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Boiler SOx SCRUBBER

Official Sea Trial Completed for SOx Scrubber-Ready MAC Auxiliary Boiler

The operation tests of MHI-MME's first SOx scrubber-ready auxiliary boiler, whose auxiliary boiler's exhaust gas is cleaned through an SOx scrubber, were completed during the official sea trial of Hyundai Samho Heavy Industries' H.S943VLCC in December 2018, followed by the official sea trial of Daewoo Shipbuilding & Marine Engineering's H.5444VLCC in January 2019. These tests were carried out in preparation for the IMO's new Sulphur limit to be implemented in 2020 (Sulphur 2020).

These two ships are equipped with SOx scrubbers. Booster fans are installed in the auxiliary boiler's exhaust gas wake flow, thereby stabilizing the auxiliary boiler's backpressure. The official sea trials confirmed the stable operation of the auxiliary boiler without any impact of changes in the backpressure caused by the scrubber and generator engine when the scrubber is used concurrently by the auxiliary boiler and generator engine.

MHI-MME's MAC Series auxiliary boilers can be used together with scrubbers, which are one of the countermeasures for the upcoming SOx regulations.



MAC Series auxiliary boiler being loaded on a ship

Boiler LICENSEE

New System for Licensed Production of Marine Auxiliary Boilers in China

Jiujiang Haitian Equipment Manufacture Co., Ltd. (hereinafter "JHT"), a licensee of our marine auxiliary boilers, has seen a steady increase in its orders since being granted a license in 2011, and recorded its highest ever figure of 112 annual orders in 2018, chiefly from the shipyards of its parent company CSSC.

In order to improve its operational efficiency for further business growth, JHT has established a new company specializing in boiler manufacturing called CSSC Jiujiang Boiler Co., Ltd. (hereinafter "CJBC") and has already started operation of a new plant for expanded production capacity, and our future licensed boilers will be provided via CJBC.

This new system was announced in a ceremony held on February 28, which was attended by a large number of Chinese customers including ship owners, shipyards, and ship classifiers, and the event was extremely successful, and we received greetings from the representatives of various companies.

We plan to further strengthen our links with the new CJBC company and strive to provide proposals that meet the needs of Chinese customers, including the development of medium capacity (15 to 25 T/H) cylindrical boilers for tankers, as well as new models and market expansion for the DF boiler series to meet current market needs.



Panoramic view of new factory



License contract transfer ceremony



Presenting with a memento

Fin stabilizer NEWS

Steady Orders Being Received for Retractable Fin Stabilizers

Incoming orders for MHI-MME's retractable fin stabilizers have been increasing in recent years. In FY2018, we delivered a record 14 fin stabilizers to shipyards, and we expect to see even more orders coming in from FY2019. The official sea trial of SNO.1085 (Ship owner: Kyushu Yusen; Ship name: Diamond Iki), which was mentioned in the 13th issue of MEET NEWS, was completed. The ferry, which is expected to begin operation shortly, is equipped with the fin stabilizer produced through the 200th incoming order that was delivered to Yamanaka Shipbuilding. Going forward, a string of other ships equipped with MHI-MME fin stabilizers will be introduced on various routes.

The increase in the number of incoming orders is attributable to the greater need for anti-rolling as compared to 30 years ago when MHI-MME first began the sale and delivery of fin stabilizers.

In addition to replacement demand for domestic coastal ferries and roll-on/roll-off (RORO) ships, new demand is also appearing. Furthermore, with an increase in the building of European-owned roll-on/roll-off passenger (ROPAX) ships in China and South Korea, we are also seeing growth in the export of fin stabilizers.

Going forward, we will continue to enhance our technological capabilities, including the development of new control systems for stabilizers. We will also enhance our after-sales service network and work diligently to further increase customer satisfaction by responding to customer after-delivery needs.



