

DIESELFACTS

A Technical Customer Magazine of MAN Diesel & Turbo

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The MAN B&W ME-GI engine photographed at MAN Diesel & Turbo's Diesel Research Centre in Copenhagen by Erik G. Lund, 18 May 2011

World Premiere of the MAN B&W ME-GI Engine

Gas engine debuts at ceremony in Copenhagen

At a major event at its Diesel Research Centre in Copenhagen in May 2011, MAN Diesel & Turbo presented its ME-GI gas engine to a 300-strong invited audience of customers, licensees and journalists. The unveiling of the two-stroke engine represented the culmination of many years' work that began in the 1990s with the company's prototype MC-GI dual-fuel engine.

MAN Diesel & Turbo originally announced plans to carry out full-scale testing of the new engine in September 2010. The successful, full-scale demonstration and performance verification test of the GI principle for all kinds of marine applications was carried out on MAN Diesel & Turbo's 4T50ME-X R&D

research engine, which was been rebuilt as a 4T50ME-GI engine operating on natural gas. Korea's Daewoo Shipbuilding & Marine Engineering Co., Ltd. (DSME) provided the ME-GI's pertaining, high-pressure, cryogenic gas-supply system according to the terms of a development agreement signed in February 2010.

Market rationale

The ME-GI (Gas Injection) engine is a gas-injection, dual-fuel, low-speed diesel engine that, when acting as main propulsion in LNG carriers or any other type of merchant marine vessel, can burn gas or fuel-oil at any ratio. This depends on the energy source available on board and is therefore dictated by

relative cost and owner preference.

In relying on relative price and availability, as well as environmental considerations, the ME-GI engine gives shipowners and operators the option of using either gas or HFO.

MAN Diesel & Turbo sees significant opportunities arising for gas-fuelled tonnage as fuel prices rise and modern exhaust-emission limits tighten. Indeed, previous research indicates that the ME-GI engine, when combined with exhaust gas recirculation (EGR) and waste-heat recovery (WHR) technologies, delivers significant reductions in CO₂, NO_x and SO_x emissions fulfilling Tier-II and Tier-III regulations.

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MAN Diesel & Turbo Launches Two-Stage Turbocharging

With the market launch of its new, medium-speed, two-stage-turbocharged MAN 18V48/60TS engine, MAN Diesel & Turbo is continuing the expansion of its product portfolio with a low-emission, stationary diesel engine whose performance has aroused much market interest.

The new engine offers significantly increased turbocharging efficiency that contributes greatly to the engine's overall efficiency and power density. The newly developed HFO-run engine also meets World Bank 2008 guidelines for exhaust emissions at higher efficiency.

The two-stage turbocharged 18V48/60TS engine offers:

- an increased continuous power-output up to 1,200 kW/cyl
- NO_x emissions of 1480 mg/Nm³ (@15% O₂) while operating

at an increased output of 1,200 kW/cyl

- a very-low specific fuel oil consumption of 171.1 g/kWh while retaining an output of 1,050 kW/cyl
- flexible operation between 1,050 and 1,200 kW/cyl that gives operators the choice between low fuel consumption or high power output
- the possibility to retrofit existing 18V48/60 engines to two-stage turbocharged installations.

Uniquely, MAN Diesel & Turbo is the only engine builder that develops and builds its own turbochargers for large diesel engines, a unique expertise that translates into exceptional efficiency and reliability. Two-stage turbocharging is

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Ultra-long-stroke engine group adds bore sizes

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Vale newbuilding creates new shipping class

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MAN Diesel & Turbo

ME-GI World Premiere



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MAN Diesel & Turbo predicts a broad, potential market for its ME-GI engine, extending from LNG and LPG carriers to other oceangoing vessel segments such as container ships as well as ships plying a fixed trade. As such, the ME-GI engine represents a highly efficient, flexible, propulsion-plant solution.

Considered timing

"The unveiling of the ME-GI engine is MAN Diesel & Turbo's response to current market conditions and the large audience in Copenhagen is proof of the great interest in this propulsion solution," said MAN Diesel & Turbo's Søren H. Jensen, Vice President and Head of Research & Development, Marine Low-Speed.

He continued: "The ME-GI engine is the culmination of years of

research and development and we consider the timing of its release to market to be optimal. We see many potential applications for the ME-GI's increased flexibility and greater control both within the LNG sector and generally within marine trans-

portation, as operators seek to control costs and emissions."

Jensen concluded: "With the addition of the ME-GI engine to its existing portfolio, MAN Diesel & Turbo now offers the two-stroke market's most comprehensive ar-

ray of prime-mover solutions all the way up to 98-bore."

Technical details

MAN B&W ME-GI two-stroke engines possess economical and operational benefits compared to other, low-speed engine plants, irrespective of ship size. Based on the successful, electronically controlled ME heavy-fuel-burning diesel engines, the ME-GI design accommodates natural gas and liquid fuels.

Dual-fuel operation requires the injection of both pilot fuel-oil and gas fuel into the engine's combustion chamber via different types of valves arranged in the cylinder head. The ME-GI engine head is fitted with two valves for gas injection and two for pilot fuel with the pilot-oil valve is a standard ME fuel-oil valve. MAN B&W ME-C and ME-GI engines are broadly similar and

share the same efficiency, output and dimensions. In comparison, the ME-GI engine's key components are its modified exhaust receiver, modified cylinder cover with gas-injection valves and gas-control block, an expanding top gallery platform, high-pressure fuel-supply pipes, and mounted gas-control units.

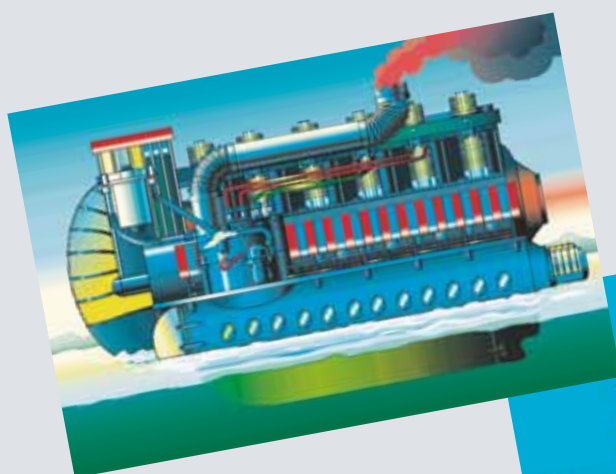
Benefits

The ME-GI engine contains many inherent benefits, including:

- low operational costs
- low investment costs
- flexible burning of HFO and gas
- clean exhaust gas
- conventional MAN B&W two-stroke technology:
 - high reliability
 - low maintenance
- maximum engine-room safety
- two-stroke dual-fuel experience since 1994. ■

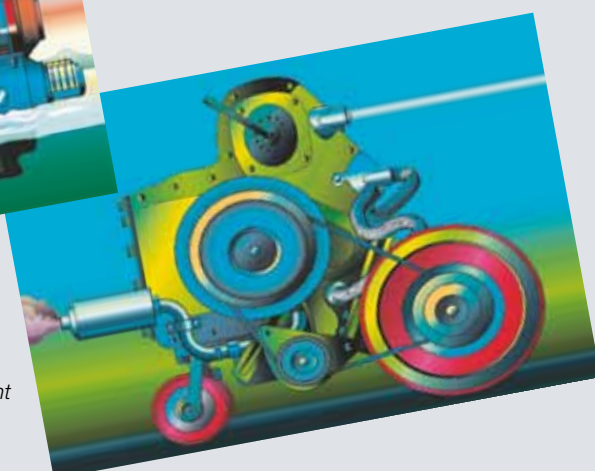


Testing took place at Copenhagen's Diesel Research Centre



Left: Helmut Meinerzhagen, *The Journey*, 2003, Pigment on hand made paper (edition 100 prints), 60 x 43 cm

Right: Helmut Meinerzhagen, *Joyride*, 2003 Pigment on hand made paper (edition 100 prints), 60 x 43 cm



Grand Opening of 2011 Art Exhibition at Turbocharger BU

Art lovers came together at MAN Diesel & Turbo's Turbocharger Business Unit's premises recently for the grand opening of the company's 2011 art exhibition. No fewer than eight artists presented more than 40 exhibits exploiting different techniques such as paintings, drawings and photography. Some works deal directly with proper MAN topics, for ex-

ample, marine, stationary and traction engines, and could well have originated from the drawing board of a very creative and lateral-thinking engine designer. The Turbocharger business unit's art exhibition was first set up in 2006 when the unit moved into new offices. The exhibition runs till the end of February 2012. ■

■ Two-Stage Turbocharging

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a modular system whose design enables retrofitting in the case of most MAN Diesel & Turbo 18V48/60 power plants.

