

YANMAR

SERVICE MANUAL

MARINE DIESEL ENGINE

MODELS

1GM (10L)

2GM (F)(L)

3GM (D)(F)(L)

3HM (F)(L)

FOREWORD

This service manual has been compiled for engineers engaged in sales, service, inspection and maintenance. Accordingly, descriptions of the construction and functions of the engine are emphasized in this manual while items which should already be common knowledge are omitted.

One characteristic of a marine diesel engine is that its performance in a vessel is governed by its applicability to the vessel's hull construction and its steering system.

Engine installation, fitting out and propeller selection have a substantial effect on the performance of the engine and the vessel. Moreover, when the engine runs unevenly or when trouble occurs, it is essential to check a wide range of operating conditions—such as installation on the hull and suitability of the ship's piping and propeller—and not just the engine itself. To get maximum performance from this engine, you should completely understand its functions, construction and capabilities, as well as proper use and servicing.

Use this manual as a handy reference in daily inspection and maintenance, and as a text for engineering guidance.

Models **1GM·2GM(F)·3GM(D)(F)·3HM(F)**

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A. Engine model (3GM, 3GMD)

B. Engine model name plate and Clutch model name plate

SM/1GM•2GM•3GM(D)•3HM

A. Engine Model (3GM, 3GMD)

The difference between the engine models 3GM and 3GMD is that a different model of marine gear box is fitted to the same engine body, namely, KBW10-D to 3GM and KM3-A to 3GMD.

Therefore, the items described as 3GM(D) in this service manual are identical for both 3GM and 3GMD engines.

When the items are separately described as 3GM as 3GMD, the description applies specifically to either 3GM or 3GMD.

B. Engine Model Name Plate and Clutch Model Name Plate

To every engine model described in this manual, an engine model name plate and clutch model name plate are fitted as shown in the following figures. In addition, the engine serial number is stamped on the cylinder body.

Specifications of engine and clutch to be shipped are recorded and filed using the numbers marked on the engine model name plate and clutch model name plate.

The specifications or components of the engine or clutch may be partially altered to improve performance, and the components involved may not necessarily be interchangeable.

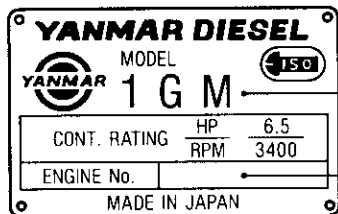
Therefore, when parts are ordered, please furnish the item description in the blank spaces shown in the figures, using the descriptions given on these plates.

B-1 Item descriptions on the model name plates and information to be forwarded to us

[Item descriptions on Model name plates]

[Information to be forwarded to us]

