



Performance Measurement Indicator

MAN PrimeServ



PMI

Optimized equipment

Your partners for retrofit solutions

Reliability, greater efficiency and compliance with new environmental legislation are just some of the benefits our advanced retrofit solutions provide.

Keeping your equipment consistently up-to-date

Your existing engines, machinery, auxiliary systems, instrumentation and control systems might be aging, but that does not mean they cannot keep delivering value. Our comprehensive, tailored retrofit solutions can bring your assets up to date and keep them there, through continuous development and modernization.

Available for a wide range of engines, propulsion systems and turbochargers, our retrofits and upgrades will help you improve efficiency, boost performance, save on fuel and lube oil, while lowering maintenance costs and enabling more flexible operation.

MAN PrimeServ retrofits will also help you comply with increasingly stringent environmental regulations and put your operations on the road to energy transition and decarbonization. And they will benefit your employees by improving crew safety, making equipment easier to operate and lowering emissions onboard.

For reducing emissions from diesel engines, consider our dual-fuel retrofit solutions. In addition to improving your environmental performance, these retrofits can help you save fuel and reduce operating costs.

Better performance less effort

Wear on engine components, changes in ambient conditions, and changes in fuel bunker quality can all affect engine efficiency, resulting in higher fuel consumption and overall engine wear. Continuous engine monitoring is effective in countering the problem but can be difficult and time-consuming when handled manually.

At MAN Energy Solutions, we have solved this challenge with an automated measuring and tuning system called PMI (Performance Measurement Indicator). Available in different two configurations – PMI Auto-tuning and PMI VIT (Variable Injection Timing) – the system delivers a wide range of benefits, including:

- Substantial fuel savings
- Improved running performance and engine efficiency
- Lower engine maintenance costs and increases reliability
- Simplified operability eases crew workload and eliminates time-consuming manual adjustment
- Automatic engine adjustment in response to changes in fuel bunker and ambient conditions

- Lower CO₂ and particulate emissions
- Less potential for human error thanks to automatic parameter adjustment
- PMI Auto-tuning can be installed during normal service
- Lower risk of mechanical and thermal engine overload

PMI: How it works

Our PMI systems are built around the same basic process: A monitoring unit uses a transducer on each cylinder to monitor cylinder pressure, and the pressure data is then used to automatically balance and tune the engine. The latter step is where the two configurations differ (see below). The performance data is also displayed on a screen, keeping the crew aware of opportunities for additional engine tuning.



PMI Autotuning

PMI Autotuning is used for electronically controlled MAN B&W two-stroke engines. This PMI system configuration ensures the optimal cylinder pressure by adjusting the fuel-injection timing and the opening of the exhaust valve.

Engine types

The PMI Autotuning configuration is suitable for all ME/ME-C and ME-B engines.

PMI installation process



Step 1. Complete pre-inspections

In this step, you will need to define all relevant specifications for each engine setup. Due to the complexity of this task, we recommend asking an MAN PrimeServ service engineer to assist on board.

Step 2. Receive offer and place order

After you have submitted the pre-inspection documents, you will receive an offer. Then you can place your order. Note that PMI VIT installation should be scheduled during an off-hire or docking period, whereas PMI Autotuning can be installed during normal service.

Step 3. Receive parts and prepare for installation

In this step you will receive your parts, and your crew can install the hardware components. This work involves fitting and electrical work, and MAN PrimeServ can assist with the process.

