



## **61.3% NO<sub>x</sub> Reduction after Retrofit of HAM System** First Humid Air Motor for the Norwegian fishing industry

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**The Norwegian vessel KVANNØY is the world's first fishing vessel to benefit from Humid Air Motor technology. Humid Air Motor is abbreviated to HAM. At last month's commissioning test and technical seatrials, KVANNØY's exhaust gas NO<sub>x</sub> emissions were reduced by 61.3%**

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### **Advanced ship**

From the very beginning, the purse seiner/trawler and factory vessel KVANNØY, which was built in 2002, has been synonymous with very advanced ship design and sophisticated propulsion technology. Examples are a reduction gearbox with two-step PTO, floating frequency, a large PTO/PTH shaft alternator/motor with a power boost function – where auxiliary engine power can be added to the propeller at peak requirements. Remarkable features and great propulsion flexibility were introduced already 10 years ago with this hybrid-like power concept in the KVANNØY newbuilding.

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Today, KVANNØY's innovative owners, Nyholmen AS from Bodø, have again taken a pioneering step – this time in the field of exhaust gas NO<sub>x</sub> reduction systems. After a re-building process performed at MAN PrimeServ Frederikshavn, Denmark, the main engine has successfully been retrofitted with a HAM system. As a result, KVANNØY now operates the world's first Humid Air Motor onboard a fishing vessel. It is also worth noting that this high-tech fishing vessel has become the world's second HAM vessel of all types.

### **NO<sub>x</sub> reduction and savings**

The main engine is an MAN 16V28/32A rated 3,920 kW at 775 r/min. The seatrial test results showed a NO<sub>x</sub> emission of only 3.6 g/kWh, measured according to the IMO MARPOL, E2 test cycle. This corresponds to a total NO<sub>x</sub> reduction of 61.3%, compared to the emission of the main engine running with its original charge air coolers – without HAM. The new HAM NO<sub>x</sub> level is 1.2 g/kWh above the IMO Tier III limit, and on an annual basis KVANNØY's accumulated NO<sub>x</sub> emissions are reduced by 50 ton. The economic benefits are annual savings of NOK 800,000 (EUR 100,000)



due to reduced NO<sub>x</sub> taxes for operation within Norwegian waters. Consequently, the calculated payback time for the HAM retrofit is approx. 3 years.

### **Proven technology**

HAM systems have already been thoroughly tested and proven in operation in two stationary diesel power plants, and additionally for more than 10 years of successful operation onboard the Viking Line-operated cruise ferry MARIELLA. The MARIELLA is powered by four S.E.M.T. Pielstick engines, type 12VPC2.6. MAN Diesel & Turbo SAS, France (which was formerly S.E.M.T. Pielstick) originally developed the HAM concept, and has continuously gained good operational knowledge of it.

### **The HAM principle**

With the HAM system, the turbocharger charge air is saturated with sea water vapour before it enters the charge air channels and engine combustion chambers. As a result, the temperature peaks in the combustion process are lowered, and the formation of NO<sub>x</sub> is reduced.

### **The operational advantages of the HAM principle are:**

- Major NO<sub>x</sub> reductions – good performance at full and part load
- Very low operational costs – no NO<sub>x</sub>-reducing agents are required
- Reduced fuel oil consumption – and no requirements for low sulphur fuels
- Good engine performance – reduced thermal load, cleaner engine and longer TBOs
- Low maintenance requirements – because of a self-supporting system
- An environmentally sound method – only using sea water

### **The main components in the Humid Air Motor system are:**

- The HAM vessel – the humidifier
- The HAM catch tank
- The HAM water supply and preheating units
- The HAM control and monitoring system

The HAM system layout and installation onboard KVANNØY was performed in close cooperation with the DNV classification society. Additionally DNV carried out the final



emission analysis, including NO<sub>x</sub> measurements during seatrial – running the main engine both with and without HAM. MAN PrimeServ's Service Center Denmark, Frederikshavn handled the installation and engine retrofit in cooperation with their French colleagues and HAM experts. The HAM system units, as well as the control and monitoring equipment, have been supplied by MAN Diesel & Turbo France SAS, Saint-Nazaire, France.

**KVANNØY particulars:**

Vessel type:	84 metre purse seiner/trawler
Shipyard:	Fitjar Mekaniske Verksted AS
IMO number:	9258090
Owner:	Nyholmen AS, Bodø, Norway
Manager:	Hansen Dahl Fiskeri AS
Main engine:	MAN 16V28/32A (3.920 kW)
Reduction gear:	With two-step PTO and PTH/PTI power boosting (1.880 kW)
CP Propeller:	MAN Alpha type VB1080
Control system:	MAN Alphasonic IIA
Classification:	DNV (Det Norske Veritas)