Engine model name plate

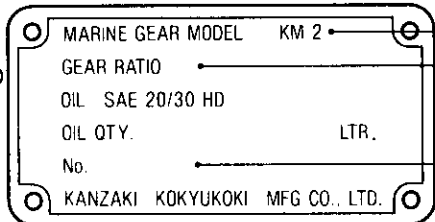


Your engine model

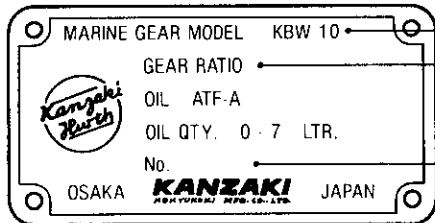
Your engine number

Clutch model name plate

1GM
2GM
3GMD



3GM
3HM



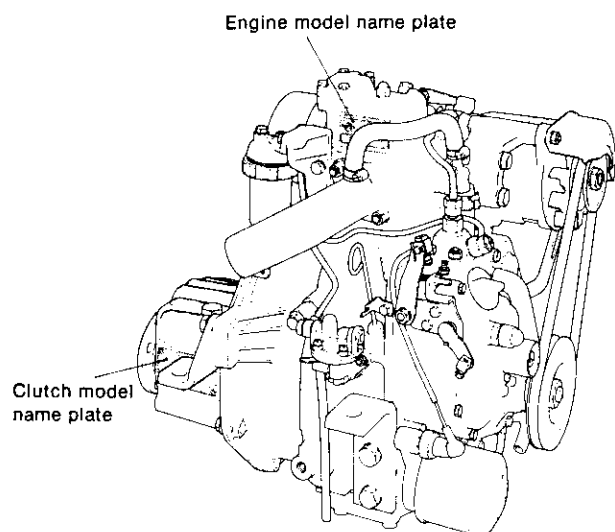
Your clutch model

Your clutch gear ratio

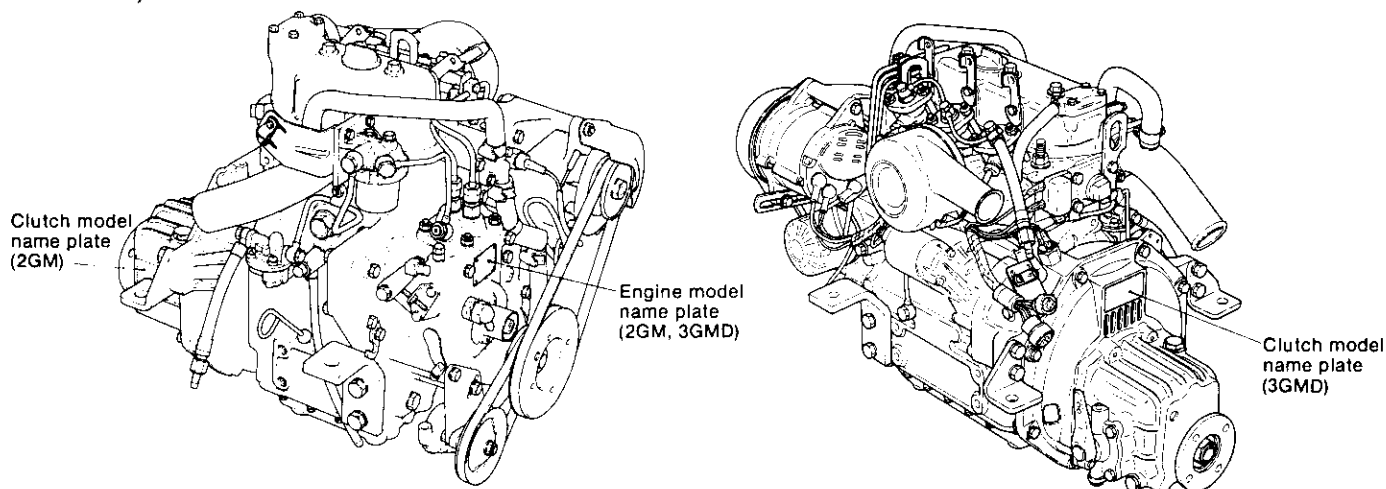
Your clutch number

B-2 Location of engine model name plate and clutch model name plate

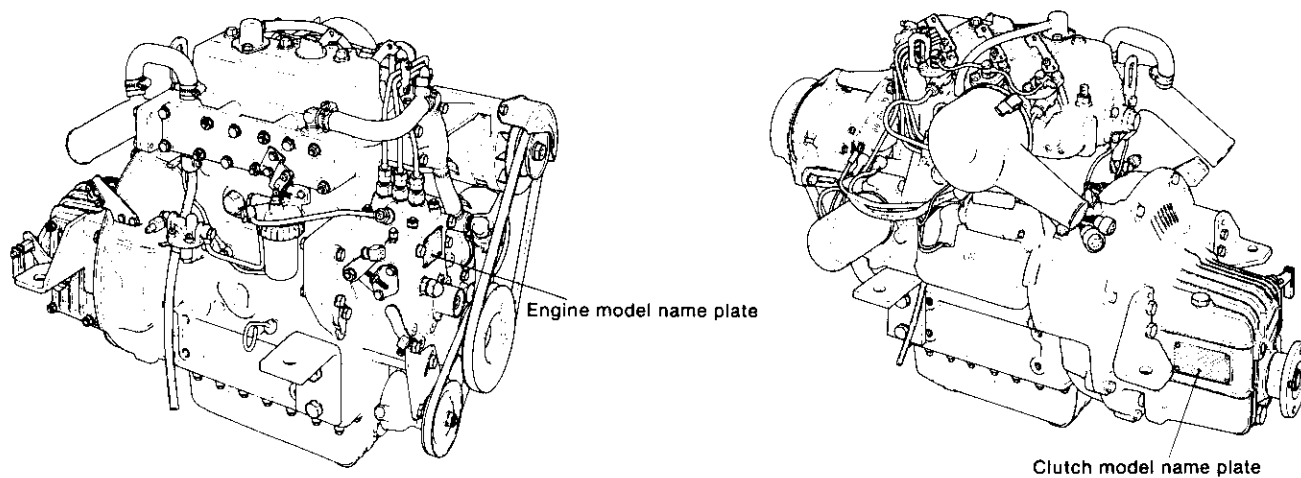
B-2.1 1GM

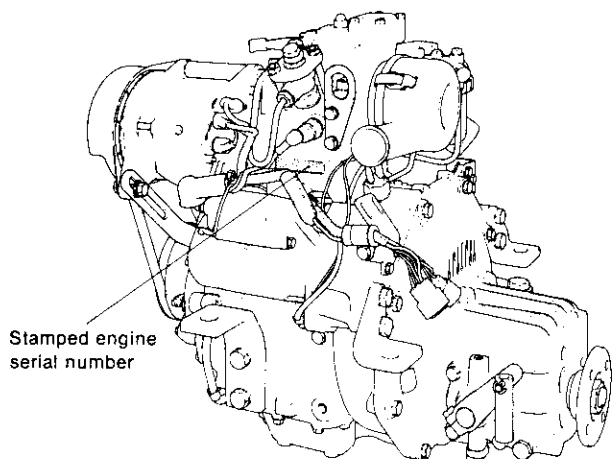
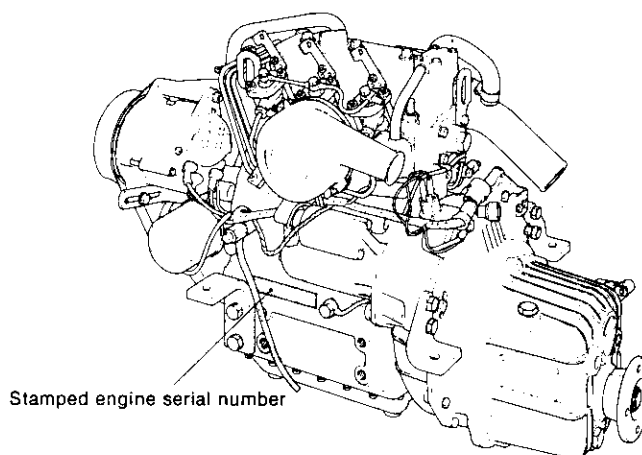


B-2.2 2GM, 3GMD



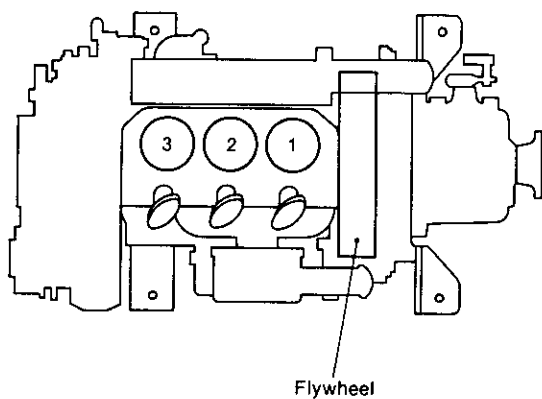
B-2.3 3GM, 3HM



B-3 Location of stamped engine serial number**B-3.1 1GM****B-3.2 2GM, 3GM(D), 3HM**

C. Cylinder Number

The cylinder numbers of the 2 cylinder engine (2GM) and 3 cylinder engine (3GMD, 3GM, 3HM) described in this manual are designated as follows.



- (1) The sequence of cylinder numbers is given as No. 1, No. 2 and No. 3 starting from the flywheel side.
- (2) These cylinder numbers are consistently used for devices and parts connected with the cylinder head and valve moving mechanism. However, please note that items related to the fuel injection pump do not correspond to the numbering of the cylinders.