The 48/60TS engine represents an exciting step forward in the power segment where the introduction of two turbochargers in sequence provides a new dimension in engine performance, NO_x reduction and operational flexibility. As such, the 18V48/60TS sets a new benchmark for diesel engines in its class.

The 18V48/60TS engine

The engine was developed at MAN Diesel & Turbo's headquarters in Augsburg, Germany, and is available in an 18-cylinder vee-configuration based on the well-known and reliable engine – the MAN 48/60B type. The 48/60TS is assembled in Saint-Nazaire, France.

Since its launch in 1988, MAN Diesel & Turbo has sold nearly 800 × 48/60 units, bound for a broad range of power-generation and marine-propulsion applications. Thanks to its high efficiency, the 18-cylinder variant is the 48/60 engine family's bestselling configuration.

The overall design of the two-stage turbocharged 18V48/60TS has been kept as simple as possible and differs in the form of just a few modifications from the standard engine. These include:

- modified fuel-injection nozzles for the higher power-output range
- a three-ring piston with higher compression ratio
- a modified camshaft for enhanced Miller timing
- an additional exhaust-gas bypass valve to avoid smoke during start-up.

The high-pressure turbocharger is directly mounted to the engine with the low-pressure turbocharger located upstream on its own steel frame. The combustion-air and

exhaust-gas piping between both turbochargers is fitted with compensators, ensuring complete insulation from vibrations.

Lowest fuel-oil consumption or NO_x emissions

The excess combustion air from the turbochargers provides greater operational flexibility. The high charge-air pressure can be used for enhanced Miller Cycling, delivering significant fuel savings. Alternatively, it can be leveraged to significantly increase engine power-output while, simultaneously, further reducing NO_x emissions.

At the power output of 1,050 kW/cylinder, the 18V48/60TS diesel engine has a very low specific fuel-oil consumption of 171.1 g/kWh, referenced to engine power output without engine-mounted pumps, at ISO 3046 conditions with a tolerance of 5%. This is equivalent to a heat rate of 7,305 kJ/kWh or a pure engine efficiency of 49.2%.

Referenced to an electrical genset power-output, assuming a generator efficiency of 97.5% and with engine-mounted pumps, the heat rate is 7,607 kJ/kWh or 47.3% electrical genset efficiency. This is an efficiency rate for four-stroke diesel engines, which makes the two-stage turbocharged 18V48/60TS one of the most cost effective diesel engines in its class.

The excess combustion air can alternatively be leveraged to significantly increase the engine's power output up to 1,200 kW/cylinder. Although this does not save fuel, it does allow for a greater reduction of NO_x emissions within a wide operation range. NO_x emissions of 1,480 mg/Nm³ make the 18V48/60TS one of the cleanest diesel engines in its power range.

Flexibility

Like the standard engines in the 48/60 series, the two-stage-turbocharged 18V48/60TS can be operated with a wide range of different

fuels, including:

- heavy fuel oils with a viscosity up to 700 cst
- marine diesel and gas oil.

Two-stage turbocharging enables the 18V48/60TS to operate continuously at shaft power outputs from 18,900 up to 21,600 kW. In a stationary-power scenario, for example, this would allow power providers to operate engines at a normal load of 18,900 kW, taking advantage of the extremely low fuel-oil consumption and allowing the possibility of a spinning reserve up to 21,600 kW.

Two-stage turbocharging technology

The advanced technology offered by two-stage turbocharging enables the 48/60TS to reach peak performance in the market. The new engine's design arranges two turbochargers in series, allowing very high combustion/air-pressure ratios that open up a whole new dimension of operational possibilities.

The 18V48/60TS deploys MAN Diesel & Turbo's TCA88 and TCA77 standard turbochargers in sequence. The TCA88 is located upstream and provides the low-pressure turbocharger, while the TCA77 forms the high-pressure turbocharger, next to the engine. In this configuration, both turbochargers can achieve pressure ratios in the range of 6 bar at significantly higher efficiencies compared to a single-stage turbocharged system.

Despite the two-stage turbocharger modular system being an engine add-on, the 48/60TS does not require any more space than an engine with a single-stage turbocharger system.

The engine features an uncomplicated design that has especially concentrated on making each and every component easily accessible for maintenance, in spite of its compact nature. ■



The 18V48/60TS engine pictured at MAN Diesel & Turbo, Saint Nazaire, France

18V48/60TS Principal Data

No. of cylinders	18
Bore/Stroke (mm)	480/600
Speed (r/min)	500/514
Frequency (Hz)	50/60
mep (bar)	22.6 to 26.5
Piston speed (m/s)	10.0/10.3
Power Output (kW/cyl)	1,050 to 1,200

Source: MAN Diesel & Turbo

Autoridad del Canal de Panama Goes With MAN B&W Low-Speed Power

The Miraflores power plant has ordered 81 MW worth of stationary engines for base-load operation.

The public bid for the expansion of the Miraflores power plant in Panama recently concluded with the awarding of the contract to Hyundai Heavy Industries Co. Ltd. for the construction of two MAN B&W 12K80MC-S engines. The existing plant has a total installed capacity of 151 MW based on power generated by three gas turbines, two steam turbines and three medium-speed MAN diesel engines.

The new, two-stroke engines bound for Miraflores are equipped with a turbo-compound system (TCS) that recovers energy from exhaust gas. At 100% MCR, the

engines will each develop 41.47 MW_m – an efficiency rate of 49.2% (mechanical) – at site ambient conditions. Hyundai Heavy Industries Co. Ltd. will supply the engines to ACP as part of a turnkey solution.

The MAN B&W 12K80MC-S engines will run on HFO with a measured sulphur content of 3%. In terms of NO_x emissions, the engines' design complies with the World Bank's 1998 regulations that state a limit of 2,000 mg/Nm³ and, accordingly, secondary measures for compliance with NO_x regulations are not necessary. Particulate emissions are controlled by means of an electrostatic precipitator (ESP) that keep levels within the prescribed 50 mg/Nm³ limit. ■



The Miraflores site in Panama lies adjacent to the famous canal that currently is undergoing a significant expansion that will enable even larger ships to use the famous shortcut through central America. (source: Autoridad del Canal de Panama)

First Orders Signal Acceptance of G-Type Engine

MAN Diesel & Turbo's assessment of the two-stroke market has borne fruit with a number of Greek ship-owners showing concrete interest in the company's new, G-type, ultra-long-stroke engine programme.

Athens-based shipowner Thenamaris has placed a surprise order for four 6G80ME-C9.2 engines to power 4 x 5,000-teu container vessels, to be built by Hyundai (HSHI) in South Korea. Specifications for the contract indicate a ship speed at NCR of 21.5 knots with a design draft of 12 m. Hull numbers S616 – S619 have already been assigned to the newbuildings with the first ship scheduled for delivery in August 2013. MAN Diesel & Turbo reports that another, Greek shipping company is currently undertaking a technical evaluation on the feasibility of using the 6G80ME-C engine in a series of 4,800-teu container vessels to be built at Zhejiang Ouhua Shipbuilding Co., Ltd. in eastern China.

