

Taking the tension out of harbour mooring for Viking Line's Gabriella

Viking Line cruise ferry *Gabriella* has pioneered the first use of a state-of-the-art mooring winch solution comprising latest motor and variable speed drive (VSD) technology. One year on, the pilot solution has proved to be faster, smoother and more reliable than traditional solutions.

The *Gabriella* underwent a major refit and upgrade in 2016 with retrofit motor-drive installation for its mooring winches as part of the project. Her original winches, in operation since 1985, used a three-speed control system with three-winding, direct-on-line (DOL) motors, and an external mooring controller and load sensor in the gearbox.

Each speed change (low, middle, or high speed) would result in a DOL start of one of the motor's windings. This, combined with the high torque demands of the mooring operation, placed substantial stress on the winch system. This led to greater risk of rotor breakage in the winch motors and failure of the contactors used for DOL motor starting – adding to maintenance needs.

As part of the retrofit of the *Gabriella*, Viking Line piloted a new mooring winch solution from ABB, comprising a synchronous reluctance motor (SynRM) and ACS880 variable speed drive (VSD) package. The pilot project encompassed design, commissioning, training and fine-tuning.

This new winch concept enables precise motor control and operation while eliminating the need for costly and troublesome encoders, load cells or external mooring controllers.

As the *Gabriella* arrives in harbour, the new winch solution starts with the drive under hand-mooring control to quickly and smoothly let out the rope at high speed. When the rope is connected to the harbour, the winch brings in the slack quickly, until its control software's peak torque protection function



The *Gabriella* leaving Helsinki. (Kalle Id)

automatically stops the hand-mooring operation as the torque limits are reached.

The winch operator then switches to auto-mooring mode, which uses time control sequences to continually monitor the rope's tension. The software in the drive uses the torque information from the motor together with its algorithms to determine how the rope tension has changed. The system then makes the automatic adjustments needed to bring the tension back to the set-point selected by the operator. When the correct set-point is reached, the motor goes back to sleep and the sequence continues until the ship is ready to leave harbour.

Mechanical brake control is integrated into the winch control software of the VSD. It controls the disc brake of the winch motor (SynRM). The brake control ensures that the brake is open before the motor starts

to rotate, and closed before switching off motor torque.

The simplicity of the solution has helped improve the mooring winch system's reliability and reduce maintenance needs by causing less wear and tear on the winch motors, as well as making it easier to use for the ship's crew. It provides instant response, with much faster start and stop times, and enables the operator to simply release the mechanical brake and let the speed controller take over. When the winch operator uses a joystick to start the winch, the system run on the SynRM motor-drive technology reacts immediately and starts rotating. By contrast, in a traditional large induction motor there is a pre-magnetizing delay of up to one second before VSD can rotate the motor.

The innovative DTC (Direct Torque Control) technology provided by the



drive ensures more precise regulation of lower motor speeds with high torque levels. Handling line tension with time control means fewer components are at risk of faults, further enhancing reliability.

Current peaks used to be a constant problem on the winch deck. Previously, when the lever was shifted to full-head

it resulted in a peak current demand that posed the risk of system failure. Now, the VSD and SynRM combination has eliminated this serious issue.

The SynRM motor itself also requires less maintenance. This is because it has no rotor windings and runs cooler, which means a longer lifetime for the bearings. At about 600 kg, the new

Pictures above: Viking Line mooring using the new technology aboard Gabriella . (Viking Line)

SynRM is also only about half the weight of the induction motor it replaced. With a total of six mooring winches on board, the transition to lighter, more compact technology delivers more power in a much smaller package.