CHAPTER 1

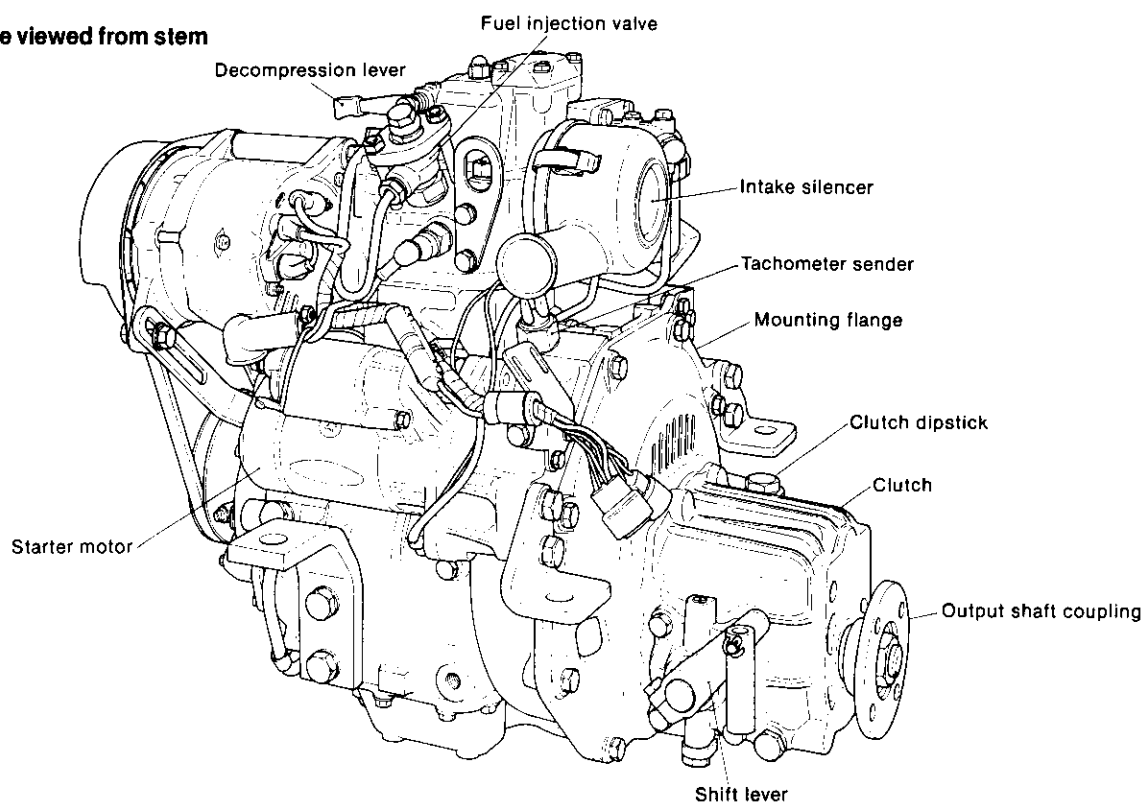
GENERAL

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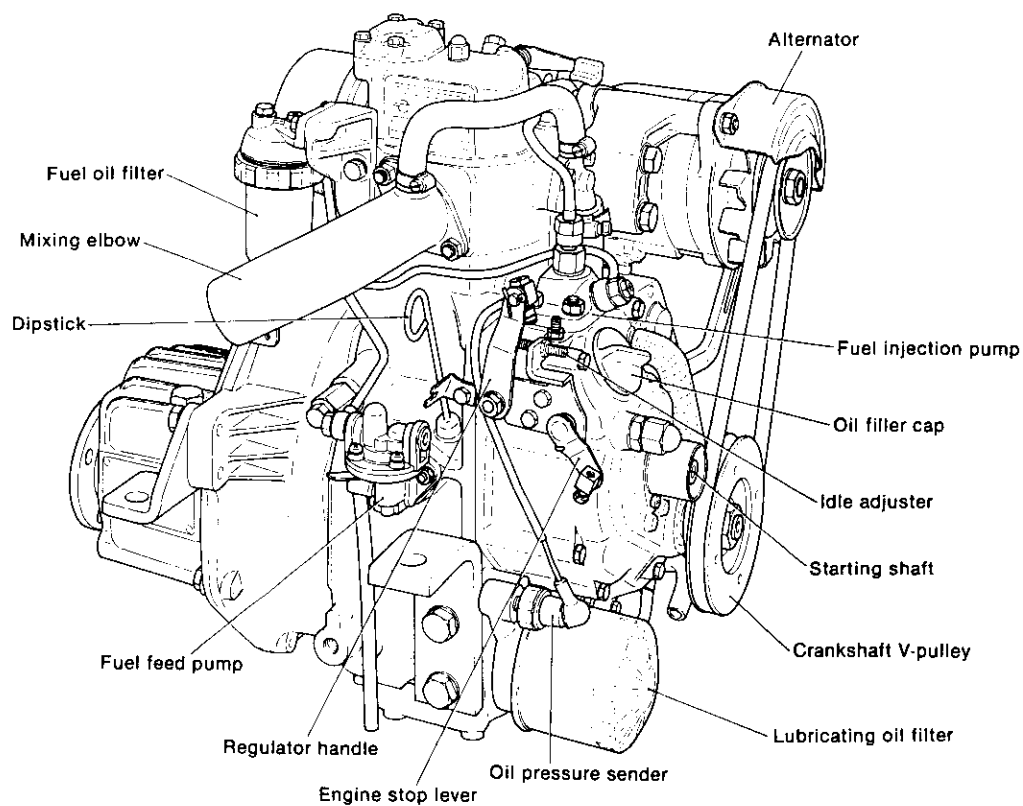
1. Exterior Views

