keeping the course

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The protection of the environment and the reduction of emissions have become a focal point of the marine industry's interest. This edition is featuring a "GreenGuide" that emphasises the environmentally friendly characteristics of the presented technologies.
German marine equipment – first place in innovation and reliability

The maritime suppliers of Germany are world champions in innovation, and their chief aim is to significantly improve economy and the environmental footprint in the global shipping industry. This publication is meant to bring international shipowners, shipyards, naval architects and all those interested in shipbuilding up to date on current technology and the latest developments in a number of important ship systems offered by German industry. The main topics here are lower fuel consumption, alternative fuels, a higher degree of automation, longer periods between overhauls, comprehensive onboard environmental protection and the reduction of ships’ operational costs. With these things in mind, German suppliers are further optimising their product-related, flexible service networks worldwide and concluding forward-looking cooperation deals.

On board modern commercial ships, more than 30 equipment systems have to be dovetailed into a single, complex “floating plant” and operate at a very high degree of reliability. These equipment systems – ranging from propulsion, energy supply, automation and intelligent loading systems to navigation and communication equipment as well as safety systems – need to work perfectly around the clock. This is the job of a highly capable and specialised shipbuilding equipment industry that works closely with national and international shipyards and shipowners when products and systems are being developed.

Over the decades, Germany has forged a highly qualified marine industry whose globally recognised competence stems largely from a combination of experience and innovation. More than 400 companies, scattered throughout the country, make up the German equipment supply industry. They have succeeded in boosting their exports to more than 70% of their production, with an annual turnover of EUR 12 billion.

German equipment suppliers are working consistently to mould their employees’ work practices and way of thinking into a future-oriented form of co-operation. The fact that shipowners, as customers, along with capable technology partners at German universities and classification societies are also closely involved in this process and cooperate within the “shipbuilding network” is a quite unique and important competitive advantage for the German shipbuilding industry.

We’re convinced that this publication will provide readers with interesting, practical and cutting-edge information, and arouse interest in seeking or deepening contacts with Germany’s highly skilled marine equipment companies.

VDMA – MARINE EQUIPMENT AND SYSTEMS

A special division of the well-known non-profit organisation VDMA (German Engineering Federation), VDMA – Marine Equipment and Systems represents Germany’s entire maritime supply industry with member companies from all branches, including mechanical engineering, electrical engineering and electronics.

VDMA supports its member companies with a wide range of activities and services:

› intensifying mutual cooperation with yards and operators in technological as well as commercial fields,
› helping worldwide customers in arranging contacts with German marine equipment manufacturers,
› fostering free and fair market principles in the global marine market by means of close contacts with various international organisations,
› sponsoring important international exhibitions and conferences in the shipbuilding sector.

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ME-GI dual fuel done right

The new ME-GI generation of MAN B&W two-stroke dual fuel ‘gas injection’ engines are characterised by clean and efficient gas combustion control with no gas slip. The fuel flexibility and the inherent reliability of the two-stroke design ensure good longterm operational economy.

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Engineering the Future – since 1758.

MAN Diesel & Turbo
Reducing exhaust emissions and fuel consumption as well as increasing engine efficiency are key factors in modern shipping. As one of the world’s leading suppliers of state-of-the-art propulsion and power generation solutions for the maritime industry, MAN is constantly extending and optimising its wide range of engines and turbochargers.

Both business units of the engine and mechanical engineering company MAN SE, MAN Diesel & Turbo as well as MAN Truck & Bus recently introduced their latest developments for marine applications to the market. While MAN Diesel & Turbo has developed a new efficient dual-fuel engine and presented the new powerful MAN 175D high speed engine, MAN Truck & Bus extended its power range of high-speed marine engines for heavy-duty operation to 735 kW.

High-speed marine engines
MAN Truck & Bus presented a newly developed twelve-cylinder V-engine for use aboard working vessels, in the process extending the power range of its high-speed marine engines for heavy-duty operation up to 735 kW (1,000 hp).

Engines for heavy-duty operation
The D2862 LE441 is MAN’s 735-kW (1,000hp), twelve-cylinder V-engine for heavy-duty operation. By adapting the turbocharger and the valve timing, MAN was able to raise the mean pressure and increase the power rating by 73 kW (100hp) compared with the most powerful engines available until now: the D2862 LE431 and D2842 LE421, which are still available. The new, efficient MAN marine engine D2862 LE441, with its increased power and a dry weight of 2,270kg, offers an excellent power density for heavy-duty applications such as tugboats and freighters. With a capacity of 24.24 litres, a bore of 128mm and stroke of 157mm, the powerful MAN marine engine can achieve a maximum torque of 4,380 Nm at 1,100 to 1,600rpm.
According to MAN, the D2862 LE441 proves particularly efficient when the costs over its entire life cycle are taken into account. Even with a specific consumption under full load at maximum torque, the twelve-cylinder engine has an outstanding minimum consumption of 192.3g/kWh. Furthermore, it features oil change intervals of 600 hours and average overhaul intervals of 18,000 operating hours. Individually mounted cylinder heads also ensure ease of service.

The engine foot positions and installation dimensions are identical to the previous series, making it ideal for engine upgrade projects. Compactly scaled at 2,124mm x 1,153mm x 1,289mm (length x width x height), the 735-kW MAN twelve-cylinder engine has an outstanding power density. The D2862 has also passed numerous field trials and measurements successfully. Furthermore, the D2868 and D2862 marine engines have received type approval from various classification societies.

MAN offers its entire product range of new common-rail engines for commercial and leisure sailing in EPA Tier 3. The new 735-kW (1,000-hp), twelve-cylinder engine is therefore also available in the currently applicable emission standard – as the D2862 LE444.

New high-speed MAN 175D

MAN recently introduced its twelve-cylinder MAN 12V175D model, which was specially developed for shipping applications. The 175D stems from customer requests for a high-speed engine that works as reliably as a medium-speed engine and that is tailor-made for maritime use.

“With the MAN 175D, we are supplementing and completing MAN Diesel & Turbo’s and MAN Truck & Bus’s product portfolio in the maritime sector,” said Dr Hans-Otto Jeske, MAN Diesel & Turbo’s chief technology officer. The new engine will be...
offered with an output spectrum from 1,500 to 2,200 kW and be available to the first pilot customers during 2015.

The twelve-cylinder version of the MAN 175D is designed to precisely meet the needs of commercial shipping and is optimised for propelling ferries, offshore supply vessels, tugboats and working vessels. Other applications, such as the markets for superyachts and marine applications, are served by special versions.

“The MAN 175D is compact, reliable and efficient – properties that are of essential importance for use on working vessels to allow safe manoeuvrability in the most challenging and rough weather conditions,” said the project leader responsible for the MAN 175D, Dr Matthias Schlipf.

The MAN 175D’s compact and modular exhaust gas after-treatment system uses the selective catalytic reduction (SCR) method and is based on the MAN Ad Blue® technology which has undergone many thousands of hours of testing. The engine therefore satisfies the strict IMO Tier III environmental standards while its compact dimensions and low weight make it an efficient powerhouse.

New dual-fuel engine

MAN Diesel & Turbo’s new S1/60DF engine is a dual-fuel marine engine that converts diesel fuel or natural gas into electrical or mechanical propulsion power efficiently and with low emissions. In combination with a safety concept designed by MAN Diesel & Turbo for applications on LNG carriers, the multi-fuel capability of the engine represents an appropriate drive solution for this type of vessel, as well as for other marine applications. The ability to change over from gas to diesel operation without interruption rounds out the engine’s flexibility.

MAN Diesel & Turbo is also a leading manufacturer of the key technologies that determine the economic and ecological performance of a diesel engine, including high-efficiency exhaust-gas turbochargers, advanced electronic fuel-injection equipment and electronic hardware and software for engine control, monitoring and diagnosis.

After a longer period of evaluation, an international consortium including Teekay LNG Partners selected a dual-fuel diesel-electric (DFDE) propulsion solution featuring 2x12V51/60DF + 2x8L51/60DF engines for each of four liquid natural gas carriers (LNGCs). The DFDE solution provides the customer with the optimum redundancy.

The engines will be produced at MAN Diesel & Turbo’s facility in Augsburg, Germany, with delivery scheduled during 2015. They are specified as IMO Tier II-compliant in diesel mode with lower exhaust-gas emissions in gas mode than IMO Tier III stipulates.

New TCT turbocharger generation

The demands made on a modern turbocharger are manifold and include optimal pricing, small overall dimensions, high operational reliability, low maintenance frequencies and long working life. The conflict of objectives is obvious. When developing the TCT range, it was important to MAN Diesel & Turbo to balance the individual demands of the different groups of customers to achieve an optimum overall result. According to MAN, the range of turbochargers that emerged is considered to be the best overall package for two-stroke engines.

With the new TCT range, MAN Diesel & Turbo has specifically looked at the requirements of two-stroke engines and increased efficiency by 5% by using newly developed compressor and turbine wheel geometry, consequently increasing WHR potential by 30%, e.g., by means of the company’s Turbo Compound System (TCS-PTG). Simultaneously, the TCT range will deliver a 10% greater air flow at a turbocharging pressure 25% higher, while being 30% smaller and 40% lighter than the existing TCA range.

Individual TCT turbochargers will cover a wider range of engine ratings, depending on their size. Engine manufacturers will be able to use just one size for turbocharging different numbers of cylinders. Individual adaptation of the turbocharger to the engine is by the established method of using a variety of exchangeable parts within the turbocharger. TCT turbochargers can be manufactured cost-effectively by dispensing with the alternatives required for four-stroke engines.

Customers familiar with the TCA range will find TCT in -
To lower the operating costs of large diesel engines and meet present emission regulations, Heinzmann, a specialist in engine and turbine management solutions, is converting conventional fuel injection systems into state-of-the-art common-rail technology. The solution seems promising. According to Heinzmann, the practical experience gained so far confirms the high expectations.

During the winter season 2014/2015, tests with the new technology were performed on an icebreaker operated by the Swedish Maritime Administration in the Baltic Sea. The exceptional operating conditions, with frequent and fast load variations, were a big challenge for the engine control system. In a first step, one engine was converted to common rail for the test operation so that the results could easily be compared with the remaining engines. The test ran more than four months, with almost uninterrupted engine operation. All of the results regarding fuel consumption, exhaust emissions and general operating characteristics were more than satisfying, says Heinzmann. The savings in diesel consumption were 10%. The emission of black smoke disappeared completely. Furthermore, a positive influence on operational smoothness and dynamic performance was noted. The advantages owed mainly to the flexibility and injection accuracy of the fully electronic-controlled system. Clear improvements were achieved in entire operating behaviour this way.

Heinzmann’s next steps are aimed at a reduction of NOx values to a level comparable to that of new engines. For this purpose, promising tests are in progress with exhaust gas recirculation and manifold air humidification. When these tests have been completed by the end of the winter season 2015, it is planned to retrofit the remaining engines as well as further Swedish icebreakers to common rail.

ABOUT HEINZMANN

The Heinzmann Group was founded in 1897 and is headquartered in Schönau, Germany. In the field of engine and turbine management, it ranks among the leading suppliers worldwide. The company’s product range includes components and system solutions for optimised management of diesel, gas and dual-fuel engines as well as gas, steam and water turbines.

www.heinzmann.com

Retrofitting diesel engines with common-rail technology

Large diesel engines with conventional fuel injection systems can be converted into common-rail technology

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Innovative propulsion solutions ready for IMO Tier III

MTU  Currently MTU is developing and testing various innovative marine propulsion systems, ranging from gas engines to custom-tailored hybrid drives. Solutions designed to meet IMO Tier III emissions regulations, due to come into force in 2016, include SCR exhaust after-treatment for diesel engines and a new gas engine. Custom-tailored E-drive systems and variable-speed gensets will mean further benefits for shipyards and vessel owners in terms of emissions, fuel consumption and propulsion performance.

In spring 2015, MTU and the Hamburg-based shipping company Fairplay Towage will be testing an MTU diesel genset with exhaust aftertreatment technology on board a harbour tug. According to MTU, the trials will be among the first in the world involving high-speed diesel engines with an SCR (selective catalytic reduction) system designed to meet nitrogen oxide limits in IMO (International Maritime Organization) Tier III regulations.
The new Fairplay tug was built by the Spanish yard Astilleros Armon and will be putting its 90-tonne bollard pull to the test in Rotterdam’s harbour starting in summer 2015. MTU is supplying the two 16V 4000 M63L main propulsion engines, each producing 2,000 kW, a 16-cylinder Series 4000 M23F diesel genset that will deliver 1,520 kW, and the SCR system. Linked to the diesel genset, the SCR system utilises, as in modern commercial vehicle drives, an aqueous urea solution that reacts with the nitrogen oxides in the exhaust gas to neutralise them.

MTU is using the 10,000-hour trials on the Fairplay tug to pave the way for a series solution for IMO Tier III marine engines. From 2016, newly built vessels operating in Emission Control Areas (ECAs) off the North American coast and in the Caribbean will be required to meet nitrogen oxide limits in line with the IMO’s Tier III specifications as provided for under MARPOL Annex VI. The 30m-long tractor tug will be powered by a combined diesel-mechanical and diesel-electric propulsion configuration. The diesel-electric plant and SCR system will be used primarily when leaving or entering the harbour, with the two main propulsion engines being switched on for additional diesel-mechanical propulsion during full-load operation. The SCR system enables the boat to achieve environmentally friendly operation with minimal emissions during service in heavily populated areas.

Harbour tug with gas engines

From 2016, MTU, the Netherlands’ Damen shipyard and Denmark’s Svitzer shipping company will be introducing the world’s first harbour tug powered by high-speed gas engines. The new tug will feature high levels of performance coupled with reduced fuel consumption and lower emissions. Its 16-cylinder gas engine is based on MTU’s proven 16V 4000 M63 diesel engine for workboats and will be enhanced by multi-point gas injection, dynamic engine control and a safety concept optimised for gas operation. The new series of gas engines will be specifically developed to cover the tug’s extreme load profile, and acceleration will be comparable with that delivered by diesel units. The clean combustion concept makes compliance with IMO III exhaust standards possible without the use of additional after-treatment technology. Producing 2,000 kW, the MTU gas engine will deliver high-level power density with low fuel consumption. Market introduction of the natural-gas-powered MTU marine engine is planned for 2018.

Systems provider for E-Drive solutions

MTU offers custom-tailored E-Drive system solutions incorporating diesel engines and electric motors, gearboxes, energy storage batteries, power electronics and control and monitoring systems. These comprehensive propulsion packages mean benefits for shipyards in terms of integration costs and innovative products as well as advantages for operators thanks to minimal emissions, low life-cycle costs and outstanding propulsion performance. The E-Drive solutions are particularly suited, for example, for tugs with widely fluctuating load profiles and for yachts operating in coastal waters. Yacht owners can benefit from the key advantages of quiet and emission-free energy for onboard or propulsion power as well as from increased trip range thanks to enhanced fuel efficiency.

With its pioneering achievements in injection technology, L’Orange has again and again met the most demanding challenges, setting milestones in the history of technology. As a leading supplier of injection systems in the off-highway segment, we contribute to our customers’ success with innovative technology and efficient processes. Today our injection systems are found in high-speed and medium-speed engines from all successful manufacturers worldwide.

