



Marine product guide

Engines and generator sets





Marine product guide

Engines and generator sets

Contents

| | | |
|---|----|--|
| Introduction | 2 | |
| Rating definitions | 4 | |
| Fuel consumption method | 6 | |
| Engine model name explanation | 7 | |
| | | |
| Propulsion specifications | 8 | |
| Diesel-electric propulsion specifications | 50 | |
| Auxiliary generator specifications | 64 | |
| Generator set specifications | 90 | |
| Gas generator set specifications | 98 | |

Mitsubishi marine power

Mitsubishi Heavy Industries (MHI) boasts a long tradition in manufacturing engines, tracing back to the production of Japan's first unit for commercial use in 1917 and spanning both diesel and gasoline types in two – and four – stroke configurations. MHI continues to supply engines for a multitude of applications, from industrial and marine to off-highway and agricultural uses, and in line-ups ranging from as small as 0.3 kW to gigantic 66,000 kW. As a result, MHI now ranks as one of the world's leading engine manufacturers.

To date MHI has supplied more than 120,000 marine diesel engines for both main propulsion and auxiliary applications in ships and boats. They are preferred especially in applications demanding dependable, continuous operation combined with outstanding durability, excellent fuel efficiency and minimal requirements with respect to lubricants and spare parts. This way, MHI marine engines offer the dual advantages of ease of operation and optimum ease of maintenance.

The company's impressive record of engine deliveries is proof of MHI's close and unbroken relationship with marine industries.

Marine engines made in Japan

All MHI marine diesel and gas engines are manufactured to the highest standards, applying state-of-the-art production facilities combined with experienced workmanship. Production is carried out exclusively at the Sagami Works in Japan, a facility conforming to strict ISO-9001 international quality standards as certified by DNV (Det Norske Veritas, Norway).

MHI marine engines have been purpose-designed for marine use. The base of the engine was designed based on marine vessels used in Unrestricted Continuous Duty circumstances.

According to our customers, the engines perform excellent in terms of reliability, durability, fuel consumption, long overhaul and easy maintenance.

Emission regulations

MHI has long been engaged in the production of four-stroke cycle diesels, and already its conventional models incorporate a number of important breakthroughs. Next to that, MHI makes significant investments in the Environment-friendly engines development.

A summary of major regulations which Mitsubishi Heavy Industries adheres to is listed here.

Regulations summary

IMO - Annex VI of MARPOL 73/78 which International Maritime Organization (IMO) has issued, entered into force on 19 May 2005. It applies retroactively to new engines greater than 130 kW and installed on vessels constructed from 1 January 2000 or to those which will undergo a major conversion after that date. The regulation also applies to fixed and floating rigs and to drilling platforms.

EU (Includes CCNR) - The emission limitations are valid for propulsion and auxiliary engines of inland vessels in EU inland waterways (Non-Road Directive 97/68/EC, amended 2010/26/EU). Alternatively, the limitations set by the Central Commission for Navigation on the Rhine (CCNR) may be applied (mutual agreement was reached on 1 July 2007).

The following classifications will appear on subsequent pages to identify the regulation with which the engine will be certified or complaint once placed on the market:

- non emission** – Not compliant to emission regulations.
- IMO-T1** – IMO Tier I compliant; Engine International Air Pollution Prevention (EIAPP) certificates available. IMO Tier I is available for replacement only.
- IMO-T2** – IMO Tier II compliant; Engine International Air Pollution Prevention (EIAPP) certificates available.
- IMO-T3** – For IMO Tier III solutions, please contact Mitsubishi Turbocharger and Engine Europe B.V.
- EU-3A** – EU NRMM for inland waterway vessels stage 3A certified (CAT V1:4).
- EU-5** – For future EU stage 5 solutions, please contact Mitsubishi Turbocharger and Engine Europe B.V.
- CCNR-2** – CCNR stage 2 certified.