1-1 1GM

1-1.1 Intake side viewed from stem

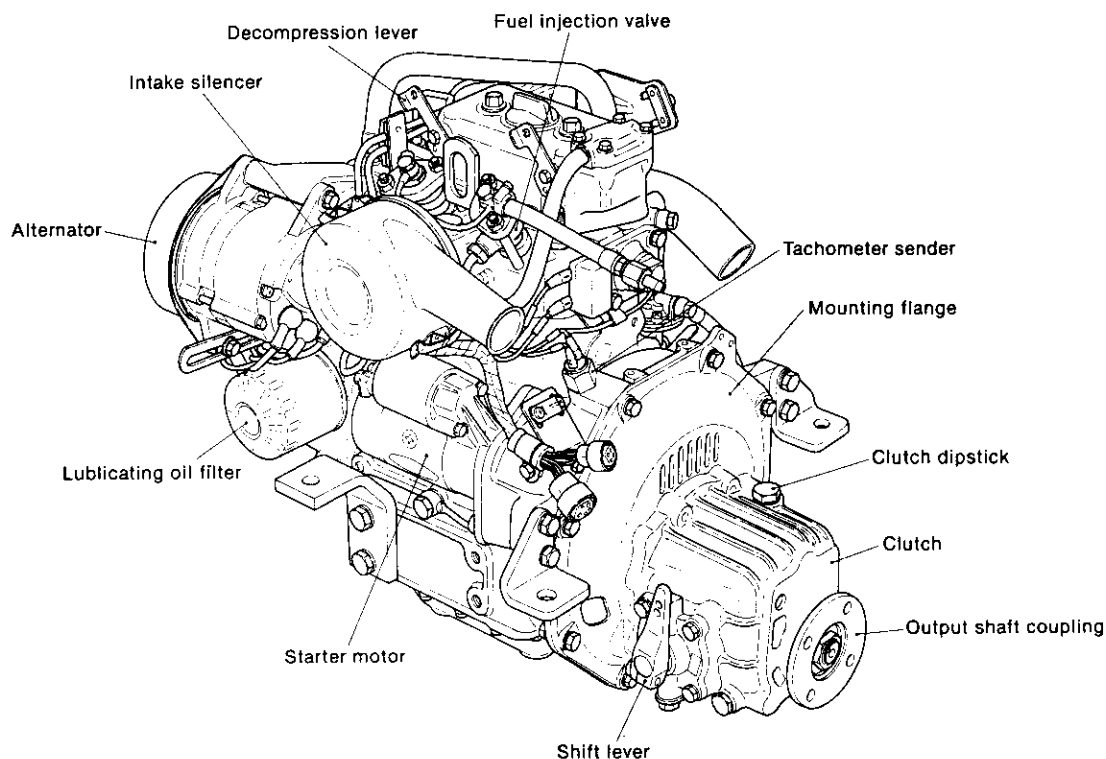


1-1.2 Exhaust side viewed from bow