Diamond Iki (equipped with an MHI-MME fin stabilizer)

Service SINGAPORE

On-shore Site for Steering Gear Maintenance Begins Operation in Singapore

Hydraulic pumps are the heart of steering gear. The aging of their sliding parts cannot be avoided, making regularly scheduled maintenance indispensable.

Many customers are opting to utilize the pump rotation program offered by MHI-MME as a way to carry out maintenance of hydraulic pumps. However, because pump maintenance shops were located only in Japan, the cost of transport was an issue when sending pumps from overseas.

Based on customer needs, MHI-MME has opened a pump maintenance shop in Singapore, which is an important hub for maritime traffic. Dropping off a pump when calling at the Port of Singapore will greatly reduce shipping costs. Furthermore, customers can avoid the bother of arranging for shipment by providing us with information on their Singapore-based agent and utilizing MHI-MME's shipboard pump pickup/delivery service. We will continue to offer proposals that match customer needs.



Operating stand at the Singapore maintenance shop

MET DELIVERY

Turbochargers Delivered for the First X-DF Engine (12X92DF)

In December 2018, we delivered three MET83MB units for the first WinGD12X92DF, which is the largest dual fuel engine in the world. These MET turbochargers are scheduled to be installed in the 12X92DF engines designed by Win GD, manufactured by CSSC-MES Diesel Co., Ltd. (CMD), and installed in nine mega-container series ships.

The IMO has strengthened regulations regarding the emission of nitrogen oxides (NOx) and sulfur oxides (SOx) from vessels in order to prevent atmospheric pollution that negatively impacts human health and the environment.

The X-DF Low-pressure, dual fuel engine is one of the famous leading choice for on environmentally-sustainable low-speed main engine in vessels today.

MET turbochargers were first adopted in the WinGD X-DF engine in 2017, then adopted in X52DF, X62DF, X72DF, and X92DF engines, and up until now we have received total orders of 53 MET turbocharger units for 35 WinGD X-DF engines.

We will continue to actively provide turbochargers for dual fuel engines in the future.

MET NEW MODELS

New Turbocharger MET-MBII Series · MET-ER Series

The new MET-MBII Series launched this year provides turbochargers that are one or two models more compact when compared to previous models with the same engine output, thanks to its larger impeller capacity.

In order to maintain high efficiency while achieving a large capacity, a new compressor impeller with an optimized blade count and blade angle distribution has been developed for the MET-MBII Series. Furthermore, the series also adopts a new turbine with optimized turbine blade throat distribution.

On the other hand, casing components except for the silencer have not been changed from the previous MET-MB Series, which enables the product to inherit the high reliability and maintainability of that series.

The MET-ER Series has been developed based on high pressure ratio requirements for turbochargers, in order to improve the performance of and reduce the NOx emissions of four stroke engines. This turbocharger further increases the pressure ratio of the previous MET-SRC Series and can support a maximum compressor pressure ratio of 6.0.

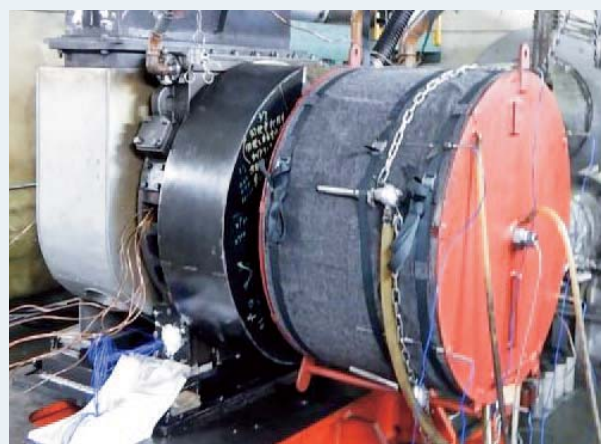
The series features seven types, and a single turbocharger can handle engine outputs from approximately 500 kW to 5,800 kW.