L’Orange GmbH, P.O. Box 40 05 40, 70405 Stuttgart, Germany, www.lorange.com
economy. For tug operators, E-Drive solutions mean increased bollard pull and the prospect of extending main engine TBO by switching to gen set power or combined operation.

**Variable-speed gensets for yachts and commercial vessels**

As a one-stop systems supplier, MTU is able to offer variable-speed gensets for yachts and commercial vessels. Compared with constant-speed gensets, variable-speed units use significantly less fuel during partial-load operation and, because there is no dependence on a particular electrical frequency, operators can call upon maximum power of 3,440 kW mec at 2,100 rpm. According to MTU, operators will also benefit from low noise emissions, increased runtime between major overhauls, reduced maintenance costs and a considerable increase in gen set power density. Overall, this amounts to significant savings on operating costs for commercial marine applications in particular, says MTU.

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**MTU Series 4000 with SCR**

MTU provides customised E-Drive systems incorporating diesel engines and electric motors, gearboxes, energy storage batteries, power electronics, and control and monitoring systems.

**MTU’s natural-gas marine engine meets IMO Tier III emission standards without resorting to exhaust after-treatment**

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**ABOUT MTU**

MTU is part of Rolls-Royce Power Systems, headquartered in Friedrichshafen, Germany, and employs about 11,000 people. The product portfolio includes MTU-brand high-speed engines and propulsion systems for ships; power generation; heavy land, rail and defence vehicles; and the oil and gas industry. Available in numerous cylinder configurations, engine series bearing the MTU brand cover a wide performance spectrum up to 10,000 kW. [www.mtu-online.com](http://www.mtu-online.com)
Sustainability and lower costs with remanufactured fuel injectors

L’ORANGE | The fuel injection systems manufacturer L’Orange GmbH has been offering a remanufacturing service for used injectors for 16 years now, thereby contributing to resource conservation and environmental protection. Remanufacturing the systems also has a cost advantage over completely replacing the injectors. In 2015 L’Orange will reach a milestone in this growing market segment with its 150,000th order for a remanufactured injector.

“Remanufacturing is taking on great importance in the aftermarket. We at L’Orange can be very proud of the 150,000 mark, which is an incentive to expand the process,” said Ralph-Michael Schmidt, managing director of L’Orange.

A sustainable alternative, remanufacturing an injector requires about 25% fewer resources than manufacturing a new, technically equivalent product.

“Efficiency is a key to success in all areas of motor engineering. We offer this efficiency not only in the injection process, but also in the remanufacturing of our products,” Schmidt said.

All of the nearly 150,000 injectors that L’Orange has remanufactured so far have undergone a three-step process in which worn but still usable parts are restored. In the first stage, the basic diagnosis, the condition of the various parts is assessed and they are cleaned. Depending on the extent of wear, they are then either replaced with new parts or restored. This is the second stage of the process. Parts that can’t be restored are returned by L’Orange to the raw materials cycle. Magnets, controls and other valuable assemblies can be reused. Remanufacturing injectors is therefore not only an ecology-minded alternative, but also an economical one. For customers, remanufacturing means lower life-cycle costs with no change in product quality. This is guaranteed in the third step of the process, during which the remanufactured injector must pass the same quality tests that a newly manufactured one does. So the time between overhauls (TBO) is the same for both remanufactured and new injectors.

Backed by a worldwide dealer network L’Orange says it can guarantee prompt, resource-efficient and high-quality remanufacturing. It sets great store by the continual expansion of its range of services and product lines.

ABOUT L’ORANGE

A subsidiary of Rolls-Royce Power Systems AG, L’Orange has been manufacturing and marketing pioneering fuel injection systems for large engines from 1,000 to 40,000 kW worldwide for over 80 years. It currently employs more than 1,000 people at its German sites in Stuttgart, Glatten, Wolf-rathausen and Rellingen as well as in Suzhou and Ningbo in China. The company’s offering encompasses the entire range of products in injection technology including common rail technology for diesel and heavy fuel engines in the off-highway sector.

www.lorange.com
SICK | The use of intelligent emission-measurement technology, providing reliable accuracy under the conditions found on board ships, plays an essential part in the successful reduction of emissions in the shipping industry. A manufacturer of continuous emission monitoring systems, SICK AG has developed the emission monitoring device MARSIC, characterised by reliable measuring results, high flexibility of application and low maintenance requirements.

The measuring ranges and accuracy of MARSIC already exceed the requirements of MARPOL Annex VI and MEPC.184(59). The system has been specifically developed for use on board ships, providing long maintenance intervals and simple service procedures, says SICK.

SICK’s new ship emission-measuring devices are available in two versions, each using a different technology: MARSIC200 performs cold-extractive measurements, while MARSIC300 uses the hot-extractive measurement principle. Both gas analysers are DNV GL type-approved for SOx and CO₂ upstream and downstream of the scrubber as well as for NOx upstream and downstream of SCR (selective catalytic reduction) systems. A single gas analyser is sufficient to manage up to eight measurement points and monitor up to nine components at the same time, including SO₂, CO₂, CO, NO, NO₂, NH₃, CH₄, H₂O and O₂.

Both systems, MARSIC200 and MARSIC300, are able to optimise processes on board ships as they can measure CH₄ slip from LNG and dual-fuel engines, or CO₂, O₂, CO and NOx to optimise fuel oil consumption of the main and auxiliary engines. According to the manufacturer, the results are documented quickly and the measured values are consistently reliable and accurate.

Current MARPOL regulations stipulate a maximum drift of ±2% per hour. The MARSIC300 system, featuring a convenient drift monitor, is guaranteed to be much more stable in the long term, says SICK, referring to the DNV GL type-approval. The drift has to be checked with calibration gas only after replacement of the system’s optical parts in case of servicing. So neither manpower nor time is needed. Stockpiling expensive calibration gases and expired test gas certificates is no longer necessary thanks to the innovative calibration set-up. And the operator of the vessel is always in the position to show compliance with the regulations of the flag state, class or Port State Control.

With MARSIC300, drift testing is carried out automatically using internal measures without any external calibration gas. The system features an innovative internal adjustment filter. Calibration performed at the factory is known as the master calibration, based on a series of test gas concentrations and stored in the gas analyser. To check the given drift, MARSIC300 switches into test mode and the measuring cuvette is flushed with instrument air to determine the zero. Once the zero point has been fixed, special adjustment filters pivot into the infrared light beam upstream of the detector. This fully automatic process continues by measuring the specific light attenuation of the specific gas component and making a comparison with the master calibration. This procedure ensures that the entire beam path from the light source to the detector is checked without interruption. The full inspection of the light beam detects the ageing effects of all the optical parts simultaneously and automatically reverts to the master calibration.

According to SICK, minimal maintenance is needed and there is little wear because moving parts have deliberately not been used. Maintenance and servicing can easily be carried out by an onboard engineer. SICK says that modules can be easily replaced, and the company offers remote servicing whenever an operator needs external help. Additionally, the global SICK network ensures the availability of service and spare parts anytime all over the world.

SICK’s emission monitoring system MARSIC offers reliable measuring results, high flexibility and requires minimal maintenance.

ABOUT SICK

The Process Automation segment of SICK AG, based in Reute, is a major manufacturer of continuous emission monitoring systems. The company has long experience in power plants, waste incinerators and cement plants. Rounding out its product portfolio are gas analysers along with dust and flow measurement.

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Bachmann Integrated Automation Solutions win because of a proven system availability of more than 99.96 percent. We offer today advanced technologies for your future Marine and Offshore automation challenges above or below deck.
Combating cat fines

GEA WESTFALIA SEPARATOR GROUP Along with rising demand for low-sulphur fuels, an increase in engine damage due to cat fines has been seen in recent years. GEA Westfalia Separator Group GmbH offers a reliable solution to combat the problem: CatFineMaster.

In recent years the classification society DNV GL has registered a considerable increase in engine damage due to cat fines, even though the bunkered fuel complied with the ISO 8217 fuel standard and a standard fuel oil processing system was installed on all vessels. ISO 8217, however, does not provide any...
information on the size of cat fines. The quickest damage attributable to cat fines occurred after only 100 operating hours, making the engine completely useless or requiring a complete replacement of pistons and liners.

New rules for sulphur content in fuels

The main driver for utilising silicon oxides in the refinery process is the increasing demand for low-sulphur fuel oil (due to emissions regulations), which results in a higher percentage of cat fines. A further aspect is that the quality and characteristics of bunkered fuel vary and fluctuate considerably; ship operators sometimes do not know what quality they are getting in a particular port. According to the latest requirements by the International Maritime Organization (IMO), emissions of NOx and SOx are to be reduced. MARPOL Annex VI regulates global and regional emissions of sulphur oxides by limiting the sulphur content in fuel. Accordingly, the permissible sulphur content will decline globally from 3.5% (by weight; effective from 2012) to 0.5% (by weight) in 2020. In Emission Control Areas (ECAs), such as coastal regions of North America, parts of the North and Baltic seas as well as some Caribbean islands, permissible sulphur content will fall from 1.0% (by weight) at present to 0.1% (by weight) in 2015. Additional coastal areas might also be classified as ECAs, such as coastal regions of Mexico, Japan, Australia and the Mediterranean.

Intelligent processing of fuel on board is necessary

The new regulations require a different fuel composition, namely low-sulphur fuel. To make this fuel in a refinery, larger volumes of catalysts are needed to break down the crude oil. A side effect of this process is an increase in catalytic fines, better known as cat fines, in the end product. Microscopically small, cat fines are hard, brittle and extremely abrasive particles of aluminium and silicon oxides from 1 to 75 micrometres in size – much tinier than a grain of sand. After being used as catalysts in the distillation of crude oil, they are retained to a certain extent in the heavy fuel oil (HFO) used in ships’ diesel engines. In such applications, cat fines may pose a considerable threat to components of the injection system and also in the cylinder, and can thus cause serious engine damage. The repair or replacement of a piston alone is extremely expensive, not to mention the time lost by ship operators. The maximum cat fine content in fuel oil has been set at 60ppm by the International Organization for Standardization (ISO). However, leading engine manufacturers do not want more than 15ppm in their engine fuel. It is therefore urgently necessary that the fuel be processed on board the vessel. For optimised removal of cat fines from HFO, GEA launched a suitable technology in 2014, called CatFineMaster, which overcomes the new challenges in a cost-efficient manner.

Separator handles additional tasks in fuel processing

The separator always plays the main role in processing the HFO in addition to the static settling procedure in the bunker tanks, sedimentation tank and day tank. For cost reasons, however, separators are frequently designed with an optimum performance limit for the ship design, so the separator may not be sufficiently dimensioned if used with lower-quality fuel. This means the processing efficiency and purity of
the processed HFO on board vessels is not always satisfactory, which can be corrected by using a more powerful separator from the very beginning. Secondly, the separation process is carried out at higher temperatures or the flow is regulated.

**Details of the system solution CatFineMaster**

GEA Westfalia Separator Group’s CatFineMaster is a system that can remove cat fines from HFO more effectively than has previously been the case. Presented for the first time at the SMM (shipbuilding, machinery & marine technology international trade fair) 2014 in Hamburg, it ensures the reliable and efficient operation of engines on ships and in land-based power stations, says GEA. To achieve the optimum separating behaviour with cat fines of different sizes, CatFineMaster enables two major process parameters to be varied. First, the separating temperature can be altered. Hot separation of up to 110°C reduces the viscosity of the fuel, allowing very small cat fines to be better separated. The second process parameter is the flow rate, which can be adjusted with a feed pump for the optimum adjustment of the flow rate of the HFO to the required process. This provides an additional boost to efficiency and simultaneously reduces energy consumption. CatFineMaster consists of the separator as the core element, the frequency-controlled feed pump, optional measuring and analysis equipment as well as the new GEA Westfalia Separator IO control unit. An optional analysis unit can be included to achieve the optimum adjustment of the flow to the HFO fuel centrifuges relative to the cat fine contamination present.

**Intelligent control generation with efficiency programs**

The new control generation IO used with CatFineMaster places emphasis on ease of operation. The initial consideration for developing the programming was not what the control unit and centrifuge are capable of providing, but what the user – either the operator, the commissioner or the company’s own service engineer – requires for his or her specific task. According to GEA, the operator can rapidly understand the centrifuge’s control unit – the familiarisation period is relatively short – making the operation more flexible, more reliable and safer. The advantage is that the wide range of functionalities now available is much more intuitive for the user. However, the IO is not only able to control and display, but also to evaluate. This is because it is not sufficient merely to display the status of the machine; instead, data such as current fuel consumption or cat fine content also have to be interpreted in order to optimise the operating processes. The concentration of cat fines can be measured online by the analysis system CatGuard during ongoing operation; this system is optional and can be integrated in cooperation with the manufacturer, NanoNord. The IO control unit also provides additional assistance by means of integrated efficiency programs. The operator only has to decide on the optimum status of the centrifuge: Is the separating result or energy consumption to be optimised, or is performance to be maximised? A push of a button is sufficient, and the centrifuge automatically adjusts to the desired status. This also illustrates the major advantage of installing a centrifuge and control unit as a complete solution.

**More safety on board**

CatFineMaster offers an extremely attractive ratio between the calculable additional costs of the system and the incalculable additional costs of repairing the main engines along with possible temporary shutdowns, delays, downtime, loss of charter contracts, etc, says GEA. It offers optimum energy efficiency as a result of the preset operating programs and will provide considerably better performance than the threshold values that have so far been valid for cat fine content. According to GEA, CatFineMaster is the first system on the market that ensures an efficient reduction of cat fines, targeting a concentration of less than 5ppm and separation of all particles larger than 3μm. GEA’s unitrolplus sensor system also ensures the continuous monitoring of the oil for water content and the sludge space filling in a single step. Depending on the water content in the oil, the separator adjusts automatically to function in purifier or clarifier mode. The result: higher specific separating capacities combined with optimum separation efficiency. No regulating ring is required for this automatic monitoring process. Thanks to unitrolplus, the user does not need to make manual settings anymore.

> ABOUT GEA WESTFALIA SEPARATOR GROUP

GEA Westfalia Separator Group is part of GEA Group Aktiengesellschaft, a leading systems provider of food processing and energy generation. Founded in 1893, it offers cutting-edge mechanical separation technology employing separators and decanters.

www.gea.com
With a carrying capacity of up to 100 t, the JDN PROFI is exceptionally energy efficient and fast, features sensitive control, is particularly reliable and, of course, explosion protected. Made in Germany, engineered for extremes and perfect for ship building and repairs. www.jdngroup.com
Duct explosion protection for gas and dual-fuel engines

HOERBIGER Large spark-ignited gas and dual-fuel engines need protection from explosions in their inlet and exhaust systems. Hoerbiger provides proven explosion relief valves and, just as important, accurate models to ensure that they are properly sized and located.

Gas and dual-fuel marine engines continue to gain popularity thanks to their flexibility, lower fuel costs and lower emissions compared with diesels. But along with these advantages, gas engines bring the risk of explosions in their inlet and outlet manifolds and exhaust ducts. An explosion in a duct 2m in diameter and 25m long, as found on the largest marine engines, can be very serious.