MAN Diesel & Turbo states that

it is also currently involved in several, active VLCC projects where the G80ME-C9.2 is the preferred engine choice. Indeed, this vessel type was originally the primary target behind the introduction of the G80ME-C9.2 engine. The shipping industry is currently debating whether or not VLCC lay-out speed should be reduced to 13 knots from the existing 15 to 15.5 knots, a scenario which the G80 is tailor-made to meet.

Ole Grøne – Senior Vice President Low-Speed Promotion and Sales – MAN Diesel & Turbo said: "We are delighted with the market response to the G-type. We viewed its introduction as both viable and timely and are pleased that the market has seen fit to back this up."

He continued: "We always follow developments in the shipping market closely and have kept a close eye on the trend for fuel optimisation in recent years. As such, we experienced great interest in the G-type engine during the extensive consultations MAN Diesel &

Turbo held with industry partners, stemming from which we initiated a variety of projects with shipyards and major shipping lines during the lead-in to the G-type's market introduction."

The G-type programme

The G-type programme was introduced to the market in October 2010 with the G80ME-C9 model. MAN Diesel & Turbo subsequently expanded the ultra-long-stroke programme in May 2011 with the addition of G70ME-C9, G60ME-C9 and G50ME-B9 models.

The G-types have designs that follow the principles of the large-bore Mk-9 engine series that MAN Diesel & Turbo introduced in 2006. Their longer stroke reduces engine speed, thereby paving the way for ship designs with unprecedented high-efficiency.

Rationale for G-type introduction

Tankers and bulk carriers have traditionally used MAN B&W S-type engines with their long stroke and



Ole Grøne, Senior Vice President Low-Speed Promotion & Sales, MAN Diesel & Turbo

low engine-speed as prime-movers, while larger container vessels have generally tended to use the shorter-stroke K-type engine with its higher engine speed.

Following efficiency optimisation trends in the current market, MAN

Diesel & Turbo has also thoroughly evaluated the possibility of using even larger propellers and thereby engines with even lower speeds for the propulsion of tankers and bulk carriers. Larger container vessels are now increasingly being specified with S80ME-C9 and S90ME-C8/9 engines because of the opportunity they offer to employ larger propeller diameters; an S90ME-C9 engine will replace a corresponding K98 with the same cylinder count.

Such vessels may be compatible with propellers with larger diameters than current designs, and facilitate higher efficiencies following adaptation of the aft-hull design to accommodate a larger propeller. It is estimated that such new designs offer potential fuel-consumption savings of some 4-7%, and a similar reduction in CO₂ emissions. Simultaneously, the engine itself can achieve a high thermal efficiency using the latest engine process parameters and design features. ■

Keep Your Engines in Tip-Top Condition

PrimeServLab monitors engine fluids as part of preventative maintenance package

Damaged fuel pumps, needless lube-oil exchange, heavy corrosion – poor-quality operating fluids can lead to many problems in modern diesel engines.

Disregarding the monitoring of fuel, lube oil and cooling-water quality can unfortunately prove to be an expensive lesson.

Increasingly, many marine and power-plant engine operators have decided to entrust this vital service to MAN Diesel & Turbo that, as an original engine manufacturer, has the best engine know-how.

MAN Diesel & Turbo took its first step into this business 3 years ago with its 'Fluid Monitoring Package' service that has recently been renamed to 'PrimeServLab'.

Almost without exception, existing PrimeServLab customers extend the service after the initial period's expiry, which is typically after one year. However, one power-plant customer has already signed up for a third year.

What is PrimeServLab?

At its German headquarters, MAN Diesel & Turbo operates its own chemical lab specialised in the analysis of non-metallic materials and engine fluids, such as fuel, lube oil, cooling water. In addition to all the equipment required for the standard analysis of operating fluids according to common specifications, for example, ISO8217 for



PrimeServLab operates its own, specialist laboratory out of Augsburg, Germany

fuels, the lab also possesses more sophisticated equipment for what is termed a 'forensic' analysis.

The PrimeServLab service analyses operating fluids at regular intervals over one year and consists of five packages:

- comprehensive fuel analysis
- lube-oil analysis
- lube-oil separator control samples
- fuel-separator control samples
- cooling water.

The sampling interval for each package can be adjusted to meet individual customer requirements

best. Typically the interval for the comprehensive fuel analysis is adjusted to suit fuel-bunker logistics. The interval for lube-oil analysis is typically a month but can be adjusted to every three months as is typical for the remaining three packages.

What makes PrimeServLab unique?

The chemical lab in Augsburg has vast experience with all kinds of engine fluid and has been involved in service issues and trouble-shooting processes for decades. Know-

ing the sample in the bottle, as well as the engine it comes from, enables PrimeServLab to provide more than just an analysis, rather, it can provide a technical recommendation that represents the translation of the analysis into practical instructions.

PrimeServLab's main objective is to ensure the high quality of engine fluids and to react proactively when necessary. This increases engine availability and reduces the risk of expensive damage caused by low-quality engine fluids. Another objective is the economical optimisation of all products used. For example, a mismatch between lubricating oil and used fuel quality can result in overly expensive oil costs or, even worse, the need for oil drains.

To put it into perspective, the prevention of one lube-oil drain is enough to pay for the PrimeServLab service over several years that can prevent damage for decades.

The standard analysis of operating fluids is not sufficient for maximum reliability. The PrimeServLab service covers unique measurements such as a fuel analysis that includes calorific value and screening for chemical waste as standard.

Fuel contamination in lube oil is also an important consideration and a method developed by MAN Diesel & Turbo is even capable of identifying contamination sources.

Similarly, the efficient cleaning of

fuel and lube oil is essential. The monitoring of fuel and lube-oil separator efficiency is only possible by measuring particles in samples taken before and after separation. Unfortunately, the standard lube-oil analysis, as typically provided by oil suppliers, does not contain any information about particle contamination. However, PrimeServLab uses a recently developed method to count particles in oil and judge oil-separator efficiency.