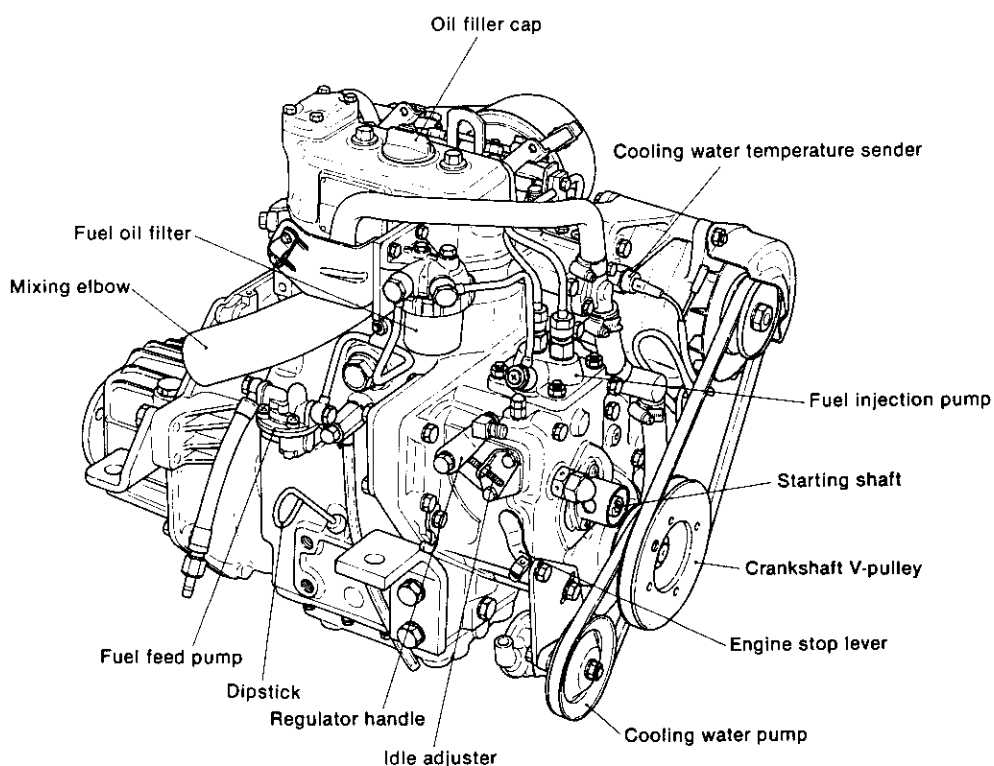


1-2 2GM

1-2.1 Intake side viewed from stem

