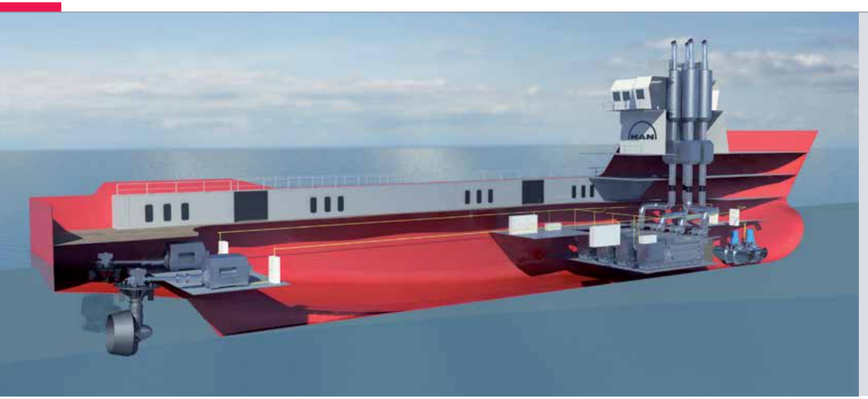
Highly-Efficient Diesel-Electric Propulsion

Lower fuel oil consumption, better performance



In today's world, fuel-saving propulsion systems are a must, and that requires new and innovative solutions. But is it possible to design a highly-efficient diesel-electric propulsion plant without sacrificing performance?

A renaissance in direct current

For many years, electric propulsion plants employed alternating current (AC) distribution systems. AC systems were long regarded as the best solution, and a large number of diesel-electric vessels with AC systems and variable speed drives were built, for diverse purposes. But times are changing, thanks to new direct current (DC) components and an innovative engine control philosophy Diesel-electric propulsion has evolved, creating a much more compact solution with a range of potential applications.

EPROX

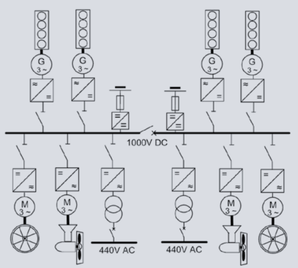
EPROX is the new fuel-efficient diesel-electric propulsion system from MAN Diesel & Turbo, developed in partnership with leading e-suppliers. Efficient propulsion plants with integrated energy storage sources are now a reality due to advances in DC distribution technology. This decouples some of the load applications on the propeller from the diesel engine, reducing peak loads, and making the entire propulsion plant more responsive and dynamic. When powered solely by electricity from storage sources, the system produces zero emissions.

Benefits of EPROX

Variable speed gensets for extra efficiency

The benefits of EPROX

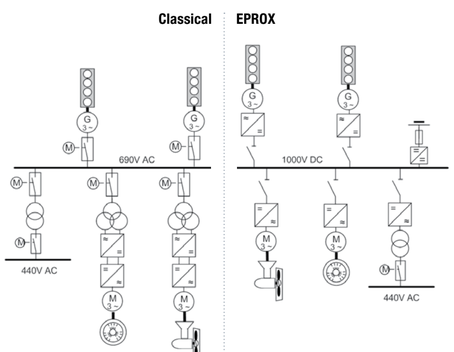
- Very low fuel oil consumption. Diesel engines run at a set speed defined by the control system according to the current system load – maximising efficiency, minimising fuel oil consumption.
- Engines can operate at variable speeds: gensets run independently without needing to be synchronised.
- Engines' ability to operate at a wide range of speeds ensures enhanced and robust dynamic response.
- Energy storage sources, such as batteries or fuel cells, can be used to reduce transient loads on diesel and dual-fuel engines. In DP operation, this improves the propulsion system's dynamic response, generating significant benefits.
- Load peaks are shaved as power can be sourced from energy storage devices. Load acceptance is diverted away from the engines.
- The number of online engines is reduced by the electrical spinning reserve. Peak loads can be managed without starting a standby genset.
- EPROX plants comprise fewer components and require less space. The total footprint of a system of this type is up to 25 per cent smaller in comparison to classical diesel-electric systems. This reduces installation costs.
- In addition to buffering against load peaks, batteries can act as the sole power source if they have sufficient capacity. During periods of low load, full electric propulsion is possible, with zero emissions.
- Energy storage sources contribute to a reduction in diesel engine maintenance.



Single line diagram of a EPROX system for a PSV. The system is available up to a total installed power of 20 MW.

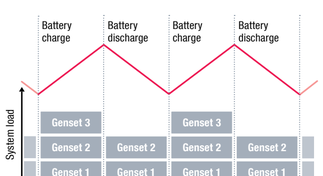
Variable speed diesel engines combined with DC technology

The new EPROX energy-efficient diesel-electric propulsion system boasts a host of key design elements, such as the latest DC distribution and circuit breakers, and the intelligent arrangement of rectifiers and inverters. What's more, heavy components such as supply transformers have been removed. This innovative equipment was developed by leading e-suppliers such as ABB and Siemens. MAN Diesel & Turbo is cooperating with these key players to provide a fully-optimised system. The result is a best-in-class propulsion system that combines innovative electrical technology with industry-leading diesel and dual-fuel engines.