Compared with explosions in crankcases, those in manifolds and ducts are hard to model, and the shipping industry lacks accepted standards for sizing and locating explosion relief valves in this case, Hoerbiger points out, adding that design methods based on 3D computational fluid dynamics (CFD) are often slow, expensive and of unproven accuracy. Hoerbiger’s new modelling technique, on the other hand, is quick and easy to use, and matches experimental results well, the company says. By helping engineers to optimise relief systems, the new software makes engine system design safer and cheaper.

Understanding flame propagation and detonation

When a gas mixture ignites, a chemical reaction front – the flame front – runs forward into the unburnt gas. Depending on the conditions, the reaction takes one of two forms: deflagration (slow) or detonation (fast).

In a deflagration, flame propagation is governed by the rate at which heat is conducted ahead of the flame front, raising the temperature of the unburnt gas mixture.
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until it ignites. When the methane air mixture is at rest, the flame front is smooth and travels at about 0.5 m/s (Figure 1, left). In practice, however, turbulence causes the flame front to become “wrinkled”, increasing the rate of heat transfer and hence the flame speed (Figure 1, right).

As a result, the laminar flame front accelerates as it becomes progressively more turbulent. Under suitable conditions, a supersonic shock wave develops. The resulting, almost instantaneous temperature rise causes the very rapid decomposition known as a detonation.

Modelling explosion causes and consequences

Crankcase explosions are generally deflagrations because the compact shape of the crankcase stops turbulence from developing a compression shock wave, strong enough to trigger a detonation. Proven design codes help system designers to position relief valves appropriately.

But in a long, narrow manifold or duct, the gas mixture is more likely to detonate, with very high peak pressures. Such explosions are harder to model, and reliable design guidelines have so far been lacking. CFD can be used, but it is complex and expensive, takes a long time to produce results and has not been well tested on real duct explosions.

Hoerbiger therefore decided to develop a simpler yet accurate modelling method dedicated to duct explosions. The company chose a proven numerical algorithm for transient gas dynamics known as the ROE scheme. This “first-order” method...
requires only modest computing power yet can handle all the physical effects associated with both subsonic and supersonic flow.

The result is ExploSE (explosion simulation and engineering), a dedicated Windows-based modelling program for duct explosions. ExploSE allows designers to simulate real duct systems by adding components including pipes, elbows, silencers and relief valves. Given the initial gas conditions and the point of ignition, the software then quickly plots explosion pressure as a function of duct length and time (Figure 2).

Predictions match experimental data well

To verify the new simulation software, Hoerbiger arranged tests at the independent FTZU Physical-Technical Testing Institute in Ostrava, Czech Republic. The tests used pipes in diameters of 100–600mm and lengths of 1–25m, fitted with explosion relief valves, to create realistic physical layouts. Figure 3 shows the very good agreement between simulation and experiment. The software accurately predicts not only the right qualitative behaviour but also the size and timing of the pressure peak.

Broad range of explosion relief valves

Hoerbiger has been setting standards in safety technology for decades, benefiting manufacturers and operators of diesel, gas and dual-fuel engines. The tried and tested EVT and EVM valve series are used by almost all the renowned engine builders.

Properly sized and sited, Hoerbiger explosion relief valves provide reliable flameless explosion venting and complete protection for operators, engines and associated equipment. For manifolds and exhaust ducts, correct relief valve sizing and positioning has previously been difficult to ensure. Hoerbiger’s new software provides a simple yet accurate and proven way to design explosion relief systems, and is a major contribution to improving the safety of engines as a whole.

According to Hoerbiger, the combination of ExploSE software with the company’s explosion relief valves gives secure and uninterrupted engine operation; a detailed understanding of potential failure modes and their impacts; the optimal number, size and position of explosion relief valves; and lower costs for safety systems while maintaining or improving safety levels.
Hybrid concepts for vessels with highly variable work cycles

SCHOTTEL Propulsion expert Schottel offers a wide range of hybrid solutions that feature a compact and space-saving design, are simple to install and maintain and are characterised by reduced fuel consumption and emissions during operation.

The successful operation of Svitzer’s ECOTugs with the electric Schottel Combi Drive (SCD) led Schottel to develop further solutions for vessels with highly variable work cycles. These solutions are primarily geared towards customer demands for more environmentally friendly propulsion systems, not to mention compact, powerful and maintenance-friendly solutions.

Tugs must fulfil a variety of tasks covering the full power spectrum, including periods requiring either very low or very high power (for example in standby state or towing operations). Conventional, direct diesel-driven tugs are rarely operated continuously at the optimal engine power. This results in high fuel consumption and pollutant emissions. Schottel hybrid concepts allow tugs to be operated in accordance with their tasks. At part load, the electric motor suffices. The diesel engine is employed for operation with higher load requirements, and the electric motor can easily be switched on to provide additional power if needed. In FiFi mode, the electric motor maintains the position and the diesel engine is available to the FiFi pump.

2 x SRP 3000 PTI: 10 kn with an electric motor alone

The latest environmentally friendly tug concept can be found in the innovative newbuilding Eddy 1, designed by the Dutch company EDDY Tug and in service since June 2014, as well as in two tugs currently under construction.

The 65-tonne BP EDDY tug is equipped with two SRP (Schottel Rudderpropeller) 3000 PTIs. This propulsion Schottel hybrid solutions allow switching off the diesel engine when less power is required (e.g., transit and idling), reinforce the diesel engine when more power is required (e.g., boost and bollard pull) and offer additional safety with redundant motors.
The system consists of a mechanical rudder propeller (1,900 kW) and a PTI mounted on the above-water gearbox opposite the power input. The PTI is an electric motor that provides 460 kW at 1,100 rpm for manoeuvring and transit at up to 10 kn when the diesel engine is switched off. The diesel engine can be used for operation with higher load requirements, and the electric motor can supply supplementary power as needed. This option is available in boost mode, at maximum bollard pull, or for high torque requirements at part load. The system allows simple switching between diesel and electric operation while on the move, and achieves smooth transitions, Schottel says. The PTI and diesel engine are controlled centrally as a single system.

The SRP 3000 PTI is also available as an SRP 4000 PTI (2,500 kW). This concept for high-speed diesel engines can also be applied to ferries.

Strong Schottel hybrid gearbox

Two 90-tonne BP tugs currently under construction are each to be fitted with two Schottel SRP 4000s (2,240 kW) with Schottel hybrid gearboxes. The hybrid gearbox is a powerful transmission with a hydraulic clutch and an electric motor (600 kW), enabling the tug to be operated with the diesel engine, the diesel engine and the electric motor, or the electric motor alone. This solution is flexible as far as the diesel engine and electric motor are concerned, and suitable for hybrid concepts with rudder propeller input power ratings of up to 4,200 kW.

Kotug hybrid tugs with Schottel propulsion systems

Additional hybrid tugs equipped with Schottel propulsion systems and modern frequency control are currently in service. Schottel was involved in the conversion of Kotug's modern Rotor®tug RT Adriaan (three SRP 1215s) back in 2012. Kotug has now market-launched its first hybrid newbuilding with Schottel systems. It has three SRP 3000s (1,900 kW each), three electric motors and generators, and a modern energy management system. Selection of the optimal operating modes should result in a reduction in emissions of up to 50% along with fuel savings of up to 27%, Schottel says.

Schottel's compact hybrid solutions are simple to install and maintain, the company emphasises. These concepts do not require batteries. In addition to reduced fuel consumption and emissions during operation, costs can be saved at the investment stage. For example, the main propulsion system requires a smaller combustion engine than conventional solutions. What is more, the operating hours of the engine are considerably reduced, which leads to a longer service life and lower maintenance costs. And the electric motor ensures greater reliability as a redundant device.
New shifting clutch combination for hybrid tugs

VULKAN COUPLINGS | Coupling manufacturer Vulkan recently introduced its new coupling TDS Plafrix, which has been specially developed for use in hybrid tugs.

Growing environmental awareness in recent years as well as the economic imperative to save energy have become key factors in the maritime industry. For harbour tugs in particular, a feasible solution appears to lie in their special operating profile. In most diesel-driven tugs, the main engines operate at maximum power for only 2% of their service life and at less than 20% of nominal power about 80% of the time. Moreover, these tugs usually spend most of the time at pier and therefore seem almost predesigned for hybrid propulsion. With a combination of electrical power for low-load operation, and the full power of diesel engines, smaller engines consuming less energy can be used. They can be operated most of the time at their design point, where combustion is optimised and pollutants in exhaust gases are minimised.

A configuration with a shaft generator integrated into the propulsion line to carry out most low-speed and low-load operations on electrical power may have the best prospects. This configuration has already been realised in Kotug’s tug RT Adriaan, in service for about a year now. According to Kotug, it achieves a reduction in fuel consumption of nearly 15% along with reductions of 44% in hydrocarbons, 33% in NOx and 38% in SOx emissions.

New shifting clutch combination: TDS Plafrix

To separate and re-engage the diesel engine and electrical motor, Vulkan is offering the TDS Plafrix, a clutch coupling combination of the market- and service-proven components Vulastik L by Vulkan and Planox by Desch Antriebstechnik, designed especially for this configuration.

Considering the operational profile and related running time of the diesel engine, a Vulastik L 4010, which under constant load is capable of transmitting between 10 kNm and 12.5 kNm, can be loaded up to 11.57 kNm and 14.46 kNm, respectively, for this application. Through use of an appropriate stiffness, the torsional vibration behaviour of the installation can be optimised and the sound level and comfort on board increased. The integrated, pneumatically actuated clutch with radial air supply, a specially designed Planox 184/00, is capable of transmitting a nominal torque of 30 kNm. This high value is needed to fulfil the safety requirements for clutches of the various classification societies when transmitting the torque of each type of diesel engine usually installed in these tugs. By using dry-running organic friction discs, the number needed to transmit this torque has been reduced. This reduces not only weight, but also drag torque. The latter is further minimised by separating the friction discs with springs when declutched.

To transmit the full torque of the engine at a speed of up to 1,800 rpm – for a short time up to 2,200 rpm – and to engage the clutch at a differential speed of up to 650 rpm, pressurised air at 5.5 bar is needed. This medium to activate the clutch was chosen out of “clean ship” considerations – in case of leakage, the engine room will not be sullied with oil as in hydraulically activated clutches. Moreover, compressed air is assumed to be a medium that is available on board as standard and no additional tanks or aggregates are needed.

Reduced in size and weight

The flywheel coupling and clutch are integrated in a lightweight aluminium housing that is connected to the flywheel housing. Due to the internal bearing system, the weight of clutch and coupling is supported by the engine housing, keeping the crankshaft bearing nearly completely free of additional weights and loads. The total weight of about 620 kg and total length of 550mm (without hub) were achieved by a systematic utilisation of the operational profile of harbour tugs. Running most of the time on electrical energy means that the clutch is usually declutched, leading to smaller-sized bearings and thereby further reducing the size and weight of the TDS Plafrix.

ABOUT VULKAN COUPLINGS

Vulkan Kupplungs- und Getriebebau Bernhard Hackforth GmbH & Co KG, based in Herne, and part of the Vulkan Group, is a family-owned enterprise that manufactures highly flexible couplings, brake systems, elastic mounts and shaft systems for marine propulsion, power generator applications and industrial drives. Vulkan Kupplungs- und Getriebebau comprises the divisions Vulkan Couplings (marine and stationary power generation) and Vulkan Drive Tech (industrial applications). Vulkan couplings are used in cruise ships, working and container ships, as well as in the oil and gas industry, mining and materials handling technology. www.vulkan.com
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With the innovative “5D propulsion” concept, MMG is setting new standards in the field of high-efficiency propeller drives. By using five innovative digital technologies, the propeller manufacturer guarantees design quality and production accuracy for products that are unique worldwide.

“5D propulsion”: a new design and manufacturing standard

MMG

High marine fuel costs and low freight rates are causing operators to seek ways to boost ship efficiency. Advanced ship propulsion solutions are one way to achieve considerable improvements in this regard but require highly detailed concept, design and construction processes. German propeller manufacturer Mecklenburger Metallguss GmbH (MMG) has tackled the issue of implementability and developed its own standard for ship propellers in accordance with design and geometry quality standards. MMG’s “5D propulsion” concept, which strictly adheres to the industry’s “built as designed” requirements, combines five different methods to design, construct and produce propellers, their acronyms being MDC, NPS, OPM, NCP and VCT.

MDC – multi-data design concept

The multi-data design concept offers the option to base all relevant calculations, starting at an early stage, on a broad database that represents real ship operations more accurately. Unlike the conventional method in which the propeller is fixed at one specific point only, MDC allows highly detailed designs depending on the available database. Options range from optimisation matrices as condensed descriptions of a ship’s operating profile in relation to vessel speeds and draughts all the way to high-resolution descriptions of ship operations in the form of frequency distributions. The resulting propeller design guarantees improved effectiveness in line with the ship’s operating profile.

NPS – numerical propulsion simulation

To accurately determine the overall effectiveness of a propeller, the forces interacting between it and the hull must be determined. Effectiveness is both lost (e.g., suction of the propeller at the aft of the ship) and gained (e.g., untwisting of the propeller flow by...
Based in Waren an der Müritz, Mecklenburger Metallguss GmbH (MMG) has been manufacturing propellers for the shipping industry since 1948.

www.mmgprop.de

Typically, model tests are performed to determine the propeller-hull interaction forces. Further development of the numerical method in flow simulation now enables model tests to be simulated on state-of-the-art, high-performance computers in suitably fast calculation times.

To make the design phase easier, MMG has introduced this simulation technique in both newbuilding and redesign projects. With NPS, several propeller variants can be examined and compared under model test conditions during the design phase, allowing developers to identify the configuration with the maximum overall effectiveness.

**OPM – optical precision measurement**

To translate greater accuracy in propeller design into higher manufacturing quality, MMG has introduced the optical measurement method to monitor quality. The propeller’s surface is scanned at an accuracy of up to 1/100mm using fringe pattern projection, and then is available as a 3D surface model for target/actual comparison with the design geometry. The consistent use of OPM for life-sized and model-scale propellers ensures the overall quality of the design.

**NCP – numerically controlled processing**

To facilitate production processes and minimise accuracy losses in the design, construction and production stages, customised CAD applications are used to generate the propeller geometries. The applications can be deployed throughout the company without the need for conversions. This, combined with the processing of these geometries on bespoke CAM applications, minimises accuracy losses throughout the entire development chain – from the hydrodynamic analysis all the way to machining – for both life-sized final products and model-scale propellers.

**VCT – virtual contact test**

As a logical complement to the optical measurement of external propeller surfaces, MMG has developed a new method to measure and analyse the surface fit between the shaft and hub bore of the propeller. This contact pattern has commonly been checked using a blue bedding test, whereby the proportion of the surface contact between the shaft and the hub bore is quantified in per cent using a colour print. The optical measurement method used in VCT, however, directly delivers a digital surface model of both contact pattern partners, and the proportion of the surface contact is then quantified numerically. This method makes it possible to have the final processing of the hub bore done at MMG and simplifies propeller assembly at the shipyard. VCT is therefore a prerequisite for successful propeller retrofits.

