MARINTIME GLOBAL REPORT

World’s First Cruise Ferry Using Pure Gas Engine Propulsion

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Key Highlights

Category	Marintime Global Report
Standard	DIN
Weight / Size	Signalling a step change in the ferry traffic between Norway and the EU ...
Certificate	ABS, LR, BV, DNVGL, NK, KR, IRS, RMRS, CCS

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Technical Specifications

Category	Marintime Global Report	**Model / SKU**	World-s-First-Cruise-Ferry-Using-Pure-Gas-Engine-Propulsion
Standard	DIN	**Weight / Size**	Signalling a step change in the ferry traffic between Norway and the EU in terms of vessel size, environmental standard and onboard comfort, the 31,678gt Stavangerfjord has now begun regular operation.
Surface	Bolideck Select Soft Teak Effect gives a teak-like finish and is anti-skid without being rough-textured.	**Certificate**	ABS, LR, BV, DNVGL, NK, KR, IRS, RMRS, CCS
Warranty	12 Months unless specified otherwise	**Origin**	China

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Rather than opt for dual-fuel machinery, as used by other shipping companies to allow operation on natural gas, Fjord Line finally decided on lean-burn Bergen gas engines for Stavangerfjord and newbuild sister Bergensfjord. The favourable emission properties of plant designed for 100% gas ingestion means that the Norwegian-owned ferry specialist can already satisfy the considerably tougher sulphur controls due to be imposed in its operating area from the outset of 2015, as well as IMO Tier III NOx limits.

The sleek Stavangerfjord has been phased into the schedule linking Bergen and Stavanger, on the Norwegian west coast, with the Danish port of Hirtshals, near the northern tip of Jutland. Following arrival in Hirtshals, she then makes a return day crossing to Langesund, about 40km west of Larvik, in southern Norway, before picking up the overnight sailing back to Stavanger and Bergen, and then repeating the cycle.

Second-of-class Bergensfjord is expected to be available towards the end of this year, superseding the present ship of the same name. With both vessels of the new generation in service, Fjord Line will be able to offer daily departures throughout the year on the Bergen/Stavanger/Hirtshals and Hirtshals/Langesund routes. The latter is a new service, opening a direct connection between the European continent and Norway's largest industrial area, Grenland. The Norwegian operator has assigned the ferries to its Danish subsidiary, with registry under the Danish flag.

The greatest attention has been paid in the design to all factors bearing on passenger comfort and the travel experience on the day and night sailings, maintained throughout the year in the often rigorous conditions encountered on the North Sea's eastern fringe. Contemporary and flexible interiors cater to a maximum 1,500 passengers in the summer season, reduced to 1,200 during the winter months, with a total 306 cabins providing 1,180 berths. Retractable Neptune fin stabilisers are fitted to reduce roll.

The ro-ro payload equates to 1,350 linear metres, with a maximum free height of 4.5m. When the hoistable car deck sections are fully deployed, the ship can take some 600 cars, or a lower number in combination with freight, and all vehicular access and egress is through the stern. Each ship's twin stern ramps and 1,700m² liftable car deck and integral ramps were supplied by TTS.

The shipbuilding contract was awarded to the Bergen Group, drawing on the particular expertise of the company's Fosen division as regards passenger ship design and construction. Hull production was assigned to Stocznia Gdansk in Poland, with interior outfitting and ship completion carried out at the Rissa premises of Bergen Group Fosen. Fjord Line's current Bergensfjord came from Fosen in 1993.

Home-grown technology forms the beating heart of the exceptional new breed of cruise-grade ferries. Rolls-Royce Marine was contracted to deliver each shipset of four gas engines, powering a Promas integrated rudder and propeller system. Designed and manufactured at the Hordvikneset factory near Bergen, the engines are 12-cylinder, vee-form models of the B35:40 type, individually rated for a maximum output of 5,400kW at 750rpm. The four main engines drive two Rolls-Royce Kamewa controllable pitch propellers through Renk RSHL-1350 gearsets.

Drawing fuel from two 293m³ capacity LNG tanks, the installation thereby offers a total power concentration of 21,600kW, ensuring schedule-keeping at 21.5 knots. Using double-walled pipes, LNG is transferred from each tank through a cold box, where it is converted back to gas, which then flows through a gas reduction unit for further temperature and pressure regulation before introduction to the engines.

Initially, the shipowner had planned to fit MAN common-rail diesel engines for optional subsequent adaptation to dual-fuel operation. After the vessels had been ordered with L32/44CR-series main engines, and with the first ship somewhat delayed, it was decided instead to employ gas propulsion. The shift to a machinery specification based on immediate and full-time use of LNG, with the attendant nomination of pure gas engines of the Bergen marque, is understood to have been assisted by a contribution from the Norwegian NOx Fund.

While the technology is well proven in offshore vessel, small ferry and coastal cargo ship applications, Stavangerfjord's debut provides the newly-formed entity Bergen Engines, as part of the Tognum Group following the latter's takeover by Rolls-Royce and Daimler, with a prestigious reference in the large passenger ship domain.

