



TECHNICAL CIRCULAR

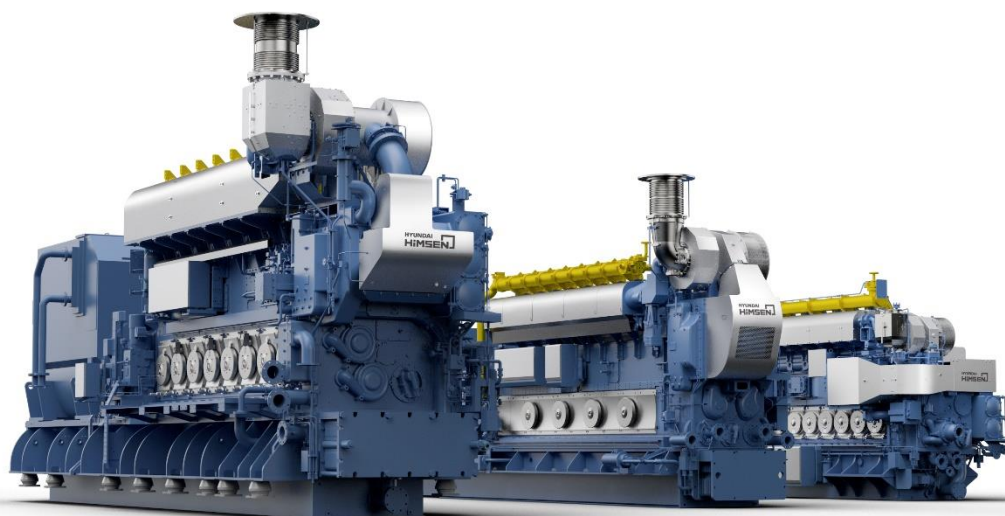
SUBJECT: METHANE SLIP REDUCTION TECHNOLOGY

TYPE: LNG DUAL FUEL ENGINE

TEC No.: TEC2022-K2V0-007-YO-R0

DISTRIBUTION

Marine	<input checked="" type="checkbox"/> Ship yard	<input checked="" type="checkbox"/> Ship owner
Stationary	<input type="checkbox"/> Power plant	



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[BACKGROUND]

This technical circular is for introducing methane slip solution of HiMSEN Dual Fuel (hereinafter DF) engines. Everyone knows that regulations on reduction of Green House Gases (hereinafter GHG) are getting strengthened now. Among greenhouse gases, methane generates a larger greenhouse effect. It has 29.8 times of Global Warming Potential of 100 years compared with CO₂ according to Sixth Assessment Report of Intergovernmental Panel on Climate Change (IPCC). Therefore, HHI-EMD studied methane slip reduction technology to DF engines.

[INTRODUCTION]

HHI-EMD developed technology to reduce methane slip in two aspects: control logic and combustion components.

STEP 1 : Update of Control Logic

In terms of engine operation, newly developed Methane Slip Solution (hereinafter MSS), sub-operating mode from the existing gas mode, could be applied as an option. It is integrated in HiMSEN DF Engine Control System (Type: HiMECS-A2, HiMECS-A2+, HiMECS-S).

The MSS mode is consist of Multi Pilot Injection (hereinafter MPI) and Cylinder Cut-Off (hereinafter CCO). This mode is operated with predefined optimal combination of both modes and parameters for each DF engine at 0 to 50% loads. The operator should select the on/off of this function via the vessel control system in order to enter the MSS mode.

1. MPI

By additional pre-injection of pilot fuel, the mist of diesel fuel is pre-mixed with the air, which promotes flame propagation in the combustion.

2. CCO

By means of the superiority characteristics of high load combustion performance, the Nth gas admission valve is intentionally deactivated to increase the load of the active cylinder.

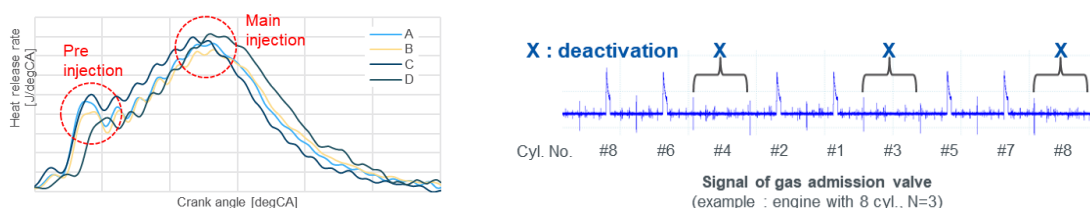


Figure 1. Operation of MPI and CCO

The followings are pre-conditions prior to enter the MSS mode.

- Gas mode operation
- Engine remote control position
- Current load is below max. load of MSS mode.