Classification approvals

Mitsubishi engines are delivered tested and ready for installation on board. We are cooperating with the following major classification societies:

- American Bureau of Shipping (ABS)
- Bureau Veritas (BV)
- China Classification Society (CCS)
- DNV-GL
- Korean Register of Shipping (KR)
- Lloyd's Register (LR)
- Nippon Kaiji Kyokai (NK)
- Registro Italiano Navale (RINA)
- Russian Maritime Register of Shipping (RS)
- Russian River Register (RRR)
- Türk Loydu (TL)

For availability and more information on marine classification society certification, please contact your local distributor or Mitsubishi Turbocharger and Engine Europe B.V.

Propulsion

Unrestricted Continuous Duty (UCD)

Typical operation:

- Allowable load factor is less than 100% of rated power.
- Allowable cruising speed is less than 100% of rated speed.
- Operating hours are unlimited per year.

Typical vessel application:

- Cargo vessels and fishing boats.

Heavy Duty (HD)

Typical operation:

- Allowable load factor is up to 83% of rated power.
- Allowable cruising speed is up to 94% of rated speed.
- 100% of rated power is available intermittently for 8 h per every 24 h operation.
- Operating hours are less than 6,000 h per year.

Typical vessel application:

Working, fishing, tug and ferrie boats and passenger vessels.

Medium Duty (MD)

Typical operation:

- Allowable load factor is up to 75% of rated power.
- Allowable cruising speed is up to 91% of rated speed.
- 100% of rated power is available intermittently for 1 h per every 6 h operation.
- Operating hours are less than 3,000 h per year.

Typical vessel application:

- Pleasure and patrol boats and high performance vessels.

Diesel-electric propulsion

Typical operation:

- Average load factor is 60 - 80% of rated power.
- Operating hours are 3,000 - 6,000 h per year.
- Momentary overload: 110% is available for max. 25 h per year on emergency basis.
- 100% of rated power is available for max. 3 h per every 12 h operation.

Typical vessel application:

- Offshore and inland cargo vessels and ferries.

Auxiliary generator

Main power supply

Typical operation:

- Average load factor is 60 - 80% of rated power.
- Operating hours: 3,000 - 4,000 h per year.
- Momentary overload: 110% is available for governing purpose.

Typical vessel application:

- Fishing boats, ferries, cargo vessels and tankers.

Emergency power supply

Typical operation:

- Average load factor is 60% of rated power.
- Operating hours: up to 500 h per year.

- Overload: 110% can be used for less than 25 h per year.

Typical vessel application:

- Tankers, cargo and cruise vessels.

Gas-electric propulsion

Typical operation:

- Average load factor is 60 - 80% of rated power.
- Operating hours are 3,000 - 6,000 h per year.
- 100% of rated power is available for max. 3 h per every 12 h operation.

Typical vessel application:

- Offshore and inland cargo vessels and ferries.

RATING DEFINITIONS MEDIUM SPEED

Propulsion

Heavy Duty (HD)

Typical operation:

- Allowable load factor is less than 100% of rated power.
- Allowable cruising speed is less than 100% of rated speed.
- Operating hours are less than 8,000 h per year.

Typical vessel application:

- Inland cargo vessels, fishing boats and coasters.

Medium Duty (MD)

Typical operation:

- Allowable load factor is up to 83% of rated power.
- Allowable cruising speed is up to 94% of rated speed.
- 100% of rated power is available intermittently for 4 h per every 12 h operation.
- Operating hours are less than 3,000 h per year.

Typical vessel application:

- Tug and fishing boats.

Light Duty (LD)

Typical operation:

- Allowable load factor is up to 75% of rated power.
- Allowable cruising speed is up to 90% of rated speed.
- 100% of rated power is available intermittently for 1 h per every 6 h operation.
- Operating hours are less than 1,000 h per year.

Typical vessel application:

- Fast vessels with low load.

