State of the art

Effective automooring systems aboard passenger-vehicle ferries are crucial for safe harbour operations

A recent upgrade to a SynRM motor and ACS880 drive unit has improved M/S *Gabriella's* mooring power and control

Back in 2016, Viking Line took up an ABB offer to carry out a pilot installation of a SynRM motor and ACS880 variable frequency drive combination to drive a mooring winch.

A long-standing ABB customer, Viking Line operates in the northern Baltic Sea, offering passenger travel and cargo carrier services on routes serving Finland, Sweden and Estonia using seven vessels – including the M/S *Gabriella*.

M/S *Gabriella* can carry around 2,400 passengers, has a crew of 170, and is able to accommodate as many as 300 cars or up to 900 metres of semi-trailer trucks.

The ship was built in 1992, so some of its deck equipment is approaching the end of its lifespan. Viking Line is carrying out an upgrade program to ensure that it will always meet its operational targets. This included the first retrofit upgrade for M/S *Gabriella's* mooring winches that are now state of the art.

Stop and start

The SynRM motor and ACS880 drive combination piloted on board Gabriella has a much faster start and stop time. It means that when the winch operator uses a joystick to start the winch, it reacts immediately and starts rotating. In contrast, when the operator touches the joystick on a traditional large induction motor there can be a lag of up to a second while the variable frequency drive magnetizes the motor. Only when the stator is magnetized is the brake released so that the winch can start to rotate.

Gabriella's boatswain Satu Pankinaho reports that the instant response now provided by the SynRM combination has had a positive impact on crew operations, as the operator simply has to release the mechanical brake and let the speed controller take over.

"If you start the winch and you need to change the speed between one, two and three, it's very smooth," she says.

"That's what we all like. And it has to be reliable. That's the most important thing.

"You must know that you can rely on it every time. It's crucial that when you pull the joystick, or whatever you do, it reacts immediately."

Drive options

Power consumption had been a constant problem on the winch deck. Previously, when every lever was shifted to full-head it resulted in a peak current demand that posed the risk of system failure. According to *Gabriella's* chief electrician Christian Holmberg, there were a few times when he wondered if the ship would even be able to dock. Now, the new variable frequency drive and SynRM motor have eliminated this serious issue.

"We now have two different new drives. The first was installed with the old motor – which was a good improvement. However, the second one was installed with a new motor.

"This is so much better because, as well as using less power, it is really smooth when you change the speed," explains Holmberg.

With his responsibility for maintaining electrical systems, Holmberg also appreciates the compactness of the solution.

"We asked ABB for new drive options. And they came up with something that is much smaller and even better. There are now fewer components and that makes fault finding easy. The variable frequency drive cabinet is almost empty. So, there's also less maintenance."

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 600kg, the new SynRM is also only half the weight of the induction motor it replaced.

And with six mooring winches on board, the transition to lighter, more compact technology delivers more power in a much smaller package.

Automooring system

The automooring system onboard a passenger-vehicle ferry like the *Gabriella* is crucial for its operations. When the ship comes into harbour it has a certain load draft as unloading and loading take place its level in the water changes. So, constant precise adjustment to the mooring winches is vital to maintain the correct tension.

This is where ABB's solution offers another important saving as the drive features a built-in time control sequence for automooring, handling tension control without a load cell sensor in the gearbox.

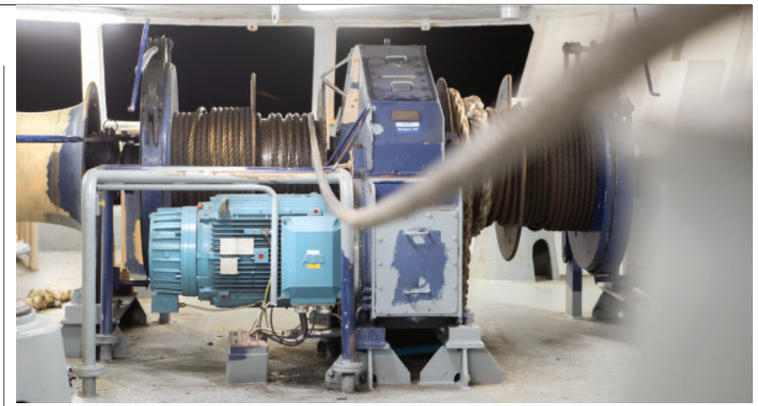
There is now no need for an expensive speed feedback device in the motor.

"Once we've moored, we switch it to automatic control and it takes care of everything," says Jouni Ahokangas.

The innovative direct torque control (DTC) 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 face the risk of possibly being subjected to fault conditions, further enhancing reliability.

The ease of conversion and the fast installation also made a deep impression on Christian Holmberg.



The smaller, lighter SynRM motor was mounted using the existing winch gearbox

"We cleared out the cabinet before ABB came aboard and they had a round trip to install the new components. We had the system up and running before docking. Of course, some adjustments in the program were still needed, but you could use it right away!"

Fine-tuning

The aim of the *Gabriella* pilot program was to test the concept of using a SynRM motor for the crucial operation of powering a mooring winch. The project encompassed design, commissioning, training and fine-tuning. The installation was completed and commissioned in January and was then followed up by ABB training for electrical personnel on board.

"The real fine-tuning is based on what you find out through practical hands-on user experience," explains Mikael Holmberg, ABB's sales manager for marine winches and cranes.

The upgrade has provided faster and much smoother mooring winch operation, according to *Gabriella's* boatswain, Satu Pankinaho

"At first, the winch operators were not completely comfortable with the new installation and its configuration. And their feedback led to further improvements.

"Initially, some drive parameter adjustments had to be made, which is normal in this type of pilot exercise. However, the biggest issue we discovered was not a problem with the motor or the retrofit, but with how the operators were actually using the system, which was fixed with a minor reconfiguration."

Originally, the only way for the operators to control the winch was with a joystick. But, sometimes when they change a clutch, they like to operate the system nearby with clutch control push buttons. That was not a feature of the legacy system that required two operators at different positions on the winch deck.

Push button operation is common on winch set-ups, and this was installed to give operators two options for working the winch.

Like any vessel, *Gabriella* has a maintenance program to ensure everything is working to the standards needed to achieve the targets of 'fast, efficient, safe' noted by chief officer Sebastian Henriksson. "Every week we test our equipment. We are constantly doing upgrades and the latest was our winches."

Henriksson says that after a year of using this unique winch power system, he and his crew are looking forward to using more of ABB's SynRM motor-drive packages.

"The crew are very happy with the new mooring winch setup, because it's smoother to use and starts and stops much faster. We've installed one now and in half a year or, so we'll change another motor over. So, in about five years, we will have upgraded all the motors."

The success of the SynRM motor and ACS880 drive combination has shifted mooring power and control to a new level for the *Gabriella*. Henriksson says he expects to have SynRM motors powering all of his vessels' mooring winches within five years. ■