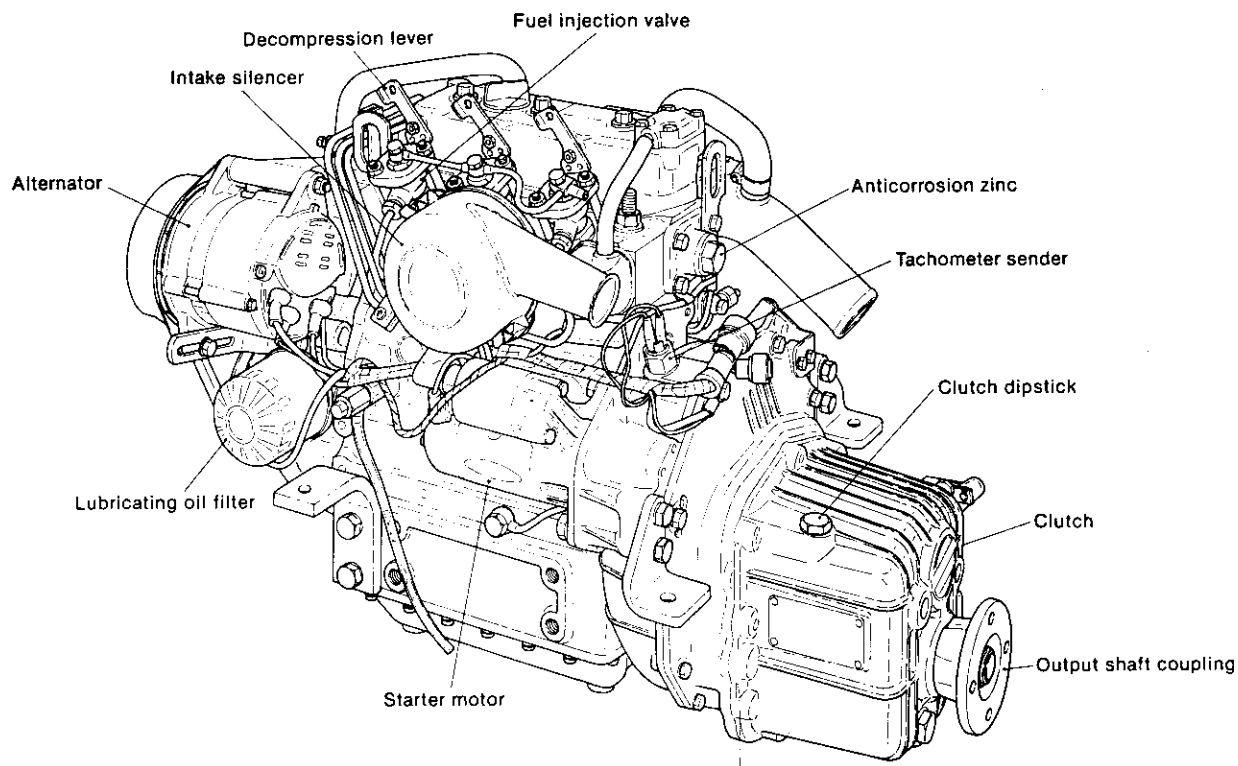


1-2.2 Exhaust side viewed from bow

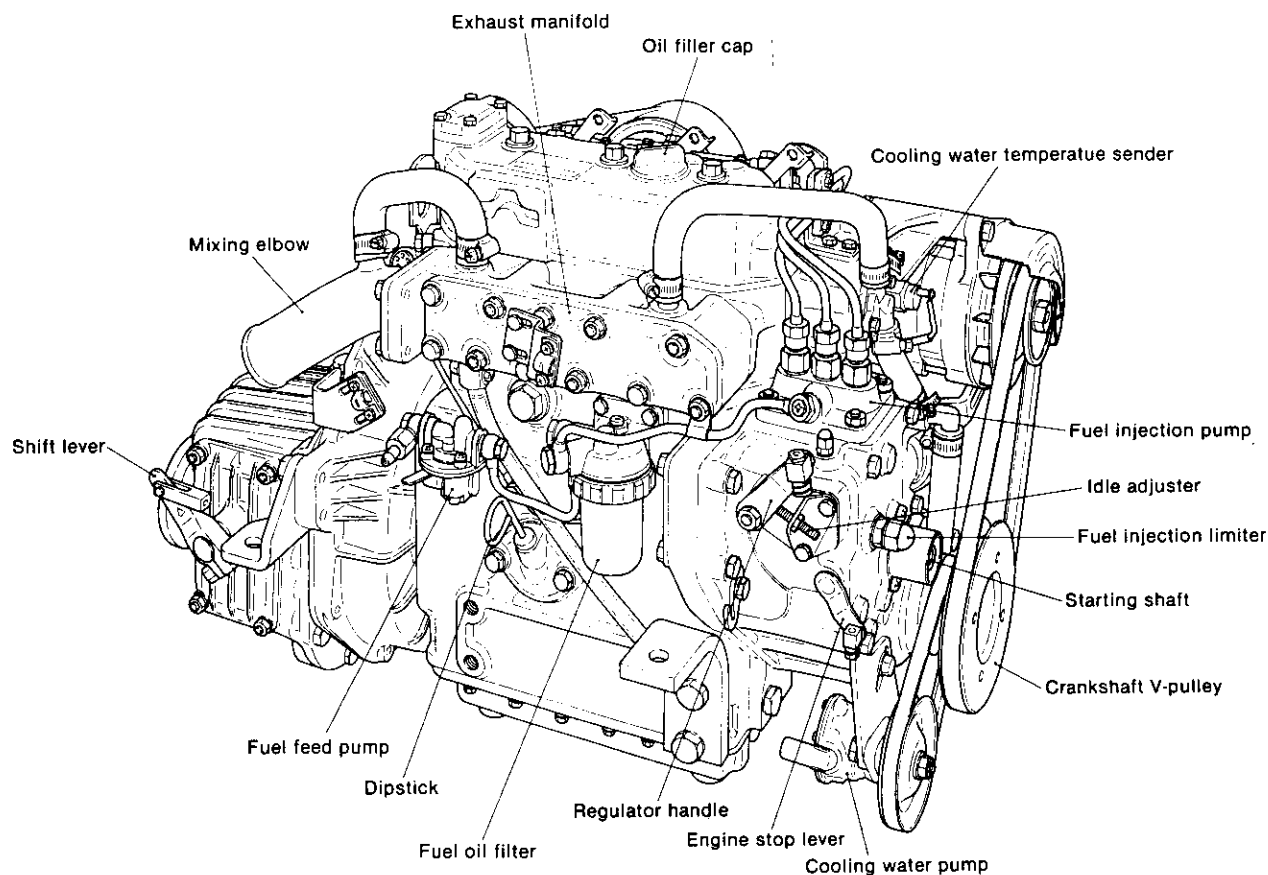


1-3 3GM

