

# Market Update Note



21 September 2020

## Advantages of the flexible ME-GA concept

**MAN Energy Solutions is committed to develop new technologies in demand by the market and our customers.**

In September 2019, we revealed main data for a new ME-GA engine, the two-stroke MAN B&W G70ME-C10.5-GA. A low-pressure, dual-fuel engine tailored to LNG carriers. The engine has been designed as a supplement to our existing, successful dual-fuel ME-GI engines.

The ME-GA engine features the following concepts and benefits:

- ✓ The well-proven MAN B&W dual-fuel platform
- ✓ Unique gas admission concept with minimal installation and operating costs
- ✓ Well-known engine room design similar to ME-C/ME-GI
- ✓ The crew's existing ME-GI know-how can be utilised on the new ME-GA engine
- ✓ Worldwide service network providing maximum security

### Engine philosophy

The ME-GA engine is a pre-mixed, dual-fuel engine type, where methane is admitted during the compression stroke, see Fig. 1.

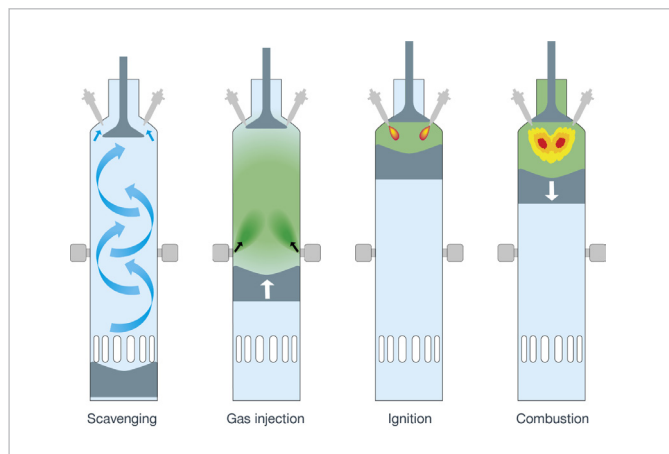


Fig. 1 Pre-mixed dual-fuel combustion

This allows for a low gas supply pressure, which is advantageous for vessels with larger amounts of boil-off gas, like LNG carriers.

The ME-GA version features some of our most successful concept ideas from ME-GI and ME-GI Mk. II platforms.

### Unique gas admission concept

The simple supply and purging concept minimises installation costs.

The gas admission system enables a safe and reliable operation at lowest possible costs.

### Supply and purging concept

The safety and purge concept from ME-GI Mk. II has been adapted to the ME-GA version with the introduction of beneficial features.

### Safe gas admission valve

The safe gas admission valve (SGAV) placed in the cylinder liner has been developed as a unique and simple component, which provides both the ultimate safety against gas leakage into the cylinder and secures optimal conditions for gas admission.

Since the SGAV contains a gas admission as well as a window valve in one unit, the safety against gas leakage into the cylinder is doubled. Basically, the improved safety will eliminate additional requirements for complex monitoring as a safety precaution as opposed to other low-pressure, dual-fuel, two-stroke engines.

The SGAV design gives room for easy overhaul of the valve itself along with maximum space for overhaul on the engine top.

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## Gas regulating valve

In order to achieve a simple and easy installation of the ME-GA engine and the fuel supply system, a hydraulically actuated gas pressure regulating valve has been developed. The valve is controlled directly from the engine control system, simplifying the requirements for control of the supply system.

Moreover, the gas regulating valve enables depressurising of the system without dedicated blow-off piping. The hydraulically actuated bypass valve is of similar design as the ME-GI blow-off valve.

## Pressure-equalised three-piston-ring package

Our experience with development of piston ring configurations for different engine types combined with know-how gained from ME-GI operation has enabled us to develop a rigid and reliable piston ring package for the ME-GA engine. A ring package similar to the well-known pressure-equalised three-ring package for the ME-GI engine, see Fig. 2.

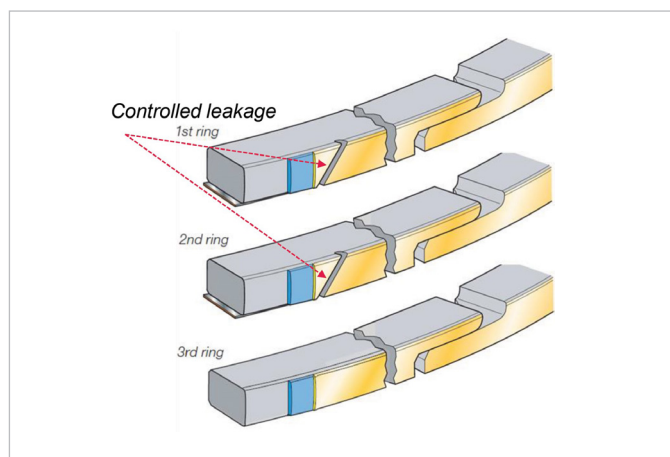


Fig. 2 Design of the three-piston-ring package

The properties of the three-piston-ring package are achieved by combining the controlled gas leakage of the first and second rings with a gas-tight third ring. The advantageous combination ensures an even pressure distribution, featuring:

- Minimum build-up of deposits in the ring grooves
- More robustness against ring collapse than typical applications with a gas-tight top ring

These properties are the basis for obtaining satisfactory cylinder conditions on the ME-GA engine and for giving the large freedom to optimise the combustion process.

The design of the ME-GI ring package has endured millions of running hours accumulated in service on G70 engines. Low wear rates show that the time between overhaul of piston crown and piston rings is well within our guidance values.