Combined, the five methods represent a new manufacturing standard that ensures compliance with the propeller design specifications in the final product, too. Discrepancies between the performance forecasts based on hydrodynamic calculations or model tests and fuel consumption in real-life operations can thus be reduced, MMG says.

ZF IS PROPULSION.

Fleet operators and ship owners want highly efficient and reliable vessels. Equipment onboard must be easy to maintain, have low through-life costs and perform around the clock in the most demanding conditions. With continual research and development ZF Marine Propulsion Systems is able to provide customers with a wide range of marine transmissions, thruster systems and appurtenant controls specifically designed for the commercial marine and work boat market.

www.zf.com/marine
Efficient bearing supports for marine propulsion systems

Schaeffler offers a comprehensive portfolio of application-specific bearing solutions as well as intelligent condition-monitoring systems.

As mid growing environmental awareness, economic constraints and stricter regulations, the reduction of pollutant emissions from marine propulsion systems has increasingly moved into focus in recent years. To cater to the special requirements in marine applications, Schaeffler offers a comprehensive portfolio of application-specific bearing solutions under its product brands INA and FAG. Furthermore, thanks to the use of condition-monitoring, crucial operating conditions can be recorded and made available to the control system. This means that Schaeffler, as a bearing manufacturer, also plays a key role on the road to “Industrie 4.0”.

Schaeffler’s product range includes rudder and shaft bearings, for example in rudder propellers, thrusters, Voith Schneider propellers and water-jet drives. In addition, the portfolio has solutions for the support of engine shafts and bearings that aid the folding and pivoting of ship stabilisers. Bearing supports for cranes, rope and anchor winches, as well as porthole bearings, also form part of the special bearing range for marine applications.

Bearings of the FAG brand are used in compact drives. These bearings guide the drive shaft on the locating bearing side and accommodate thrust forces and weight forces from the engine and propeller. Axial spherical roller bearings are used to support the main thrust forces, while smaller counter-bearings serve to support loads resulting from thrust reversal. Radial spherical roller bearings support the radial forces arising from the weight and the dynamic forces of the engine and propeller. The bearings in the Schaeffler thrust bearing unit are arranged so that they align via a common point and can thus compensate for misalignment of the drive shaft. To optimise the kinematic conditions in the bearing system and reduce friction, the outer rings of the radial spherical roller bearings and the housing washers of the axial spherical roller bearings are coated with a Durotect® Z layer. Developed by Schaeffler, this surface coating provides reduced friction and adhesion tendency, as well as increased resistance to corrosion and fretting corrosion.

In addition to rolling bearings and housings, Schaeffler’s scope of delivery includes all connections and sensors required for the continuous online monitoring of the rolling bearing units. Monitoring is carried out using temperature measurement, oil sensor and vibration analysis. Especially in heavily contaminated industrial transmissions such as marine propulsion systems, but also in planetary gearboxes in wind turbines or gear units in the mining and paper industries, smooth operation is usually critical to the overall availability of the system. Condition-monitoring enables operators to respond immediately to anomalies in the bearing unit. This can often help to save significant downtime costs that would be incurred in the shipping industry, for example by an unplanned stay in the dockyard.

With the FAG SmartCheck, Schaeffler offers an online condition-monitoring system that provides comprehensive information on the status of machine components, taking into account additional parameters such as the engine torque. The device is integrated into the machine control system and thus into process-monitoring.

The FAG Wear Debris Check monitors increases in the amount of particles or contaminants in the oil circuits, e.g., of industrial gearboxes, evaluating them by their constituents and size. This sensor system, too, can be easily integrated into monitoring and control systems. In combination with vibration analysis, it even enables the accurate identification of the defective transmission component. Delivery time requests, spare parts ordering and the creation of repair schedules can thus be automated.

The reduction of pollutant emissions from marine propulsion systems is a topic that has attracted increasing attention over the past few years. Application-specific and optimised bearing supports are...
indispensable in modern drive units to meet the strict limits of future regulations. Schaeffler’s bearing calculation and simulation program, Bearinx, makes it possible to calculate the energy efficiency of different bearing supports under actual operating conditions. Friction calculations performed with Bearinx have shown that the greatest potential for optimisation lies in the choice of the correct bearing type and size for the respective operating conditions. This potential can reduce friction by up to 60%. In addition, calculation, tribology, surface quality, loading, misalignment, speed and cage type all play a crucial role. This means that Schaeffler can identify the highest savings potential for a given system at an early design stage, the company says. Based on this, the bearing systems can be optimally tuned to low friction, further improving the energy efficiency of these applications. Thus the friction level of rolling bearings in marine transmissions can be reduced by up to 40%.

About Schaeffler
Schaeffler Technologies AG & Co KG offers application-specific bearing solutions under the INA and FAG brand names. In addition to bearing supports, this also includes the required housings, documentation and release procedures. The product spectrum ranges from rudder and shaft bearings to transverse thrusters and water-jet drives. Furthermore, the company offers solutions for engine shaft bearing supports and bearing supports for the opening and tilting of ship stabilisers. Bearings for cranes, winches, windlasses and hatchway supports also form part of the special bearing range.

www.schaeffler.com
KINKELE | Gear casings for outboard thrusters are typically designed as welded assemblies. Because of the enormous powers that are transferred and the power density of mechanical drives, the casings are highly stressed mechanical components. Fatigue strength and rigidity of the casing are paramount when operating safety and efficiency of the gear need to be improved. Production specialist Kinkele has found a way to improve the rigidity and precision of bevel gear casings for marine applications, resulting in reduced weight and increased efficiency of the gear. The new manufacturing method increases the quality of both execution and subsequent non-destructive testing (NDT) of the full-depth welds of a thruster gear casing, Kinkele says. A semi-automatic, submerged arc welding machine with turntable is used to weld the circular seams, whereas the complex three-dimensional geometry of the intersection between oval shaft and cylindrical bevel casing demands a MAG hand-welding process. As Kinkele employs its own certified NDT personnel, a process has been designed that allows intermediate in-line non-destructive testing that has significantly improved the detection of potential welding defects early in the process. This leads to a significantly higher welding quality at the end of the process, allowing structural engineers to increase their safety factors on required nominal loads without increasing material thickness or the size of the welding seam. For the efficiency of a bevel gear, the adjustment of the gear play is a key factor. The main influence apart from the quality of the gears is the position and shape tolerances of the axis for the shafts in the gear casing. Kinkele has now introduced a machining process whereby the whole gear casing can be machined on a large machine tool sitting on a turntable, eliminating re-clamping for different machining operations. In combination with a hydrostatically supported carrier beam of the machine spindle, tolerances of less than 0.03mm can be achieved repeatedly. With these close tolerances, the adjustment of the play in the gear is very precise, resulting in increased overall efficiency of the whole gear, Kinkele says. Not only net power output increases by 1–2%, but also heat rejection to the cooling oil is significantly decreased.

Precise fabrication process for improved safety and efficiency of gear casings

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Non-destructive testing (ultrasonic) of a full-depth weld seam

ABOUT KINKELE

The 130-year-old, family-run company excels in building highly stressed, custom-designed weldments, focusing on applications that require precision, complex project management and stringent control and documentation of the manufacturing processes. Kinkele employs 350 highly skilled people in its state-of-the-art factory near Würzburg.
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Reliable heave compensation system for research ship Sonne

SAM ELECTRONICS  Heave compensation systems compensate for heave-related movements of ships, thus enabling controlled lowering of loads and measuring equipment. In collaboration with Hatlapa, a heave compensation system from SAM Electronics has been installed and successfully tested on the German research ship Sonne.

The German deep-sea research vessel Sonne, built at the shipyard Meyer/Neptun Werft in Papenburg, Germany, was put into service in 2014. Its technically sophisticated heave compensation system was delivered by SAM Electronics.

According to the manufacturer, the required ship motion compensation level of 95% was even exceeded in practical testing in heavy seas – with a heave of about 7m, the load moved approximately 10 to 15cm. This was demonstrated by a plumb line attached to the load. The compensation system operates up to the mechanical limits of the dynamic rope store. Beyond this, the heave compensation remains active, with the compensatory movements being capped only at the displacement limit.

The heave compensation system consists of a friction winch, dynamic rope store, storage winch, and motion signal from the motion reference unit (MRU). With active heave compensation, the friction winch follows the length of the rope in line with the motion of the ship. The MRU calculates the heave speed and stroke relative to the pulley on the sliding boom or A-frame. The length of rope required for heave compensation is taken up/made available by a dynamic rope store located between the friction winch and storage winch. The inert storage winch regulates its counter-motion in such a way that the piston of the dynamic rope store operates around the centre.

Heave compensation is effective to depths of 2000m. Beyond this point, sea currents and the spring of the rope are usually so great that the required stabilisation is affected by other parameters and not just by the overriding influence of the motion of the sea.

The friction winch raises and lowers the load. The speed of the rope movement is set manually using a joystick. When heave compensation is selected, the vertical sea motion is superimposed on the heaving and lowering. As well as the weight force, the friction winch drives need to accommodate the accelerating torques for the revolving masses of the friction winch (drum, gears, rotor of the motor). The control signal from the motion reference unit is calculated according to the vertical movement of the sliding boom or A-frame. In terms of drive size, the moments of inertia of all the
rotating parts are minimised. Particular attention is paid to the design of the drive motors, as the rotational energy of the inert masses increases by the square of the rotational speeds.

The dynamic rope store operates passively. Its pulleys are moved using a hydraulic piston with gas storage spring. This keeps the rope taut at all times, with the speed of the friction winch being so limited that the maximum stroke of the hydraulic cylinder is not exceeded. The dynamic rope store has a piston stroke of 2m. For a quadruple shear rope, the working stroke is therefore ±4m. The gas pressure is adjusted to the rope tension. The highest possible gas volume ensures constant piston force regardless of the given displacement.

The storage winch operates with a constant tensile force, which is regulated in relation to the average expansion force of the rope store. The position of the piston of the dynamic rope store is measured and the storage winch moved in such a way that the piston always oscillates around the centre.

Vertical acceleration is produced by superimposition of heave, pitch and roll. Actual vertical acceleration depends on the position of the load hook (sliding boom extended, A-frame extended), the ship's speed, and the motion of the sea. The Hamburg Ship Model Basin (HSVA) has forecast vertical acceleration from

TECHNICAL DATA

Specifications for operating friction winches with superimposed heave compensation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliable superimposed rope speed</td>
<td>1.5m/s (plus compensation ±2m/s)</td>
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<tr>
<td>Working load in compensation mode</td>
<td>10 to 80 kN (max 120 kN)</td>
</tr>
<tr>
<td>Compensation heave</td>
<td>6m (max 8m)</td>
</tr>
<tr>
<td>Guaranteed compensation level</td>
<td>&gt; 95% (measured &gt; 98%)</td>
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</tbody>
</table>

Example design for one 60-kN CTD winch

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static motor power</td>
<td>106 kW</td>
</tr>
<tr>
<td>Dynamic motor power with heave compensation</td>
<td>170 kW</td>
</tr>
<tr>
<td>Static motor speed with rope speed of 1.5m/s</td>
<td>1,150rpm</td>
</tr>
<tr>
<td>Dynamic motor speed with heave compensation</td>
<td>1,800rpm</td>
</tr>
</tbody>
</table>

The shipping industry is facing increased damage to engines caused by abrasive cat fines in HFO worldwide. Keep the destruction off your ship with the new GEA Westfalia Separator CatFineMaster: the first on-board solution engineered to ensure maximum cat fine removal. Its simple, innovative control offers three efficiency modes for peak performance under any conditions. Ask our specialists for the right formula to protect your investment: One touch. Finest fuel.

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0.4 m/s² to 2.8 m/s². This range is covered for a load of 8 tonnes. The drive motor and converter are powerful enough to provide sufficient torque and speed reserves for heave compensation requirements alongside ordinary lifting capacity. The motor’s torque reserve has to be able to accelerate itself, the gear stages and drum. As the load rises, the heave amplitude that can be compensated for may be restricted depending on the size of the drive.

Smaller, direct-drive winches can also be configured to compensate for the motion of the sea. The drive’s torque reserve needs to be such that the entire rope storage drum can be accelerated.

The control algorithms were optimised in the simulation, thereby cutting commissioning times significantly. The behaviour of the actual winch system was almost identical to the results of the simulations. Comprehensive simulations are essential for this type of system, as the different amplitudes and swells of the sea with different loads cannot be covered in a reasonable period in actual tests.

ABOUT SAM ELECTRONICS

Hamburg-based SAM Electronics GmbH is one of the world’s leading manufacturers and suppliers of maritime electrical and electronic systems. The company’s portfolio includes electrical power packages, electrical drive systems, automation systems, navigation and communication equipment as well as safety, security and entertainment systems.

www.sam-electronics.de
Universal cargo pumps for high- and low-viscosity products

LEISTRITZ PUMPS  A wide range of screw pumps as well as complete pump systems and packages are offered by the German manufacturer Leistritz Pumpen (“Pumps”). One of its latest innovations is a submerged cargo pump that allows continuous, almost pulsation-free pumping of cargo liquids at low power consumption.

Leistritz’s screw pumps are positive displacement pumps designed to pump liquids of various viscosities. They are tested at the company’s facilities and approved by classification societies including ABS, BV, DNV, GL, LRS and RINA.

Loading and unloading
Cargo fluids ranging from low-viscous diesel oil to high-viscous bitumen, asphalt or molasses are handled with the Leistritz screw pump series L2/L4/L5. According to Leistritz, the design and operating principle of these pumps ensure a very low noise level and almost pulsation-free delivery. Used with frequency controlled motors based on the nearly linear relation of speed and flow rate, the pumps have a delivery rate that is easily adjustable by changing the pump speed. Alternatively, Leistritz screw pumps can be driven by hydraulic motors. Depending on requirements of the application and cargo products, the available pump casing materials are cast iron, nodular cast iron, cast steel and stainless steel. The pumps are available either as submerged unloading and stripping pumps or for dry installation on the tank top. For hazardous zones – the motor installed in a safe area – Leistritz offers gastight bulkhead seals (type-approved).

One of Leistritz’s latest developments is a submerged cargo pump series that allows continuous, almost pulsation-free pumping of cargo liquids at low power consumption. Deck installations of...
Cargo screw pumps are typically unable to satisfactorily unload the full range of cargo viscosities in tanks deeper than 7m to 8m, Leistritz points out. And they cannot provide the suction conditions necessary to avoid cavitation effects during unloading and stripping. Furthermore, standard submerged pump types are normally unable to provide proper stripping and draining of the tank and suction lines, the company adds. To overcome this challenge, Leistritz has developed the submerged cargo pump series L2NT/L5NT. The pumps are installed in a separate barrel, usually hanging from the deck in the aft cargo tank, doing away with the need for a pump room. The barrel acts as a large suction chamber, providing the pump with additional suction ability. The pumps have only one shaft seal (stuffing box or mechanical seal) to the atmosphere. They are suitable for handling hydrocarbon products and other viscous liquids, including slightly abrasive and corrosive fluids. Their special screw profile allows continuous, almost pulsation-free pumping of cargo liquids at low power consumption, Leistritz says. When the barrel installation with the suction line flange connection is placed above the inlet to the pump, the entire pump is flooded with the pumped liquid even without tank filling levels. Due to this configuration, the pump handles entrained air and gases without vapour locking or losing prime. For pumps in asphalt operation, Leistritz recommends heating coils in the suction area of the barrel, and a heating jacket for the stuffing box. With at least two pumps normally installed in a barge, each can be designed with full unloading capacity to achieve system redundancy. Thanks to the layout of the suction piping system, each pump can service any of the cargo tanks. The pumps can be driven either by a diesel engine through a right-angle gear connected to the vertical drive shaft or by an electric motor. The pump flow can be controlled by varying the pump speed. This helps strip the line and tanks to optimise the total cargo discharge time. An electric motor with frequency control can also be used. Leistritz says its cargo pump is up to 40% more efficient than a centrifugal pump. It can be supplied for both retrofits and newbuilds and is suitable for several viscosities, ranging from kerosene to asphalts.

