STANDARDISATION OF SHIP AND SHORE-BASED POWER SUPPLY (COLD IRONING)

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AKA: AMP, OPS, HVSC
History

• The Navy, which traditionally spends a long time at sea followed by long periods in port, has used shore power for decades at ports where the voltage and frequency match and there is shore power infrastructure support.

• The proper voltage, frequency and infrastructure have been generally available only in Navy ports of their home country.
• With long in-port periods and low power demands, shore power (cold ironing) is cost effective for navies.

• Commercially, cold ironing has been in place and used successfully for merchant vessels in Juneau, Alaska (2001), Göteborg (2000), and Los Angeles (2004) for many years.

• Seattle, Long Beach, Tacoma, other ports in Europe now have shore power
What are the Benefits?

• Virtually all emissions from the vessel, including NO\textsubscript{x}, SO\textsubscript{x}, CO\textsubscript{2}, are eliminated from the port area when the engines are secured and the ship receives power from shore side. PRIMARY BENEFIT

• The cost of energy may be favorable compared to ship’s fuel cost. SECONDARY

• Less frequent bunkering and correspondingly less watch standing requirements. Maintenance can be performed with engines secured. SECONDARY
What are the challenges?
Voltage, Frequency

• The voltage and frequency (V and f) must ultimately match the ship’s design V and f for the ship to receive shore power.

• This may require a transformer to adjust the volts (V), a frequency converter to adjust the hertz (f), or both (worst case).

• More equipment requires more infrastructure (cost).

• A 2 Megawatt load at 6.6 kilovolts requires only one cable. The same 2 Megawatt load at 450 volts requires 9 cables.
Cable, plugs and switches

- Shore side primary ckt brkr
- Shore side supply transformer
- Shore side switchgear
- Shore side secondary ckt brkr
- Interlocked
- Shore to ship connection box
- Shore connection switchboard
- Main switchboard
- Synchronizing circuit breaker
- Ship
- Power plug
- Power Receptacle
- Earth switch
- Shore side Feeder Ckt Brkr
- Flexible power cable (cable management reel not shown)
- Incoming circuit breaker
Cable, plugs and switches (cont.)

• The power cable, plugs and switches can, and have been, capable of transferring the large voltages and loads involved with cold ironing.

• For vessels to efficiently connect to shore power at different ports of call, it is critical that standardized dimensions of components be established.
Cable, plugs and switches (cont.)

- Most ships (about 90 percent) are still 450 volt electrical systems.
- The 450 volt vessels will likely require an additional transformer to step down the shore voltage to 450 volts.
- Trends for higher voltage systems on new ships, particularly passenger ships with high power requirements, may benefit cold ironing as an alternative.
Safety concerns

• When working with high voltages, safety is paramount.
• Important to build safeguards into the system design through standardization of procedures and equipment.
• Proper training of personnel, and well-developed and understood plans for connection, are also essential.
Safety concerns (cont.)

• Proper grounding of faults
• Opening of circuit breakers on ship and shore when faults occur.
• Efficient disconnect during emergencies for weather or excessive ship movement relative to pier.
• Proper handling of heavy power cables, and efficient communications between ship and shore personnel.
Many stakeholders

- Ports
- Vessel owners and operators
- National and international maritime agencies and other legal regulatory bodies
- Local electrical utilities
- Funding sources for ports (cities, states, countries)
- Environmental protection agencies and groups
Standardisation efforts

- ISO, IEC and IEEE are jointly developing a standard for onshore power supply (cold ironing) for ships – IEC/ISO 60092-510. This document focuses on general and vessel-specific requirements.
- An IEC/ISO publicly available specification (PAS) was published in 2009. Working group meetings 2009-2010 have included significant participation from ports, ship owners, utilities, class societies, and manufacturers.
- Goal for 2010-2011 is to finalize international standard (IS).