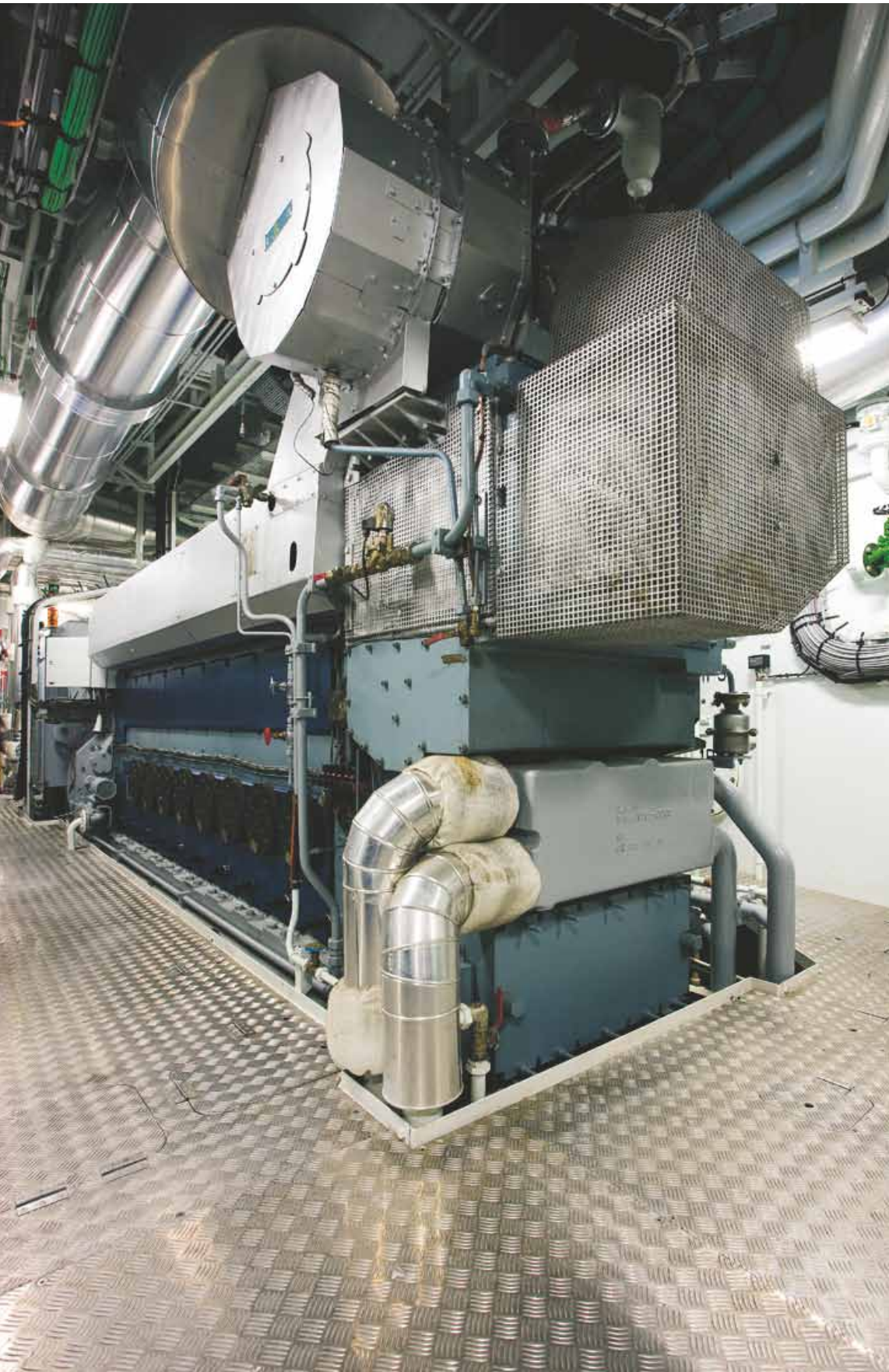
Cooling water is often disregarded as a fluid and the measurement of corrosion-inhibitor concentration is often performed with simple and inaccurate methods on-site. Cases have been documented where these methods have been applied incorrectly or where results have not been measured but instead a plausible number filled into the control form. Unsurprisingly, heavy corrosion is the inevitable result. Regular cooling-water analysis is the antidote to such unnecessary and expensive damage.

How does PrimeServLab work?

After ordering PrimeServLab, MAN Diesel & Turbo supplies the plant or vessel with sample bottles in pre-packed cardboard boxes adjusted to the agreed scope of the package. Subsequently, samples are collected and sent to Augsburg with, typically, a comprehensive report sent by email 2-3 days after the lab receives the samples. ■

Norwegians Take Delivery of MAN-Powered Offshore Vessel

Specialist vessel to service hydrocarbon rigs and platforms in challenging environments



View of the engine room and its diesel-electric propulsion system featuring 6 x MAN 9L21/31 four-stroke engines

GC Rieber Shipping of Bergen, Norway recently took delivery of the offshore ROV-survey vessel – the ‘Polar King’ – constructed by CNP Freire shipyard in Spain.

The newbuilding has a diesel-electric propulsion system that features 6 x MAN 9L21/31 engines and will support activities in the hydrocarbon sector. MAN Diesel & Turbo reports that delivery of a second, twin vessel – the ‘Polar Queen’ – is currently scheduled for the end of summer 2011.

The MAN L21/31 engine is a proven member of MAN Diesel & Turbo’s engine portfolio and has references in many applications, including the offshore segment that requires reliable engines that can perform for long periods under harsh conditions.

The Polar King project originally commenced in 2008 but the global financial crisis caused a 6-month delay in construction while refinancing was found. Finally, GC Rieber Shipping took over the project itself in 2009 with the

ship subsequently being launched in 2010.

About CNP Freire

Originally established in 1895, the 42,000-m² CNP Freire shipyard is located on the Atlantic coast in Vigo, Spain. Freire has a long history of shipbuilding within many different segments and made its debut in the offshore sector in 2006 with the delivery of an oceanographic research vessel.

About GC Rieber Shipping

Based in Bergen, Norway, GC Rieber Shipping’s offshore/shipping business deals with the ownership and operation of specialised vessels with an emphasis on high-quality marine ship management. Project development and industrial portfolio management within sub-sea, ice/support and marine-seismic segments are also a major part of its business. The group has a unique competence in operating offshore in harsh environments and in the design, development and operation of seismic vessels. ■

Main Propulsion

Engines	6 x MAN 9L21/31
Bore (mm)	210
Stroke (mm)	310
rpm	900
Output per engine (kWm)	1,980

Polar King – Main Particulars

Length o.a. (m)	110.16
Breadth mid (m)	20.00
Depth mould to main deck	9.80
Draught max. Abt.	7.50

Capacities

Gas oil /diesel oil (m³)	1722
Cargo deck abt. (m²)	925
Deck load (metric t)	580
Max. dwt abt.	4,360
Complement	120
Max. speed (knots)	15.85

Source: MAN Diesel & Turbo



For a more detailed view of DieselFacts, including video, visit our online site at:

www.mandieselturbo.com/dieselfacts

Independent Brand More Than Ready to Salvage Success

On-site machining specialist 'Metalock Denmark' primes itself for expansion

The last time DieselFacts interviewed Frank Hansen (see DieselFacts 2009_3), the Dane dropped us off afterwards outside a train station located within one of North America's most infamous ghettos. That fateful day, DieselFacts got straight outta Compton while, two years on, Hansen has moved from PrimeServ Los Angeles to his next posting at Metalock Denmark.

These days, Frank Hansen works in the Copenhagen suburb of Ishøj as Managing Director of Metalock Denmark. Founded in 1952, the specialist, in-situ machining company was an approved supplier of MAN Diesel & Turbo in the late '90s before being bought by it in 2008. Today, Metalock Denmark is officially a part of MAN PrimeServ, MAN Diesel & Turbo's after-sales service, but retains its own brand.

Contrast

For Hansen, the biggest difference between his work in the US and that in Europe is the nature of the jobs: PrimeServ Los Angeles is a service facility whereas Metalock Denmark deals with on-site

machining, salvage jobs in other words. Where Los Angeles provided service and preventative maintenance for its customers, Ishøj is all about something that has gone wrong and needs to be repaired quickly. "It's difficult to sell salvage beforehand!" laughs Hansen. "Metalock operates worldwide so the business culture is pretty similar to that in America. Maybe the Americans move a little faster in tackling outstanding issues, but I enjoyed doing business with them in the 3 ½ years I lived there."

Ishøj

24 people are employed in Ishøj, five in administration and 19 as travelling service engineers. The company premises comprise offices and a 1,000-square-metre workshop, predominantly used for preparing and developing the company's tools. These are typically used aboard vessels and on windmills, at power plants, turbine stations, etc.

Hansen states: "Our focus is on working on-site. This is where we are strong, this is what we do well and we do not compete with

local service workshops. Our sharp competencies lie within the on-site machining of, predominantly, crankshafts and line boring of two- and four-stroke diesel engines." Metalock Denmark also does some metalocking, the old method of crack repairing in cast iron where welding is not possible, although this is slowly dying out.

Hansen says that in-house repairs form only a minor part of Metalock's service and that the workshop can be considered as a giant playground for developing tools. As an example of this, he highlights a recent Metalock innovation – a new tool development used for line boring in the machining of bedplates for two-stroke engines – and says: "The traditional tool required a total repair time of 2-3 months to machine such a bedplate on a two-stroke engine. Together with MAN Diesel & Turbo in Copenhagen, we have developed a tool that enables us to cut this machining down to just 4-5 days."