Step 4. Install and commission

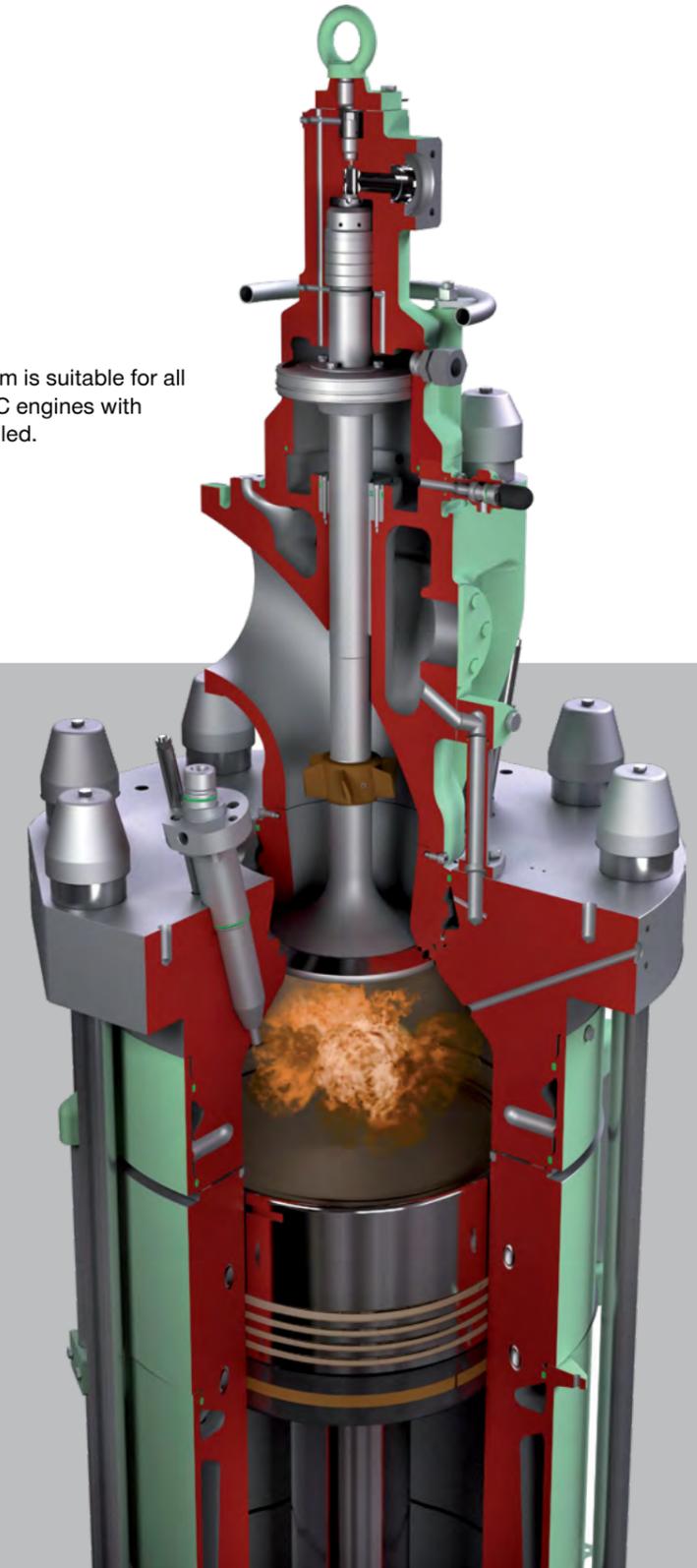
Software updates are installed, and your system is commissioned. It is possible to connect your OEM equipment to the alarm and monitoring system (AMS). Should you wish to do that, you should request assistance from your AMS supplier, who works together with an MAN PrimeServ superintendent. A sea trial is additionally required for the PMI VIT installation.

PMI VIT

The PMI VIT system is used for mechanically controlled MAN B&W two-stroke engines and ensures the optimal cylinder pressure by controlling fuel-injection timing via an electronic actuator on the VIT (variable injection timing) rack.

Engine types

A PMI VIT system is suitable for all 50-98 MC/MC-C engines with a VIT rack installed.



PMI Adaptive Cylinder Control

Automated and improved engine performance with large fuel savings

A successor to PMI Auto-tuning, PMI Adaptive Cylinder Control is a fully automatic system that will constantly help you secure optimal engine tuning regardless of engine load, load range, load changes, and varying fuel calorific values.

The PMI Adaptive Cylinder Control is based on a patented closed loop algorithm. Using values from the engine's performance trial as reference, the algorithm adjusts the fuel index and exhaust valve operation of each cylinder.

Fully automatic and working in all load ranges, PMI Adaptive Cylinder Control help to ensure the lowest possible fuel consumption. Depending on your load profile, fuel saving will be approx. 1 to 3.5 g/kWh compared to operation with PMI Auto-tuning.

Engine types

The PMI Auto-tuning configuration is suitable for all ME/ME-C and ME-B engines.



PMI Offline

Guidance to a better engine performance

The PMI Offline system is used for all MAN B&W two-stroke engines. It gives you a status of how the engine is performing. The performance is measured at each cylinder by connecting the sensor manually to each cylinder.

The Sensor will send the data to the CoCoS-EDS which allows the crew to analyze the data and see if any corrections is needed to improve the engine performance.