The use of gas-fuelled engines means that emissions of SOx and particulate matter are negligible while NOx is reduced by about 90%, compared to operation on heavy fuel oil, such that the vessel is already compliant with future IMO Tier III requirements. In addition, carbon dioxide (CO2) emissions are said to be lessened by around 23%. Another major advantage claimed for the spark-ignition, lean-burn gas engine technology used by Bergen is that there are no operational limitations either on sustained low load or transient running. Also, the efficiency and power under propeller law factors are such as to allow comparatively simple mechanical transmission solutions to be selected.

Fjord Line has contracted with the Norwegian company Skangass for the supply of LNG bunkers. Over the short-term, during the ship's initial operation in the first six months or so, the scheduling arrangements for the Stavangerfjord provide for her to take on LNG three times a week in Hirtshals, at the Danish end of the route, and once per week at Risavika, in the Stavanger area, where the Skangass LNG production and bunkering facilities are located close to the ferry terminal.

Clearly, the adoption of single-fuel LNG bunkers in a large ferry maintaining an international route sets a precedent for the industry, and calls for the utmost prudence in certain practices in the early days until operations can be normalised and turnarounds optimised. During the start-up phase, therefore, the time the vessel spends docked in Hirtshals and Risavika has been extended, resulting in adjustments to the timetable.

"We hope these temporary adjustments will allow the time we need to establish fuelling procedures. That is a top priority," said Fjord Line's chief executive Ingvald Fardal. In July, he had also observed that "Norwegian rules prohibit filling LNG when passengers are on board, causing problems in general for a ship that is in continuous, round-the-clock operation. We hope these rules will soon be revised so we don't have to send 10 tanker trucks of LNG by road from Stavanger to Hirtshals every week."

The redundant subdivision of the main machinery spaces is such that the forward engine compartment comprises two main engines plus starboard side gearbox and associated shaft generator, and the aft compartment houses two engines, port side gear and shaft alternator. The LNG tanks were delivered as part of the Rolls-Royce machinery and equipment 'package' and are located in separate watertight and fire protected compartments under the main vehicle deck.

Diesel usage is retained through MAN L21/31-series auxiliaries and a Mitsubishi engine-based emergency genset. The auxiliaries are only run in port and incorporate catalytic converters, minimising NOx emissions. So as to attain the high level of manoeuvrability demanded of such a ship, two 1,600kW tunnel thrusters supplied from the Rolls-Royce factory in Ulsteinvik are fitted forward.

The waste heat recovery (WHR) system supplied by Alfa Laval Aalborg consists of four economisers drawing on the exhaust streams from all four main engines, and supplying steam to a Shinko turbogenerator. The system thereby captures waste heat to provide electricity for the public rooms and cabins. An important contributor to the efficiency of the ship's plant as a whole is the adoption of two 1,850kW Marelli shaft generators, driven by power take-off (PTO) from the gearboxes.

On behalf of Bergen Group Fosen, Finnish consultancy Deltamarin undertook the basic design of the vessel, including hull design, part of the outfitting, interiors, HVAC (heating, ventilation and air-conditioning) and machinery diagrams, as well as detail engineering for production purposes. Deltamarin's input was extended to cover both basic and detail design updates following Fjord Line's decision to change to wholesale LNG-fuelled propulsion.

Most of the vessel's public spaces are located on deck 7, and a 'mall' runs the length of the main area. Lightweight decking systems provided by the Dutch specialist Bolidt have been used on both external and internal areas on three of the uppermost deck levels, including the top deck. The selection was made by Oslo-based project architect Falkum-Hansen Design, and has entailed three systems.

Bolideck Future Teak is a "sustainable", lightweight alternative to teak, with the added advantage of reduced laydown time. Bolideck Select Soft has been developed with the emphasis on sound attenuation qualities, and is finding increasing application on passenger ships, especially for areas above cabins. Bolideck Select Soft Teak Effect gives a teak-like finish and is anti-skid without being rough-textured. The systems are said to ally with the ships' overall design ethos, by contributing to fuel savings through light weight, and by avoiding the environmental downsides of using natural wood.

At the 2013 Nor-Shipping Exhibition in Oslo, Stavangerfjord and Bergensfjord won the trade show's Energy Efficiency Award, in recognition of the owner's comprehensive and future-orientated approach to the standards vested in its new generation of combined day and night service ferries.

Principal particulars — STAVANGERFJORD

Length oa 170.0m

Length bp 148.0m

Breadth, moulded 27.5m

Depth 9.3m

Draught 6.4m

Gross tonnage 31,678gt

Net tonnage 14,270t

Deadweight 3,900dwt

Passengers, summer season 1,500

Passengers, winter season 1,200

Ro-ro capacity 1,350 lane-metre/600 cars

Propulsion system Gas mechanical

Main engines (gas) 4 x 5,400kW

Total main engine power (gas) 21,600kW

Service speed 21.5 knots

Class DNV +1A1, Ice-1B, Car Ferry A, E0, MCDK, F-M, Naut-AW, CLEAN, VIBR, GAS FUELLED, COMF V(2), TMON

Flag Denmark