This innovation saves customers a small fortune in slashing yard time and putting the vessel back in service 2-3 months earlier than

previously was the case. Hansen confirms: "We've just performed such a job down in Greece and this is cutting-edge technology. It cannot be compared with anything else and we are the only company able to do this in the market at the present moment." In fact, Metalock constantly develops processes such as this and is currently looking at how to cut four-stroke engine repair-times.

Global and local

Metalock Denmark operates globally with some 95% of its turnover coming from outside Denmark. Its most important market is the on-site machining of two-stroke crankshafts, bedplates and line boring, in fact, all rotating elements whether from turbine shafts or windmill elements. Currently, Metalock is laying plans to expand, both abroad and within the Danish market.

Hansen explains that more business within Denmark is beneficial in that he can advantageously load his people with additional work, while creating new business areas strengthens Metalock as a whole. He says: "Denmark is cost-

ly for owners to dismantle things like large windmills located in the sea as these are expensive to take apart, ship on-shore for repair and put back in place afterwards. We are working on developing a share of this market and have already made good contacts within the Danish windmill sector. All new markets take time to develop but we're getting there."

Competitive times

As a global player, Metalock Denmark faces keen competition around the world, especially in the Far East where salary bases and general costs are lower. While this is another reason to develop new markets, Metalock has a significant advantage in the large volume of repeat business it has with clients where the company is not necessarily competing on just price but can trade on its long reputation for quality, reliability and speed.

"We deliver what we promise and do it as quickly as possible", Hansen says. "It might be that our services are slightly more expensive than our competitors, but we are also aware that they are better."



View of Metalock Denmark's 1,000-square-metre workshop where it prepares and develops its tools

Of course we keep an eye on the competition but customers know that they will have their vessels back in operation faster with us."

Day to day

Metalock is a small company and, accordingly, Frank Hansen wears a lot of different hats at work, ranging from giving customers quotations, to allocating resources, analysing figures, defining strategy and handling human resources. He also handles marketing and sales and thinks the many, different tasks make the job challenging but more interesting. As a result, Hansen says he is in touch with everything going on in the company. He also praises Metalock's internal communication where different viewpoints are always discussed when tackling issues.

Customers are contacted on a daily basis, either by email, phone or face-to-face meetings. Hansen says that networking drives business to a certain extent and, obviously, reputation, while PrimeServ Copenhagen is his biggest customer: "We follow PrimeServ but work independently within the group. I work very often with them. We frequently share ideas and knowing how they think enables Metalock to help them."

The right stuff

Most Metalock jobs involve damaged rotating elements such as scored surfaces, journal scores and bearing failures. However, its service engineers typically encounter a lot of one-off tasks that they never have met before – analytical skills are absolutely a part of the job description for Metalock Denmark service engineers.

"The service engineers here are very skilled and are able to work independently in difficult environments on complex tasks," says Hansen. "It requires a special ability to carry out what they do on-site because nothing is scheduled and nothing is straightforward when it comes to the type of damage we see in our daily work. Therefore, our engineers have to be very in-



A Metalock Denmark speciality – the mobile machining of a seat for a steam turbine steam valve

novative and able to produce solutions on the spot – this type of innovation absolutely characterises our work." He adds: "They're proud of what they do and the jobs they work on."

Metalock engineers are invariably qualified as skilled machinists before joining the company. Starting as trainees, they undergo a long, basic-training period where they learn about the tools Metalock uses and how to control them – a period that Hansen describes as a challenging education in itself. He says: "It's not something you can learn in school. Our trainees don't get to stand on their own two feet before they have been here three or four years." Today, Metalock engineers typically have eight to 20 years' experience and staff turnover is low, ensuring Metalock retains a vast bank of knowledge and experience.

The message

Reflecting on any message Metalock may have for its customers, Hansen says: "I think it's very im-

portant our customers are aware when choosing Metalock Denmark, that we provide a reliable, fast service. We're trustworthy – we don't back out on a job, we fulfil it very quickly. This is our hallmark while our close relationship with MAN Diesel & Turbo ensures that any spare-parts required on a job are delivered swiftly and trouble-free. Our customers are invariably happy after doing business with us."

The future

Hansen is confident about Metalock Denmark's future: "Things will go our way as long as we continue to develop our own, cutting-edge technology and closely follow the market. I don't think there's anyone out there who carries out an on-site machining of a crankshaft as fast as us. Continuing to work closely with the engine manufacturer – MAN Diesel & Turbo – is also a key consideration." Hansen reveals that Metalock is also planning a move into the Hong Kong market later this year with an eye

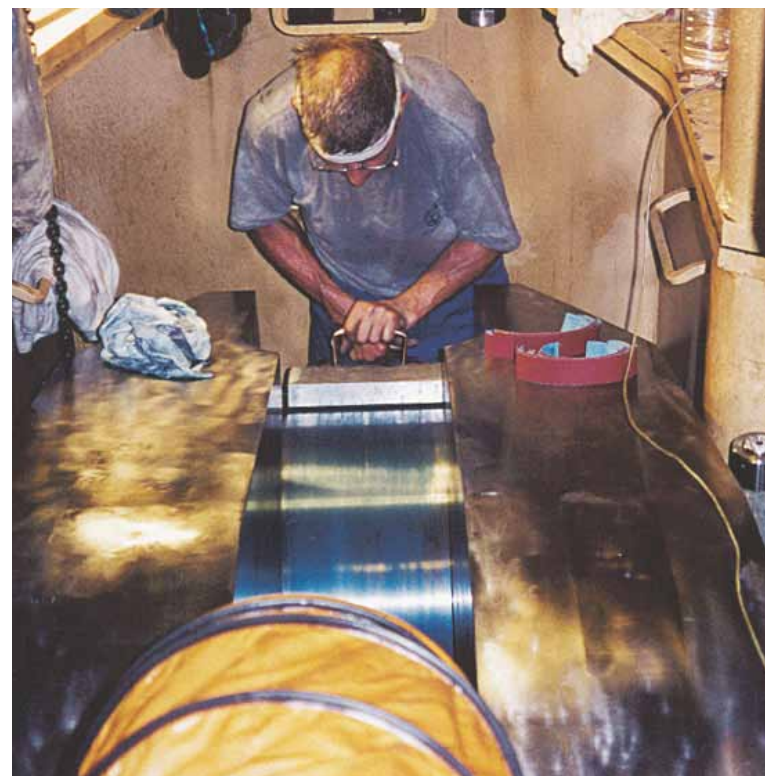


Frank Hansen, Managing Director of Metalock Denmark, pictured at the company premises in Ishøj, Copenhagen

to expanding into other regions subsequently. Metalock's planned expansion is based on moving into areas where there is already a PrimeServ service centre, meaning that no new investment in facilities is required and Metalock can just move in with its tools and knowledge to provide a quality service.

Interview concluded, Frank Hansen takes DieselFacts on a tour of the Metalock Denmark facility

and mentions again his recent posting in Los Angeles: "I liked the US a lot – and the weather! But it's great being back home after 10 years. Maybe I'll go out in the world again – you never know – but I'm going to be here for many years to make Metalock even more successful and see where that takes us." Interview concluded, DieselFacts takes no chances and orders a taxi back to base. ■



Metalock Denmark at work: (left) crank-pin machining on a two-stroke engine; and (right) blue marking and final touch-up by means of blue mark – a dye used in metalworking to aid in the marking out of rough areas that require further machining – and a specially fabricated test shell

MAN Diesel & Turbo Technology Delivers Clear Boost to Efficiency

WHR and TCS-PTG techniques significantly improve performance of large engines

MAN Diesel & Turbo used the world premiere of its MAN B&W ME-GI gas engine in Copenhagen to present efficiency technologies for its two-stroke engines, namely its WHR (Waste Heat Recovery) systems, that include its TCS-PTG (Turbo Compund System with Power Turbine and Generator) turbines, and which are offered as an integrated solution.

