

Delivery of G95ME-C10.6 engine for Large Container Ships 84

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By Builder

By Ship Type

Largest two-stroke marine propulsion engine G95ME-C10

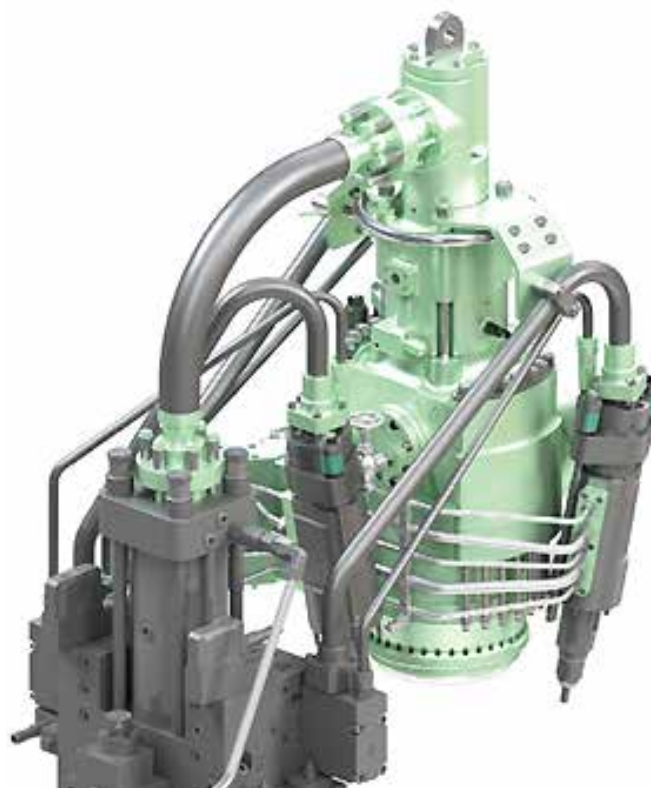
We, MITSUI E&S Co., Ltd. manufacture a two-stroke marine propulsion engine under license from MAN energy solutions. G95ME-C engine is the largest engine applied to container vessels with output range from 27MW to 82MW.

G95ME-C10.6

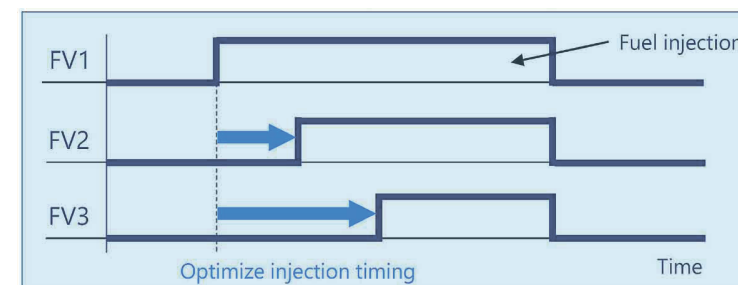
The engine with improved SFOC (Specific Fuel Oil Consumption) in the low load range based on the existing G95ME-C10.5. The layout area and engine footprint are same as conventional engine. G95ME-C10.6 has the following feature.

Sequential fuel injection

The sequential fuel injection can be applied in the high load range and NOx emission rate is reduced. The technology controls fuel injection timing individually for each injection valve. Reduced NOx emission rate in the high load range is used as SFOC improvement in the low load range.



G95ME-C10.6 engine



Overview of Sequential fuel injection

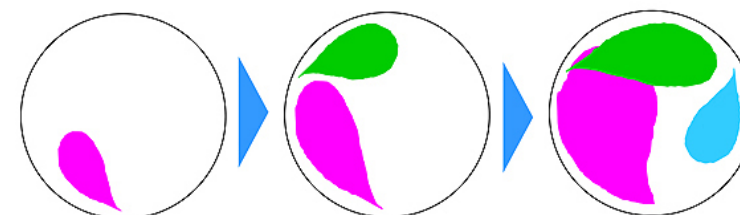


Image of fuel injection

Delivery of LNG-fuelled main engine S60MEC10.5-GI for car carriers 85

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In 2015, MITSUI E&S Co., Ltd. manufactured LNG-fueled engine; ME-GI (Gas Injection) which offers environmental benefit of decreasing large amount of CO₂, SO_x and PM emission. It has been adopted and delivered the container ship, LNG carrier and car carrier and so on.