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Lube oil system in engine rooms
Leistritz screw pump series L3NG for lube oil transfer is available in foot, flange and pedestal version for various installations in an engine room. The L3NG series features different housing materials and seals, is equipped with a mechanical shaft seal and can be used for different kinds of lube oils.

In main- and pre-lube oil applications for diesel engines, Leistritz screw pump series L2, L3 and L5 can be used. Available besides submerged versions for tank installation and dry-mounted versions are flanged pumps directly driven by the main engine. Submerged pump versions save space and ensure trouble-free starting in cold conditions, Leistritz says. Tailor-made designs can be supplied in cooperation with the engine manufacturer. According to Leistritz, the pumps feature excellent NPSH values, noiseless running and accept high percentages of dissolved air in lube oil.

Fuel oil system in engine room
Fuel oil modules for the supply of diesel engines are operated by Leistritz screw pump series L3NG as feeder and booster pumps in flange or pedestal design. Parallel to conventional mechanical shaft sealing systems for these pumps, magnetic couplings are being increasingly used. Particularly when heavy fuel oil with temperatures above 120°C is to be handled, this sealing system provides zero leakage and a maintenance-free design, Leistritz says.

Steering gears and pitch propellers
Central hydraulic systems, e.g., for the supply of hydraulic motors, hydraulic driven propellers and steering gears, are among the application areas for screw pumps on ships. Leistritz L3MF screw pumps in duty or standby configuration provide proper fluid delivery and pressure to the actuator. A 100-hour test of the pumps for steering gears was successfully conducted under classification supervision to prove their reliability under different working conditions.

Winches
Various winches are used on vessels, for example to pull anchors or mooring lines. Winches with gear assemblies are often powered by special hydraulic drives. Leistritz pump series L3MF reliably supplies fluid to the components of the system. The pressure demand in the system reacts directly to the workload.
Complete water management on board

RWO | For 40 years, water treatment specialist RWO has treated all kinds of water on board ships and offshore installations. Its latest product, the oily water separator OWS-COM, was introduced in 2014. As are all oily water separators from RWO, the OWS-COM is a suction model and reliably reaches the 5ppm limit. The bilge water passes a first stage, where it is filtered and then separated via gravitation from the oil by means of a coalescer material. Only after this stage does it pass through the pump, sparing it from attrition by particles and dirt, which are already removed in the first stage. Behind the pump, a sensor measures the remaining oil content. If below a set limit, the bilge water goes directly overboard. But if emulsions and further oil particles are left, it is subject to a second stage, where adsorber cartridges remove the remaining contamination. The OWS-COM is certified by all necessary institutions, and the classification society DNV GL has confirmed that it reliably reaches the 5ppm limit in accordance with IMO Resolution MEPC.107(49).

Support systems for difficult bilge water conditions
In difficult conditions, RWO offers bilge water treatment with technical support systems. A splitting and filtration unit is available that removes emulsions and contamination, thereby enabling more economical operation of the second stage of the oily water separator. RWO’s BilgeEconomiser is a stand-alone oil monitor with automatic and manual three-way valves. It is installed behind the discharge pump of the clean drain holding tank. As long as the oil content of the clean drain is below the set discharge limit, the bilge water is discharged directly overboard. Whenever the oil content exceeds the limit, the bilge water is diverted to the bilge holding tank for further treatment by the oily water separator. This allows fewer operations of the OWS and an increased cargo capacity due to a smaller bilge holding tank.

Sewage treatment
The RWO WWT-LC sewage treatment plant involves a three-chamber process. The heart of the plant is a well-established moving-bed biofilm reactor (MBBR), where organic matter is degraded into carbon dioxide and water by microbial activity. The air required for this process is generated by an integrated blower. The aeration simultaneously stabilises the biomass and prevents harmful gases from forming. The degrading takes place directly in the first chamber, making a buffer tank obsolete and saving space on board. In addition, integrated solid separation is part of the first step. From the bioreactor, the wastewater flows into the clarifier compartment. Here residual solids are separated by sedimentation and returned to the bioreactor compartment. The treated wastewater flows into the disinfection compartment, where a chlorine-based disinfection chemical is added. The clean and hygienically safe water is pumped overboard via the discharge pump, controlled by a level sensor in the disinfection tank. To meet the limits set for the chlorine content, a special neutralising agent is dosed prior to the discharge pump. According to RWO, this post-treatment process is a unique feature of the WWT-LC, making it independent of onboard water quality and keeping the pH values within limits. Flammable chemicals are not used. Excess sludge that has been treated and reduced in volume can be discharged or collected in an external tank. Due to the biomass retained by the MBBR process, sludge discharge does not interfere with the performance of the plant. The very low effluent values for BOD5 and COD achieved during the type-testing process demonstrate the efficiency of the wastewater treatment system WWT-LC. Since early 2015, WWT-LC has been MEPC.227(64)-certified and treats wastewater in accordance with almost all environmental class notations, RWO says.

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ABOUT RWO
The Bremen-based company, a subsidiary of Veolia Water Technologies, is a leading supplier of water and wastewater treatment systems on board ships and offshore installations. Since its founding in 1975, RWO has been developing, designing, manufacturing and servicing forward-looking and cost-efficient technologies for all sorts of water treatment, including ballast water treatment, oil/water separation, wastewater treatment, process water treatment and freshwater treatment for both new-buildings and retrofits.
Customised ejector solutions

KÖRTING | With more than 140 years’ experience in jet ejector technology, Körting Hannover AG can offer highly efficient and proven solutions for the shipbuilding industry. In a recent project for China’s COSCO Dalian Shipyard Co, Ltd, Körting developed a highly customised solution to the shipyard’s specifications. COSCO Dalian contracted Körting Hannover AG to produce jet ejectors to nominal widths of DN 300 for bilge and ballast systems. A new generation of the existing product range was required, and jet ejectors with a suction power of more than 500m³/h had to be developed and manufactured. Körting says it was able to meet the customer’s special demands in a short amount of time. The first two consignments have already been delivered. Testing capacities were quickly expanded to check the performance of the jet ejectors because it was vital to precisely measure whether the correct quantity was sucked through them, Körting says. At its headquarters in Hanover, Körting had a total volume of 250m³ of water, which was circulated about three times per hour. As a result, it was able to provide proof of performance to the classification society DNV GL. Körting says it is currently the only company whose jet ejectors are fully DNV GL-certified up to nominal widths of DN 300.

Körting’s jet ejectors are custom-made to performance specifications and characterised by cavitation-free operation, minimal energy consumption and maximum suction power, the company says. The jet ejectors in nominal widths of DN 300 for COSCO Dalian are made of high-quality, fully seawater-resistant cast bronze. In addition to being lightweight, the ejectors are hard-wearing and consequently maintenance-free. They have no electrical or mechanical drives, dynamic seals or moving parts, and feature optimised dry-running capabilities. Its project for COSCO Dalian, Körting says, shows that it is fully capable of reacting to any conceivable enquiry from a customer thanks to its experience, flexibility and highly professional approach. Körting has already received enquiries about products in nominal widths of DN 300 for future projects.

MORE ON BOAT DYNAMICS

Körting Hannover AG is a leading supplier of ejector technology in the shipbuilding industry, and the oldest manufacturer of ejectors in general. All Körting ejectors are tailor-made to the required performance data at the design point.

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TECHNICAL DATA

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motive flow</td>
<td>240m³/h seawater</td>
</tr>
<tr>
<td>Suction flow</td>
<td>&gt; 500m³/h seawater</td>
</tr>
<tr>
<td>Suction and motive connection</td>
<td>DN 250</td>
</tr>
<tr>
<td>Mixed flow outlet</td>
<td>DN 300</td>
</tr>
</tbody>
</table>

WISKA is your expert for installation material, maritime lighting and CCTV. Every product reflects our know-how. Since 1919. www.wiska.com
In October 2014, KSB successfully finished land-based testing of its newly developed ballast water treatment system (BWTS). The testing was conducted as per US Coast Guard (USCG) standards and included tests with different water qualities along with a unit endurance test of at least 10,000m³ passing through the system. With Japan and Georgia having recently ratified the Ballast Water Management Convention and USCG regulations entering into force, the search for a suitable treatment technology is now in full swing. While shipowners, shipyards and ship management companies worldwide make up their minds to retrofit existing vessels with BWTSs, the market still lacks a solution that complies with all regulations around the globe. Currently (as of Q1/15), out of at least 50 IMO-approved BWTSs, none have attained full USCG type approval. The fate of already-installed, IMO-approved BWTSs is still unknown since they might not be accepted by the USCG in the coming years. This issue, however, gave some system manufacturers an opportunity to reinvent their systems or come up with a new, second generation of BWTSs.

The KSB BWTS consists of an automatic back-flush filter, a low-pressure UV disinfection unit and a system control unit. The automatic back-flush filter is available in two variants: as a vertical candle filter or proximity nozzle filter. A filter mesh size of 30 μM is used to ensure the highest possible reduction of large organisms. Filtration this fine can also reduce sediment build-up in ships’ ballast water tanks to a certain extent. According to KSB, the system manages to fully compensate the back-flushing so that the system provides full-capacity performance. After passing through the filter, the test medium enters the UV unit for disinfection. KSB opted for a low-pressure UV disinfection unit in order to overcome the energy consumption constraint experienced on some ships. A 200m³/h ballast water treatment unit requires approximately 19 kW maximum for ballasting and about 18 kW for deballasting operations. This economy of power consumption demands optimisation as well as efficient control and monitoring of the complete system. This is ensured by the KSB system control unit, which includes all the necessary logics for efficient operation of the system. The control unit not only monitors the critical system parameters such as flow, pressure, etc, but also provides a complete overview of the test cycle in progress (ballasting, deballasting, cleaning) and a graphical representation of the parameters and data logging for Port State Control. The complete system along with components, piping, framework and skid mount can be assembled in a 20-foot container with some void space remaining, which demonstrates the adaptability of the system for installation on vessels with limited space. Another important feature of the system is its capability of coping with highly challenging waters in different parts of the world.

The KSB BWTS has undergone intense testing starting in April 2014 at DHI in Denmark, with the inlet species count above 50 μm varying from 200,000 to 500,000 per cubic volume of testing medium. To make the testing conditions more challenging, the medium UV-transmission value was adjusted to 44-45%. The successful completion of the first ten tests has not only proved above-par performance of the system but also its capability of coping with highly challenging waters in different parts of the world.

The next steps involve testing the system on a vessel as per USCG guidelines, which require that the system pass five consecutive “shipboard” tests within the test period of at least six months. Keeping the current time plan in mind, KSB plans to launch the product in the first quarter of 2016.

KSB is a leading supplier of pumps, valves and associated systems. They are used in a wide variety of applications, ranging from building services, industry and water transport to wastewater treatment and power plant processes. Founded in Frankenthal, Germany, in 1871, the company has a presence on six continents with its own sales and marketing organisations, manufacturing facilities and service operations. Its service centres around the globe provide inspections, maintenance and repairs. The company’s workforce numbers about 16,300.
DVZ GROUP has introduced the DVZ Jet-Zone-Reactor (JZR), a compact and sheltered sewage treatment module designed and built in accordance with the highest offshore standards and able to operate in harsh environments. The system incorporates the company’s sewage treatment system DVZ-JZR “BIOMASTER™” and is type-approved in accordance with the latest IMO Resolution MEPC.227 (64). The high-performance JZR bioreactor (Jet-Zone-Reactor) employs a newly developed aeration technology that operates on the injector principle for the treatment of wastewater in the plant-specific biological cleaning stage. Due to the high throughput and compact construction of the reactor, this treatment technology requires very little space. For designers, this means the greatest possible flexibility for integration into the ship. All systems are certified to the latest relevant IMO regulations and have proved successful in practical onboard operation. According to DVZ-GROUP special importance was placed on ecologically friendly and economical operation, the use of high-quality materials and components as well as extremely resistant, efficient and operation-safe filter technology. Its special construction without moving parts ensures low maintenance and high operational safety for many years, DVZ-GROUP says.

DVZ Sewage Treatment Module including DVZ-JZR “BIOMASTER™”

About DVZ-GROUP
DVZ-GROUP offers a wide range of water treatment equipment for any size and area of maritime and industrial activities. Based in Syke, it has a worldwide network of representatives and service stations with comprehensive after-sales service.

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Compact enclosures for lighting control on *Norwegian Getaway*

**RITTAL** To create the perfect atmospheres for its themed restaurants and exclusive decor, the cruise vessel *Norwegian Getaway*, delivered in January 2014 by German shipbuilder Meyer Werft, is fitted out with sophisticated lighting systems. The large-scale use of LED technology offers many possibilities for energy-saving lighting effects. The system is based on an intelligent infrastructure with controllers installed in compact enclosures from Rittal.

Among the features of Norwegian Cruise Line’s *Norwegian Getaway* are contemporary-themed restaurants, luxurious decor and furnishings, and high-tech entertainment. Equipped with the latest technology, the ship boasts environmentally friendly propulsion systems, safety features such as evacuation alarm and fire alarm systems, and sophisticated lighting systems meant to help turn a voyage on board the luxury cruise ship into an unforgettable experience.

A key component of the vessel’s infrastructure is a modern, indirect LED lighting solution deployed in all public areas. The innumerable light elements installed throughout the vessel, even in the machine room, can be controlled via dimmer units from the bridge. The Meyer Werft shipyard in Papenburg, Germany, contracted L3-FUNA, an Emden-based specialist in the installation of communications and entertainment systems on ships, to supply all of the LED lights for the public areas. Rittal’s SE 8 system enclosures were used for the installation of control modules and power electronics for the lighting systems.

The LED lighting system is based on 68 dimmer enclosures installed in tight spaces and niches on the ship and redundantly connected via a network of fiberglass and CAT-7 cables. The configuration posed quite a challenge for the installation engineers. As the planning phase began two to three years before handover of the ship, and the floor plan had not yet been finalised at that point, the installation technology needed a highly adaptable design with plenty of scope for modifications. On board the *Norwegian Getaway*, Leistritz Pumpen GmbH, with its headquarters in Nuremberg/Germany, has been producing Screw Pumps for almost all application since 1924. With the widest product range of Screw Pumps, Leistritz can offer complete pump packages as a perfect partner in the shipbuilding industry.

