

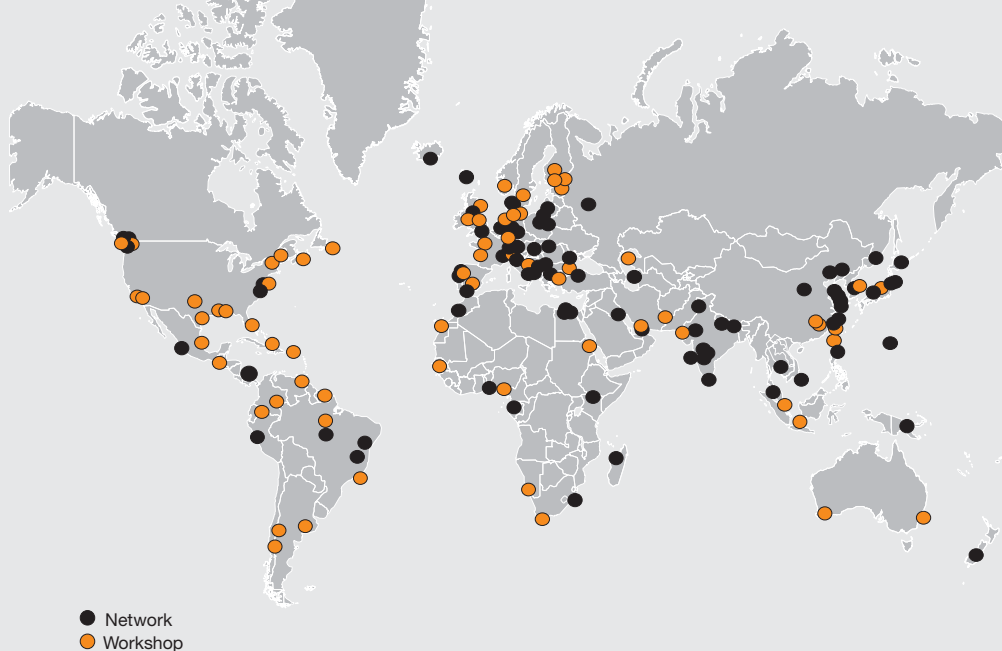
WÄRTSILÄ

Engine Services



# WÄRTSILÄ ENGINE SERVICES

Engine Services form the core of our activities. We provide complete services for engines and related systems globally, for Wärtsilä and other makes of engine. Our OEM services range from in situ machining, repair, retrofit and rebuilding to fuel conversions and environmental solutions. They include basic support, operational support, performance optimizers, environmental solutions and online support.



● Network  
● Workshop

## BASIC SUPPORT

We provide full service throughout the product lifecycle for both marine and power plant customers. Our basic support offers you OEM spare parts, field and workshop services worldwide, advanced technical services and global training services for all needs.

### ORIGINAL PARTS

We offer a full range of OEM spare parts for the engine room, covering all Wärtsilä engines and auxiliary systems. We also supply original parts (OEM) for all these brands:

- Wärtsilä
- Sulzer
- DEUTZ marine engines
- Nohab Diesel
- Wärtsilä Diesel
- GMT
- Wichmann
- SACM
- Stork SW Diesel
- Moteurs Duvant Crepelle
- Nordberg
- Poyaud
- Bolnes

**1,200,000**  
LINES PER YEAR

**1,2 MILLION LINES PER YEAR**  
**5'000 LINES PER DAY**  
**1'000 SHIPMENTS PER DAY**

The quality of parts is essential – only original parts guarantee reliability. All original parts have passed through extensive laboratory and field tests. Certain parts are manufactured under the supervision of the classification societies and then supplied with corresponding certificates. In line with Wärtsilä's commitment to environmental issues, we use IMO-codification of engine parts to comply with the latest IMO requirements.

### FIELD SERVICE

The reliability of our field service is based on a comprehensive knowledge of your installations and service history. Our global organization with 7000 field service professionals is available around the clock. We have a large range

of competent manpower available; experts, supervisors & superintendents, mechanical and electrical engineers and technicians.

