

**DAIHATSU**

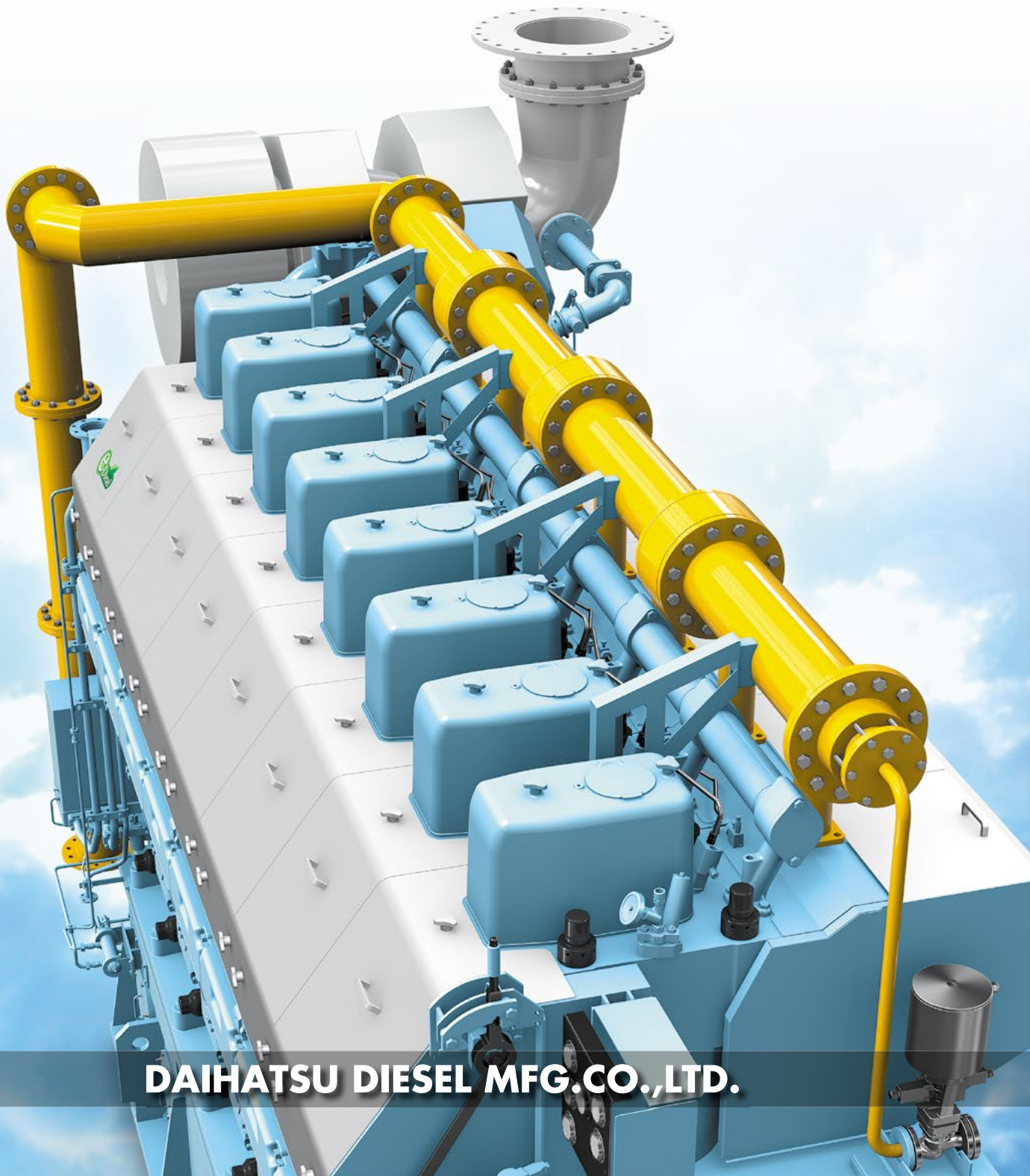
**DAIHATSU DIESEL**

**DF**

**Dual-Fuel Engines**

**DE20DF DE23DF**

**DE28DF DE35DF**

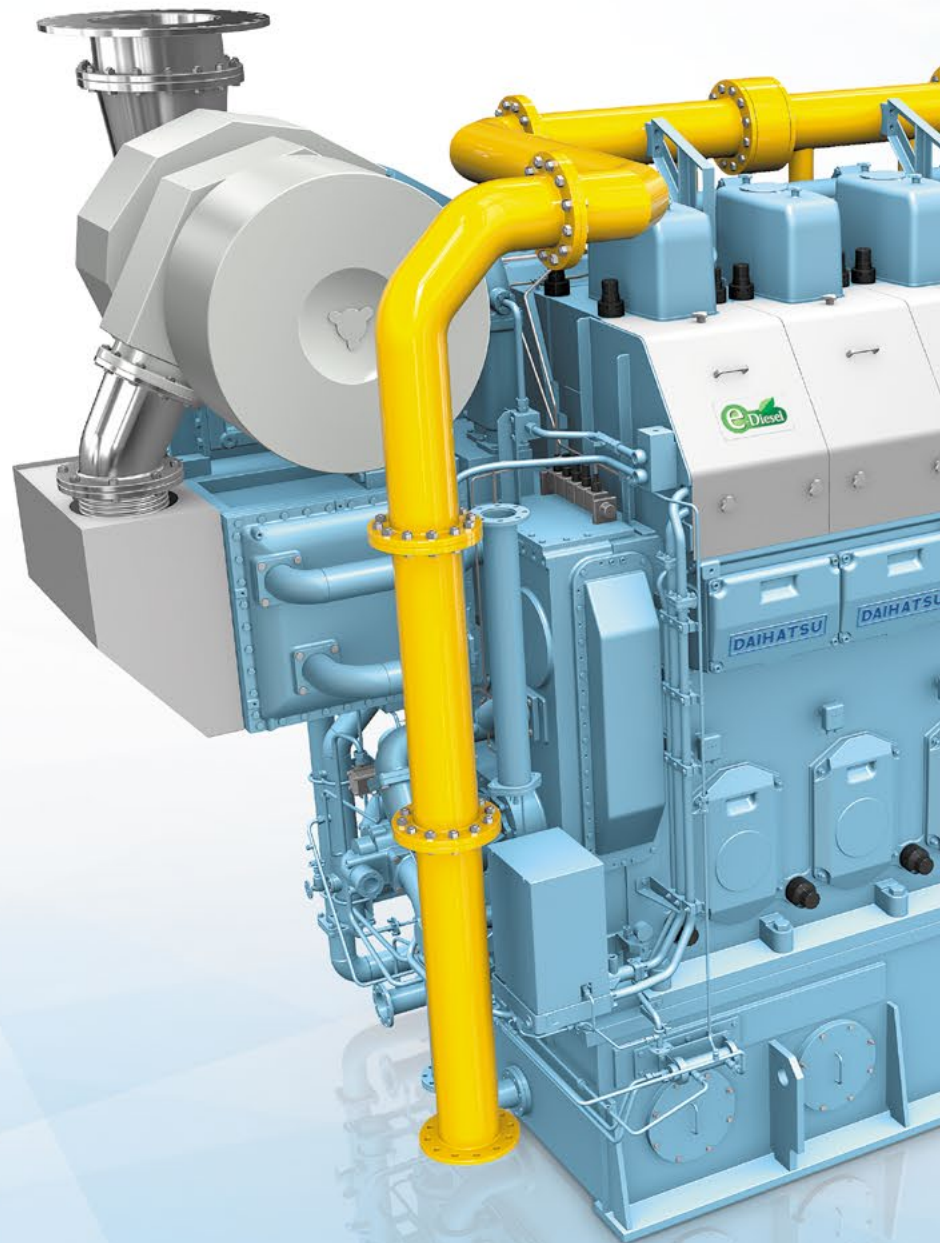


**DAIHATSU DIESEL MFG.CO.,LTD.**

# Daihatsu Diesel Dual-Fuel Engines: High Environmental Performance through Precise and Detailed Control

Dual-fuel engines that operate on both environmentally friendly natural gas and conventional petroleum fuel require precise control and must offer high safety and durability. Daihatsu Diesel has incorporated the results of extensive research on the internal combustion engine into the development of our dual-fuel engines.

Daihatsu Diesel dual-fuel engines offer accurate and stable operation on natural gas while incorporating the excellent environmental performance inherited from the company's diesel engines, which boast features such as a fuel injection system with high control precision, superb fuel efficiency, and outstanding engine durability.



