LNG shipping

MAN Energy Solutions
Future in the making

Cost-cutting dual fuel solutions
Future in the making

MAN Energy Solutions is the world’s leading provider of large-bore diesel engines, turbomachinery, and integrated power systems. We make four-stroke and two-stroke engines for marine and stationary applications, turbochargers and propellers, gas and steam turbines, compressors and chemical reactors.

Our marine systems expertise is focused on emission reduction, complete propulsion packages, electrical propulsion, dual fuel, LNG, and digitized services.

In the competitive field of liquefied natural gas shipping, with its fluctuating fuel prices, we offer cost-effective propulsion systems that comply with all emission legislations and meet strict safety requirements.
Versatile engines for complex tasks

Getting a good return on your investment

Although the market for LNG keeps on growing, building a vessel for the LNG supply industry is a major investment in complex technology that has to be amortized with a maximum of yearly operating hours. You also have to factor in competition from other carriers, environmental regulations, and unpredictable fuel costs.

Success factors

Maritime transport of LNG has proven safe thanks to very high safety standards. However, LNG is a highly valuable freight and delivery delays are costly; that means cargo tank management is essential. The engines have to be capable of coping with different boil-off gas (BOG) qualities and quantities, in line with charter requirements.

Flexible propulsion solutions

Different LNG shipping applications have comparable requirements with a different technical emphasis: reliability, flexibility, capital expenditures (CAPEX) and operating expenses (OPEX), emission regulations, and the energy efficiency design index (EEDI). Our dual fuel propulsion solutions can be tailored to meet every need.
Four-stroke engines for LNG vessels

- MAN 28/32DF GenSet
  - 1,000 – 1,800 kW

- MAN 35/44DF GenSet
  - 3,060 – 5,300 kW
  - 6,900 – 10,350 kW
  - 13,800 – 20,700 kW

- MAN 23/30DF GenSet
  - 625 – 1,200 kW

- MAN 51/60DF Propulsion
  - High efficiency
    - 6,300 – 9,450 kW
    - 12,600 – 18,900 kW
  - High power
    - 6,900 – 10,350 kW
    - 13,800 – 20,700 kW

MAN Energy Solutions
LNG shipping
LNG carriers have to deliver highly valuable freight on time, which means they require operational flexibility. Sailing globally through environmentally sensitive waters demands low emissions and the operational safety of the propulsion system is paramount.
In a multiple dual fuel engine plant, the MAN 51/60DF ensures high reliability and vessel speed flexibility. The engines within a multiple engine concept can be switched on and off according to the power demand. You can thus operate at highest efficiency with the lowest possible fuel consumption and best load dynamics.

The low-pressure gas supply system is proven and easy to handle. The fuel quality manager optimizes the engine’s combustion according to the quality of the boil-off gas.

Benefits

Full environmental compliance
IMO Tier III in gas mode and liquid mode (with optional MAN SCR)

High power output
Up to 1,150 kW per cylinder

Safe engine operation
In accordance with latest standards and regulations

Operating stability and flexibility
Gas start capability, seamless switch from HFO to gas mode and vice versa, gas operation even above 100% MCR

Lower maintenance costs
Intelligent use of the engines enables the minimization of yearly maintenance costs. Additional benefits derive from the use of the same engines (with the same technologies) for propulsion and onboard power generation.

Safety beyond the standards
The MAN 51/60DF comes fully equipped with a safety and control system developed for full compliance with classification society standards. MAN SaCoS allows for safe engine operation in liquid fuel or gas mode, offering optimum fuel consumption and very low emissions. In addition to all safety-relevant engine features, we offer an integrated safety concept for the whole engine room, tailor-made for each specific application.

Flexible fuel sharing
The capability to operate the engine in gas, liquid or fuel sharing mode with HFO, MDO, MGO or LNG leads to highest fuel flexibility. It also offers maximum usage of boil-off gas under the most efficient engine operation.

Further power solutions
MAN 35/44DF GenSet
MAN 35/44DF
The floating link

The floating storage and regasification unit (FSRU) turns the LNG fuel to gas, which can be pumped straight into the gas grid. It is a clever alternative to building a regasification plant on land and thus a key element in the LNG supply chain. An FSRU is a promising business opportunity for owners and operators, but it does involve many technical, contractual and environmental issues.

Working with clean power

The FSRU has to comply with coastal environmental regulations as well as the emission requirements of the ship’s flag state. In terms of engine operation, safety comes first. Service support is important for high operational availability.

In terms of engine output, the operation of the regasification equipment usually requires less power than the propulsion. Careful cargo tank management is important to maintain pressure in the cargo tanks and handle the boil-off gas. Our dual fuel solutions make it easy.
In a multiple dual fuel engine plant, the MAN 51/60DF ensures high reliability and vessel speed flexibility. The engines within a multiple engine concept can be switched on and off according to actual power demand, allowing the highest efficiency with the lowest possible fuel consumption and load dynamics. Intelligent engine utilization also makes possible the minimization of yearly maintenance costs.

The MAN 51/60DF complies with IMO Tier III regulations in gas mode. In liquid mode it complies with the help of the MAN SCR (selective catalytic reduction) exhaust gas-cleaning system.