Our range of services draws together the technical expertise of our entire organization worldwide to meet the requirements of your business. You can expect short response times and immediate attention to all your questions from your specially dedicated contact person at your local network office.

Our field service philosophy is proactive, service is based on comprehensive knowledge of your installations and service history.

### WORKSHOP SERVICES

Wärtsilä workshops around the globe are a key factor in the overhauling, repair and upgrading of equipment and provide strong support for our field service activities. Maintenance and overhaul are major elements in the down time, and therefore the availability of an engine. That is why many operators want to carry them out in the shortest possible time, but with no compromise on quality. Wärtsilä workshop services are the answer to that





equation as they handle complete systems and components in the shortest possible down time, to the highest technical, quality and warranty standards and in accordance with classification rules.

The services carried out range from the complete engine to all its components and auxiliary systems, including turbochargers, governors and electronic controls. Wärtsilä workshops have highly trained personnel with years of experience and are equipped with high-tech machine tools, equipment and instruments. Specialists are at hand and in close touch with the engineering department, and key spare parts are available in stock.

A service in a Wärtsilä workshop cuts overhaul times and gives guaranteed quality, reducing the risk of breakdown during operation. If needed, we can take care of the logistic chain between your installation and our service centres and provide an exchange component pool.

#### **RECONDITIONING SERVICES**

Reconditioning is an ideal way to enable your installation to continue operating profitably

while meeting new regulations and future requirements.

With our reconditioning services, you will be able to achieve the maximum service life for your components with minimized maintenance cost without compromising safety or reliability. With the application of the latest technology, expertise and design, we provide full quality and warranty for all reconditioned components; you will regain full functionality, helping you to exceed your operational targets.

Our worldwide Wärtsilä reconditioning network with production facilities in Canada, China, Italy, the Netherlands, Dubai and Singapore supply reconditioned engine components for all low and medium-speed engine brands.

A wide variety of exchange components is available in all units, which enables you to take a reconditioned part on board while your vessel is berthed and return the old part to the nearest reconditioning centre without extra cost.

#### **TECHNICAL SUPPORT**

We have in-depth knowledge of every engine, installation, component and system.

Each local service network company has specially appointed, fully dedicated contact persons to handle technical inquiries.

Our task force of product specialists, coupled with a database of accumulated information and experience on customer installations, enable us to provide the best possible support and methods of measurement, analysis, investigation and research.

## MANAGEMENT SUPPORT

We are continually broadening our range of services and adding valuable products and management support services to our portfolio. In this way we can support you on board your vessels or in your power plants.

The choice available to you ranges from different service agreements to a variety of comprehensive, customized long-term service agreements, including performance and operations & management agreements. Moreover, with our condition monitoring and CBM services you can optimize the operational availability and maintenance profile of your installation.



### AGREEMENTS

The service agreements cover all aspects of lifecycle optimization, including parts supply and daily assistance, inspection and maintenance. With a Wärtsilä service agreement, you can focus on what matters – the productivity of your investment.

#### SERVICE AGREEMENT

Our service agreements are tailored to your exact needs, letting you choose from different levels of partnership, or a day-to-day business relationship.

#### MAINTENANCE AGREEMENT

Maintenance agreements cover overhauls at regular intervals and technical support during major overhauls, including inspection of parts and maintenance reports and recommendations.

#### SUPPORT AGREEMENT

Support agreements cover in situ support for

daily routines, advice and assistance in the planning of different routines, in situ instruction, participation in on-site reporting routines, in situ staff management, extensive customized training and development of site routines.

#### SUPPLY AGREEMENT

Supply agreements ensure the supply of parts and materials to a designated location.

The agreement covers supply reliability, parts guarantee and information on upgrades, with the option of monitoring your stock levels and proposing refills.

#### GLOBAL CUSTOMER AGREEMENT

Global customer agreements are designed to meet the challenging requirements of global ship operators. These agreements cover as many vessels as needed over selected intercontinental trade routes. The scope of the agreements can cover main and auxiliary engines, the engine room and propulsion equipment.