PMI Offline will Show an automatic calculation of Effective Power, Mean Indicated Pressure Pi, Compression Pressure Pcomp, Maximum Pressure Pmax and Scavenge air pressure Pscav. It also gives a graphical presentation of PT, PV and balance diagrams, together with Pmean and Pmax, and calculates proposals for fuel pump index adjustments.

Engine types

The PMI Offline configuration is suitable for all ME/ME-C and ME-B engines.

PrimeServ Assist

Powered by **MAN CEON**

MAN PrimeServ Assist is the new proactive service solution that helps you optimize the efficiency and availability of your MAN equipment. Advisory and instant technical support is provided 24/7 from MAN PrimeServ Remote Operation Centers around the world.

MAN PrimeServ Assist enables you to optimize the efficiency and availability of your MAN equipment. It is part of the new MAN CEON platform, which provides authentication and authorization, asset management, asset status visualization and other functions – all based on securely transferred key equipment data.

Using state-of-the-art connectivity technology, our experts are there for you 24/7, continuously monitoring and analyzing live data from running systems, diagnosing anomalies and notifying on-site engineers with valuable operational and maintenance advice supported by the MAN CEON platform. You get an accurate status of your machineries and advice on how to keep it operating at peak efficiency longer. Your local MAN representative will inform you about the retrofit needed to connect your engine.

PMI helps Chevron save 22 tonnes of fuel per day

Chevron case-story

In a bid to save fuel, Chevron retrofitted five of its vessels with an MAN Energy Solutions PMI system and allowed MAN Energy Solutions to review subsequent fuel consumption data. The results were impressive indeed.

PMI VIT delivers 9% improvement in fuel consumption

One vessel, the *Andromeda*, saw a 6S90MC-C engine fitted with a PMI VIT system while docked. Chevron also cleaned the hull and installed propeller boss cap fins.

Data from the vessel shows an 18% improvement in fuel consumption, down from 97.7 to 80.1 tonnes per day at a speed of 14.1 knots. Chevron estimates that half these savings – or 9% – were due to the PMI system retrofit.

ME engines see 10% fuel savings from PMI Autotuning retrofit

Vessels with electronically controlled ME engines, such as the *Aries Voyager*, show even slightly better results after a retrofit and cleaning.

The *Aries Voyager's* MAN 6S90ME-C engine had been consuming 106.4 tonnes of fuel per day at a speed of 14 knots. After docking, consumption dropped to just 84 tonnes per day, half of which (10%) is estimated to result from the PMI system retrofit.



MAN PrimeServ

Service with passion



MAN PrimeServ is the dedicated MAN Energy Solutions service brand. Via a network of over 100 service centers worldwide, MAN PrimeServ provides 24/7 service across the globe. Our range of services includes technical support, consulting and OEM spares, as well as maintenance, repair and comprehensive individualized service plans.

365
days a year

24
hours a day



MAN PrimeServ's aim is to provide

- Prompt delivery of high-demand OEM spare parts within 24 hours
- Fast, reliable and competent customer support
- Individually tailored O&M contracts
- Ongoing training and qualification of operators and maintenance staff
- Global service, 24 hours a day, 365 days a year
- Diagnosis and troubleshooting with our high-performance Online Service



MAN Energy Solutions and legacy brands

MAN PrimeServ is our brand name for high-quality aftersales support for the entire MAN Energy Solutions product portfolio. Through refinements to our products and repair techniques, we ensure and enhance our technological leadership and technical expertise as an Original Equipment Manufacturer (OEM) for the brands united under MAN Energy Solutions.

Worldwide service

100

Service centers
worldwide

We offer retrofitting and upgrade services to bring engines and turbochargers already in service up to the very latest standards of performance and efficiency.

Represented in all key markets and major ports, with a network of more than 100 service centers, and with skilled field service managers at the ready to provide first-class technical support, MAN PrimeServ is fully primed to provide 24/7 service, wherever you are. In power plants, marine engines & systems and turbomachinery, offering reliable technical support when you need it most, our service solutions include OEM spare parts, engine and machinery maintenance and repairs, customized service agreements and individual consulting.

For existing equipment our holistic retrofit and modernization solutions keep your engines or turbochargers up-to-date and at optimal levels of reliability, availability and economic

efficiency. Through cutting edge digital technology we're able to hike performance and minimize downtimes, while our remote connections enable live data analysis, ensuring quick, effective solutions. MAN PrimeServ Academies provide expert training courses around the world, developing the operational and maintenance skills required.

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