, the ship to shore connection interface equipment, the ships requirements, LVSC system control plus monitoring, verification and testing, and documentation.

The Standard also includes a number of technical annexes.

One of the key requirements is to ensure that the operating frequencies (Hz), phase rotation and voltages of the ship and shore electrical systems match. This is because ships operate in different parts of the world and have to dock in countries with different voltages and frequencies.

The Standard also covers two important procedures for connection to a shore supply. The first is requirements for load connection to a 'blacked-out' ship by means of interlocking so that the shore supply can only be connected to a dead onboard receiving switchboard. This is often essential for smaller ships plugging into a low voltage shore supply facility. The second is load transfer via synchronization, which, for high voltage systems, is most often essential to maintaining continuity of supply onboard. (In an alternating current electric power system, synchronization is the process of matching the frequency, phase rotation, and voltage of one power source to another power source).

Operating procedures

To create shore connections to ships that are in port requires detailed operating procedures. The electrical power has to be transmitted from the shore to the vessel using special flexible electrical cables on the dock. The cables require purpose-made cable handling systems, such as a large shore-based cable reel. The system needs to be designed to accommodate the rise and fall of the tide and a specially designed heavy duty plug and socket arrangement on the vessel.

For example, Part 3, which covers low voltage shore connections, includes a general operating procedure that requires electrical competence and/or special training for it to be safely performed. This particular procedure is for load transfer via synchronisation. The stages are given as follows in the Annex of Part 3:

- the ship arrives.
- safety checks must be carried out on shore and on board the ship.
- ship-to-shore communication starts.
- cable management system operation starts.
- connections are made.
- permission to start up LVSC from the ship is made.
- LVSC start up – shore connection circuit breakers closed.
- synchronisation of ships generators.
- coupling of ships power system to shore LVSC.
- ramp down of ships generators.
- ships generators turn off.
- ship now supplied on shore power.

Conclusion

It is important to be aware that this article only gives a brief overview of the ongoing standards work on high and low voltage shore connection systems at IEC level.

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