### OPERATIONS & MAINTENANCE AGREEMENT

Our O&M agreements focus on optimizing performance and maximizing equipment life so you can concentrate on your core business. We take full performance and operational responsibility for the installation, engines and auxiliary systems.

With more than 3000 MW and 150 Wärtsilä-operated installation references around the world, our O&M agreements provide proven performance and reliability. Regardless of the type of ship power system or power plant you own, we can help you control lifecycle costs and realise the full profitability potential of your investment.

#### CONDITION MONITORING AND CBM

With condition monitoring you can fine-tune equipment operation parameters, taking into account the operating profile, ambient conditions, type of fuel and other factors that can affect the lifecycle performance.





## E-SOLUTIONS

E-Solutions give added value to your business. The setup of the services is always customer specific, only containing information that is relevant for your Wärtsilä supported products. The user interface of the services support you in a clear and structured way to maintain your installation throughout its lifecycle.

E-Solutions can be used from anywhere anytime. No additional software or hardware installation is required. All you need is a computer with an internet access.

### SPARES ONLINE

Spares Online is a tool for inquiring spare part price and availability online and order spare parts in an effective way. Spares Online is available for you 24/7.

The identification of parts is easy and the system supports you to use the correct spare part numbers. Spare part catalogues are supported by photos to facilitate identification. Spares Online offers an improved and more efficient way to handle your purchasing process.

Spares Online can also be integrated to your purchasing system.

### BULLETINS ONLINE

Bulletins Online is the fastest and most convenient way to access Service Bulletins valid for your Wärtsilä products.

Bulletins Online provides installation and engine specific information concerning service letters, technical bulletins, operating instructions, spare part notices, measurement records and special information on operating principles and routines.

All your bulletins are automatically archived so you never lose anything that you might need later. You can also be sure that you never miss a bulletin published by Wärtsilä.

### ELDOC ONLINE

Eldoc Online includes engine specific manuals and spare part catalogues. Once your documentation is available online, everyone in your organisation can access the information. You can minimise distributing your paper manuals internally to different locations.

Eldoc Online includes a spare part catalogue with diagrams and pictures to help you identify the parts. In addition you can use the catalogue to pick the parts for purchasing them online with Spares Online.

Condition monitoring is also the basis for CBM (Condition Based Maintenance) which switches maintenance efforts from a scheduled preventive format to a more flexible and accurate condition-based predictive format. CBM will keep you up-to-date on how your installation is performing and help you detect any deviation from expected normal performance data in good time.

Our CBM systems monitor the equipment condition and analyse operating data continuously. They diagnose and calculate the optimal performance parameters, and thus predict the future status of the equipment.



## PERFORMANCE OPTIMIZERS



### UPGRADES

Our upgrade solutions maximize equipment performance throughout the installation's lifetime and bring older Wärtsilä power systems up to today's technical standards.

### CONVERSIONS

When an installation is designed, capital investment is focused on expected energy trends and known environmental regulations. Throughout its lifetime, generally over 25 years, fuel prices vary and environmental requirements become more stringent. This often affects the profitability of the investment and could lead to a different load profile, or to the need to invest in emission control technologies or change to another fuel. Conversions are a simple way to return to profitability while complying with regulations.

#### CONVERSION FROM FUEL OIL TO GAS

Conversion of an HFO (Heavy Fuel Oil) or MDO (Marine Diesel Oil) installation to operate on natural gas offers many benefits and is becoming more attractive in many areas,

especially if there is a requirement to reduce emission levels.

- Engine conversion consists mainly of installing a gas fuel system on the engine.
- Plant conversion consists of modifications to gas handling systems and the control system.

Wärtsilä gas conversion technologies are of three types: gas diesel, low-pressure natural gas and dual-fuel.

Gas diesel (GD) is based on high-pressure natural gas injection in the diesel cycle, which means that engine modification is limited to the injection equipment and control systems. Pilot fuel ignited with light fuel oil and fuel switching enables maximum fuel flexibility. GD conversion is available for Wärtsilä Vasa 32, Wärtsilä Vasa 32LN, Wärtsilä 38A and Wärtsilä 46.