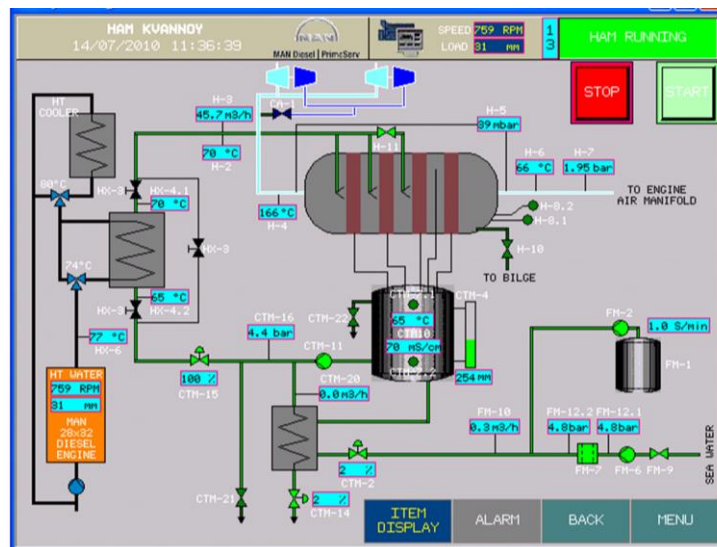


**Illustrations and captions:**

*The 84 metre KVANNØY, one of Norway's largest and most advanced fishing vessels – retrofitted with NO<sub>x</sub> reducing Humid Air Motor technology.*



*The HAM system – shown at KVANNØY's control and monitoring display panel.*



*Main components:*

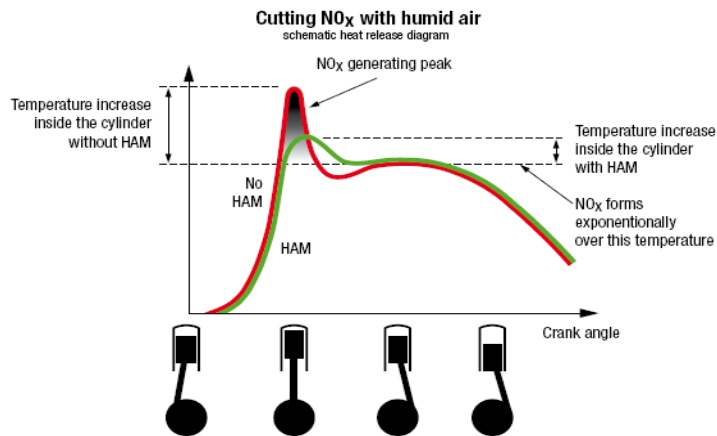
*HAM vessel – the humidifier*

*HAM catch tank*

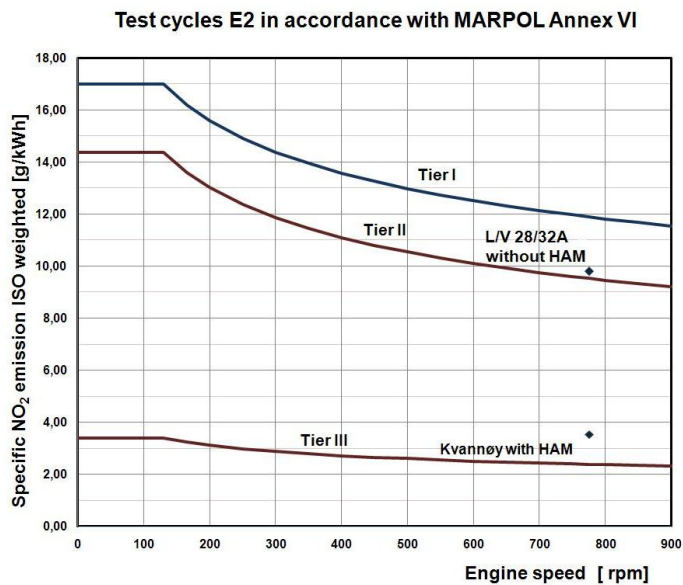
*HAM water supply and preheating units*



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NO<sub>x</sub> reduction down to 3.6 g/kWh after KVANNØY's HAM retrofit, showing a level just above the IMO Tier III limit. If e.g. additional heat from an exhaust gas economizer had been applied for KVANNØY, together with further research and fine tuning of the parameters, it would have been realistic to reach the IMO Tier III limit.



# Press Release

## MAN Diesel & Turbo



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### **About MAN Diesel & Turbo**

MAN Diesel & Turbo SE, based in Augsburg, Germany, is the world's leading provider of large-bore diesel engines and turbomachinery for marine and stationary applications. It designs two-stroke and four-stroke engines that are manufactured both by the company and by its licensees. The engines have power outputs ranging from 450 kW to 87 MW. MAN Diesel & Turbo also designs and manufactures gas turbines of up to 50 MW, steam turbines of up to 150 MW and compressors with volume flows of up to 1.5 million m<sup>3</sup>/h and pressures of up to 1,000 bar. The product range is rounded off by turbochargers, CP propellers, gas engines and chemical reactors. MAN Diesel & Turbo's range of goods includes complete marine propulsion systems, turbomachinery units for the oil & gas as well as the process industries and turnkey power plants. Customers receive worldwide after-sales services marketed under the MAN PrimeServ brand. The company employs around 12,700 staff at more than 100 international sites, primarily in Germany, Denmark, France, Switzerland, the Czech Republic, Italy, India and China. MAN Diesel & Turbo is a company of the Power Engineering business area of MAN SE, which is listed on the DAX share index of the 30 leading companies in Germany.

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