Furthermore, the series features improved responsiveness and reduces the number of parts to achieve a more compact design and increase maintainability. MET-ER turbochargers will be released to the market after conducting tests with engine manufacturers this year.

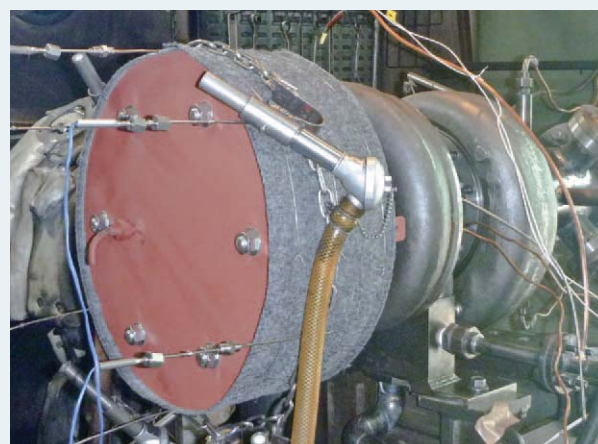


New compressor impeller

The new MET-ER Series radial turbochargers and new MET-MBII Series axial flow turbochargers are scheduled to be announced at the CIMAC 2019 to be held in Vancouver, Canada on June 10 to 14.



MET-MBII trial turbocharger



MET-ER trial turbocharger

MET SERVICE MENU

Recommendation of MET Turbocharger Vacuum Breaker Cleaning and Inspection for Even Safer Operation

During a questionnaire survey of personnel engaged in the overhaul of MET Turbochargers, we found that while they had a correct understanding of vacuum breakers, they sometimes forgot their cleaning and inspection.

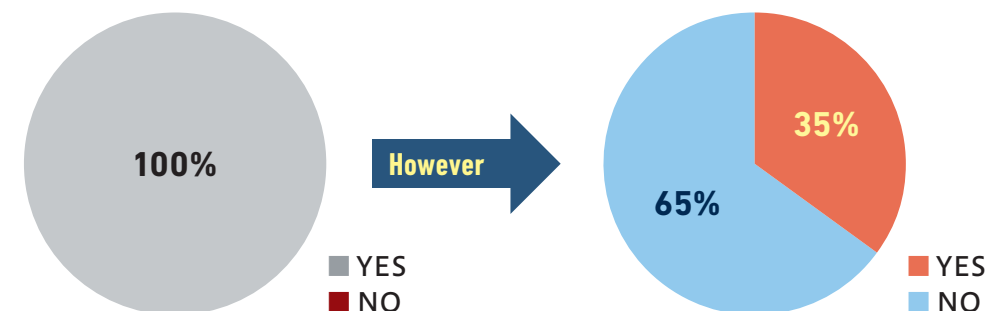
Worn vacuum breakers can lead to oil leakage during low-load operation. Inspection is very easy as it only requires the loosening of bolts. We recommend that to ensure reliability, you remember to clean and inspect the vacuum breaker when carrying out turbocharger maintenance.

If you have any questions, please feel free to contact us at: a-met-service@mhi-mme.com.

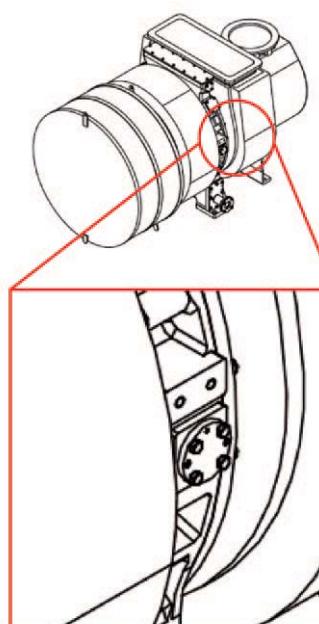
Actual Circumstances Related to Vacuum Breaker Inspection and Replacement

Do you know where the vacuum breaker is located as well as its function? (Maintenance worker interviews)

Have you ever forgotten to inspect the vacuum breaker?