**DAIHATSU DIESEL**

**DF**

**Dual-Fuel Engines**

**DE20DF DE23DF**

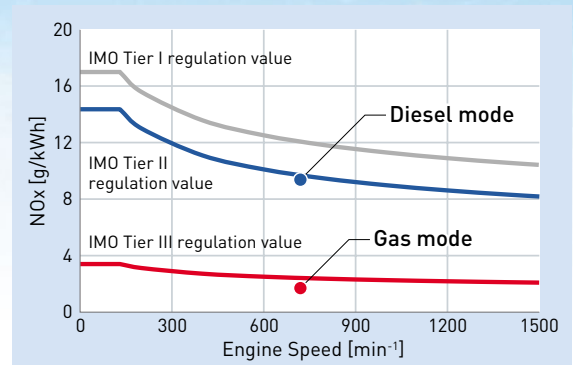
**DE28DF DE35DF**



Type approval certificate

## Compliance with NOx Tier III standards in gas mode and Tier II standards in diesel mode

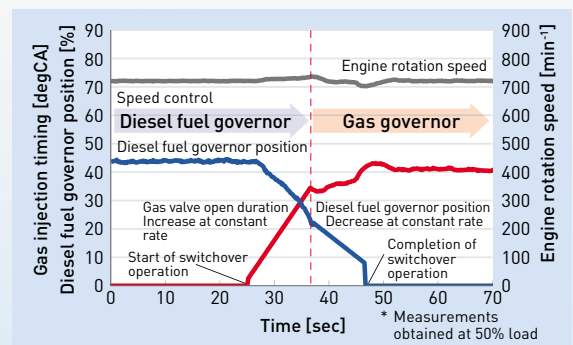
Daihatsu Diesel dual-fuel engines comply with the IMO NOx Tier III standards when running in gas mode and with the Tier II standards when running in diesel mode. The operating mode can be switched as needed, such as when navigating on a sea where clean engine operation is required or when there is a fuel procurement issue. They can operate in the most suitable mode according to the situation.



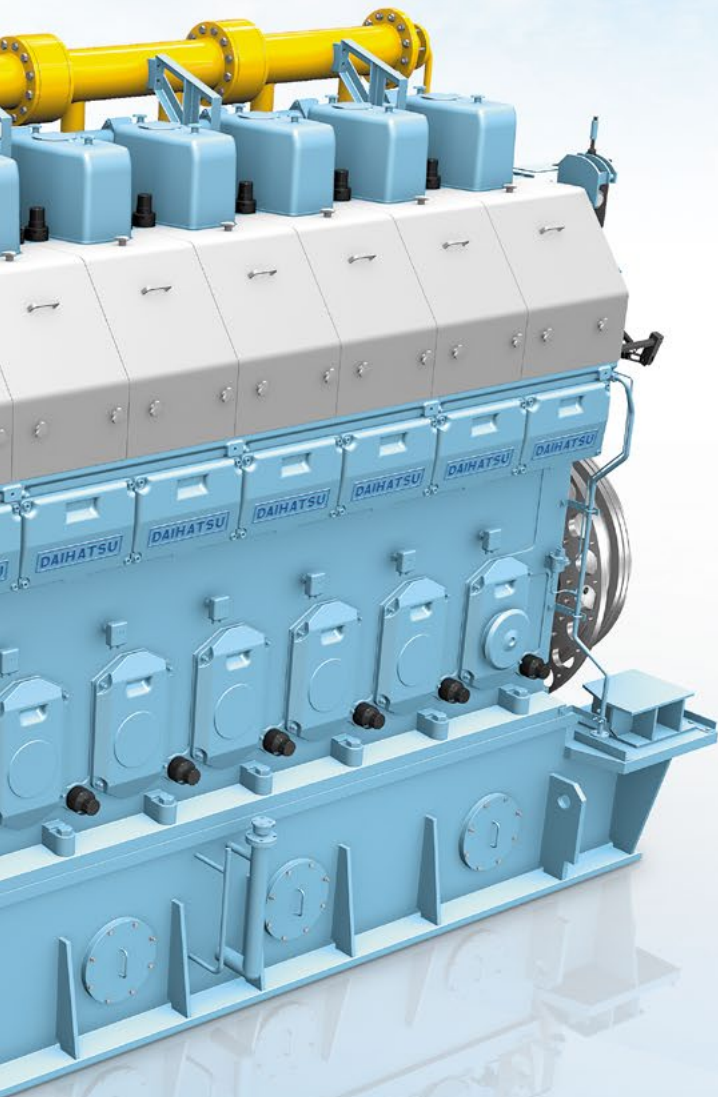
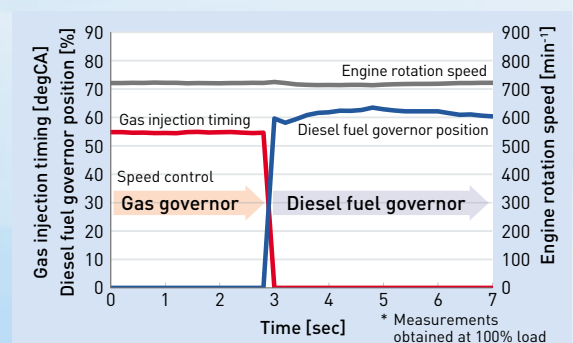
## No change to engine rotation speed when switching to gas mode or diesel mode