When MSS mode is requested,

- If the engine is being operated in gas mode, the engine enters MSS mode immediately.
- Even if the MSS mode is requested in diesel mode, the engine is operated in diesel mode continuously without any malfunction.

If the engine control system detects abnormal condition which cannot be maintained with MSS mode, the engine itself escapes the MSS mode and returns back to MSS mode after the engine operation is stable.

STEP 2 : Exchange of Combustion Components

In terms of design, the following combustion parts with the minimized crevice volume (hereinafter CV) are applied.

- Cylinder head
- Cylinder liner
- Flame ring
- Metal gasket

By reducing the crevice volume, methane slip can be further reduced at the entire load.

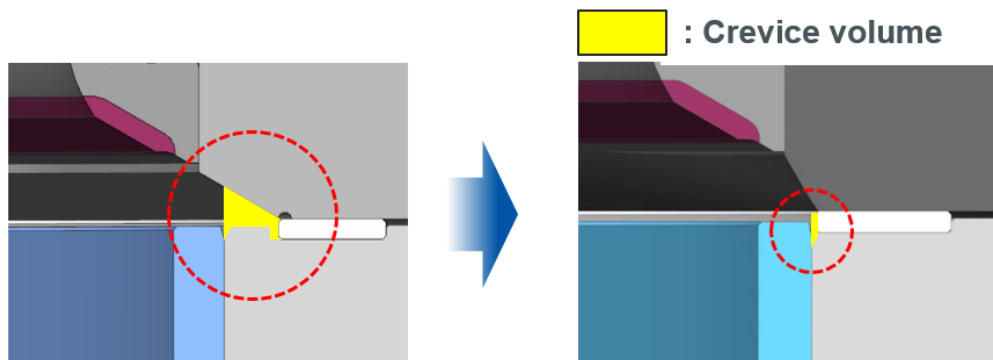


Figure 2. Change in crevice volume of combustion chamber parts

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The reduction rate (for reference) of methane slip are shown in the figure below.

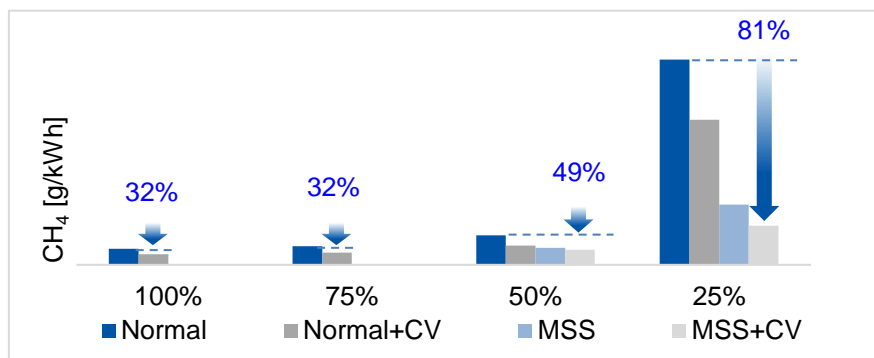


Figure 3. Methane slip reduction rate of HiMSEN DF

[CONCLUSION]

HHI-EMD developed the methane slip reduction technology for HiMSEN DF engines to cope with stricter GHG emission regulations. This technology includes the control logic (MSS) to enhance the combustion performance and the combustion components (CV) with minimized crevice volume. MSS can be applied as an option and CV as a standard for newly contracted projects from July 2022. For MSS, the vessel control system shall be modified accordingly in consideration of additional communication, control, etc.

This technology can also be applied to the delivered vessels by retrofit. In this case, the additional tests and amendment of EIAPP certificate are required because MSS and CV affect NOx emission. For details of retrofit procedures, please contact Hyundai Global Service.

If you need more detail information about this technical circular, please contact your nearest HiMSEN service station or follow the links below.

- HYUNDAI HEAVY INDUSTRIES – ENGINE & MACHINERY (HHI-EMD)
- : <http://www.hyundai-engine.com/customer/customer07.asp>
- HYUNDAI GLOBAL SERVICE(HGS)
- : <http://www.hyundai-gs.com/eng/Main.do>

[The end]

Yours sincerely,



K.H.Kim / Senior Engineer

Head of Engine Development & Engineering Dep't

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※ HiMSEN Action Code

	Engine in service on vessel/plant (Commerical operation)	Engine in production (Before commerical operation)	New contact engine (Before contract)
A	Modification by HHI-EMD, Disposal of stock		Standard application
B	Modification upon customer's firm order (Spare parts modification by HH-EMD)	Modification by HHI-EMD, Disposal of stock	Standard application
C	Modification upon customer's firm order		Standard application after using stock material
D	Modification upon customer's firm order		Standard application
E	Modification upon customer's firm order		Option
F	Information delivery		