Until recently, an ABB synchronous reluctance motor (SynRM) had never been used to drive a mooring winch. However, a pilot installation onboard Viking Line’s M/S Gabriella has turned this revolutionary concept into a practical application. Now, after a year of user experience, it has proved to be a resounding success in terms of both engineering and ease of operation by the ship’s crew.
“This new system works faster, starts faster, stops faster. It runs more evenly, and is more reliable. It’s simply easier to use,” says winch operator Jouni Ahokangas.

Speed, ease, and reliability of operation are key points that repeatedly come to the fore when the crew talks about the new SynRM-powered mooring winch on board the Viking Line M/S Gabriella.

In early 2016, Viking Line took up an ABB offer to carry out a pilot installation of a SynRM motor and ACS880 variable frequency drive combination. The project has delivered major operational benefits for the crew together with the potential for long-term cost savings for the company.

Viking Line is a long standing ABB customer. The company is a market-leading brand in passenger traffic on the northern Baltic Sea. It offers passenger travel and cargo carrier services on routes serving Finland, Sweden and Estonia with its seven vessels, including the M/S Gabriella.

“Our goal is to ensure that our vessels sail as fast, efficiently and safely as possible,” explains Gabriella’s Chief Officer Sebastian Henriksson.

M/S Gabriella takes about 2400 passengers, has a crew of approximately 170 and can load about 300 cars or 900 meters 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.

**Fast starts, fast stops**
The SynRM motor and ACS880 drive combination piloted on board M/S Gabriella has a much faster start and stop time. That means 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 is 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.

Boatswain Satu Pankinaho says that the instant response now provided by the SynRM combination has had a positive impact on crew operations, since the operator simply has to release the mechanical brake and let the speed controller take over.

“"This new system works faster, starts faster, stops faster. It runs more evenly, and is more reliable. It’s simply easier to use."
"If you start the winch and you need to change the speed between one, two and three, it’s very smooth. That’s what we all like."

Operational reliability is another key issue stressed by Pankinaho. This is absolutely essential when operating a mooring winch. "It has to be reliable. That’s the most important thing. You must know that you can rely on it every time."

Peak current issues are eliminated
Power consumption used to be 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, in the past 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 Christian 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 about 600 kg, the new SynRM is also only about half the weight of the induction motor it replaced. With six mooring winches on board, the transition to lighter, more compact technology delivers more power in a much smaller package.

Automooring is critical for operations
The automooring system onboard a passenger-vehicle ferry like the Gabriella is crucial for its operations. When the ship comes into harbor 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," smiles 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.

“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 M/S 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 Segment Sales Manager for Marine Winches and Cranes.

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

“There was initially some drive parameter adjustments that needed to be made. That 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.

The first SynRM package but far from the last
Just like any vessel, the M/S Gabriella has a maintenance program that ensures that everything is working to the standard 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 good 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 is very happy with the new mooring winch setup. They like that it’s smoother to use and it starts and stops 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.”

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