

ENGINEERING
TOMORROW

Danfoss

Case story | VACON® NXP Drive

Hybrid powertrain improves tugboat economy and maneuverability

20%

savings on
operating costs
compared to
traditional tugboats

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A hybrid powertrain enables the Telstar tug to reach new heights of performance at the same time as delivering significant savings in operating costs. The Telstar is the new hybrid ship in the Iskes Towage fleet. Launched in October, 2016, it operates up to ten times daily to deliver port and terminal services. On average, the Telstar operates eight to ten times a day to tow ships within the port, and to and from dock. The Telstar always operates within the piers, and is not intended for seagoing service.

Telstar was built by Holland Shipyards and has the unique EDDY Tug design. This makes it easy to drive, easy to maintain and easy to move in any direction. EDDY Tugs are equipped as standard with a hybrid powertrain to minimize operational costs and realize savings. The powertrain consisting of electric, diesel or direct diesel-electric drive was chosen because its low power profile is well-suited to tugboat operating requirements.

Low diesel consumption, smaller engines, reduced wear

On the Telstar the direct diesel savings are 10%, with the potential for additional savings by further optimization. Telstar has already achieved significant cost savings by reducing the running hours on the main diesel and scheduled overhauls.

Service downtime for change of filters, oil and consumables is reduced accordingly, since the main engines run less often and experience reduced wear.

The small diesel engines are basically standard lorry engines which are much cheaper to service than larger engines, due to cheaper parts, lower lube oil volume, and fewer running hours.

VACON® drives optimize the hybrid propulsion

The propulsion operates with the aid of two identical azimuth propellers, each a diameter of 2.6 m, which are mounted in line with the hull. A hybrid drive system using VACON® drives has improved maneuverability and economy.

The efficient permanent magnet electric motor/generators are fully integrated with the thruster. Each azimuth thruster is controlled by a VACON® NXP drive.

When running purely electric, the ship can perform a pull of 27 tonnes. With the main engines switched on, this performance rises to 75 tonnes, supplied by two Mitsubishi main diesel engines of 1450 kW each, and two electric motors.

Using only electric propulsion, the ship can travel at 10 knots (18.5 km/h), when combined with the main diesel engines the maximum speed increases to 13.5 knots (25 km/h). When running in electric mode, the vessel saves significantly on fuel costs. However, because the tug often requires peak power suddenly, the main engines are always ready on standby to supply power.