Now, we have delivered 6S60ME-C10.5-GI engine applied with the latest ME-GI Mk.2 for car carrier, which has the following features.

Features of ME-GI Mk.2 system

● Reduction of pilot oil consumption

The ME-GI engine needs the injection of a small amount of pilot oil as ignition sources. The conventional type (ME-GI Mk.1) required 3% pilot oil consumption at L1 point. On the other hand, it is possible to reduce from 3% to 1.5% of pilot oil for ME-GI Mk.2. By adding a lift function to the fuel valve, it is possible to inject small amount of pilot oil using only small atomizer holes during gas operation.

● 1cyl. Gas cut operation function

When a problem occurs in a specific cylinder during gas operation, the gas operation is stopped in all cylinders and changeover to fuel oil operation. By identifying the cylinder in which the problem occurred, the other cylinders can restart gas operation.

● Simplification around the cylinder cover and piping

Removing the double wall return pipe has simplified around the cylinder cover and piping.

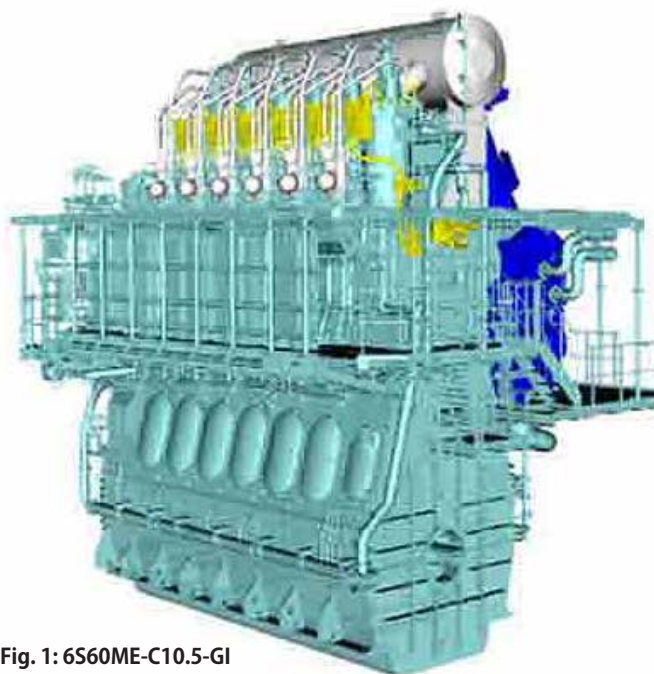
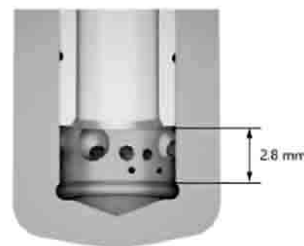


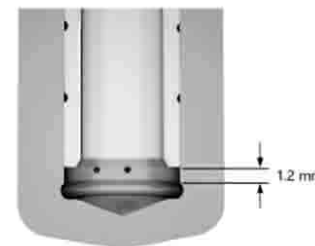
Fig. 1: 6S60ME-C10.5-GI

During fuel operation



Large and small holes

During gas operation



Small holes only

Fig. 2: Fuel valve

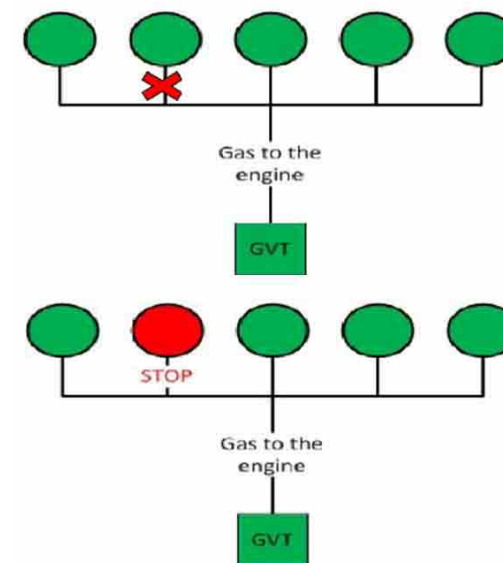


Fig. 3: 1cyl. Gas cut

Received consecutive orders for methanol-fuelled main engine (ME-LGIM) 86

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In 2015, MITSUI E&S Co., Ltd. released world's first methanol-fuelled ME-LGIM (Liquid Gas Injection Methanol) engine, which offers environmental benefit of decreasing amount of CO₂, SO_x, PM emission. As methanol is liquid form and easy to handle, the cost of methanol supply system can be lower compared to gas system. Three ME-LGIM engines, 7S50ME-B9.3-LGIM, were delivered to shipyard and installed on methanol carriers. These three methanol-powered vessels went into service in 2016.