**Leistritz Screw Pumps and Systems**

Leistritz Pumpen GmbH can offer complete pump packages as a perfect partner in the shipbuilding industry. The testing of the pumps through all well known classification societies as ABS, BV, DNV, GL, LR, RINA and others is made on Leistritz test fields to generate contribution to international shipping safety and maritime regulation.
FUNA says, smart infrastructures had to be created, that delivered maximum flexibility despite major space constraints.

This applied in particular to the enclosure systems, slotted into the tightest spaces, in which FUNA installed all of the control modules and power electronics for the lighting systems. In this context, flexible extension options were vital for possible alterations later on in the shipbuilding process. Rittal’s SE 8 system enclosures and FUNA’s installation solutions enabled the incorporation of a large number of components while offering a great deal of flexibility. The owner’s specifications demanded a clearly structured installation layout, which was equally important to FUNA in terms of facilitating later maintenance and refits. According to Rittal, a huge advantage is the versatility of the new SE 8 system, which enables flexible interior enclosure installations based on standardised modules. Thanks to the wide range of system accessories, any number of variants can be implemented quickly and reliably, the company notes.

Unlike bayed enclosures with frames and removable side panels, the body of Rittal’s SE 8 freestanding enclosure, comprising two side panels and a roof, is made in a single piece from sheet steel. This simplifies handling, as the side panels do not have to be assembled separately. The rear panel is screwed on for easy access to the enclosure. Like the TS 8 bayed enclosure system, the integrated base frame can accommodate various cable entry options. The SE 8’s doors and base/plinth match those of the TS 8. It also offers attractive design features, including automatic potential equalisation of the body with the rear panel and gland plates. Special contact elements that are pushed into the surface coating during assembly create a reliable electrical connection. This solution significantly cuts costs and assembly times, Rittal says. Moreover, it was possible to fulfil 80 to 90% of enclosure-related requirements using standard components from among Rittal’s system accessories. Suppliers may benefit from the highly modular structure of the enclosure range, for instance in light of the many and various locking systems used by shipping companies. By using standard components, it is ensured that the installations can be serviced for a long time in the future.

ABOUT RITTAL

Rittal GmbH & Co KG, headquartered in Herborn, is one of the world’s leading system suppliers of enclosures, power distribution, climate control, IT infrastructure and software and services. Customers from all industry sectors – e.g., mechanical and plant engineering and the IT and telecommunications market – make use of system solutions from Rittal.

www.rittal.com
The new LED multi-purpose luminaire 4000 is the latest addition to WISKA’s maritime LED lighting range. Designed for use in weather-exposed areas as well as interior spaces, this innovative lighting system is characterised by reliability, durability and high efficiency, the company says. It is manufactured in Germany and certified by DNV GL.

The LED multi-purpose luminaire 4000 has a minimum of system components and, according to WISKA, is maintenance-free. The elimination of extra housing not only reduces procurement and storage of spare parts, but also simplifies installation.

The time-consuming process of opening and closing the housing to replace the lamp is completely eliminated. The LED tube can be clicked easily into place without any additional tools. The system can be attached to the wall, ceiling or braces using mounting rails or clamps, which can be flexibly adjusted and adapted to existing footprints.

Optimised lighting solution for wide range of maritime applications

WISKA

Jaouad Bahaoui – Business Unit Manager – Technical Sales Thermamax

Space onboard ships is limited – even when it comes to safety issues.

Jaouad Bahaoui – Business Unit Manager – Technical Sales Thermamax

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and therefore meet all mounting requirements. This allows users to easily upgrade their conventional lighting system to this technology.

The light source consists of an efficient LED unit in an environment-resistant plastic tube, the LED technology benefiting the user with permanent energy and cost-saving operation. It is suitable for weather-exposed areas as well as for technical lighting of interior areas, e.g., engine rooms, workshops and warehouses, work platforms, car decks or cargo holds and passageways. The power connection is provided via quick connectors, connecting leads or junction boxes. The luminaire is seawater-resistant and halogen-free, as well as resistant to vibrations, UV radiation and corrosion, WISKA says. Through the use of breathable VentGLAND cable glands or VentPLUG pressure compensation units, it also provides protection against condensation water, even under large temperature variations. The risk of short circuits and corrosion is reduced to a minimum, ensuring consistent operational safety.

Based on a modular design, the LED multi-purpose luminaire 4000 can be easily combined with other units depending on the desired application and lighting requirements. The flexible interconnection of two or multiple tubes along with a variety of other options, including an emergency backup or 110-V version, enable individual solutions and applications, achieving an optimal level of illumination in all areas.

ABOUT WISKA

WISKA Hoppmann & Mulsow GmbH, located in Kaltenkirchen is one of the world’s leading single-source suppliers of maritime lighting solutions, electrical equipment, reefer container sockets and CCTV camera surveillance. Since 1919, WISKA has been developing and manufacturing highly efficient and reliable products made in Germany for use in demanding maritime environments. www.wiska.com

SPECIFICATIONS

Protection class | IP 66 / 67 / 68 (subject to specification)
Temperature range | -30°C to +55°C
Material | Polycarbonate / Polyamide
Power | 1x13 W, 2x13 W, 4x13 W, 1x26 W, 2x26 W
Operation area | Engine room, cargo hold, weather-exposed areas, workshops, stores
Variations | 100 - 230 V, battery backup, light colour, power connection method
Light distribution / beam | 120° (single), up to 240° (double and multiple)
Light colour | 5,600 K, others on request
Lumen | 1,000 lm (13 W) / 2,000 lm (26 W)
Lifetime (L70) | > 35,000h at 45°C ambient temperature
Colour rendering index | > 80
Safe lighting solutions in hazardous environments

R. STAHL | Good visibility is crucial for safety at the workplace. This is particularly true in hazardous areas. R. Stahl offers a versatile range of conventional and explosion-protected lighting solutions for different areas on board a ship. The product portfolio includes individual luminaires, floodlights, compact luminaires, full-scale emergency light solutions complete with a central battery system, and a versatile range of LED luminaires.

LED-based models such as R. Stahl’s EXLUX 6002 and 6402 lines, for example, now serve as very energy-efficient general lighting solutions in Ex zones 1/21 and 2/22. One 52-W model of these new LED devices can replace two standard 36-W fluorescent lamps while ensuring a much longer life span of 100,000 operating hours, the manufacturer says. Given a high luminous flux of 5,800lm, it also achieves an excellent light yield that surpasses 100 lm/W. The case is the same as the tried-and-tested enclosure for conventional fluorescent lamps of the EXLUX 6001 line.

R. Stahl also offers compact LED-based tubular light fittings for use in Ex zones 1/21 and 2/22 that provide users with an innovative alternative to typical linear luminaires. With a diameter of merely 55mm, the new lights take up less than half the space required by conventional linear luminaires, and also weigh some 50% less, R. Stahl says. The tubular design makes the new 6036 series extraordinarily light-efficient. Thirty such LED-based fittings with a length of four feet (1,240mm), for instance, ensure an illuminance of approximately 500lx. That would usually require 35 linear luminaires with two 36-W fluorescent tubes each, or even 48 conventional box-type units retrofitted with LEDs. However, R. Stahl’s new lights consume only about half as much power, and the specific power consumption per 100lx amounts to a mere 1.5 W/m². Operating expenses are therefore greatly reduced – realistic cost savings range from some 20% to more than 50%, the company notes. They can also be fitted with a light sensor to ensure automatic switch-off as long as sufficient ambient light is available. In this case, operating costs can come down even further in some applications.

Of course, LEDs are not the only lighting option for hazardous areas. There are also novel developments for luminaires using conventional illuminants. For example, R. Stahl recently introduced a new generation of robust, hazardous-area light fittings with regular illuminants in the EXLUX 6001 line. These achieve a higher energy efficiency and provide approximately 10% more luminous flux than otherwise comparable products. Current EXLUX 6001 luminaires for use in Ex zones 1/2 and 2/22 also feature a design that is considerably more compact, stable, and torsion-resistant than the preceding generation. Depending on their performance class, new 6001 series luminaires are a quarter to a third lighter than their predecessor models and other products of this category. Other notable developments for R. Stahl are extra-tough signalling devices for use in Ex zones 1/2 and 2/22. FX15 series beacons are designed to withstand extreme environmental conditions, e.g., a wide ambient temperature range of -55°C to +70°C. A GRP enclosure combined with a stainless steel guard and fixings provide a corrosion-resistant product. The light source is a xenon tube providing a high light output. A polycarbonate Fresnel lens helps to direct and enhance the impression from the 5-joule xenon flash. FX15 series beacons with a clear lens produce an excellent luminous intensity of 49 effective candela.

R. Stahl has designed the robust FX15 series flashing beacons for rugged conditions in Ex zones 1/21 and 2/22

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R. Stahl has designed the robust FX15 series flashing beacons for rugged conditions in Ex zones 1/21 and 2/22

Safe lighting solutions in hazardous environments

R. STAHL | Good visibility is crucial for safety at the workplace. This is particularly true in hazardous areas. R. Stahl offers a versatile range of conventional and explosion-protected lighting solutions for different areas on board a ship. The product portfolio includes individual luminaires, floodlights, compact luminaires, full-scale emergency light solutions complete with a central battery system, and a versatile range of LED luminaires. LED-based models such as R. Stahl’s EXLUX 6002 and 6402 lines, for example, now serve as very energy-efficient general lighting solutions in Ex zones 1/21 and 2/22. One 52-W model of these new LED devices can replace two standard 36-W fluorescent lamps while ensuring a much longer life span of 100,000 operating hours, the manufacturer says. Given a high luminous flux of 5,800lm, it also achieves an excellent light yield that surpasses 100 lm/W. The case is the same as the tried-and-tested enclosure for conventional fluorescent lamps of the EXLUX 6001 line. R. Stahl also offers compact LED-based tubular light fittings for use in Ex zones 1/21 and 2/22 that provide users with an innovative alternative to typical linear luminaires. With a diameter of merely 55mm, the new lights take up less than half the space required by conventional linear luminaires, and also weigh some 50% less, R. Stahl says. The tubular design makes the new 6036 series extraordinarily light-efficient. Thirty such LED-based fittings with a length of four feet (1,240mm), for instance, ensure an illuminance of approximately 500lx. That would usually require 35 linear luminaires with two 36-W fluorescent tubes each, or even 48 conventional box-type units retrofitted with LEDs. However, R. Stahl’s new lights consume only about half as much power, and the specific power consumption per 100lx amounts to a mere 1.5 W/m². Operating expenses are therefore greatly reduced – realistic cost savings range from some 20% to more than 50%, the company notes. They can also be fitted with a light sensor to ensure automatic switch-off as long as sufficient ambient light is available. In this case, operating costs can come down even further in some applications.

Of course, LEDs are not the only lighting option for hazardous areas. There are also novel developments for luminaires using conventional illuminants. For example, R. Stahl recently introduced a new generation of robust, hazardous-area light fittings with regular illuminants in the EXLUX 6001 line. These achieve a higher energy efficiency and provide approximately 10% more luminous flux than otherwise comparable products. Current EXLUX 6001 luminaires for use in Ex zones 1/2 and 2/22 also feature a design that is considerably more compact, stable, and torsion-resistant than the preceding generation. Depending on their performance class, new 6001 series luminaires are a quarter to a third lighter than their predecessor models and other products of this category. Other notable developments for R. Stahl are extra-tough signalling devices for use in Ex zones 1/2 and 2/22. FX15 series beacons are designed to withstand extreme environmental conditions, e.g., a wide ambient temperature range of -55°C to +70°C. A GRP enclosure combined with a stainless steel guard and fixings provide a corrosion-resistant product. The light source is a xenon tube providing a high light output. A polycarbonate Fresnel lens helps to direct and enhance the impression from the 5-joule xenon flash. FX15 series beacons with a clear lens produce an excellent luminous intensity of 49 effective candela.
Highly resistant doors for marine structures

PODSZUCK | An extensive range of fire doors for the maritime sector is supplied by Kiel-based Podszuck GmbH. The doors can be used in interior and exterior areas on all types of vessels, including yachts, cruise ships and merchant ships, as well as on offshore platforms. The newly developed single-leaf A60 hinged door LMD-H1 with single/middle lock featuring an A60 window and hose port recently passed a fire test. The door has a clear opening width of 1,250mm (plus 15% = 1,438mm) and clear opening height of 2,200mm (plus 15% = 2,530mm). It withstood a fire test lasting 75 minutes although International Maritime Organization (IMO) regulations stipulate a test duration of only 60 minutes. According to Podszuck, the temperatures were far from the maximum allowed and all door tests (cotton-wool pad tests and gap gauges tests) were successful.

Furthermore, the A60 single-leaf hinged marine and offshore door LMD-H1 has been successfully tested as bulletproof, Podszuck said.

According to the company, in a recent emergency on board the ferry *Dieppe Seaways*, an A60 single-leaf hinged door from Podszuck successfully withstood a fire and prevented it from spreading. The fire had broken out in the engine room but could not breach the door.

Podszuck’s product range includes single- and double-leaf A60 hinged and sliding fire doors, single- and double-leaf A60 hinged lightweight fire doors, single-leaf A30 and B30 hinged fire doors. The portfolio is complemented by spray- and weathertight doors, spray- and weathertight wheelhouse sliding doors, galley sliding doors, lift doors, container doors, C-class fire doors and H120 fire doors. All door types are available with different sill and frame designs, including windows, magnets, door closers, different surfaces (galvanised and primed, stainless steel 304 and 316, laminated, foil-coated or painted) and a huge selection of locks, handles and plates.

ABOUT PODSZUCK

Podszuck GmbH, headquartered in Kiel, specialises in the design, engineering and manufacture of high-quality doors for all kinds of ships – including container vessels, ferries and yachts – as well as for offshore platforms. All fire doors are certified by ABS, BV, GL, LR, RINA, RRS, SBG, TC and USCG. www.podszuck.eu
Heat-resistant vibration mounts reduce structure-borne noise

SB BRONESKE | Rubber vibration mounts reduce structure-borne noise very effectively, while stainless steel wired mesh is heat-resistant but does not reduce structure-borne noise. A specialist in elastic support for exhaust pipe systems, SB Broneske has developed a sophisticated vibration mount technology that combines reduction of structure-borne noise and heat resistance.

The fix points of the vibration mounts, made of a highly effective heat-resistant elastomer, are specially designed for the exhaust pipe system of ships. They are shearproof, fireproof, heat resistant up to 300°C and very effective in reducing vibrations and structure-borne noise, SB Broneske says.

In a series of tests, the company investigated the temperature at the vibration mount. The exhaust pipe system of ships usually reaches a temperature between 290°C (two-stroke engines) and 550°C (four-stroke engines). Insulation material covers the exhaust pipes to protect operators and limit the heat transfer from pipe into engine room and funnel casing. Without insulation, the surface of the exhaust pipe would reach 300°C or more. With insulation, the surface of the insulation might reach 150°C, but elastomeric vibration mounts with natural rubber are only heat-resistant up to 80°C. Even the use of ceramic insulation washers does not completely solve the problem, because in difficult installation places the natural rubber vibration fix points will melt.

Vibration mounts for heavy loads
SB Broneske's anchorage points and fix points for heavy loads are very effective in reducing vibrations and structure-borne noise, the manufacturer says. In 2013 it extended its range of products, and it implemented an elastic support for a 100-tonne marine boiler on board two cruise ship newbuildings.