## Adaptive cylinder control

The unique adaptive cylinder control (ACCo) system used on ME-C and ME-C-GI engines will also ensure the best performance and the lowest possible fuel consumption at all times for the ME-GA engine.

The ACCo algorithm optimises the operation of each individual cylinder according to specifications by automatically adjusting engine setting parameters, for example to counteract the possible negative impact of varying fuel qualities and calorific values.

## Combining the ME-GA engine with EGR

Exhaust gas recirculation (EGR) is and has been a Tier III option parallel to SCR for our complete engine programme for the last decade.

EGR will of course also be an option available for our ME-GA engine to ensure Tier III compliance when running on diesel. EGR is an effective way of reducing  $\text{NO}_x$  emissions from the diesel combustion process with only a marginal negative impact on the combustion process itself (SFOC).

Testing of EGR and the ME-GA engine in diesel mode as well as gas mode has revealed, as expected, that EGR efficiently reduces  $\text{NO}_x$  emissions, also in gas mode. In addition, the test has shown that EGR is a strong and efficient tool for improving the gas combustion process of the pre-mixed Otto type engine.

Specifically, the EGR application optimises ME-GA operation by:

- Suppressing pre-ignition (operation on different gas qualities is possible)
- Suppressing excessive combustion rates (the improved cylinder condition gives better operating conditions for the piston ring pack)
- Improving optimisation possibilities of specific gas consumption (SGC) due to the increased compression ratio and optimised gas admission
- Reducing the heat load due to the optimised gas admission
- Improving the specific fuel oil consumption (SFOC) in diesel operating mode ( $\text{NO}_x$  constraints are removed)
- Reducing the methane slip

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The EGR application will reduce SGC and SFOC compared to an ME-GA engine running without EGR. SGC is reduced approx. 3% in the complete load range, when operating in gas mode, and SFOC approx. 5%, when operating in diesel mode.

Further testing is required before we can quantify the methane slip for the ME-GA engine with EGR. We foresee reduction levels of 30-50% compared to an ME-GA engine without EGR.

## Compliance with emission regulations

As the pre-mixed combustion results in low NO<sub>x</sub> emissions, the ME-GA engine is inherently Tier II and Tier III compliant in gas operation mode. To utilise the dual-fuel potential (gas and diesel operation) in Tier III areas, the ME-GA engine requires application of EGR or SCR.

## Timeline

So far, developing the MAN B&W ME-GA engine has included more than 600 test runs at the Research Centre

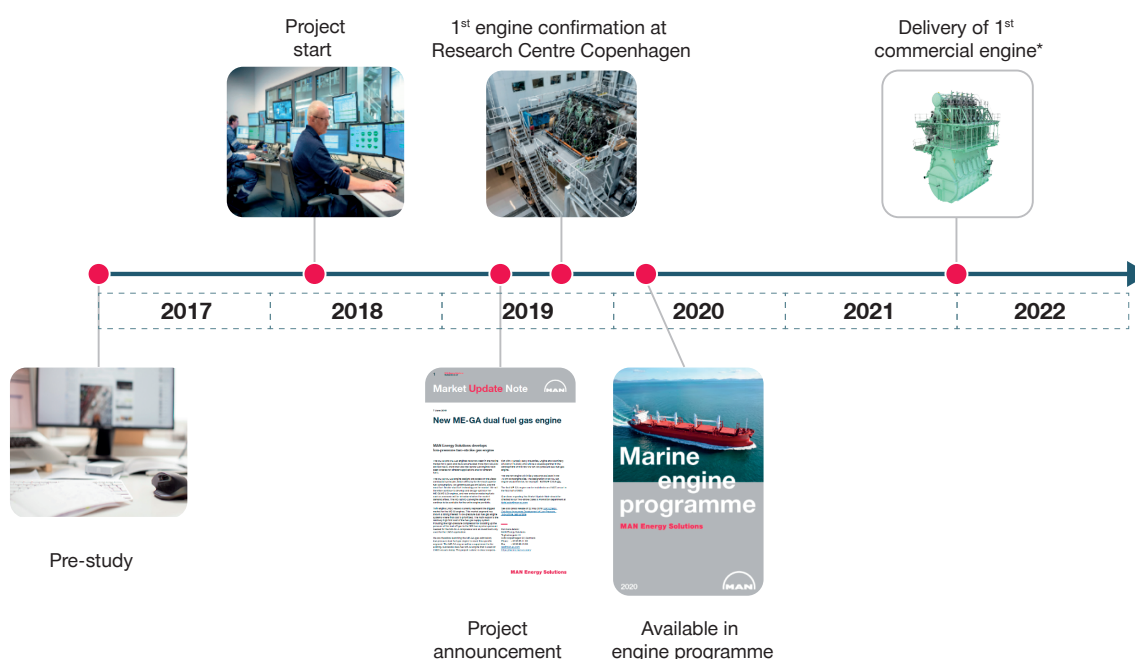
Copenhagen. Fig. 3 shows milestones in the development of the engine, one of these is that the ME-GA engine will be ready for delivery at the end of 2021.

## If you need further information

Questions regarding this Market Update Note should be directed to our Two-Stroke Sales & Promotion department at [kjeld.aabo@man-es.com](mailto:kjeld.aabo@man-es.com)

[See previously released MUN of 16 September 2019 regarding the ME-GA engine.](#)

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\*Includes EGR versions, find the performance strategy of these in section 3

Fig. 3 Timeline