And in 2023, we have received the orders of many LGIM engines ; 6G80ME-C10.5-LGIM for Container vessels and 7G50ME-C9.6-LGIM for Panamax bulk carriers. Many customers are interested in methanol fuelled vessels for using "green methanol" in future to comply with GHG regulations.

Features of ME-LGIM system

- Same as ME-GI engine, ME-LGIM is dual fuel engine which can run on both conventional fuel oil as primary fuel and methanol as secondary fuel. Engine operation mode can be selected between FO mode (fuel oil running) and SF mode (methanol running).
- Diesel type combustion is adopted to methanol running as same as fuel oil running.
- Compared with normal ME engine, only the supply line and fuel injection valve for methanol are newly added on the engine and the other parts including fuel oil line are remaining as conventional.
- Engine output and load response of methanol running



7S50ME-B9.3-LGIM

- is almost the same as that of fuel oil running, and totally independent of weather/sea condition or engine load.
- In case of detecting abnormal condition during methanol running, the engine automatically changes to fuel oil

running immediately.

- ME-LGI type engine can also be adopted for the other secondary fuel such as ethanol, LPG, and dimethyl ether

Entered service of hydraulic waste heat recovery system, THS2 87

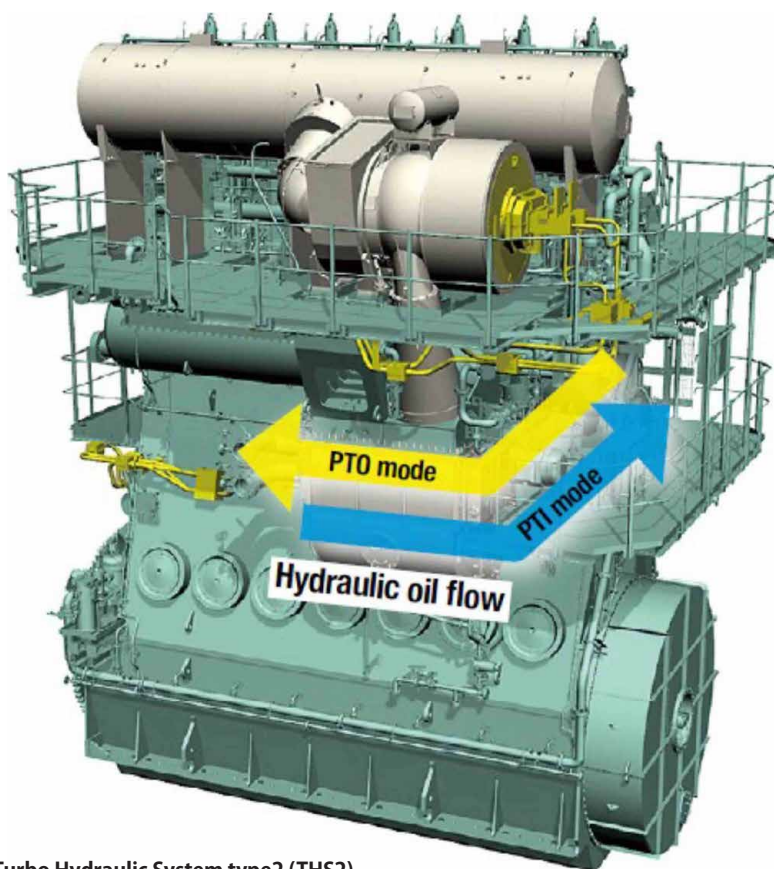
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Turbo Hydraulic System type2 (THS2)

The excess exhaust gas energy can be utilized by the recent improvement of the efficiency of turbocharger for the marine engine. THS (Turbo Hydraulic System), developed by MITSUI E&S Co., Ltd., is a system which recovers and uses the excess gas energy as hydraulic power.



Turbo Hydraulic System type2 (THS2)

THS is very compact compared to traditional waste heat recovery system and consequently large modification of the engine room is not required. THS2 is a system specialized ME-C engine, following the conventional THS technology, and is also applicable to Tier III engine. Furthermore, it is used with EcoEGR at the same time. THS2 has the following two operating mode.