While keeping the pipe in position, SB Broneske's fix points effectively reduce vibrations and structure-borne noise. According to the company, all fix points are heat-resistant up to 300°C and withstand a maximum exhaust pipe temperature of 600°C.

Flexible fire- and watertight deck and bulkhead penetration
SB Broneske also offers fire- and watertight flexible deck and bulkhead penetrations for the exhaust pipe system of ships. The flexible pipe penetration does not transfer any vibration or structure-borne noise into the ship's structure, the company says.

The system is fireproof for 60 minutes (A-60) at 1,000°C, waterproof for 30 minutes (6m, 0.6 bar) and meets the requirements of the Maritime Labour Convention 2006. Its fields of application include all kinds of passenger vessels and offshore ships.

Additional sizes and materials are available on request. Certificates for deck and bulkhead (European MED A-60, US Coast Guard, DNV GL, Lloyd's Register type approval and others) are also available on request.

Rain caps with special elastomer cushions
An advanced and durable solution against rain and splash water is SB Broneske’s self-produced and ready-for-installation rain cap. It consists of inner and outer ring(s), and highly effective, heat-resistant rubber cushions placed between the two rings. Having a guiding function on the open sea, they absorb the vibrations permanently. Designed with an inner and an outer sleeve, the rain cap effectively keeps water away from the funnel case while allowing the circulation of oxygen.

Furthermore, special rubber cushions between the inner and outer rings limit the transfer of structure-borne noise to a minimum. Compared with traditional stainless steel cushions solutions, the silicone cushions reduce structure-borne noise more effectively, SB Broneske says.

ABOUT
SB BRONESKE
SB Broneske (Schwingungstechnik-Broneske GmbH), located in Quickborn, near Hamburg, is a global technological leader in elastic support for exhaust pipe systems. Its product range comprises vibration mounts, fire- and water-proofed flexible deck and bulkhead penetrations and rain caps.

www.broneske.de
The best in RUD chain technology!

The right lifting point for each challenge!

...up to 250t!
Redesign and relaunch of heavy-duty Profi hoists

J.D. NEUHAUS | Having completed the redesign of its Profi range of air-operated hoists, J.D. Neuhaus (JDN) has launched the innovative Profi 75 TI and Profi 100 TI, which have SWL capacities of 75 and 100 tonnes, respectively. Existing relaunched products in the Profi range cover lift capacities from 250kg to 60 tonnes, ideally suited to engineering environments, the company says.

The latest additions, featuring reduced energy requirements, weight and size, meet the high demands of heavy engineering. The key component of the hoists is a new air motor unit based on the well-proven J.D. Neuhaus motor-brake concept and incorporating a patented integrated brake system with a stepped brake piston and reliable self-lubricating rotor. In the standard configuration of a 6-bar air pressure supply, the motor has a power output of 9 kW, adequate for the operation of either hoist while still providing significant energy reductions.

At full nominal lift capacities (75 or 100 tonnes), 7.6m³ of compressed air is consumed per minute, which represents more than 30% in savings over the hoists being replaced. On lowering full loads, the air consumed is 6m³/min, an impressive 50% in savings, JDN says. The new hoists are designed to meet ISO 4301/FEM 9.5 II, which is good for 400 hours of full-load operation.

Although the overall air consumption has been reduced significantly, the lifting and lowering speeds with/without loads have been increased compared with the previous hoist models, which helps to reduce handling and increase production output over a full working day. The lifting speeds at full load have increased from 0.45 to 0.53m/min (Profi 75 TI) and from 0.35 to 0.4m/min (Profi 100 TI). Lifting speeds without a load have increased from 0.85 to 1.33m/min (Profi 75 TI) and from 0.7 to 1.0m/min (Profi 100 TI). The lowering speeds at full load have also improved, increasing from 1 to 1.25m/min (Profi 75 TI) and from 0.8 to 0.95m/min (Profi 100 TI). Computer simulations such as CFD were utilised throughout the development process, with all simulation results validated in various practical tests to achieve energy savings of up to 50%, depending on the operating conditions.

The combination of optimised material selection and modern design methods has also achieved significant weight reductions for the new hoists. This ensures that the relation between hoist unit weight and safe working loads is much better than was the case with the superseded hoist designs, JDN points out. Overall weight savings of 750kg have been achieved for the Profi 75 TI, and 640 kg for the Profi 100 TI. There have also been reductions in size, particularly between the load-bearing surfaces and suspension hooks, and significant reductions in sound levels during operation. The new hoists register 77 dB(A) at full-load lifting and 83 dB(A) during lowering.

Lifting and lowering motor limiters incorporating a pneumatic pin valve design are optional for both hoists.

ABOUT J.D. NEUHAUS

A privately owned company founded in 1745, J.D. Neuhaus GmbH & Co KG is based in Witten. For over 265 years, it has been using its expertise and experience to manufacture the highest quality hoists, winches and cranes. Its products offer solutions for almost every material-handling problem irrespective of the driving medium: from air, manual and hydraulic hoists to complete explosion-proof crane installations.

www.jdngroup.com

VEINLAND GmbH; Phone: +49 (33205) 26 97-0; e-mail: info@veinland.net; www.veinland.net
Secure lifting solutions for the maritime industry

RUD KETTEN | Lifting and lashing specialist RUD Ketten recently launched a range of new products.
One is the ICE LBG SR, a VLBG-type threaded lashing point with asymmetrical force application featuring a patented dual ball bearing. The SR in its name stands for “super rotation”, i.e., the unique feature that allows loads to be rotated even at maximum capacity. This comes into its own when loads need to be turned, tipped or rotated. According to RUD, the new development minimises wear caused by steel-on-steel friction and ensures the safe handling of very high loads thanks to the use of a very special type of screw.
Another product recently introduced by RUD is the ICE bolt. ICE is the new generation of RUD Grade-120 chains. The company uses patented fine-grain steel to create products that can safely cope with loads up to 30% higher than Grade-100 chains and up to 60% higher than Grade-80 chains. This material possesses exceptional physical properties, such as notched impact strength of 56 joules at -60°C, RUD says.
This enabled RUD to substantially increase safety and load-bearing without the risk of hydrogen embrittlement that plagues hard-grade steels.
This ICE steel was also used for RUD’s third new product, the ICE mini chain. It is the smallest lashing chain with the highest lifting capacity: a single strand 4mm thick can lift loads of up to 800 kg, and two strands can lift up to 1,120 kg. This means that everyday loads of approximately 1 tonne can be lifted safely, quickly and easily.
RUD’s catalogue of weldable components has also been extended and now includes the 50-tonne and 100-tonne versions of VRBS-FIX. These new developments feature a drop-forged ring tab tempered for high strength, with swinging captive connection in two welding blocks. The VRBS-FIX is capable of sustaining loads in every direction with fourfold anti-break protection. The patented solution is superior to older versions in that it lacks exposed surfaces making it necessary to have a continuous, smaller weld seam, and it also prevents rust penetration, RUD says. The FIX version firmly holds the ring in every position, and so eliminates noise. Another advantage is that the welding blocks are positioned precisely at the right distance from the welding block and cannot be welded into an incorrect position.

ABOUT RUD

Headquartered in Aalen, RUD Ketten, Rieger & Dietz GmbH und Co KG offers future-oriented lifting and lashing solutions with chain systems and components for a wide range of applications.

www.rud.com
As oil and gas companies move farther north into the fragile environment of the Nordic Sea, the requirements for efficient oil skimmers used in harsh weather conditions including low temperatures are increasing. In case of an oil spill, fast launching and reliable handling of the skimmers are critical. MIFO, a Norwegian technology supplier for the ship industry based in Molde, has developed a complete control package for handling hatches on utility vessels for oil skimmers. The new system was installed at the customer site of Aukra Maritime, a Norwegian supplier of maritime handling equipment. The oil skimmers are launched through a large, hydraulically controlled gate on the side of a vessel. During collection of the oil, a large amount of hydrocarbon gases builds up, creating an explosive atmosphere. After the work is done, the skimmers are pulled back into the ship.

A Wago 750-881 controller is used to manage the hydraulic system as well as monitor the environment in this highly explosive atmosphere. Wago’s interface has been enhanced for use in explosive atmospheres by integrating intrinsic safety in the IO cards, thus enabling direct wiring from the PLC (programmable logic controller), placed in a relatively safe area (Zone 2), directly out into a potentially highly explosive atmosphere (Zones 0 and 1) without the traditional extra Zener barriers cabinet.

Space is always a limiting factor, even on large vessels. In order to get a compact module, MIFO has also utilised the
16-channel IO cards from Wago, enabling 16 DI/O channels per 12mm.

The hydraulic card used by MIFO can either control two hydraulic valves with a single coil, allowing unipolar or bipolar operation, or, in a mode with one valve, two coils with unipolar operation. In an explosive environment such as described here, the maximum power output is 1.6 A, while in a non-explosion-risk area a full 2.0 A is possible, allowing most hydraulic valves on the market to be directly interfaced to the control system. The card has all the required technology function, enabling smooth and fast movement of doors weighing several tonnes, including adjustable dither, ramp functions, gain compensation, etc. According to the manufacturer, the control accuracy exceeds 0.4%. Both three- and four-wire valves may be controlled. The MIFO application has six valve control cards in the same rack.

To prevent ignition of explosive gases on board ships, different types of protection are used, such as flameproof enclosures and encapsulations. Alternatively, Zener barriers are used to separate hazardous from safe areas. As the Zener barriers earth the excess energy, there is a strict regime associated with earth-fault detection and a single earth fault may require a shutdown of the systems. The use of barriers based on galvanic isolation in connection with a power limitation (current and voltage) has made this much easier. Wago’s IO cards also feature a compact design. The control engineer works with the signals in the same way as any other signal, and the extra cabinet for barriers is omitted. The Ex i modules are directly connected to the field cable going out to the explosive area. Furthermore, the Ex i signals and Zone 2 signals are on the same rail; separation is done with the Ex i power module, ensuring both the power limitation as well as the required creeping distance of 50mm between intrinsically safe and non-intrinsically safe modules. The controller with its interface cards is approved for Zone 2 installation, according to ATEX and IECEx.

WAGO’s 750 Series I/O-System includes both standard and Ex modules. The proportional valve module controls valves up to Zone 2.
Fast development of controllers via model-based design

BACHMANN With its software solution M-Target for Simulink®, Bachmann electronic offers a reliable, user-friendly, model-driven design tool that integrates Bachmann’s M1 controller hardware as the target system. The solution enables faster implementation of controllers through shorter controller design phases, shorter commissioning processes through reliable automatic code generation, and a higher level of agreement between machine model and controller model.

Simulation: solution development on the computer model and direct download to the M1 controller Source: Bachmann electronic GmbH

The challenges placed on automation in offshore applications and on ships are constantly increasing. The growing size of plants and the introduction of new technologies have also increased the complexity of operational control programs. New development techniques for creating these programs are needed in order to minimise the development effort required on the one hand, and to bring out technically mature and highly available plants on the other.

If simple analytical advanced calculations can no longer describe or predict the response of a system, practical experimentation is the only solution. Models and prototypes are used to obtain findings and develop a solution. If the production of these pilot systems is too expensive, offers only restricted use, or if practical tests are simply too dangerous, digital simulation may offer an alternative. The actual systems are emulated in a program in the form of a simulation model. Irrespective of the type of modeling, mathematical interrelationships are used to describe the behaviour of the system. If these simulation models are recalculated with different environmental conditions and parameters, this is the equivalent of a prototype test in virtual form. Bachmann’s software solution M-Target for Simulink® enables the simple use of model-based simulation, taking the actual automation solution into account.

Quality and efficiency
The use of high-quality algorithms increases product quality and plant yields. The increasing efficiency of plants can be achieved through the use of new closed-loop control and opti-
misation concepts. Solutions developed with the help of M-Target for Simulink® or 20-sim 4C can fully demonstrate their strengths in these disciplines. The MATLAB®/Simulink® tool from MathWorks is well established in the market. 20-sim is the modelling and simulation software developed by Controllab. It offers tools for modelling dynamic systems. Both products provide support for creating a simulation model of the subcomponent to be automated.

Standard modelling methods can be used on the one hand. Alternatively, it is also possible to use the interfaces to several commonly available domain-specific simulation programs in order to utilise part simulations that have already been created. The algorithms required for automation are then created directly in the simulation environment and their functional suitability is checked.

**Automatic code generation**
As soon as the simulation has produced satisfactory results, i.e., when no weaknesses in the requirements specifications and no algorithm errors can be identified, the compilation from the simulation language into executable code for the M1 controller is executed automatically. This is machine-compiled by the system, thus eliminating the possibility of any random errors. After code generation, the executable automation program can then be tested immediately on a hardware-in-the-loop test rig equipped with actual controller components or on the actual plant.

The highlights of Bachmann’s model-based design solution include:
- development of automation algorithms (open-loop and closed-loop) directly in Controllab/20-sim or MATLAB®/Simulink®,
- automatic code generation and transfer to the M1 controller,
- online communication between the development environment and the PLC program for convenient parameterisation and diagnostics,
- integrated simulation modes for the I/O modules used in the application,
- integrated interfaces to visualisation systems and other PLC systems,
- integrated interfaces to automation programs created in conventional programming languages (IEC61131-3, C/C++),
- support for hardware-in-the-loop systems (HIL).

The licence model of M-Target for Simulink® does not involve any unit-based purchase of licences and thus has no negative effect on product profitability. 20-sim can be purchased directly from the manufacturer and has the M1 already integrated as target.

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**ABOUT BACHMANN ELECTRONIC**

Founded in 1970 and based in Feldkirch, Austria, Bachmann electronic GmbH is an internationally active high-tech company that develops, produces and sells complete system solutions in the field of automation technology. Its innovative controller systems and visual solutions are used globally in a wide variety of industrial engineering applications such as offshore and maritime automation, wind energy applications and environmental technologies.

www.bachmann.info
Enhanced performance by fully controlled “smart” hybrid grid

Imtech Marine | The introduction of storage and renewable energy and storage sources on ships calls for a new design philosophy in regard to electrical power networks on board. Increasing demands for higher safety, higher reliability and less manning add to this need. Imtech Marine has carried out several hybrid projects with AC, DC-bus and full DC electrical power networks. In the company’s experience, traditional AC and DC grids have reached their limits with respect to safety, reliability and controllability, prompting the need to start research into a new electrical network design philosophy.

In collaboration with the Dutch company Direct Current BV and a classification society, Imtech Marine is developing a new DC grid that features unique aspects in design and operation. Newly developed DC power routers route energy in a way that is comparable to the flow of data in a data network. Moreover, these routers strongly limit the energy released in case of a short circuit. If there is a fault, the faulty part is automatically isolated and the healthy parts of the system are automatically restored in a matter of milliseconds.

The introduction of communication between the power routers creates a fully controlled, “smart” power system, Imtech says. Communication enables plug-and-play connection of components like (renewable) power, storage sources and consumers at any location, as well as automatic optimisation of energy consumption, energy generation and energy storage, depending on the actual optimisation goal. For example, the goal in manoeuvring mode (propulsion availability) can differ from that in transit mode (low fuel consumption). This automatic optimisation is vital in order to fully capitalise on the benefits of renewable energy sources. In addition, Imtech says, the new DC grid has advantages with respect to system sizes and weights.

