Cargo boat installation

A retrofit of a new, advanced hybrid drive into a cargo boat in Venice has provided improved levels of fuel efficiency and silent, smooth operation

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In early 2016, Transfluid supplied its HM2000-40 hybrid transmission with two 20kW (27hp) electric machines for a 12m (40ft), 20-ton displacement cargo boat operating in the Venice lagoon. The complete drive is a 125kW (167hp) FPT diesel engine flanged to the SAE 3-11 ½ HM2000 input. The supply includes a marine gear, frequency drive, $LiFePO_4$ chemical battery and battery charger, control lever, electronic control system with display, and all necessary CANbus cables and connectors.

The cargo boat is one of more than 1,000 similar vessels in operation in Venice and its lagoon. Vessels such as this provide transportation of goods, waste removal and construction throughout the region.

1. Transfluid's compact and flexible HT2000-40 hybrid unit powers a cargo boat in the Venice lagoon (above)

To facilitate both loading and unloading, these vessels are often equipped with a crane. The HM2000 provided a PTO that enables this function to be performed in both electric and diesel mode.

An added benefit of the hybrid drive is that it aids in the difficult maneuvering of heavy vessels through Venice's narrow canals. This is accomplished in electric mode, where the electric machine provides very high torque at very low speeds. When required, the booster function, a combination of the diesel and electric power, assists in difficult operation.

Working as a generator, the electric machine provides quick and efficient battery recharging during diesel sailing mode. This

2. For its hybrid modules, Transfluid manufactures these three-phase, PM synchronous electric machines with natural convection air cooling

provides the boat with an extended range compared with other types of propulsion.

Silent operation was important in this application because often these boats must sail at night to serve hotels, restaurants, shops and construction sites. Venice and its tourists are very sensitive to noise.

Transfluid's hybrid transmission also provides high levels of fuel economy. Sea trials have shown significant fuel savings compared with conventional drives. Late this summer, the boat entered into service in a fleet of 130 similar boats owned and operated by a beverage delivery company.

Complete system supply

Transfluid manufactures hybrid and electric transmissions for the propulsion of a wide variety of vessels. It produces components for the driveline, such as the elastic coupling, clutch, split power drive, electric machine, marine gear and electronic control (hardware and software). Frequency drive, batteries, battery chargers and CANbus cables are sourced from specialized partners. All aspects of the hybrid drive system are controlled by Transfluid's integrated proprietary software.

3. Alumarine's L'escapade passenger vessel, operating in France, is equipped with a Transfluid hybrid system

The hybrid transmission range includes four different sizes applicable for engines up to 1,100kW (1,470hp) and electric transmissions up to 75kW (100hp).

Transfluid's hybrid systems are designed to meet the majority of requirements for marine applications, including professional and recreational applications. The modules are also suitable for retrofitting on boats already in operation, as evidenced by the aforementioned installation in Venice, which was carried out on an existing boat. The diesel engine was replaced easily without any alterations to the boat and the hybrid module integrated into the existing structure.

The installation included electric machines produced by Transfluid. These three-phase permanent magnet synchronous machines (PMSM), with natural air convection cooling, provide high levels of efficiency in a compact, lightweight package. The PMSM electric machine is driven by a frequency drive, which enables mode generator management. Integration of the range of electric machines with the drives enables compact installation of the system, making it simple and effective to manage in the operational phase.

The construction of the electrical machines is optimized for use in hybrid systems, with nominal rotation at 3,000rpm. As well as enabling cooling by natural convection, this enables the power to be exploited in a progressive way for the entire range of rotation.

The torque curve is also important for this type of engine. In the first stage of rotation, the delivered torque from the engine can be three times the nominal output, for a limited time, in the rotational band up to 1,500rpm. The delivered torque, for a limited time, can be double the nominal torque, which means it is very effective in the low RPM of the propulsion system maneuvers.

Transfluid's range of electric machines is divided into two voltage bands: nominal power of 8kW, 12kW, 15kW and 20kW powered by 96V DC battery voltage; and nominal power of 35kW, 50kW and 75kW powered by batteries from 288V DC.

Transfluid has installed its hybrid modules in 13 craft with single engines and five with twin engines in various European countries, powered by different diesel and electric systems. In addition to Transfluid's conventional products, such as fluid couplings, variable speed drives, power take-offs, pump drives, elastic couplings and transmissions, the new hybrid and electric drive market will boost the company's sales and image as one of the most creative engineering companies of power transmission equipment in the world.