PTO mode - Hydraulic oil power supply to assist engine rotation

PTO (Power Take Off) mode can be applied at 50% load or more. THS is a system which recovers and uses the excess gas energy as hydraulic power, thereby, specific fuel oil consumption can be reduced by max. 2% and EEDI can be improved. In addition, it is also possible to assist the engine rotation by using excess exhaust gas energy to crankshaft side.

PTI mode – Hydraulic oil power supply to assist T/C rotation

PTI (Power Take In) mode can be applied in the low load range. Turbocharger speed is increased and the scavenging pressure is also increased. As a result, the engine operating range with the auxiliary blower stopped condition can be extended, contributing to further slow steaming. In addition, the required engine load is reduced by PTI and thereby, the acceleration time of the engine speed can be shortened.

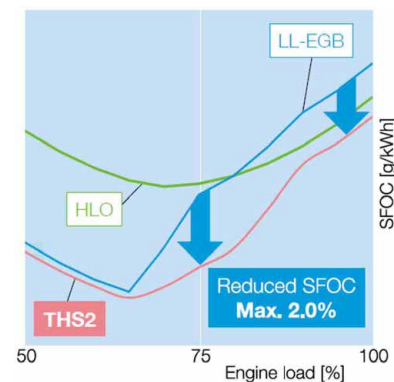


Image of Fuel consumption rate of THS2

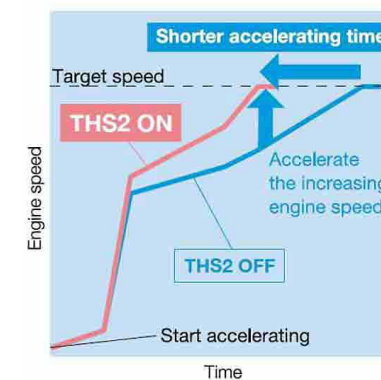
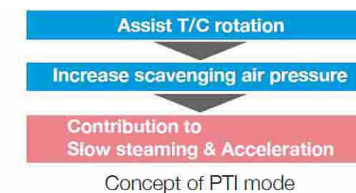


Image of improved acceleration by THS2

Received first order of High Pressure BOG Compressor for LNG fuelled vessel with ME-GI engine 89

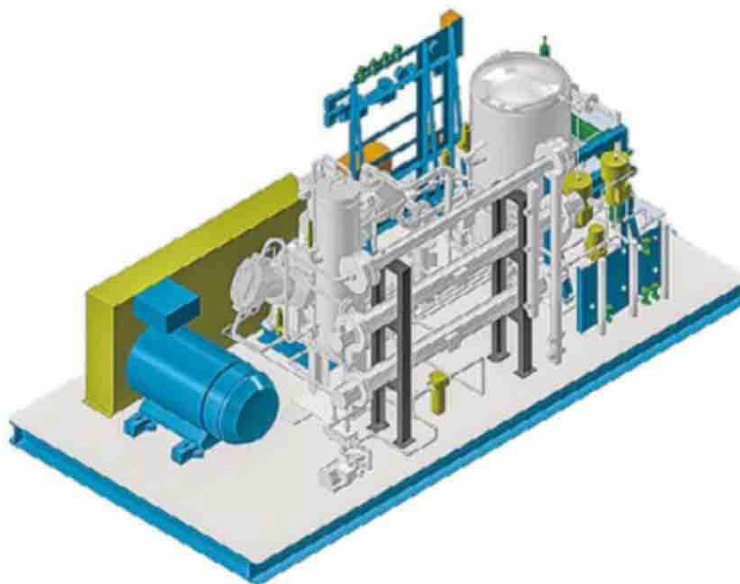
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High Pressure BOG Compressor System Outline

MITSUI E&S Co., Ltd. has released a BOG (Boil Off Gas) Compressor for LNG fuelled vessels. The product can compress BOG to high pressure and supply it as fuel for the main engine. This technology is attracting attention as energy saving with effective utilization of excess BOG. The capacity is suitable for excess BOG treatment of LNG fuelled vessels and applicable for various ship types.

System Outline

The compressor itself is proven type of many delivery records for land automotive CNG stations. We provide the compressor as a integrated unit including associated equipment, e.g. snubbers and coolers.