Recommendation: Inspect during turbocharger overhaul



The timing for replacing the flap valve: Make judgment based on the wear limit value



The timing for replacing the lead valve: The passage of five years or 30,000 hours, whichever comes first

Technology INFORMATION

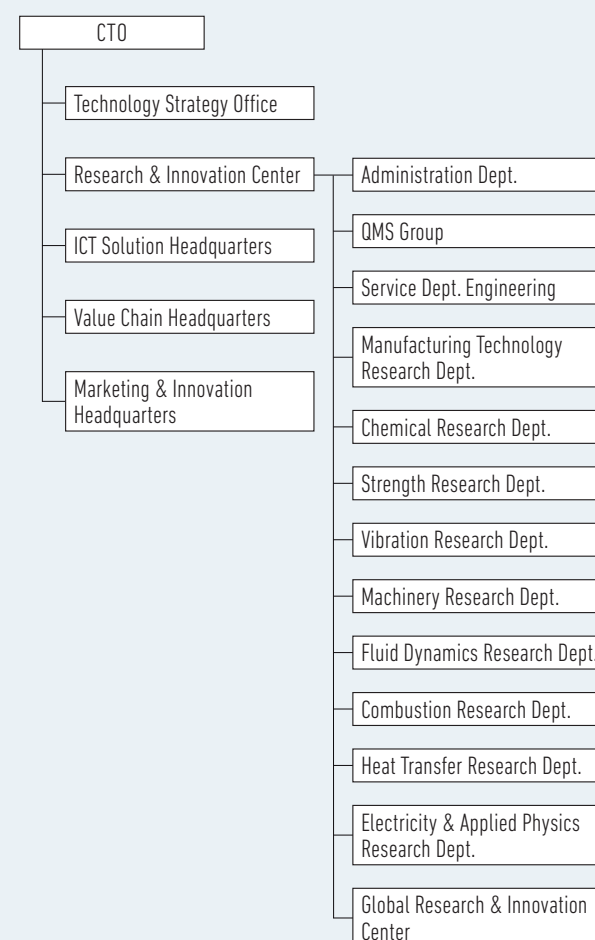
Product Performance and Reliability Supported by MHI's Technology Framework

As MHI-MME promotes its mission of providing safe and secure navigation with energy-saving and environmentally friendly technology at the core, the comprehensive strength of the Mitsubishi Heavy Industries Group is supported by the "shared technology framework" that was launched in April 2016. Under the oversight of the Chief Technology Officer (CTO), the framework comprises the Engineering Headquarters, Marketing & Innovation Headquarters, Value Chain Headquarters, ICT Solution Headquarters and the Research & Innovation Center. The shared technology framework seeks optimization throughout the MHI Group, such as by strengthening the technological foundation and marketing capabilities as well as the value chain, etc., including procurement.

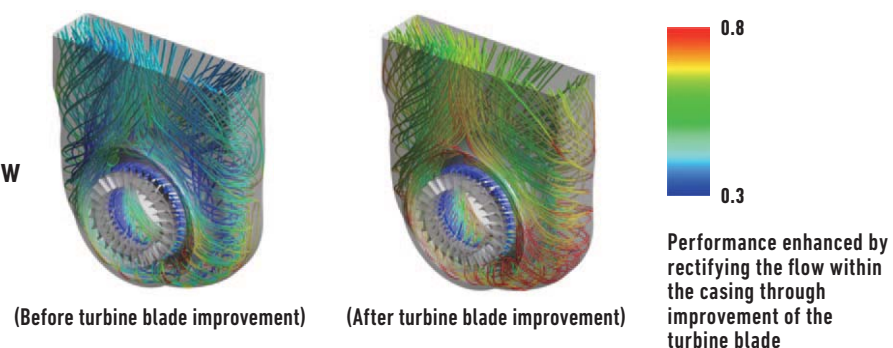
The ICT Solution Headquarters and the Research & Innovation Center play the role of providing direct support in product development related to performance and reliability. In recent years, validation of the performance and reliability of devices through numerical simulation has become extremely important in order to increase the speed of development and make performance and reliability even more certain before making a prototype. By combining large-scale simulations – made possible through great strides made in analytical hardware and software – with accumulated expertise, it is now possible to evaluate a wide range of events that mutually affect each other, such as flow, combustion, heat transfer, vibration, structural strength and lubrication, for the overall product. Furthermore, in the case of Waste Heat Recovery Systems (WHRS), which are composed of a number of devices, reliability during actual operation, including transient states, is secured by utilizing dynamic simulation.