WHR exploits, among other things, exhaust-gas energy and can be used in the production of electricity to cover a ship's electrical needs. All ME and MC types in MAN Diesel & Turbo's engine portfolio are suitable for WHR where, generally speaking, the greater the engine output, the greater the potential WHR offers and the quicker the economical return. As a result, WHR technology has traditionally been applied to container-ship and power-station applications.

MAN Diesel & Turbo offers total WHR system packages with exhaust boiler, steam and power turbine generator unit, PTO/PTI and power management.

High-load optimisation is a major

part of the WHR principle where a power turbine is placed in parallel with the main-engine turbochargers and/or steam turbine, thus utilising the heat from the exhaust gas after the turbochargers. Something in the order of 10% MCR power can be obtained with a full WHR system, that is, featuring both power and steam turbines. MAN Diesel & Turbo offers a number of WHR options for exhaust-gas utilisation:

- power turbine stand-alone: PTG – Power Turbine Generator
- steam turbine stand-alone: STG – Steam Turbine Generator
- combined turbines: Steam turbine – Power turbine

WHR aboard container ships

The installation of a WHR system aboard a container ship requires a larger exhaust piping system to ensure an even exhaust-gas distribution within the exhaust boiler. The exhaust boiler itself requires a collector to control the exhaust-flow velocity, velocity distribution and to collect the exhaust-boiler washing water. For its exhaust-boiler systems, MAN Diesel & Turbo recommends the installation of an exhaust by-pass and by-pass exhaust valves.

For WHR exhaust systems, MAN Diesel & Turbo recommends that shipyards use computational fluid

dynamics to calculate and ensure an even exhaust-gas velocity distribution into the exhaust boiler using guide vanes. This is important in securing a high WHR system efficiency. Back-pressure calculations for the exhaust system are also necessary to ensure the correct functionality of the WHR system – the correct exhaust velocity up through the exhaust boilers ensures optimal functionality and minimises the risk of soot collection on the internal surfaces of the exhaust boiler. Engine data can be provided for exhaust systems with higher back pressures in cases where WHR systems and scrubber systems are combined, a situation that especially will arise in the case of new ships serving routes in SECA areas.

Complete service

MAN Diesel & Turbo is a complete WHR system supplier and designer of main engines, turbochargers, steam turbines and power turbines. As such, the company optimises and guarantees the performance of the complete WHR cycle for

both shipyards and shipowners.

TCS-PTG

TCS-PTG is the first unit of the new generation of power turbines based on MAN Diesel & Turbo's TCR/TCA turbines; the company first patented its TCS-PTG system in 1957. In Copenhagen, MAN Diesel & Turbo displayed the first of two TCS-PTG18 units that were assembled and extensively tested in Germany and which are bound for a power project in London.

London power turbine order

H. Cegielski – Poznan S.A. ordered two TCS-PTG18 power turbine systems in 2010 to boost the efficiency of two environmentally friendly, diesel power plants currently nearing construction by Land & Marine for renewable energy company Blue-NG in London. Each plant is powered by an MAN B&W 7K60MC-S engine producing 13.9 MW. Blue-NG is committed to being best in class at building the most efficient power plants in the world, and is sparing no effort to optimally use the energy created by

Waste Heat Recovery – System Recovery Ratios

	Efficiency as % of main-engine SMCR (depending on size)
PTG	3–5
Single Steam Pressure – STG	4–7
Dual Steam Pressure – STG	6–9
Dual Steam Pressure Steam & Power Turbine unit	9–12

Source: MAN Diesel & Turbo



The PTG22 unit: 1.Generator, 2.Coupling, 3.Gear Box, 4.Power Turbine, 5.Control Flaps (plus control cabinet and software)

the two Combined Heat and intelligent Power (CHiP) sites.

MAN Diesel & Turbo's latest, market-leading, high-efficiency TCA turbochargers make it possible to divert more exhaust gas to power turbine-based, energy-recovery systems. In such applications, the power turbine is inserted into the exhaust-gas system parallel to the turbocharger. Here, it drives an electrical generator via a reduction gearbox and receives up to 12% of the exhaust-gas flow, diverted from the main-engine power.

A TCS-PTG18 will be employed at each of the coming plants, based on the newly developed, high-efficiency turbine of a TCR18 turbocharger. A high-efficiency, high-

speed gearbox will reduce turbine speed to generator speed, with the generator and gearbox connected to each other by a highly flexible coupling. The TCS-PTG18 will supply up to 570 kW to the grid and increase the power plant's overall efficiency by some 3%. At lower engine loads, the TCS-PTG will be shut down. Control valves and fast-acting emergency valves for emergency shutdown are installed in the exhaust system to ensure reliable, safe operation.

MAN Diesel & Turbo has more than 30 years' expertise in the development, production and servicing of power-turbine applications, and can boast of some 50 reference plants, mostly installed

aboard ships. The London order sets another milestone as it is the first order for the newly developed generation of power turbines based on the new TCR turbocharger series.

MAN Diesel & Turbo sees much potential for further TCS-PTG waste-heat recovery applications in diesel power plants and marine applications as the recent increase in fuel prices has revived interest in systems that maximise overall system efficiency. The company predicts that the ongoing CO₂-debate and the growing interest that companies have in environmental issues for newbuilding projects will make the power-turbine system an interesting option.

Low-temperature WHR

MAN Diesel & Turbo recently signed a cooperation agreement with Swedish energy and environmental technology company, Opcon, to exploit the possibilities arising from the merging of Opcon's 'Powerbox' WHR technology with MAN Diesel & Turbo's diesel engines for cutting fuel consumption and reducing emissions. The companies will examine how best to exploit the possibilities offered by re-using waste-heat energy from low-temperature heat sources using the Opcon Powerbox technology.

The first, groundbreaking reference – a marine installation that utilises waste heat for electricity

production – is currently underway with the Opcon Powerbox integrated with a two-stroke MAN B&W 8S60ME-C8 engine aboard a newbuilding owned by Wallenius, the Swedish shipping group.

The Opcon Powerbox can be integrated with smaller engines in contrast with existing WHR units targeted at higher-temperature applications and larger engines. It directly influences the performance of ships by reducing the fossil-fuels amount they consume during operation by 5-10%. It also significantly reduces consumption and directly cuts carbon, NO_x and sulphur emissions.

For extra information, check www.mandieselturbo.com. ■

World's Largest Bulk Carrier Uses Low-Speed B&W Power on Chinese Route

Massive dimensions of Vale newbuilding prompt creation of new shipping class

Korea's Daewoo Shipbuilding & Marine Engineering recently held a naming ceremony for what is the world's first 400,000-dwt VLOC.

At 362 m long, 65 m wide and 30.4 m high, the 'Vale Brasil' is the world's largest bulk carrier and is powered by an MAN B&W 7S80ME-C8 two-stroke engine.

Originally ordered in October 2009, Daewoo completed the newbuilding in just 17 months – one of seven VLOCs it has been contracted to build by Vale S.A., the multinational mining concern – and will build a further two sister ships later this year with the remainder scheduled for delivery by 2013.

The 362-metre long bulker is the first in a series of 19 gigantic ships ordered by the Brazilian mining company that constitute a whole new class – valemax – and which will transport iron ore from South American mines to the Chinese steelworks that currently take 60% of all iron ore mined globally. In this connection, the Vale Brasil sailed to Rio de Janeiro at the end of April.

Valemax vessels will be capable of transporting more than twice as much iron ore at a time than the



The Vale Brasil pictured during sea trials (source: Vale S.A.)

capacities that currently stand for the majority of ore transportation between South America and Asia, and will increase capacity greatly upon the route. In addition to the

19 new valemaxes, Vale has also signed contracts with other owners building similar vessels to operate in long-term contracts dedicated to them, which will bring the mining company's fleet up to, in all, 36 gigantic bulk carriers.

Currently, the company is also in progress with the rebuilding of a series of twelve other vessels – former supertankers – into bulk carriers.