Advanced fuel injection control ensures a smooth switchover to gas mode or diesel mode without changing the engine rotation speed. This eliminates any output interruption when switching modes.

### Diesel mode → Gas mode



### Gas mode → Diesel mode



# Sophisticated Technologies Behind High Efficiency

Technologies that have been accumulated through the development of diesel engines were applied to develop the gas combustion system.

High-efficiency combustion is ensured in both gas mode and diesel mode operation.

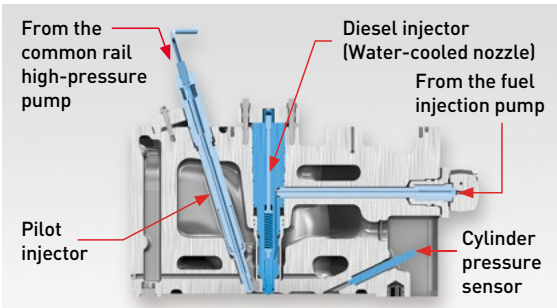
## Accurate fuel injection using a common rail

A common rail system is used for the pilot fuel injection. A precise amount of high-pressure fuel is injected at the optimal timing according to the operating condition, thus helping to improve fuel economy and reduce NOx.



## Twin nozzles

Using the two injection devices, the main nozzle and pilot nozzle, the valve train control system achieves optimal and precise operation in each cycle, thus attaining high combustion efficiency.