Together with industry partners, Imtech Marine is developing a new energy management optimisation algorithm as part of the European Union Framework Programme 7 project INOMANSHIP. The energy management system is based on the particle swarm optimisation algorithm. It is a tertiary control loop that continuously optimises the balance between power sources and consumption given the operational goal. Another benefit of this algorithm is that it can be used to find an optimal power plant configuration during the design phase of a ship.

A simulation platform is being developed in which the algorithm will find – on the basis of operational profile, goal and requirements – the optimal power plant configuration, e.g., battery size, number of gensets, PTO/PTI, etc. In a demonstrator set up at Imtech Marine’s energy test lab at the RDM Campus, located on the grounds of the former RDM shipyard, now a historic Rotterdam landmark, Imtech Marine will test and demonstrate this new DC grid and optimisation algorithm.

About Imtech Marine

Rotterdam-based Imtech Marine is a leading company in the global maritime market, operating as a full-service provider and system integrator of tailor-made, innovative and sustainable technology solutions for the entire ship. Imtech Marine specialises in automation (platform and bridge), navigation and communication including connectivity, energy and drive solutions, HVAC solutions, fire-protection technology, entertainment, lighting and maritime services. www.imtechmarine.com
The I/O system excom by automation specialist Turck has proved its benefits in many highly available plants in process industries. Since 2014, excom has been certified for marine applications by major classification societies. With its high availability and compact dimensions, it is suitable for installation on oil and LPG tankers and other special-purpose vessels working at hazardous locations.

To connect several field devices on ships to the control systems, a system planner has several alternatives: interface solutions, remote I/O solutions and exclusively fieldbus solutions. The classical method of signal transmission is point-to-point wiring, i.e., interface technology. This transfers the individual measuring signal from a measuring instrument in the field directly to the PLC.

But on ships and oil platforms in particular, cabinet space is very limited, leading planners on ships to consider point-to-bus wiring – also called remote I/O or system I/O. The signals from the field instrumentation are collected at an I/O station, converted to a digital protocol and forwarded to the control system via a bus cable. In this way, the DCS requires just a single communication interface instead of several analogue or digital input and output cards.

Turck has extended the range of its remote I/O system excom of late with ship approvals from the certification societies DNV GL, Bureau Veritas and Lloyd’s Register. This includes, for example, the mounting in control consoles, housings or cabinets on board seagoing vessels, tankers or oil platforms. Mindful of tougher requirements in the shipbuilding sector especially, Turck has designed its own mechanically reinforced module rack to ensure safe use on board.

On ships as well as in plants, excom can be installed in both Zone 2 and Zone 1. All modules with intrinsically safe circuits through to Zone 0 can be used in the “marine-ship-approved” module rack and are approved for use in the maritime environment. This benefits the user not only in terms of components optimised for a particular zone, but also because of the standard concept for configuring and parametrising the periphery and field instrumentation. If this system is installed in zones 1 and 2, a specially optimised power supply unit is available that generates the intrinsically safe system voltage. The interface to the fieldbus, in this case Profibus-DP, is also intrinsically safe.

The excom system meets all relevant EMC requirements without implementation of any additional measures such as metal housings or EMC cable glands. So installation in a control room is possible without added EMC protection. This allows substituting conventional wiring via interface technology from the field device to the DCS. If the specific application requires the use of housings, they only have to comply with explosion protection requirements. The high density of the system reduces required cabinet space, and excom can be mounted directly in the hazardous areas.

Downtime of the DCS is no option, especially on vessels or oil platforms. Excom perfectly meets this requirement with hot swapping and full redundancy. The system can be serviced and changed at any time. The I/O modules – including the power supply modules – can be plugged and unplugged during ongoing operation, even in Zone 1, without disturbing the field communication.

The system allows a fully redundant setup for the power supply and the communication interface. As a standard feature, excom also provides a system redundancy solution for the bus structure. This allows the redundant excom system to be connected via redundant bus technology to a process control system with a Profibus master. Thanks to the open standard and Turck’s implementation of different redundancy concepts, the communication redundancy can be operated with any available DCS on the market.

The excom system comes with an easy integration into DCS systems and its scan functionality allows parameterising HART field devices before the DCS system is installed. The functions and handling are the same for all types of installation. There is a standard structure and operating philosophy, both for configuration using GSD files or DTMs, and for asset management. In all cases, the system can be maintained and modified during operation. This applies both to adding individual measuring points as well as extending a system with additional modules.
Control technology at sea: plug and play for simple winches and cranes

**BOSCH Rexroth |** Using validated software and pre-configured safety and control functions, Bosch Rexroth has developed a reliable system to simplify the engineering and commissioning of hydraulic winches and cranes. The latest product of this standardised approach to be presented by the drive and control specialist is a compact, tested control solution for single-axis systems with heave compensation.

Depending on the size and equipment necessary, commissioning winches and cranes on ships can be very cost-intensive. To reduce these costs and the engineering involved up front, Bosch Rexroth has developed a modular, easy-to-adapt system with a comprehensive software standard. This allows engineers to generate preconfigured and tested control solutions quickly and flexibly for both simple and complex systems that can be installed and set up quickly on board.

**Validated software with predefined function blocks**
Bosch Rexroth's software standard is not hardware-specific, is validated and has been tested at sea. It is written entirely in standard languages in accordance with IEC standard 61131-3. The software features a modular structure with standardised components for control functions as well as for integrated safety functions. This means it is now possible to develop control systems on a very flexible basis, with design engineers able to freely choose the degree of networking that matches their individual application.

To comply with the required safety level, Bosch Rexroth provides a wide range of ready-made function blocks. In addition to active heave compensation (AHC), these include constant tension, active rope tensioning and MOPS (manual overload protection system).

**Complete solution for single-axis applications**
To reduce the amount of time needed for engineering and commissioning even further, Bosch Rexroth has now developed a compact, complete solution based on this standardised modular system to control simple winches and cranes with one axis and up to four hydraulic drives. The IP67-protected control cabinet measures only 316 x 345 x 270mm, which makes possible space-saving installation on deck. The integrated control unit is designed to meet the requirements in each particular case, Bosch Rexroth says.

**Robust control hardware**
Rexroth uses one BODAS RC28-14/30 for a hydraulic power unit and single winch drive. The control unit was originally designed for mobile applications under harsh environmental conditions and can withstand large temperature changes, vibrations and jolts. Apart from this, Rexroth's modular system offers the greatest possible freedom for efficient development, implementation and commissioning of more complex drives with several motors or more than four hydraulic pumps per axis.

One of the major benefits of the new solution is that it is particularly easy to connect to the customer-specific system due to its predefined interfaces. Thanks to the modular system and simple plug and play, the amount of time and effort needed, and the error rate at commissioning, are reduced, according to Bosch Rexroth. On-site engineers only have to set the parameters for the axis as the final step and determine the response of the controller in case of error messages. Modifications, enhancements, and the interface to the customer's system can be tested and adjusted by the design engineer up front, directly on a test stand provided by Bosch Rexroth. This way, time-consuming and expensive procedures on board the ship are not necessary. The standardised approach also means that any servicing that may be required later takes much less time compared with hardware-specific programming, since there is no need either to change specific program code or repair or replace proprietary components.

According to Bosch Rexroth, the new compact control solution impresses with its proven technology, components that have been tested in practical applications and a validated software standard. Thanks to the higher-level modular system of compatible hardware components, it is now possible to develop and implement offshore cranes and winches having heave compensation with no need for time-consuming commissioning. The process is much faster, more cost-effective and still on a customised basis, the company says. Since the system comes complete with control cabinet, preconfigured interfaces, and tested software, commissioning is reduced to an absolute minimum. For end customers, the bottom line is: minimum overall costs, full compliance with safety requirements and the best possible investment protection.

**ABOUT BOSCH REXROTH**
Bosch Rexroth is one of the leading specialists worldwide in drive and control technology. The company offers a comprehensive portfolio to the marine and offshore industry, ranging from standard products to engineered-to-order solutions. [www.boschrexroth.com](http://www.boschrexroth.com)
The efficient use of energy and resources is increasingly important in the maritime industry. Shipowners and operators face the challenge of making their shipping operations both ecologically and economically sustainable. High fuel costs, strict environmental regulations – ECA and SECA – and the Energy Efficiency Operational Indicator (EEOI) of the International Maritime Organization (IMO) place additional demands on ship operators. Furthermore, reduced crewing levels result in increasingly complex automation systems.

With its EcoMain system platform, Siemens aims at helping shipowners and operators optimise their onboard processes. EcoMAIN assists with ship management decisions by providing operating data from all relevant onboard systems and equipment on a common data platform that can also be accessed from on shore. This allows shipowners to compare important operating parameters across an entire fleet, and to identify and implement best practices that will significantly reduce costs. The primary optimisation potential of EcoMAIN lies in the areas of energy efficiency, environmental compatibility by reducing emissions, optimisation of all onboard systems and remote maintenance support as well as onshore analysis of fleet data, Siemens says.

EcoMAIN collects and processes data from up to 60,000 data points. Various data – such as temperature, speed, pressure and navigation data – are continually read via connected onboard systems like Power Management, Drive Control and Automation and consolidated in a common database. Each application can read out and take into account all data via a standard application interface (API). This enables the evaluation and optimisation of energy consumption, emissions, bunkering of liquids, maintenance schedules, document and information management, etc.

The EcoMAIN onboard system can be connected to the EcoMAIN onshore fleet system via a secure satellite connection. This allows single or multiple data records to be selected and graphically displayed for troubleshooting – also in tabular form for further analysis on shore. The system diagnostics can even be accessed while sailing. Service technicians on board and on shore can use this module for system diagnostics so that they can immediately respond to any incident.

EcoMAIN homescreen

Many external factors, some of which cannot be controlled, impact regular operations on board a ship. For example, different load profiles, varying vessel trim depending on the load, and unforeseen currents and weather conditions have a major effect on energy consumption. Nevertheless, the EcoMAIN decision support system can aid energy management in the same way as in an industrial environment. Firstly, all relevant energy consumers in the system are identified, and their interactions and mutual dependencies are made transparent. The degree of wear and servicing needs of the operational equipment can then be assessed. Key performance indicators (KPI) are developed to facilitate comparison of all the collected data. Shipbuilders and owners can use the Ship Energy Efficiency Management Plan (SEEMP) to verify higher energy efficiency in compliance with IMO regulations. For example, EcoMAIN evaluates the total specific fuel oil consumption in kg/nm, calculates the specific energy consumption in kWh/nm and distributes this information to the various consumers, such as the propulsion system and the freshwater generator.

Emission applications can display the specific emissions of pollutants, such as sulphur, nitrogen and carbon dioxides in kg/nm. Maintenance applications calculate the number of repairs and the repair costs per annum. The intelligent evaluation of such applications determines the optimum time for maintenance on the basis of current and historical operational data.
The new NautoScan NX (NSX) radar transceivers have undergone thorough sea trials

New generation of network radar transceivers

RAYTHEON ANSCHÜTZ  Navigation system manufacturer Raytheon Anschütz officially launched the latest generation of its Synapsis radar recently. The new radar is distinguished mainly by two innovations to the NautoScan NX radar transceivers: Network technology replaces analogue data transmission, and a pedestal that has been newly constructed electrically and mechanically reduces the cost of ownership and simplifies service.

Using digital technology for data communication between transceiver and radar workstation characterises a new generation of radar transceivers available on the market. Standard Ethernet technology replaces analogue data transmission through expensive and complex special cables. Radar status and radar video are generated in the transceiver, shared through a digital interface and distributed through Gigabit LAN to an unlimited number of PCs without any analogue losses.

The advantages provided by network radars are obvious. First of all, using standard LAN lowers the cost of cabling and installation. What is more, via digital technology the new-generation radar transceivers bring the benefits of the diverse possibilities and flexibility of modern network infrastructure. For example, an unlimited number of workstations and applications can be linked to the LAN to receive the radar video – without the need for separate and costly interswitch boxes.

This benefit becomes even more significant when the radar transceivers generate and distribute the real raw radar video, in which case the individual end-user applications on the bridge are enabled to process an unfiltered, high-fidelity radar video. Not only does this lead to an optimised radar video display, but applications on the bridge are given great flexibility in their individual processing of the radar signals. Consequently, the range of applications and requirements is wide – from a single radar on a small vessel to large bridge systems, from a simple “point-to-point” connection setup to a dual-redundant radar distribution network, from a navigation radar to an ice radar.

From the very beginning, Raytheon Anschütz’s new NautoScan NX radar transceivers were developed to generate and process a digital raw radar video. A star-based network approach offers the highest scalability and flexibility for a wide range of applications and requirements without the need for special cabling or auxiliary conversion hardware.

As part of the complete system redesign, critical parts such as the drive unit have been optimised to provide maintenance-free operation and extended service life. Features such as automatic performance monitoring and a magnetron sleep mode for longer maintenance intervals are now integrated in the system.

Finally, installation and maintenance access have been improved through a new pedestal design. According to Raytheon Anschütz, simplified assembly and configuration, as well as use of standard Ethernet, will make installation easier; built-in test features are
available for advanced service diagnostics and optimised service performance. All electronic and RF components are mounted on an innovative, removable tray to simplify and speed up service.

Besides integration of the new radar transceivers, the new-generation Synapsis radar consists of the new Synapsis NX bridge workstation with a display selectable from a range of different sizes, the radar software module and flat-profile antennas with sizes of 6 ft, 8 ft or 12 ft.

The Synapsis NX workstations integrate navigational data, tasks and services as needed to enable users to control any data with a single action only. The Synapsis radar can be activated as a software module as part of a workstation. The full Synapsis software generation has undergone a further upgrade to include features including system-wide unique target identifiers, further enhanced central alert management and advanced user setting management.

All workstations are based on the ultra-compact Small Marine Computer with fan-less design and solid-state disk. A newly introduced external data collector connects all sensors to the Ethernet network, while the degradation management and data distribution within the network are integrated in the Synapsis software. This setup significantly improves sensor input to the system and helps to decrease the cost of cabling and termination. Furthermore, project engineering becomes much easier; flexibility for individual system layouts is always present.

Synapsis is the world’s first integrated navigation system in compliance with IMO’s performance standard MSC.252(83) and IEC 61924-2. Two years since the product launch, more than 100 Synapsis systems have been ordered, more than half of which are already in operation.

ABOUT RAYTHEON ANSCHÜTZ

Raytheon Anschütz GmbH, headquartered in Kiel, is a leading manufacturer and integrator of bridge and navigation systems. More than 35,000 vessels worldwide are equipped with Raytheon Anschütz navigation systems, backed with a global sales and service network including subsidiaries in Shanghai, Singapore, Rio de Janeiro, Panama and San Diego. www.raytheon-anschuetz.com
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| PROSTEP AG | Darmstadt | www.prostep.de |
| Pumpenfabrik Wangen GmbH | Wangen | www.wangen.com |

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- [VDMA Ship & Offshore Directory](www.vdma.de)
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