Variable frequency drive for shaft generator (PTO/PTI)

Shaft generators are commonly used to produce electrical power for the ship’s network, in vessels equipped with a conventional propulsion system, where a mechanical shaft is driven by a slow or medium speed engine.

System design often restricts how and under what conditions the shaft generator can be used to generate electricity since, because most systems lack frequency control, such power generation depends on the ship maintaining a constant speed.

In vessels equipped with a fixed pitch propeller (FPP), this generally means that the shaft generator can only be used on open seas when the vessel is operating at its design speed, which does not allow a flexible use of the shaft generator.

In the case of vessels equipped with a controllable pitch propeller (CPP), more hydrodynamic efficient combinator control mode cannot be used together with the shaft generator, due to the fact that this would generate incorrect frequency into the electrical network.

A shaft generator is the most practical solution when equipped with a variable frequency drive (VFD). By this addition the shaft generator may be used on the wider speed range and often the meaningful part of combinator speed range is covered. The operational flexibility of an existing shaft generator can also be significantly improved, by retrofitting it with a VFD for controlling the shaft generator’s output. Also be made to the efficiency and operational flexibility of an existing shaft generator system by retrofitting it with a VFD.

- A power source which, under most conditions, generates much cheaper energy than auxiliary diesel generator sets
- With CPP propulsion, VFD installation allows efficient use of combinator mode instead of fixed speed operation, thus reducing propeller losses significantly on partial propeller loading conditions.
- With a VFD, it is possible to utilize the shaft generator at a wide range of main engine RPMs, enabling operational flexibility:
  - Nominal voltage and frequency output from the shaft generator can be maintained
  - For improved efficiency, main engine shaft power can be used to produce electricity over the entire operating area,
  - Generating power for ship network via the shaft generator alone reduces the need to use auxiliary generators
  - Flexibility in PTI/PTO function
  - Parallel running with generator sets is possible
  - Increased efficiency from optimal operation of the propeller with CPP
  - Lower noise levels
  - Improved energy efficiency reduces emissions

Benefits
Using a shaft generator with a VFD for power production is economical, environment-friendly and provides a range of advantages. This is not limited to new builds – major improvements can

Savings
Although the benefits vary from vessel to vessel and are dependent on the operating profile, the payback time can be short and the reduction in the vessel’s environmental footprint significant.