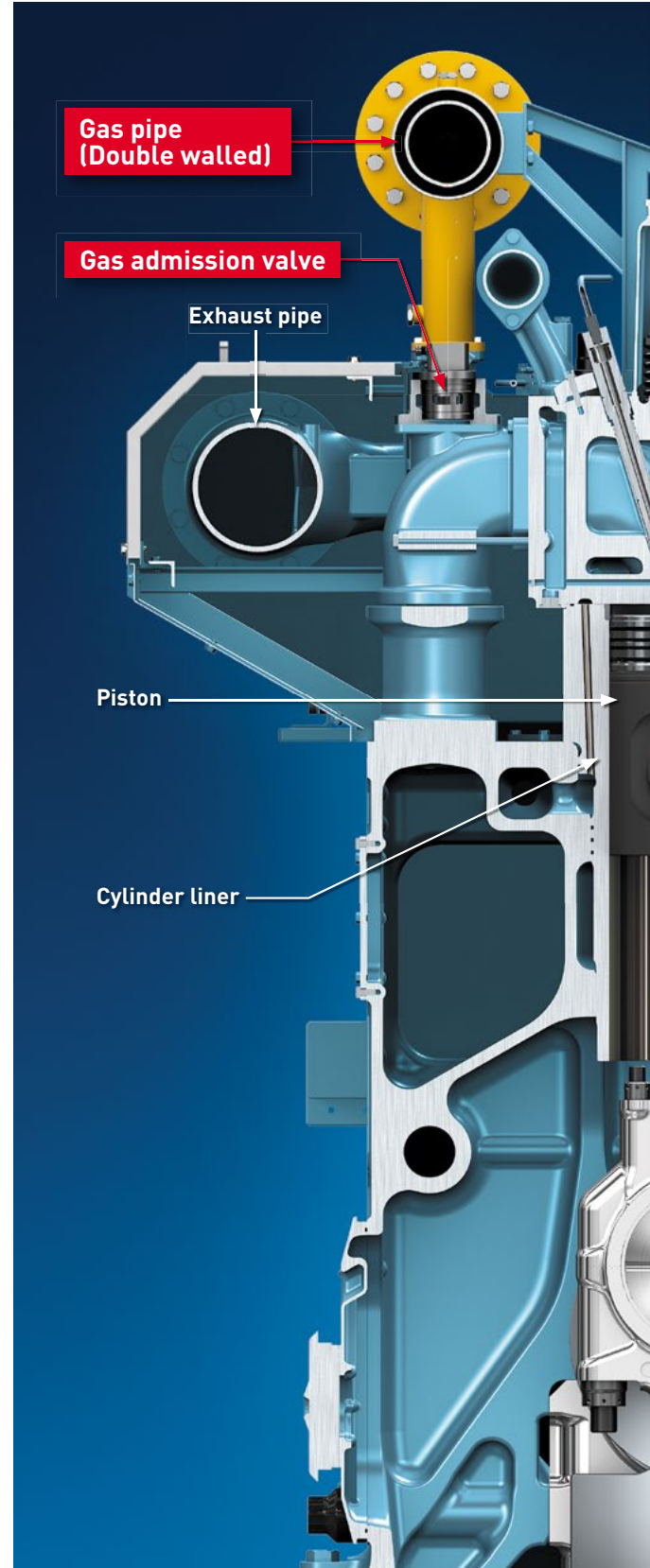



## Compatible with various types of fuels

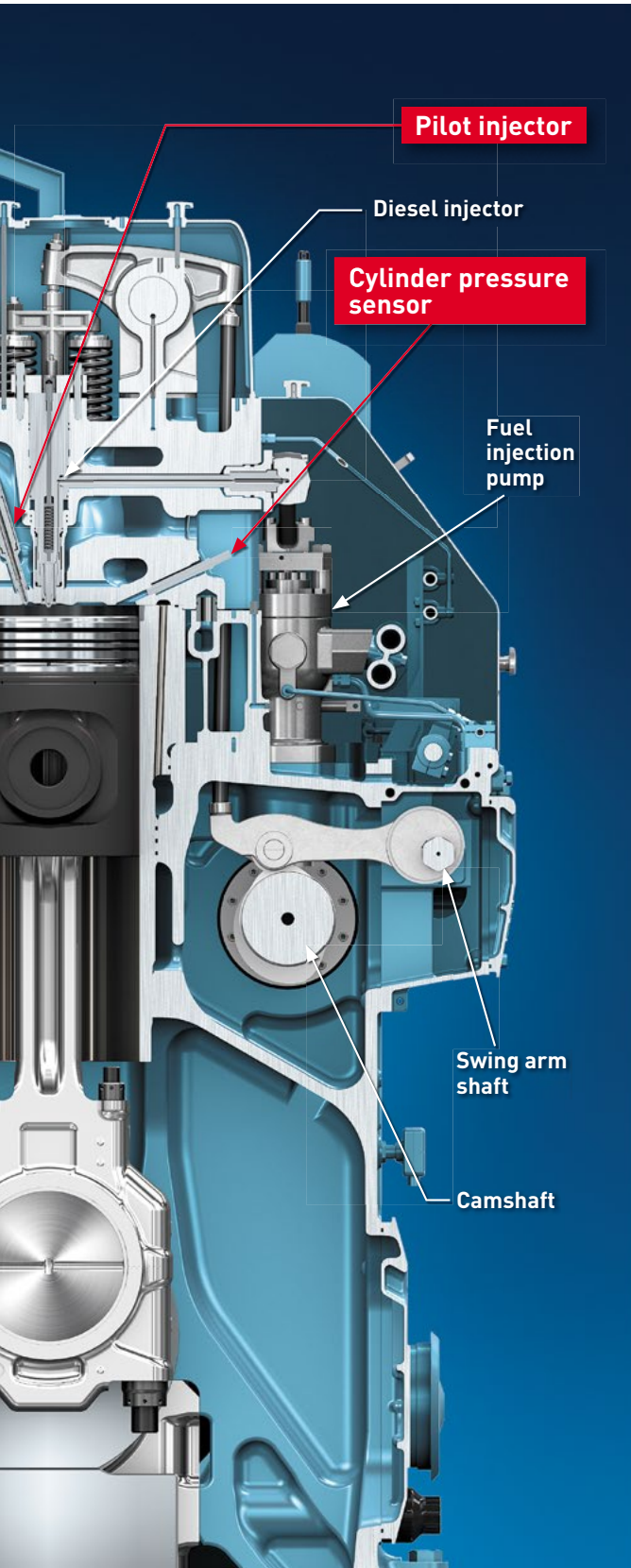
|             |                               |
|-------------|-------------------------------|
| Gas mode    | 99% Natural gas               |
|             | 1% MDO/MGO (pilot fuel)       |
| Diesel mode | 97% MDO/MGO/HFO               |
|             | 3% MDO/MGO (injector cooling) |