Heavy Duty Tugboat (HD-T)

Typical operation:

- 100% of rated power is available intermittently for 8 h per every 24 h operation.
- Operating hours are less than 6,000 h per year.
- Average load factor is 60 - 80% of rated power.

Typical vessel application:

- (Harbour) tugboats.

Diesel-electric propulsion

Continuous operation:

- Allowable load factor is less than 100% of rated power.
- Operating hours are unlimited per year.
- Overload: 110% is available for max. 25 h per year on emergency basis.

Typical vessel application:

- Ocean/sea going cargo vessels and tugboats.

Intermittent operation:

- Average load factor is 60 - 80% of rated power.
- 100% of rated power is available intermittently for less than 3 h per every 12 h operation.
- Operating hours: 3,000 - 4,000 h per year.
- Overload: 110% is available for max. 25 h per year on emergency basis.

Typical vessel application:

- Offshore vessels and harbour tugboats.

Auxiliary generator

Main power supply:

- Average load factor is 60 - 80% of rated power.
- 100% of rated power is available intermittently for less than 3 h per every 12 h operation.
- Operating hours: 3,000 - 4,000 h per year.
- Overload: 110% is available for max. 25 h per year on emergency basis.

Typical vessel application:

- Ocean/sea going cargo vessels and tugboats.

FUEL CONSUMPTION METHOD

The fuel consumption varies according to test condition, specification and application of each customer.

To obtain the fuel consumption based on the most typical test condition, we adopted average fuel consumption recommended by ISO 8178 (E3 standard test cycle for propulsion application and D2 for auxiliary applications) except for SU series*. The fuel consumption values published in this marine product guide were calculated taking each steady-state mode into account.

- | | |
|-----------|---|
| E2 | – Test cycle for “constant-speed main propulsion” applications (including diesel-electric drive and all controllable –pitch propeller installations). |
| E3 | – Test cycle for “propeller-law-operated main and propeller-law-operated auxiliary engine” application. |
| D2 | – Test cycle for “constant-speed auxiliary engine” application. |

* SU Series (Medium speed engines) belongs in a different category from our High speed Engine models, SU series indicates fuel consumption value at 100% rated power in g/kWh.

Weighting factors of type E3 ISO 8178 test cycles

| Mode number | 1 | 2 | 3 | 4 |
|------------------|------|------|------|------|
| Power (%) | 100 | 75 | 50 | 25 |
| Weighting factor | 0.20 | 0.50 | 0.15 | 0.15 |

Weighting factors of type D2 ISO 8178 test cycles

| Mode number | 1 | 2 | 3 | 4 | 5 |
|------------------|------|------|------|------|------|
| Power (%) | 100 | 75 | 50 | 25 | 10 |
| Weighting factor | 0.05 | 0.25 | 0.30 | 0.30 | 0.10 |

Fuel consumption is based on ISO 3046/1 with 5% tolerance at rated power, weighing 836 g/liter based on the regulations of JIS (Japanese Industrial Standards) and a LHV of 42,780 kJ/kg, excluding pumps.

ENGINE MODEL NAME EXPLANATION

G S 6 R2 - T2 MPTAW 3L

| | |
|--|--|
| Identical number for revision (Power up) | 3L |
| Type of charge air cooling | MPTAW |
| MPTAW | Turbocharged, double cooling, charge air cooler by closed fresh water system controlled by thermostat. |
| MPTK | Turbocharged, double cooling, charge air cooler directly cooled by sea water. |
| MPTA | Turbocharged, single cooling, charge air cooler integrated in jacket water system. |
| Compliant to emission regulations | T2 |
| C2 | CCNR-2 & IMO-T2 |
| T2 | IMO-T2 |
| Z3 | EU-3A & IMO-T2 |
| None | IMO-T1 / non emission |
| Series | R2 |
| No. of cylinders | 6 |
| S - Capital of Sagamihara | S |
| G - Gas | G |