

Low loss drive system is ready for passenger ships

Sinusoidal converter technology from a Norwegian company claims to overcome the limitations of pulse-width modulation electric drives while promising increased power efficiency and reduced fuel usage for a range of vessel types, including passenger-carrying designs

by Wendy Laursen

The Norwegian company, Stadt AS, has developed sinusoidal AC motor drive technology that promises lower electrical losses than established pulse-width modulation (PWM) concepts. The company claims that the system's increased efficiency can lead to fuel savings of up to 45 per cent.

The Stadt Stascho package is totally integrated with a ship's propulsion plant as well as with the power generation and management sections. Furthermore, it has its own configurable power controller, touch screen and interface to other systems.

According to Hallvard Slettevoll, director of Stadt and inventor of the patented system, "Stadt Stascho is normally air cooled due to its very low electrical losses, and this makes it easy to locate the drives, which can even be placed in the control room. The equipment has fewer components and is less complex than competing AC or DC drive technologies, which means easy installation and reduced operational and service requirements."

The new technology converts fixed frequency and voltage AC current from diesel alternators to adjustable current that can be used by an AC motor to control the amount of power fed to propellers, thrusters and other equipment very efficiently. Stascho converters can be provided in several configurations depending on a ship's requirements. One is called Hybrid FC; this is based on power electronics that use insulated gate bipolar transistor (IGBT) technology and thyristors in a way that produces a very clean sinusoidal wave form.

Stadt claims that the new drive technology is innovative in the way that it is based on bidirectional sinusoidal voltage and current, both toward the driving electric AC motor and backward to the switchboard. The system is designed to ensure extremely low electric losses

in electric generators, in the Stascho Hybrid converter and in the propulsion motor.

Stascho would be especially interesting for operators of ships with CP propellers, either with shaft lines or azimuth propellers. This is because the technology combines the functionality of the electric power converter with the load controllability of a CP propeller. Both propeller speed and load curve are adjustable, which also allows a speedy response when manoeuvring, compared with fixed pitch blades.

Typically, drive losses are said to be less than one per cent at full load, which results in total electrical system losses of only 5-6 per cent compared to equivalent AC drive systems based on a 12 pulse configuration; the latter are claimed to have system losses in the range of 13-15 per cent. "This new technology will have a huge impact on energy consumption for marine electric propulsion plants," Mr Slettevoll claims.

Sinusoidal voltage and current technology offers many advantages over the more widely used PWM systems, he adds. The most important is that sinusoidal technology does not generate any electro-magnetic disturbances; thereby, it enables the use of unscreened power cables and standard AC motors, without experiencing problems such as bearing damage typically found in PWM driven applications.

"PWM is a synthesised way of creating a variable frequency for speed control of AC motors. The high frequency pulse train in this synthesised voltage is the root of many complex problems, revealed by many users that have experienced these traditional frequency inverters through the years," says Mr Slettevoll. "PWM inverters are, in fact, powerful noise generators, able to transfer major distortion to



Hallvard Slettevoll: "This new technology will have a huge impact on energy consumption for marine electric propulsion plants"

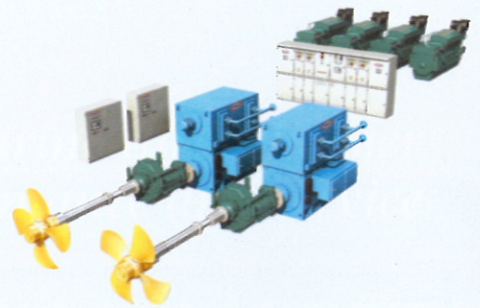


Diagram of Stadt's new Stascho system

other electronic equipment installed on a ship. AC motors were designed for sinusoidal voltage and work best with such current."

Extremely low harmonic distortion (THD) is experienced using the Stascho system, typically 2-3 per cent in the main switchboard, reports Stadt. "This is a major achievement", says Mr Slettevoll, "one that has been realised without using large transformers or filters on which other systems depend.

Since large power transformers are not required for a Stascho drive, the unit is a much more compact solution compared to competitors' drives in 12, 18 or 24 pulse configurations, says Mr Slettevoll. These transformers can be very large, sometimes even bigger than the electric motor they are supposed to feed, and their weight is substantial.

As indicated, fuel savings of up to 45 per cent are claimed when using the Stadt Stascho system within a ship's propulsion package. This is possible due to optimal operation of generator sets and the low-loss electrical AC-motor control for propellers, says Mr Slettevoll. Pollution from NOx, SOx and CO₂ is therefore dramatically reduced.

Stadt offers integrated solutions and a product range that is suitable for power requirements of up to 50MW (2 x 25MW in different configurations and voltages up to 15kV).

The new sinusoidal technology was first delivered to the Norwegian seismic research vessel, *Sanco Star*, in 2008. In this case the drives were used for the full-electric main propulsion system on the ship, driving two propellers each of 2,500kW.

The company offers complete, integrated diesel electric solutions in co-operation with well-known diesel generator and propeller manufacturers; it can deliver both low and medium voltage systems using the new drives. As of April 2009, a total of seven ships have been ordered with full electric propulsion based on the new solutions from Stadt. **PSI**