Compressor unit type	WT3-110GH
Compressor type	W-type 3-stage
Flow rate [kg/h]	250
Discharge pressure [MPaG]	31.5

Received consecutive orders of high-pressure LNG pump for LNG-fuelled main engine (ME-GI) 90

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MITSUI High Pressure LNG Pump

MHP System Outline

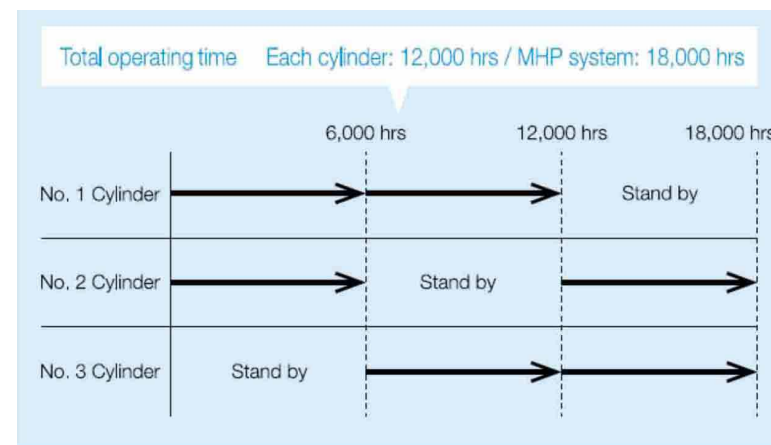
MITSUI E&S Co., Ltd. has originally developed and released Mitsui High Pressure LNG Pump (MHP) as a fuel supply system for the dual fuel engines using high pressure LNG fuel (ME-GI engines). The MHP system uses Hydraulic Drive Unit to control the operation of each cylinder of the High Pressure LNG Pump individually. Thereby standby cylinders can be installed on the same skid. In addition, the cylinder speed is designed to be low, and the life span of the cylinder is extended. Furthermore, MHP system can prevent the

sudden rise of LNG discharge pressure by controlling the startup from a low-speed cycle and the rapid stop operation in case of the emergency.

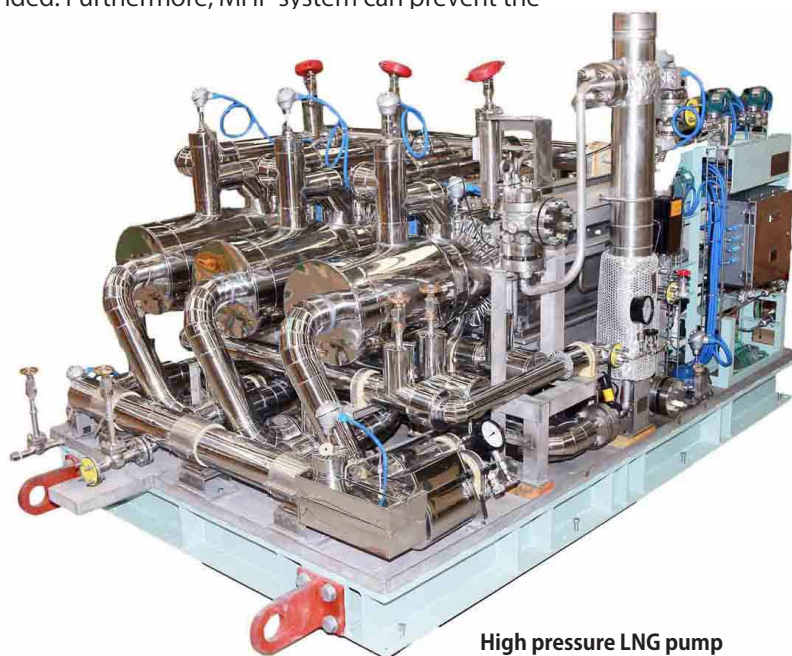
MHP Series Specifications

According to the required flow rate of the main engine, the number of cylinders can be selected as shown in the table below.

The design of the cylinder is same for all MHP models, so the cylinder can be supplied quickly even if something wrong with the cylinder.



Life span image of cylinder operation



High pressure LNG pump

TYPE	Cylinder No.		
	MHP-3	MHP-4	MHP-5
Engine output [MW]	~ 18.6	~ 27.9	~ 37.2
Cylinder No.	3	4	5
Operation Cylinder No.	2	3	4
Flow rate [L/min]	~ 70	~ 105	~ 140
Flow rate [kg/h] (@460kg/m ³)	~ 1,930	~ 2,895	~ 3,860