The MHI shared technology framework will continue to develop state-of-the-art technologies that deserve the trust of our customers, so that we may ensure ceaseless performance improvement of the products of MHI-MME and other MHI Group companies as well as assure their reliability.

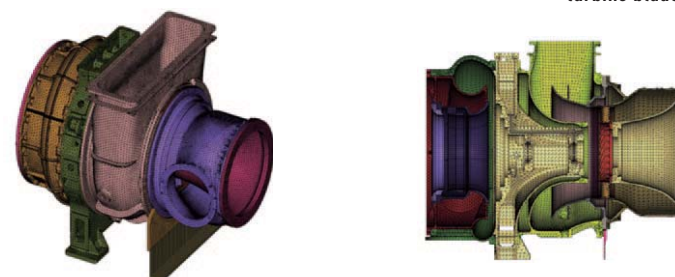
Shared Technology Framework Organizational Chart



MET Turbocharger Case example of turbine flow analysis



MET Turbocharger Finite element method model for thermal distortion and stress analysis



Deck Crane SMART UP-GRADE

Proposal of Diverse Upgrades Total delivery of Offline Filters (Hydraulic Oil Cleaning Devices) for Deck Cranes Exceeds 100 Vessels

For our deck cranes, we offer various upgrading items to achieve both "Stable operation" and "Low lifecycle costs" under the name of "Smart Up-Grade". One of the particularly popular items is offline filters, and we have delivered it for 100 vessels in last two years.

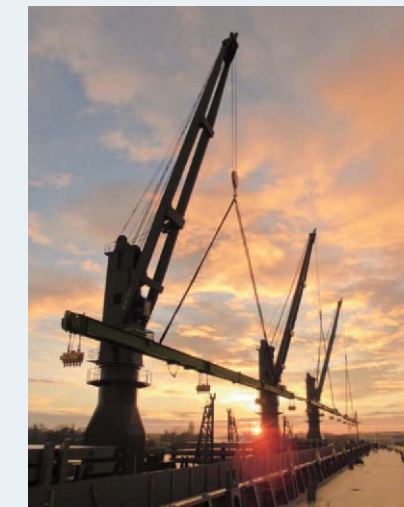
[Characteristic Features]

- High performance (Just wait for 30 minutes → Achieves a cleanliness level of NAS Grade 7)
- Portable (One unit can be used for all 4 cranes and/or other devices, such as deck machinery and steering gear)
- Super-easy one-touch installation (both for New building and Retrofit)

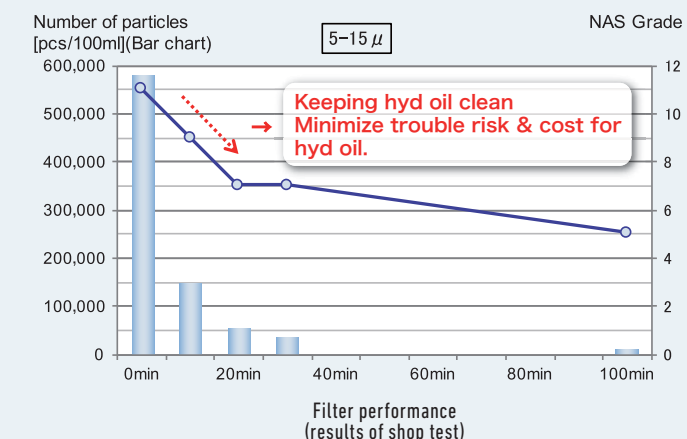
[Benefits]