Conversion of Wärtsilä Vasa 32, Wärtsilä Vasa 32LN and Wärtsilä 32 to Wärtsilä 34SG low-pressure natural gas specification makes it possible to utilise the benefits of low pressure natural gas in a spark ignited otto-cycle. The converted engine offers the same benefits as a factory made Wärtsilä 34SG: high efficiency, low NO<sub>x</sub> emissions, lean-burn, state-of-the-art design.





Wärtsilä 25, Wärtsilä Vasa 32, Wärtsilä Vasa 32LN and Wärtsilä 46 engines can now be converted to dual-fuel (DF) engines and are then able to operate on low pressure natural gas in an otto-cycle, while keeping the possibility to be run with other fuels (light fuel oil and heavy fuel oil) in a diesel-cycle. Natural gas operation is becoming more attractive all around the world, and for many installations the only restriction for conversion to gas is the limited availability. However gas distribution systems are continually being expanded and it is anticipated that the use of natural gas in many industries, including power generation will increase rapidly.

#### CONVERSION FROM MARINE DIESEL OIL OR LIGHT FUEL OIL TO HEAVY FUEL OIL

Most Wärtsilä marine and power plant installations can easily be converted from marine diesel oil (MDO) to heavy fuel oil (HFO) operation. Some additional auxiliary equipment is required for fuel oil treatment, particularly for heating the fuel oil to correct viscosity before the engine injection system. As far as the engine is concerned, the large majority of Wärtsilä

engines are designed to operate with HFO. Conversion from MDO to HFO operation is thus possible without major alterations to the engine specification. The price difference between MDO and HFO is usually so great that many customers presently operating with MDO are converting their installations to HFO operation. The considerable price difference means that the conversion project has a short payback time. The HFO conversion is installation specific and the existing fuel oil system and lubricating oil system requires evaluation due to the differences in cost of the equipment supplied. To improve the return on investment, original equipment is utilised as much as possible.

#### SAFETY SYSTEMS

Engine room safety is attracting increasing interest. It is especially important for installations where personnel are not continuously present in the engine room. Wärtsilä is continuously working with state-of-the-art technology to optimize the performance of its engines. This applies not only to efficiency and emissions but also to safety. Improved material properties,

modern production processes and a new concept design all help ensure greater safety at a lower cost than in the past.

Engines already in operation can likewise benefit from the latest technology, because new solutions are often available as retrofit packages for older engines.

# ENVIRONMENTAL SOLUTIONS

Global concern for a cleaner environment is a fact of life, affecting individuals, commerce and industry. Many regulations, both global and local, have already been set to control levels of smoke, particulates, NO<sub>x</sub>, SO<sub>x</sub> and other pollutants.

US Environment Protection Agency (EPA) legislation is one example of how limits on particulates and NO<sub>x</sub> have changed over the years: between 1988 and 2010 the requirements for emissions reduction will rise more than 95%. Forthcoming regulations are more demanding on emission reductions and most of them do not apply just to new building but also to existing installations. Compliance is a real concern for customers: they need solutions that enable them to comply in the most economical way.



benefit from improvements not available when they first entered service.

The many primary and secondary solutions available include the mechanical modification of engine components and the modification and tuning of engine parameters, as well as the installation of aftertreatment equipment such as specific catalytic reducers (SCR) or scrubbers. These secondary technologies are designed by Wärtsilä to obtain the best compromise between engine settings and performance.

## EMISSION MEASUREMENTS

We offer a system for emission measurements which meets the IMO Annex VI of Marpol 73/78 regulations for the prevention of air pollution from ships.

This code demands certified equipment, accurate calibration, correct measurement procedures and skilled personnel.

We are continuously looking for and developing new technologies to meet these requirements, to ensure environmentally sound operation in terms of low emissions, low environmental impact and sustainability. The new technology is provided as standard on new engines and can often be retrofitted on older engines, so that they too can

The NO<sub>x</sub> measurement report specifies:

- Engine speed and torque for power calculations
- Fuel consumption for calculations according to ISO 3046-1
- Temperatures of the charge air, exhaust gas, cooling water and lubricating oil
- Pressure and humidity in the charge air system
- Exhaust gas composition with regard to NO<sub>x</sub>, CO, CO<sub>2</sub> and O<sub>2</sub>.





