The pull of electric winches

Over the last decade, electric winches have started to challenge their hydraulic counterparts, promising greater simplicity and green credentials. ABB hopes to lead the transition

Winches are used on vessels across all sizes and segments to perform a wide range of operations, including anchoring, cargo lifting, towing and most frequently, mooring. Depending on the parameters of these operations – for instance the weight of cargoes to be lifted, or the size and displacement of the vessel to be moored – different winches are chosen, ranging in rated load, size, and most importantly type. While smaller vessels like yachts tend to employ manual winches, the majority of commercial vessels select either electric or hydraulic winches.

The latter has historically been, and remains, the most popular choice, installed on approximately 70% of marine vessels worldwide. Hydraulic winches are a tried-and-tested technology and are well-established within the industry, with a wide network of suppliers and servicing providers. Their durability, ability to operate continuously while the engine is running and capacity to pull heavy loads has made them the dominant technology when it comes to cargo vessels.

In common with other hydraulic machinery, hydraulic winches work using pressurised oil. The fluid – which is pressurised by a pump powered by gensets – passes through a control valve before driving the motor that rotates the winch, then passing back through a filter and into the tank to restart the process.

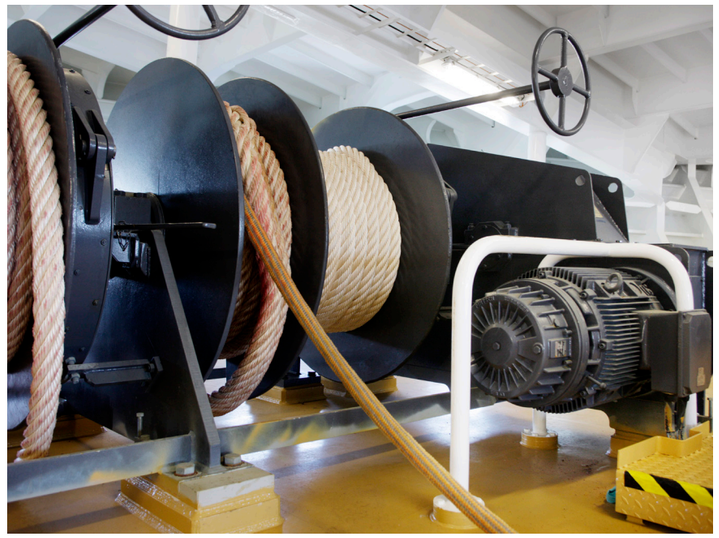
Electric efficiency

Given that hydraulic winches require electricity to power the pump, their power conversion is less energy efficient than electric winches, which are driven directly from the gensets. Moreover, electric winches avoid the danger of oil spillage and offer VSD (variable speed drive) functionality, enabling flexible operation and a high degree of control.

Streamlined drives, such as ABB's ACS880, have vastly improved electric winches

Yet electric winches initially failed to make much of a dent within commercial shipping. This might partly be attributed to shipping's oft-remarked upon tendency for slow uptake of new or alternative technologies; having been around for longer, hydraulic systems are simply better understood and trusted by ship operators who are reluctant to switch over to a new system, particularly one so crucial for vessel safety and used on a daily basis.

A few more specific reasons might be proferred for the faltering uptake of electric winches. One is the relative complexity of early/first-generation electric winch systems, with VSD winches requiring a programmable logic controller (PLC), encoders, and load sensors. Another is the substantial starting current required to operate the winches, and the potential for overheating, causing delays until the system cools down. Cost too has been a factor, particularly in the case of retrofits to replace existing hydraulic systems.



VSD functionality allows for smoother operation and greater efficiency in winching operations

However, recent advances in the technology are now leading to more streamlined solutions. A major player in electric winch development is multinational technology group ABB, already well-known across shipping for their electrical expertise. Recognising the value of this expertise in the case of winches, ABB has been working closely with "almost all of the large deck machinery OEMs," according to segment communications manager Otto Laitinen, to integrate their drives and motors.

Driving innovation

ABB released the first winch control program based on their well-known ACS800 VSD drive in 2007, but have since developed what they refer to as their "second generation" drive, the ACS880, which the company believes offers real potential for electric winches due to its simplicity. Because ABS880 drives utilise DTC (direct torque control) motor control, the shaft encoders of earlier electric winches are not needed. Moreover, built-in control software in the drive means that PLCs and additional winch controllers are also discarded, while signal delays are cut to a minimum, contributing to smoother and safer operation. Load cell sensors are also no longer required when automooring due to newly developed autotension capabilities.

Considerable simplification has been achieved via the removal or relocation of external devices and components into the drive. This has the benefit of reducing maintenance needs as there are fewer components, as well as reducing the total cost of ownership. Operationally, improvements have also been made with regard to noise reduction, winch movement (with full torque available even at low speeds, preventing jerking) and braking, with the winch drives including an integrated brake chopper. Ultimately, utilising the ACS880 drive allows for "faster and more accurate operation," says Laitinen, "reducing turnaround time in harbour."

With the improvement of electric winches spearheaded by ABB's drives, Laitinen suggests that ABB "can clearly see a market trend going from hydraulic to electric winches. And considering the clear advantages that VSD-based all-electric solutions bring to the equation, this is a quite natural direction." Next steps, according to ABB, include inbuilt intelligence taking in regenerative variants that enable energy to be brought back into the vessel's network when lowering anchors. A further possibility is the use of synchronous reluctance motors in winches, following a successful trial of a pairing of ABB's SynRM motors and the ACS880 VSD drive on board Viking Line's *Gabriella*. The main advantage of using SynRM motors is the improved response time; they do not suffer from the lag often experienced with induction motors which must be magnetised for the brake to be released. By contrast, the SynRM motor acts instantaneously once the brake is released, with the speed controller rotating the winch. A second improvement noted by the crew is more efficient power consumption, with previous peak current issues resolved. *NA*