**Benefits**

- Full environmental compliance
  - IMO Tier III in gas mode and liquid mode (with optional MAN SCR)
- High power output
  - Up to 1,150 kW per cylinder
- Safe engine operation
  - In accordance with latest standards and regulations
- Operating stability and flexibility
  - Gas start capability, seamless switch from HFO to gas mode and vice versa, gas operation even above 100% MCR
- Easy to operate
  - The low-pressure gas supply system is proven and easy to handle. The fuel quality manager optimizes the engine’s combustion according to the quality of the boil-off gas. Our PrimeServ training academy offers a tailored training program for FSRU crew.

**Dual fuel technology**

Pioneering hardware and software for engine control, monitoring, and diagnostics. Enables full fuel flexibility (HFO, MDO, MGO and natural gas). Seamless switch from HFO to gas mode and vice versa; gas operation even above 100% MCR.

**Ease of maintenance**

Segmented gas and charge air manifold for individual and simple removal of cylinder head.

**MAN SaCoS** (safety and control system on engine)

Combines all functions of modern engine management into one complete system. It controls the additional pilot injection system as well as the gas admission system assembly.

**Further power solutions**

MAN 35/44DF
Enabling the switch to gas

Low gas prices are increasing the popularity of LNG as a maritime fuel. This, in turn, is driving the demand for feeder and bunker vessels that can efficiently deliver LNG to the ships that use it as fuel.

LNG feeder and bunker vessels

High performance with low consumption

Delivering LNG to marine clients is a challenging operation. Feeders and bunker vessels need high maneuverability to perform safely. They have to be available 365 days a year and must have low overall energy consumption— the less cargo they burn, the better. They should also be suitable for operating in noise-sensitive areas and comply with emissions regulations.

With their outstanding fuel economy, our dual fuel engines offer excellent solutions for operators who are looking for low CAPEX and OPEX and worldwide logistic support.
Lowest emissions, highest output

MAN 35/44DF

The MAN 35/44DF allows you to harness all the benefits of dual fuel flexibility. It is ideal for mechanical and electric propulsion, and auxiliary GenSet applications. In gas mode, it complies fully with IMO Tier III standards. In liquid fuel mode, it fulfills IMO Tier II regulations.

The engine is equipped with a common rail injection system with injection pressures of up to 1,600 bar. With 530 kW/cyl, the engine yields the highest power output in its segment. The solid design is based on the MAN 32/44CR. Its reliable technology reduces daily maintenance and maximizes TBOs while ensuring safe operation in all fuel modes. Its success is demonstrated by the increased vessel resale value.

Benefits

Compliance with IMO Tier II and IMO Tier III standards
No after-treatment needed in gas mode, MAN SCR option for liquid mode

Based on established technology
Design based on proven MAN 32/44CR engine

Full fuel flexibility
HFO, MDO, MGO and natural gas

More intelligent ways to save costs
The MAN HyProp ECO is a hybrid solution that results in higher propeller efficiency and lower fuel consumption. The MAN 35/44DF is also available with MAN Cryo fuel gas supply and bunkering equipment as part of system supply.

Conversion from MAN 32/44CR
This is an economical retrofit solution that adds lean-burn technology from the MAN 51/60DF. Due to the high level of component compatibility, the engine can be easily re-machined on board.

MAN SaCoS (safety and control system on engine)
Combines all functions of modern engine management into one complete system. It controls the additional pilot injection system as well as the gas admission system assembly.

Further power solutions
MAN 23/30DF GenSet
MAN 28/32DF GenSet
MAN 51/60DF
Dual fuel and gas supply solutions

Leading the way in cryogenic equipment

With the acquisition of Cryo AB in February 2016, MAN Energy Solutions became one of the world’s leading manufacturers of cryogenic equipment for the storage, distribution and handling of liquefied natural gases (LNG).

For more than 50 years, Cryo AB has put skills and advanced technology at the service of the gas industry. As such, MAN Cryo products are available for demanding marine and industrial gas companies when it comes to selecting the most efficient and economical cryogenic equipment for marine gas fuel systems as well as for offshore and onshore bunkering systems.

MAN Cryo has a broad product line of equipment for LNG, both for onshore and offshore applications. It includes marine LNG fuel gas systems with more than 30 systems operating to date, LNG bunkering systems for bunker vessels and for onshore installation. Our experience and product portfolio allows us to supply equipment for all your marine LNG needs. We have the expertise to customize designs to your requirements.

Our main products for LNG applications

- Marine fuel gas systems
- Offshore and onshore bunkering systems
- Stationary distribution system for regasification or fuel filling
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.

MAN PrimeServ provides
- 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
Worldwide service

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

Using the latest digital technology, we enable you to maximize the performance and availability of your MAN equipment by accessing real-time data analysis, remote support and rapid solutions. We also offer an extensive range of training courses at MAN PrimeServ academies around the world.

Our service does not vary according to location. We know that a vessel may be built in Asia, operated in Europe for ten years and then move to Africa for the next ten years. That does not alter our focus on dedicated training, fast delivery of strategic spare parts, a comprehensive approach, or our tailored maintenance contracts.

For more information please visit www.man-es.com/primeserv
Get your engines started ...
All data provided in this document is non-binding. This data serves informational purposes only and is not guaranteed in any way. Depending on the subsequent specific individual projects, the relevant data may be subject to changes and will be assessed and determined individually for each project. This will depend on the particular characteristics of each individual project, especially specific site and operational conditions.

Copyright © MAN Energy Solutions. D2366552-N1 Printed in Germany GGKM-AUG-18082