Clean ship

Vale recently picked up an award at Nor-Shipping, the international shipping exhibition held in Norway, where the winners of the 2011 Clean Ship and Next Generation Ship Awards were announced. The awards showcase excellence in industry and are presided over by an independent jury.

The Clean Ship Award honours the shipowner and ship that has

contributed most to the reduction of emissions to air or discharges to sea in relation to its function and operation.

The Clean Ship Award went to Vale S.A. for the Vale Brasil on account of its low emissions per ton of cargo that is expected to set a new standard for long-distance dry bulk carriers. Vale reported that the ship will reduce emissions per ton of cargo carried by 35%. ■

Main Particulars – Vale Brasil	
IMO Number	9488918
Flag	Singapore
Dead weight tonnage (t)	400,000
Gross register tonnage (t)	200,000
Speed (knots)	14.8
Draught (m)	23.00
Depth moulded (m)	30.40
Breadth (m)	65.00
Length (m)	362.00 (LO)
Class society	Det Norske Veritas
Main engine	MAN B&W 7S80ME-C8
Power (kW)	29,260

Source: MAN Diesel & Turbo

About Vale

Vale is a diversified mining multinational corporation and one of the largest logistics operators in Brazil. In addition to being the second-largest mining company in the world, Vale is also the largest producer of iron ore and pellets, and the second largest of nickel. Vale also produces manganese, ferroalloys, copper, bauxite, potash, kaolin, alumina and aluminium. Vale has a presence on 6 continents and has managed to establish itself as a global mining company through joint ventures and acquisitions abroad. From 2013, the Vale fleet will have a total of 60 vessels in operation.

MAN B&W to Propel Learning at Prestigious Chinese Institution

Shanghai Maritime University opens engine room integrated laboratory

At a recent ceremony at its Lingang campus – attended by Shanghai Maritime University (SMU) academics, local dignitaries and representatives of, among others, COSCO, China Shipping, Costamare and MAN Diesel & Turbo – SMU officially opened its new teaching facility.

The facility took two years to build and comprises 2,100 square metres of floor space. The centrepiece of the new facility is a fully functional, two-stroke MAN B&W ME-B engine with its own control room that will be utilised for practical tuition.

A number of attendees spoke at the event, including Goetz Kassing, Managing Director of MAN Diesel Shanghai Co. Ltd. In his speech,



Goetz Kassing, Managing Director of MAN Diesel Shanghai, pictured delivering his speech at SMU

Kassing referenced the exploits of some of the main characters from China's proud, maritime history and drew a line connecting Shanghai's position by the Yangtze and its status as China's leading port

through to SMU's long tradition of producing maritime graduates and how it will use the new MAN B&W 6S35ME-B9 engine in training the next generation of Chinese mariners.

Kassing said: "The opening of the laboratory today in Lingang marks another step forward in Chinese maritime life. This new facility has a fully operational MAN B&W 6-cylinder S35ME-B9 engine, and MAN Diesel & Turbo was delighted to be given the opportunity to come aboard – as both a technical and commercial partner."

In conjunction with SMU and the new facility, MAN Diesel & Turbo is opening an MAN PrimeServ Academy on the same premises as the new laboratory. The Academy will:

- provide practical training courses to SMU students and crews on the operation of modern diesel engines
- host a "green project" facility,

test-running an MAN four-stroke engine on cooking oil and bio-fuel

- carry out retrofitting and upgrading projects on the main two-stroke engine with MAN PrimeServ supporting the maintenance of the laboratory engine along with that of SMU's own training ship that is also MAN Diesel & Turbo-powered
- carry out research and development on the main laboratory engine.

About SMU

Chinese maritime education has its origins in Shanghai where the shipping section of Shanghai Industrial College was founded early in the 20th century. Currently, SMU has a full-time student population of almost 20,000.

Over the course of its existence, SMU has devoted itself to fostering qualified personnel for the shipping industry and has provided shipping enterprises, public institutions and government departments with over 40,000 marine graduates. In recognition of this success, the Chinese State has honoured SMU by designating it a "cradle of qualified shipping personnel". SMU also prides itself on the quality of its staff that comprises a teaching and research body of more than 800 academics, of whom over 100 are full professors. ■



Picture of the MAN B&W 6S35ME-B9 that forms the centrepiece of Shanghai Maritime University's Engine Room Integrated Laboratory



Scene from the ceremony at SMU's Lingang campus outside the entrance to the new MAN PrimeServ Academy

Order Landed for World's First Subsea Gas Compressors

MAN Diesel & Turbo Schweiz AG, Zurich, has received an order to supply four compressors that will be used on the sea floor at a depth of around 250 metres to produce natural gas from the Asgard field in the Norwegian sector of the North Sea.

The client is Aker Solutions ASA, Oslo, which received the go-ahead in December 2010 from Norwegian energy company Statoil ASA to develop and build a complete subsea gas production system.

MAN Diesel & Turbo Schweiz AG's input will include specialist compressors as well as all maintenance and servicing over the machinery's entire lifecycle.

Dr. Uwe Lauber, Head of the Oil & Gas Business Unit and Managing Director of the Swiss subsidiary of MAN Diesel & Turbo said: "Aker Solutions' confidence confirms our leading position in subsea com-

pression, a field that we have been working very intensively on with Statoil since 2005."

The four machines will be built, tested and supplied within the next year by MAN Diesel & Turbo in Zurich. Commissioning is scheduled for 2014.

The Asgard gas reserves are located around 200 km off the coast of Norway at a depth of between 240 and 310 metres. It is the world's first project in which gas is produced and compressed on the sea floor.

Compression systems installed directly on the sea bed are significantly safer and more energy efficient at tapping gas reserves. Compared to traditional platforms, the investments and running costs are also significantly lower.

The new concept can be used for most of the gas reserves in the world's seas and oceans. ■



Prototype of the new, motor-driven subsea compressor at MAN Diesel & Turbo's test facility in Zurich

EMC Agreement Caps Hjejlen's 150th Jubilee

MAN Diesel & Turbo returned to its roots recently when it signed a remarkable EMC (Engine Management Concept) contract concerning one of Denmark's most famous vessels.

The agreement covers the maintenance and upkeep of the steam engine that has powered the 150-year-old paddle steamer 'Hjejlen' (The Golden Plover) on the Silkeborg Lakes in central Jutland, Denmark since its launch.

The Engine Management Concept is less a contract and more a partnership with much emphasis placed on building a long-term relationship with customers. Essentially, the EMC fixes customers' maintenance costs at a set level that facilitates the advance setting of budgets with any excessive maintenance costs covered by MAN Diesel & Turbo. As Hjejlen's tourist season is relatively short, keeping the steamer operational

is vital. Ultimately, the EMC provides a predictability and stability that gives Hjejlen's owners peace of mind.

Thomas Knudsen, Head of Low-Speed, MAN Diesel & Turbo signed the EMC contract on June 24th, on behalf of MAN Diesel & Turbo, with Hjejlen's owners on the very day that the ship celebrated its 150th anniversary at a series of events in the city of Silkeborg. Queen Margrethe II of Denmark played a prominent role in the celebrations and was a particularly apt choice as guest of honour in that it was her predecessor – King Frederik VII – that inaugurated Hjejlen exactly 150 years previously.

Originally built by Baumgarten & Burmeister, the original predecessor of MAN Diesel & Turbo, Hjejlen's engine was built in Copenhagen along with the actual boat in 1861. Sailed on its maiden voyage from Copenhagen to Silkeborg, the boat has since plied its trade ferrying tourists about the famous lakes. Its original steam engine comprises two oscillating cylinders 26 cm in diameter and with a stroke length of 42 cm that give an output of 18 kW/ 24 horsepower



Thomas Knudsen (right) pictured at the signing of the EMC agreement with Peder Kristensen, Director of The Hjejle Company, in Silkeborg

at 8 atmospheres. On a typical day, the stoker shovels 3/4 tons of coal into the furnace with temperatures often reaching 40 degrees Celsius or more in the engine room. Firing is started 3 to 5 hours before departure and Hjejlen can reach a top speed of some 8 knots.