## Gas pipe featuring a double-walled structure

The gas pipe features a double-walled structure for extra safety.



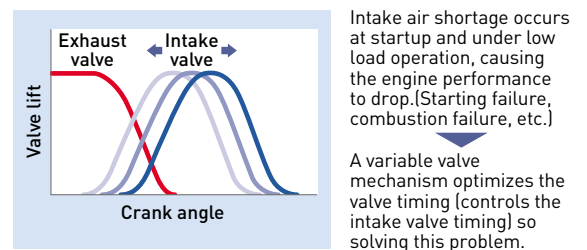
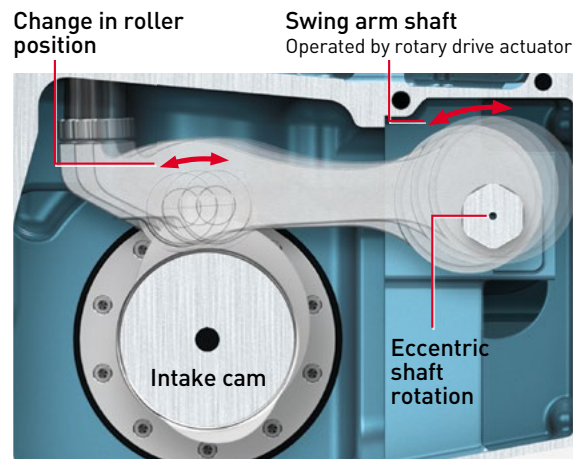
\* The parts indicated with the red background [  ] are modified from existing parts of conventional diesel engines.



designed exclusively for the DF engine; other parts are

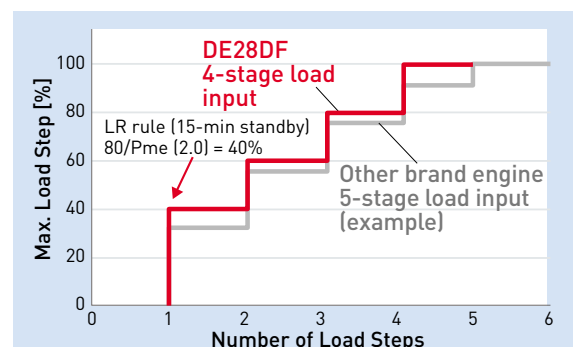
## Variable valve timing mechanism

The valve train control system incorporates a variable valve timing mechanism. The system optimally controls the timing of the valve opening and closing according to the engine speed and load, thus helping to suppress NOx emission and improve anti-knocking performance. It also provides control to provide stable output at startup and during low-load operation.