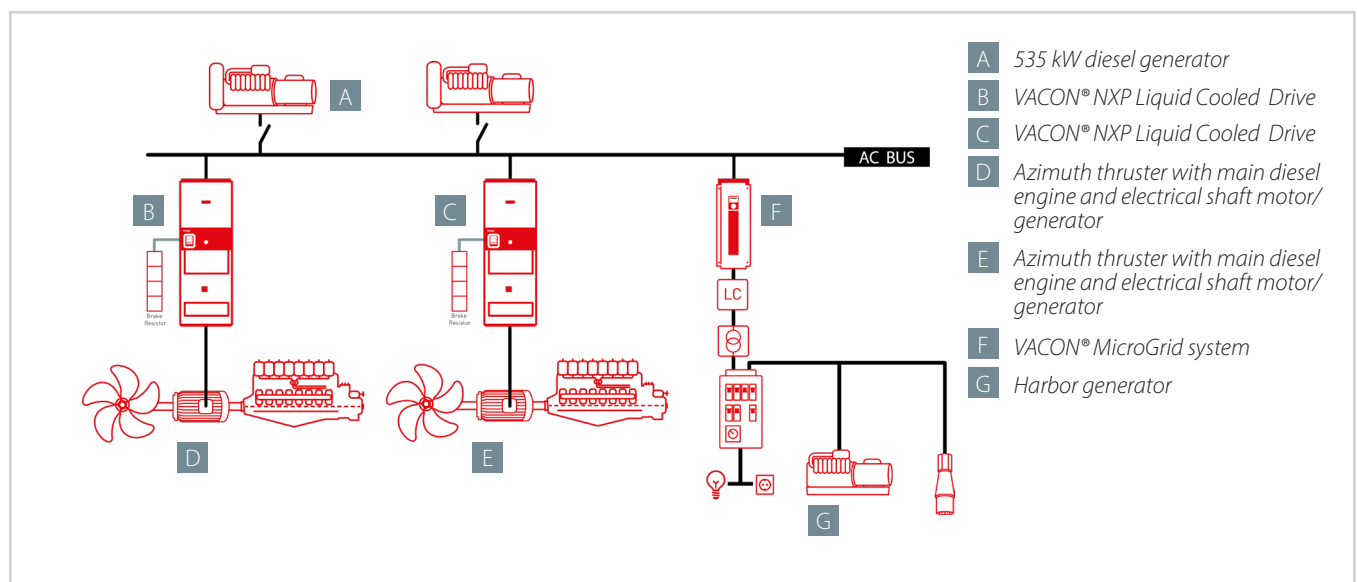


One of the Mitsubishi main engines with the Veth azimuth thruster and the permanent magnet shaft motor/generator. The main engines are used for heavy towing only.



The Scania diesel generators can power the tug during transit and light towing.

Schematic of the Telstar hybrid propulsion system



"Right from the very first project we have used VACON® drives", says commercial director Henri Kruisinga Hybrid Ship Propulsion BV: "We chose these drives not only due to their high quality, but also because they were equipped with all marine class type approvals. Our experience with the drives and the supplier is very good."

20% savings on operating costs

The Telstar captain Marcel van Peenen works closely with his chief engineer Guy Knorr, who has spent five months in the shipyard and on simulators, and therefore quickly familiarized himself with the mechanical and electronic systems on board. Van Peenen continues to experiment with towing and pushing procedures on the Telstar, and concludes: "We have already achieved approx. 20% savings on operational cost due to reduced fuel cost and less expensive maintenance with longer intervals compared to traditional tugboats – and we expect that further cost reductions are possible."

Effectiveness thanks to VACON® drives throughout

Danfoss supplied VACON® drives not only for the Telstar propulsion system, but also for the winches and control unit for the engine room ventilation. According to Guy Knorr the use of VACON® drives throughout is an important advantage.

"We only have one system to learn and we only need one brand of spare parts. The software is easy to carry about and if the display fails with one controller, I can enter commands or collect and transfer data at another controller."

Guy Knorr, Chief engineer

Chief engineer, Guy Knorr, in front of the VACON® NXP Liquid Cooled Drives



Captain, Marcel van Peenen is very satisfied with the maneuverability of the Telstar





The towing winch (left) and the VACON® NXP drives for the towing winch (right)

Telstar

Type of ship:	Hybrid tugboat
Year built:	2016
Design:	EDDY 24-70
Shipyard of construction:	Holland Shipyards in Hardinxveld-Giessendam
Electrical propulsion system:	Hybrid Ship Propulsion BV in Rotterdam
Bollard Pull:	75,0 ton
Port of registry and operating waters:	IJmuiden

Engines/propulsion

Type of propulsion:	Azimuthal Propulsion
Thrusters:	2x Veth
Type:	Z-drive VZ 1800

Propeller diameter:	2600 mm
Main engines:	2x Mitsubishi S16R2-T2MPTAW
Total power:	3770 kW (5127 bph) @ 1500 rpm
General Generator sets:	2x Scania CV AB DI16090M 535 kW @ 1500 rpm
Speed:	13.5 kn

Main dimensions

Length over all:	25.45 m
Length Loadline:	23.53 m
Length on waterline:	24.18 m
Beam over all:	12.20 m
Beam moulded:	11.40 m
Depth to maindeck:	7.01 m
Operational draught:	approximately 5.65 m



The Telstar during a fast turning maneuver

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