Energy storage devices – offering flexibility and performance

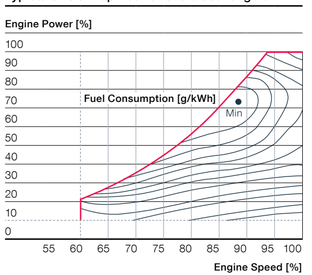
It is often beneficial to run gensets on high loads, using surplus power to charge batteries. If less energy is required, one genset can be shut down, with the remaining gensets running again at high load, supported by the batteries.



Variable speed gensets cut fuel oil consumption

Variable speed diesel engines minimise fuel oil consumption. Dependent on the current load, the control system can set the speed for optimum SFOC.

Typical SFOC map: four stroke diesel engine



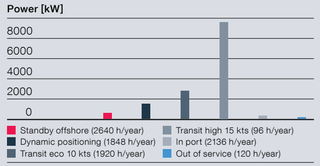
Example: EPROX for a Plattform Supply Vessel

Potential fuel savings

Platform supply vessel, DP 2

Length, overall: 94 m
Dead Weight: 4500 t
Max. speed: 15 kts
Eco speed: 10 kts
Azimuth Thrusters: 2 × 3600 kW, FPP
Bow Thrusters: 2 × 800 kW, FPP

Operational profile



Cassical diesel-electric propulsion plant

Main generator engines: 4 × 6L27/38, 4 × 2100 kW, 720 rpm
Voltage: 690 V AC, with variable speed drives

Operational profile	h/year	Power [kW]	Engines running	Engine speed [rpm]	SFOC* [g/kWh]
Standby offshore	2640	670	1	720	209
Dynamic positioning	1848	1480	2	720	205
Transit eco 10 kts	1920	2416	2	720	190
Transit full 15 kts	96	7560	4	720	189
In port	2136	150	1	720	263
Out of service	120	0	0	–	–

EPROX plant

Main generator engines: 4 × 6L27/38, 4 × 2190 kW, 480-800 rpm
Voltage: 1000 V DC, with variable speed drives

Operational profile	h/year	Power [kW]	Engines running	Engine speed [rpm]	ø SFOC * [g/kWh]	ø SFOC saving [g/kWh]
Standby offshore	2640	670	1	580	197	12
Dynamic positioning	1848	1480	2	600/500	194	11
Transit eco 10 kts	1920	2416	2	600/600	184	6
Transit full 15 kts	96	7560	4	640/640/640/660	186	3
In port	2136	150	1	500	224	39
Out of service	120	0	0	–	–	–

*All SFOC figures are calculated and for information purpose only; incl. attached pumps

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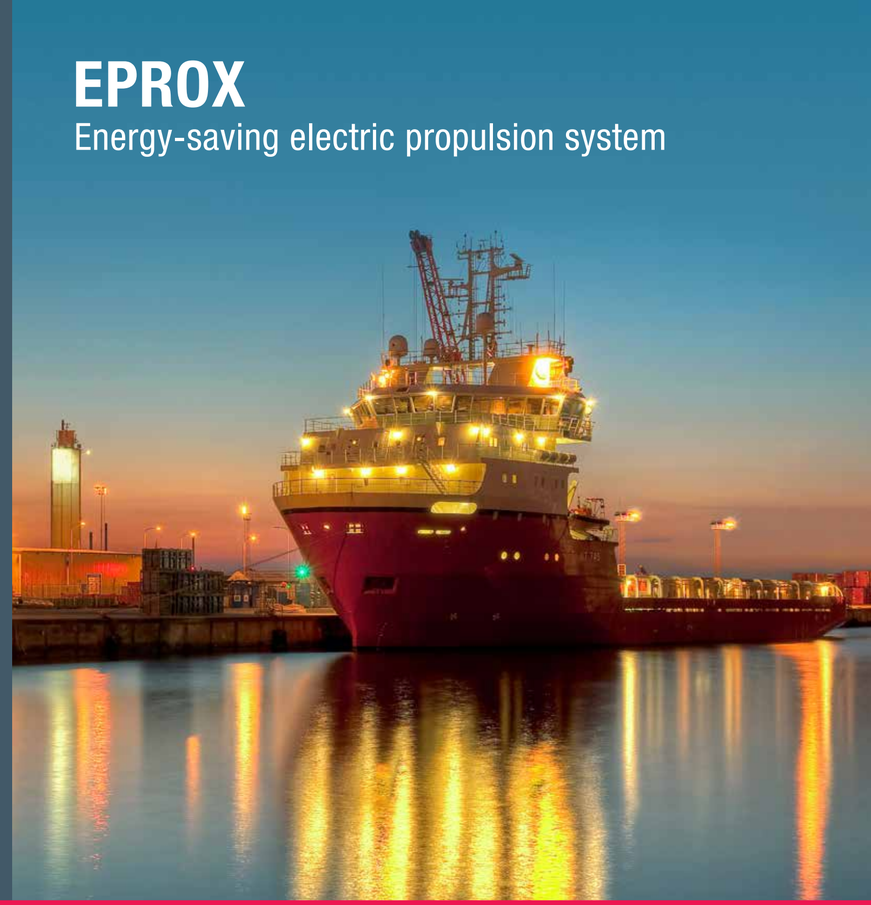
EPROX

Energy-saving electric propulsion system



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