In case of secondary technology solutions such as SCRs and scrubbers, we also offer continuous monitoring solutions for SO<sub>x</sub>, NO<sub>x</sub>, CO, CO<sub>2</sub> and O<sub>2</sub>.

The measurements are performed in accordance with the technical code for a number of different load conditions corresponding to the application category.

#### **INTERNATIONAL AIR POLLUTION PREVENTION FOR ENGINES**

The International Convention for the Prevention of Pollution from Ships issued by IMO (Marpol 73/78) and application for the IAPP (International Air Pollution Prevention) certificate also require diesel engines on board to comply with the rules on NO<sub>x</sub> emissions (EIAPP certificate). We can support you with the necessary documentation, a Record Book of Engine Parameters, technical files, etc. as well as the required IMO part codification for the engines manufactured by us. If necessary, we can also conduct emission measurements and give advice on how to reach the desired emission levels.

#### **SMOKE REDUCTION**

The need for operation with non-visible smoke has grown in recent years. Local regulations and restrictions on smoke emission have been

imposed in certain geographical areas. Alaska, which sets duties and fees for vessels sailing in the region during the summer season, is the most significant example at present. An increasing number of similar measures can be expected in the future.

Various equipment is available to improve part-load performance, such as bypass, waste gate, and variable valve timing, depending on the engine type. The ultimate is the common-rail fuel injection system available on the latest generation engines. With the common-rail fuel injection system, injection pressure is kept high and constant at any load, enabling operation without visible smoke in any situation.

#### **METHODS FOR NO<sub>x</sub> REDUCTION**

A primary NO<sub>x</sub> reduction method means that conversions are made directly to the diesel engine. Our NO<sub>x</sub> conversion packages range from engine modifications up to and including a saturation system for combustion air.

The Wärtsilä Low NO<sub>x</sub> diesel cycle upgrade combines various engine modifications designed to obtain low NO<sub>x</sub> values, aiming to find the ideal combination of compression ratio, injection timing and injection rate.

Secondary methods for reducing NO<sub>x</sub> include Selective Catalytic Reduction (SCR). The new combined silencer and SCR unit

developed by Wärtsilä is an ideal package for retrofitting projects.

#### **METHODS FOR SO<sub>x</sub> REDUCTION**

SO<sub>x</sub> reduction cannot be achieved with a primary method on the engine. The solution is to burn low sulphur fuel instead, Wärtsilä engines being already designed and optimized to run on fuels with any sulphur content.

We can offer engine checks and modifications, as well as tank and system modifications on board ships expected to operate inside and outside sulphur emission controlled areas.

Secondary methods for reducing SO<sub>x</sub> include scrubbers. Scrubbers may use different chemicals such as limestone (CaCO<sub>3</sub>), sodium hydroxide (NaOH) and ammonia (NH<sub>4</sub>OH), depending on the case. Land based applications usually scrub exhaust gas with a limestone or sodium hydroxide scrubber. Scrubber systems for marine application are currently under development in the industry; they either use sodium hydroxide or sea-water scrubbers. With several years' experience of research and developing and supplying these aftertreatment solutions, we are able to assist you in the selection, design and installation of the system best suited to your installation.



## OILY WATER SEPARATION SYSTEMS

We can today offer a complete Wärtsilä Senitec oily water system for power plants and marine applications. Together with a design that can handle today's tough conditions in the machine room, we can offer a complete extensive operation program, such as operator interface, manuals, instructions and operator training.

## OILY WATER TREATMENT SYSTEMS FOR POWER PLANTS

The purpose of the Wärtsilä Senitec P2100 and P 750 treatment systems for power plants is to create a complete system for treating the total oily water effluent from power plants. To do this it is necessary to identify and have experience of the potential problems. The oil and slop/sludge vary widely from one installation to another. Wärtsilä has experience with oil and sludge with high and low density, viscosity and water content.