In his speech, delivered at a gala dinner celebrating the anniversary, Thomas Knudsen said: "It was wonderful to experience sailing on

Hjejlen earlier today and it has given me the greatest of pleasure to sign a maintenance contract that will ensure that this gem of a boat keeps sailing into the distant future. MAN Diesel & Turbo takes pride in its reputation and, in agreeing to look after the world's oldest paddle steamer, we are demonstrating that we always stand by our products, even when they are as venerable as Hjejlen." ■



Library picture of Hjejlen on the Silkeborg Lakes (source: The Hjejle Co.)

Chinese Turbochargers Prepare to Grow

Strategic relocation to Changzhou will galvanise domestic production

MAN Diesel & Turbo has consolidated its Chinese turbocharger organisation and moved its existing production facilities from Shanghai the short distance northwest to the former 'MAN Turbo' plant at Changzhou.

The move is spurred by the economic growth the sector is currently experiencing and the need to increase production. For the time being, the turbocharger division will retain its name of MAN Diesel Turbocharger (Shanghai) Co. Ltd.

The company reports that the synergy gained through the consolidation of resources in Changzhou will deliver the desired increase in turbocharger production capacity and significantly lower costs.

In his opening speech at a ceremony marking the occasion in May 2011, acting CEO of MAN Diesel & Turbo, Dr. Hans-O. Jeske, was visibly impressed by the rapid progress of the project: "We laid the foundations for this plant in January 2007, and in November 2008 the first stage of the construction was inaugurated with perfect timing to celebrate the MAN Group's 250th anniversary. Today, we are celebrating the completion of the second stage of the construction here in Changzhou. Each new international site for the company represents an important contribu-

tion towards the expansion of business relationships beyond national borders and thus towards globalisation, a phenomenon from which we can all benefit – including MAN."

Dr. Martin Wilderer, Head of the Changzhou plant, believes that the ideal framework is already in place to facilitate this: "I'm absolutely delighted that the MAN Group is bringing together its Chinese production facilities in the Power Engineering sector here in Changzhou. This will benefit our Chinese customers, who can now not only obtain products and service locally but also from a single source, and it will also help MAN Diesel & Tur-

bo, since the merger will provide new possibilities, opportunities and synergies."

New set-up

MAN Diesel & Turbo expects to double the Shanghai headcount of turbocharger employees within two years of moving to Changzhou, a figure it expects to double again in the longer term. All financial, administration and human-resource matters will be transferred to the existing MAN Diesel & Turbo Changzhou organisation that already handles the affairs of six MAN business areas.

To cater for the consolidation,

the existing production area at Changzhou has been expanded by 100%. Silencer production capacity will consequently increase by circa 25%, while annual axial-type turbocharger assembly will be doubled.

In regard to CKD turbocharger assembly, Shanghai had the capacity to assemble axial-flow turbochargers up to TCA77 due to restrictions posed by its crane/workshop layout. In contrast, the new workshop at Changzhou can assemble all axial-flow turbochargers up to and including MAN Diesel & Turbo's largest unit – the 16-ton TCA88-25.

More benefits

Changzhou offers other, significant advantages as a consolidated turbocharger location in that its machining shop can be utilised for the machining of turbocharger components and parts from other business units alike, providing more flexibility to the individual business units on site. The shop also has plenty of room for the additional, turbocharger-related machinery that MAN will invest in, in the near future. Accordingly, machining-shop capacity there can be optimally balanced for each of the product lines.

In order to fulfil the increased market demand for small radial-flow turbochargers in China from MAN Diesel & Turbo licensees and other engine manufacturers alike, MAN Diesel Turbocharger (Shanghai) will start radial-flow turbocharger assembly in 2012. This will help to free the tight capacity situation currently being experienced by the company's European production.

A final example of Changzhou's eminent suitability is that it already has a well-established quality, logistics and procurement organisation that can quickly adapt to the needs of MAN Diesel Turbocharger (Shanghai). ■



MAN Diesel & Turbo's Changzhou facility has expanded its production area by 100% to cater for turbochargers

Engine Refit Helps Classic Ferry Sound Like Its Old Self Again

PrimeServ Frederikshavn plays key role in restoring heritage ferry to original form

MAN PrimeServ recently fitted a vintage B&W Alpha diesel engine to the antique Norwegian car ferry – 'Gamle Kragerø' – at its works in Frederikshavn, Denmark.

The installation formed an important part of the 50-year-old ferry's restoration to its original condition. The ferry was recently declared worthy for preservation by *Riksantikvaren* – the Norwegian Directorate for Cultural Heritage – which has spent some 7 million Norwegian Kroner (approx. EUR 900,000) on the project.

Engine restoration

Based on the Gamle Kragerø's original drawings from 1960, PrimeServ Frederikshavn evaluated that the ferry originally had a double-engine power plant comprising two diesel engines of indeterminate brand. These engines were replaced in 1970 with a single Alpha 403-26VO engine that had an output of 300 horsepower. This engine operated up to 1997, when it was replaced by a high-speed V8 Scania engine with reduction gears. As part of the restoration project, PrimeServ wanted to restore the power plant with a contemporary engine that could deliver the 'authentic' low-speed sound the ferry would have had in its heyday. Happily, PrimeServ Frederikshavn found a suitable replacement locally in the form of a 1975-vintage Alpha 403-26VO plant, which was recovered from



A festive Gamle Kragerø pictured back on its old stomping ground in Norway after its refurbishment (picture by Alexander Ytteborg, Riksantikvaren)

a woods near the neighbouring town of Sæby and subsequently restored to full working order.

Gamle Kragerø

Originally named 'Kragerø' (Crows' island) after the local community, Gamle Kragerø (Old Kragerø) was constructed in 1960 in the eponymous town in southern Norway and was Kragerø Fjord Boat Company's first steel ferry. Constructed as a combined passenger-car ferry and icebreaker, its task was to provide safe passage for goods and people year round. This included during the harsh winter when the sea regularly freezes over in a coastal community with its many

islands and isolated settlements.

Before the Kragerø's construction, wooden boats were often seriously damaged during the local, harsh ice-winters and put out of commission, even when their hulls were strengthened with a metal skin. By the mid-1950s, the ice was so thick that the Fjord Boat Company realised it had to try something new and accordingly decided to build a steel ferry. Expectations were therefore great on Saturday May 28th, 1960 when Kragerø was launched and it proved its worth, carrying students to and from the archipelago's peninsulas and islands, taking winter fishermen out on the ice, and delivering the post.

Prison sentence

In the '80s, Kragerø was sold further up towards the Oslo fjord, and renamed 'Foldinferga'. There, it was tasked with safely transporting employees and inmates between the town of Horten on the mainland and the open prison on the island of Bastøy, a route it served for over 21 years.

In 2009, it returned to its home port of Kragerø to be greeted by the water cannons of its much bigger and modern successor – the new 'Kragerø' – and a mighty salute from the town with cannons from Napoleonic times. Foldinferga was subsequently renamed Gamle Kragerø.

A gentler life

In its time in the Oslofjord, Gamle Kragerø travelled a distance the equivalent of 12 trips around the equator and carried close to one million passengers. Now, having undergone a complete restoration, the old ferry is set for a gentler life and will be used by the local community as a sort of floating cultural facility.

However, Gamle Kragerø's days as a working ferry are, happily, not quite over as an agreement has been signed with Bastøy prison for it to operate as a replacement ferry for the 14 days every year when its modern replacement is in dock for an annual overhaul. ■



Scenes from Gamle Kragerø's visit to PrimeServ Frederikshavn: the replacement Alpha 403-26VO engine from 1975 is hoisted aboard the old car ferry and lowered into the engine room for installation

For further information

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