- Reduces the risk of problems related to hydraulic devices
- Reduces the cost of hydraulic oil (extends the interval between hydraulic oil changes)

Please feel free to contact our after-sales servicing team at: (GUMSC-MHICRANE-AS@mhims.co.jp), or contact an authorized repair agent near you.



Offline filter exterior



Busan INFORMATION

News from MHI-MME Offices Abroad Satoshi Makino, Manager

MH Power Systems Korea, Ltd. Busan Branch



My name is Satoshi Makino. I replaced Mr. Sakamoto at the Busan Branch in August last year. I was engaged in the design of MET Turbochargers for about eight years before this and experienced the design of both axial-flow turbochargers for two-stroke engines, and radial turbochargers for four-stroke engines.

An extremely large number of ships and engines are built in South Korea, and it is a region that is indispensable for building ships. So that MHI-MME may contribute to shipbuilding here, I will offer support by providing MHI-MME products and technologies in South Korea.

I will do my utmost to ensure that our customers will feel satisfaction in the use of our products, so please feel free to contact me at any time. I look forward to meeting you.

Providing Solutions and Systems Capable of Meeting Tough Environmental Regulations



The market environment surrounding the maritime and shipbuilding industries seems to have bottomed out, but challenging conditions still remain. Although there is a sense of uncertainty about the future, such as the China-U.S. trade friction and crude oil price trends, global maritime freight movement is growing from a macro perspective. Even if gradual, the market is expected to move into a recovery trend.

Amid such circumstances, the 2020 global Sulphur limit – to be implemented under the Tier III standards of the International Maritime Organization as a measure for greater marine environment conservation – is just around the corner. What's more, strengthened Energy Efficiency Design Index (EEDI) indications, which aim to reduce CO2 emissions, will follow in its wake. The time has arrived in which countermeasure technologies, such as fuel conversion and environmental countermeasure technologies as well as the installation of additional machinery and equipment, must be applied. What's more, the time has arrived in which countermeasure technologies must be applied. We believe that the maritime and shipbuilding industries are at a significant turning point that will determine their future direction.

MHI-MME will meet customer demands flexibly and according to each circumstance. We will respond to the opinions of customers by providing its product technologies, impact analysis and other products and services that will enable customers to apply measures to comply with tougher environmental regulations.

Going forward, the company expects to see even greater energy-efficiency due to fuel conversion, increased onboard power consumption from the addition of machinery and equipment, and the need to address EEDI regulations. With this in mind, the company is making various energy-efficient systems and solutions available so that we will be ready to consider, with our customers, optimal solutions and systems that can respond to the diverse needs of our customers and their different ships and shipping routes.

As for MET Turbochargers, we have launched the MET-MBII, an axial-flow turbocharger series primarily for two-stroke marine propulsion diesel engines, and the MET-ER, which is a radial turbocharger series primarily for four-stroke engines. We have boosted performance while making the turbochargers smaller, thereby contributing to energy-saving and greater competitiveness.

In May, Japan will be moving into a new era with the abdication of Emperor Akihito on April 30, 2019. MHI-MME will remain true to its original purpose and its corporate policy, That is, to continue to be needed and trusted by customers through excellent products and services. We look forward to your further patronage.

President & CEO

Toshiaki Hori

For inquiries, contact:

Mitsubishi Heavy Industries Marine Machinery & Equipment

E-mail: info_meet@mhi-mme.com

URL: <http://www.mhi-mme.com>