Benefits:

- Low maintenance cost
- Safe
- High capacity
- Built-in stainless steel
- PLC controlled
- High dry solids
- Low operating costs
- Low space requirements

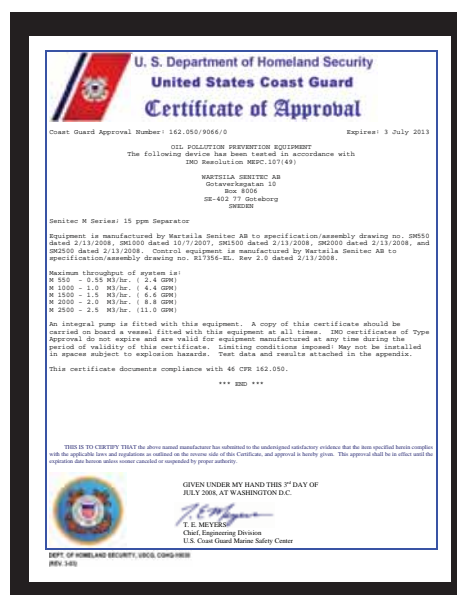
## SLUDGE AND BILGE WATER CLEANING FOR MARINE

With regard to the environment, shipping is one of the most effective modes of transportation of goods and people. The Senitec M-Series treatment system ensures that oil from sludge and bilge water does not end up in nature. The Senitec M-Series system gives the operator effective control over all bilge and sludge media as well as over any discharges made into the sea.

is a groundbreaking separator which has been rigorously tested. Today, the Senitec M-Series is the most complete sludge and bilge treatment unit on the market.

Benefits:

- Approved according to IMO resolution MPEC 107(49) and US coast guard according to US 46 CFR 162.050
- Separates oil and emulsions effectively
- Results clearly below legislative requirements
- Reduces sludge / bilge disposal need
- Smaller harbour fees and less maintenance
- Ease of operation frees up time for other tasks
- Built in modules for easy installation onboard
- Can handle 0-100% oil
- Works in low and high temperature range
- Not sensitive to soot or cleaning chemicals
- Fully stainless steel housing – long lasting quality
- Fouling of sludge tank can be avoided by separate discharge of solids



Senitec M-Series is approved according to IMO and US Coast guard. The results are sustainable over time which gives our customers the long term solution they need. The heart of the system



## FROM SERVICE TO SERVICES

A number of our customers have recognized us as their preferred service supplier to ensure the availability and cost-efficient operation of their installations. They find they get leverage from a variety of benefits by having their entire power system fully serviced by one global supplier.

Wärtsilä Services provides holistic, integrated service for our marine and power plant customers. To serve you better, we are continually broadening our range of solutions by adding products and services that further enhance the value of our one-stop-shop service and expanding our global network. We support your business, in-situ or from our numerous service centers around the globe, regardless of your equipment make.

We provide tailored efficiency solutions throughout the marine propulsion and power plant product lifecycle in the following services product lines:

- Engine Services
- Propulsion Services
- Boiler Services
- Electrical & Automation Services
- Operations & Management Services
- Training Services
- Environmental Services

We can tackle everything from basic support with parts, manpower and technical support to full service agreements. The work can encompass installation and commissioning, performance optimization, upgrades, conversions, and environmental solutions. Service contracts can extend from parts and manpower all the way to long-term, comprehensive contracts including performance and asset management agreements.

Wherever your installation is located, you will find a Wärtsilä Services center nearby. More than 11,000 dedicated professionals, operating in over 70 countries in 160 locations, are waiting for your call. We are never too far away to help.

This not just service, it is peace of mind – the security of knowing that your installation is covered by the world's most experienced marine and power plant services company: Wärtsilä.

**VISIT US AT [WWW.WARTSILA.COM/ENGINESERVICES](http://WWW.WARTSILA.COM/ENGINESERVICES)**

Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers. Wärtsilä is listed on the NASDAQ OMX Helsinki, Finland.

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ECONOMY

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