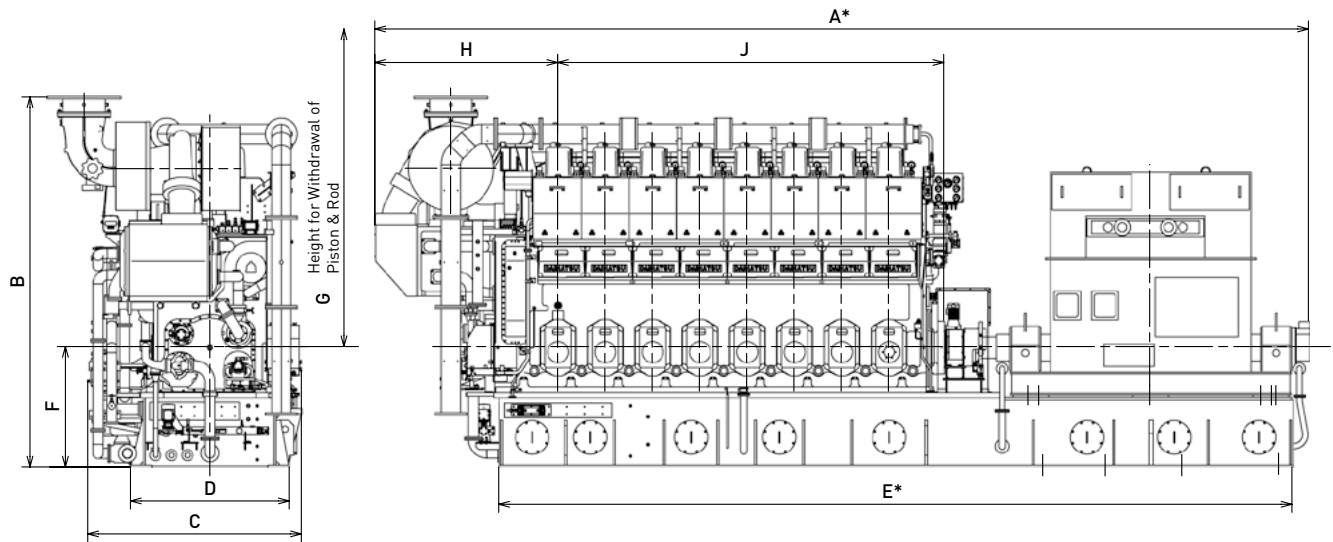


## Four-stage load input for superb load response

Each system is optimally controlled to increase the load from startup to maximum load in four stages in gas mode. This achieves quick increase of the engine speed to the usable range.



## External View



**8DE35DF**

## Dimensions and Mass

| Model   | Dimensions (mm) |      |      |      |      |      |      |      |      | Dry mass*<br>(ton) |
|---------|-----------------|------|------|------|------|------|------|------|------|--------------------|
|         | A               | B    | C    | D    | E    | F    | G    | H    | J    |                    |
| 6DE20DF | 5510            | 3245 | 1830 | 1040 | 4290 | 1000 | 1530 | 1240 | 2035 | 20                 |
| 6DE23DF | 6205            | 3330 | 1925 | 1170 | 5420 | 1150 | 1645 | 1460 | 2300 | 27                 |
| 6DE28DF | 7190            | 3070 | 2070 | 1300 | 5530 | 1300 | 1715 | 1460 | 2580 | 36                 |
| 6DE35DF | 9065            | 3950 | 2570 | 1780 | 7460 | 1350 | 2555 | 2050 | 3270 | 81                 |
| 8DE35DF | 10470           | 4150 | 2570 | 1780 | 8895 | 1350 | 2555 | 2050 | 4330 | 98                 |

\* Actual dimensions and mass may vary depending on the specifications of the generator unit.

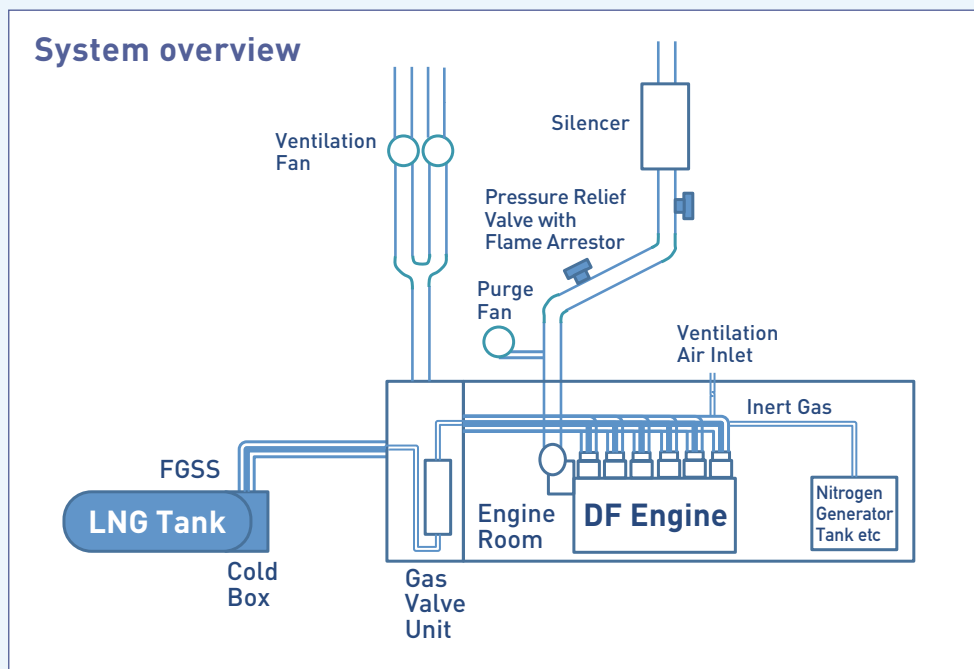
## Main Specifications

| Engine model             |                   | 6DE20DF   | 6DE23DF  | 6DE28DF  | 6DE35DF  | 8DE35DF |
|--------------------------|-------------------|---|----------|----------|----------|---------|
| Bore x Stroke            | mm                | Φ205×300  | Φ230×320 | Φ280×390 | Φ350×440 |         |
| Number of cylinders      | -                 | 6   | 6        | 6        | 6        | 8       |
| Rotation speed           | min <sup>-1</sup> | 900   | 900      | 720      | 720      |         |
| Maximum engine output    | kWm               | 890   | 1,200    | 1,730    | 3,060    | 4,080   |
| Maximum generator output | kWe               | 840   | 1,140    | 1,660    | 2,950    | 3,940   |
| NOx emission rate        | -                 | ≤ Tier III (gas mode)<br>≤ Tier II (diesel mode)        |          |          |          |         |
| Fuel                     | -                 | Natural gas (gas mode)<br>MDO, MGO, (HFO) (diesel mode) |          |          |          |         |
| Pilot fuel (gas mode)    | -                 | MDO or MGO  |          |          |          |         |



## Backed by R&D that takes marine use into full consideration, Daihatsu Diesel Dual-Fuel Engines continue evolving.

At Daihatsu Diesel's Moriyama Factory, we take onboard installation into full consideration in the research and development of marine engines. Through the R&D process, our dual-fuel engines have been refined and cleared various issues that they might encounter in actual usage. We spare no effort in R&D. For example, we have constructed a natural gas supply facility on the premises of the factory for the research and development of fuel supply and storage equipment. We continue to make our products safer and more reliable.





## **DAIHATSU** **DAIHATSU DIESEL MFG.CO.,LTD.**

[www.dhtd.co.jp](http://www.dhtd.co.jp)

### **Head Office**

1-30, Oyodo Naka 1-chome, Kita-ku, Osaka, 531-0076 Japan  
TEL: +81-6-6454-2393 FAX: +81-6-6454-2686

### **Tokyo Office**

2-10, Nihonbashi-Honcho 2-chome, Chuo-ku, Tokyo, 103-0023 Japan  
TEL: +81-3-3279-0827 FAX: +81-3-3245-0359

### **Moriyama Division**

45 Amura-cho, Moriyama-city, Shiga, 524-0035 Japan  
TEL: +81-77-583-2551 FAX: +81-77-582-5714

### **Daihatsu Diesel Himeji Mfg. Co.,Ltd.**

12-8, Fuji-cho, Hirohata-ku, Himeji-city, Hyogo, 671-1123 Japan

### **Daihatsu Diesel (EUROPE) Ltd.**

28th Floor, One Canada Square, Canary Wharf, London E14 5AA,  
United Kingdom  
TEL: +44-20-3871-5000 FAX: +44-20-7512-9291

### **Daihatsu Diesel (AMERICA), Inc.**

380 N Broadway, Suite 302, Jericho, N.Y. 11753 U.S.A.  
TEL: +1-516-822-3483/4 FAX: +1-516-822-3485

### **Daihatsu Diesel (ASIA PACIFIC) Pte.Ltd.**

16 Collyer Quay, Income at Raffles #29-02, Singapore 049318  
TEL: +65-6589-9510 FAX: +65-6536-4964

### **Daihatsu Diesel (SHANGHAI) Co.,Ltd.**

Room A-B, Floor 14, Huamin Empire Plaza, No.728, Yanan Rd.(W.),  
Shanghai, 200050, China  
TEL: +86-21-6225-7876/7 FAX: +86-21-6225-9299

- All information contained in this pamphlet is correct at the time of printing, but may be subject to change without notice.