1-3.1 Intake side viewed from stern

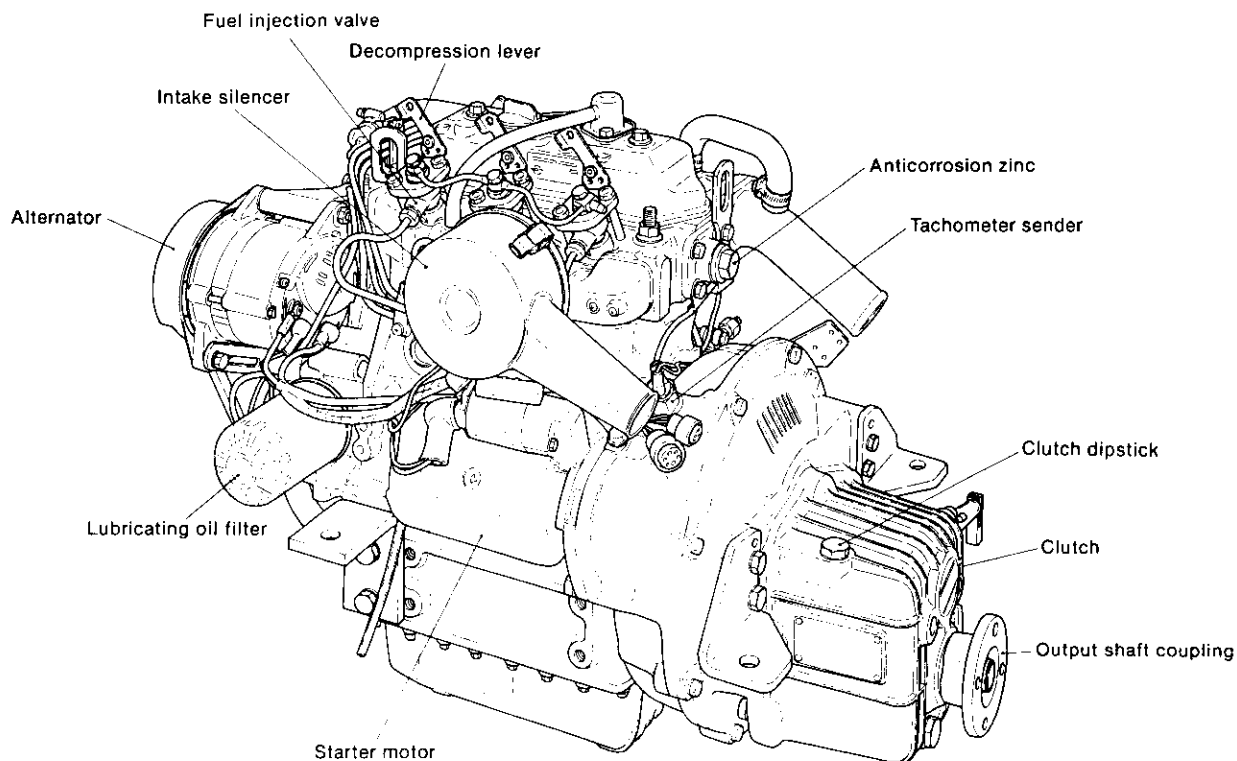


1-3.2 Exhaust side viewed from bow

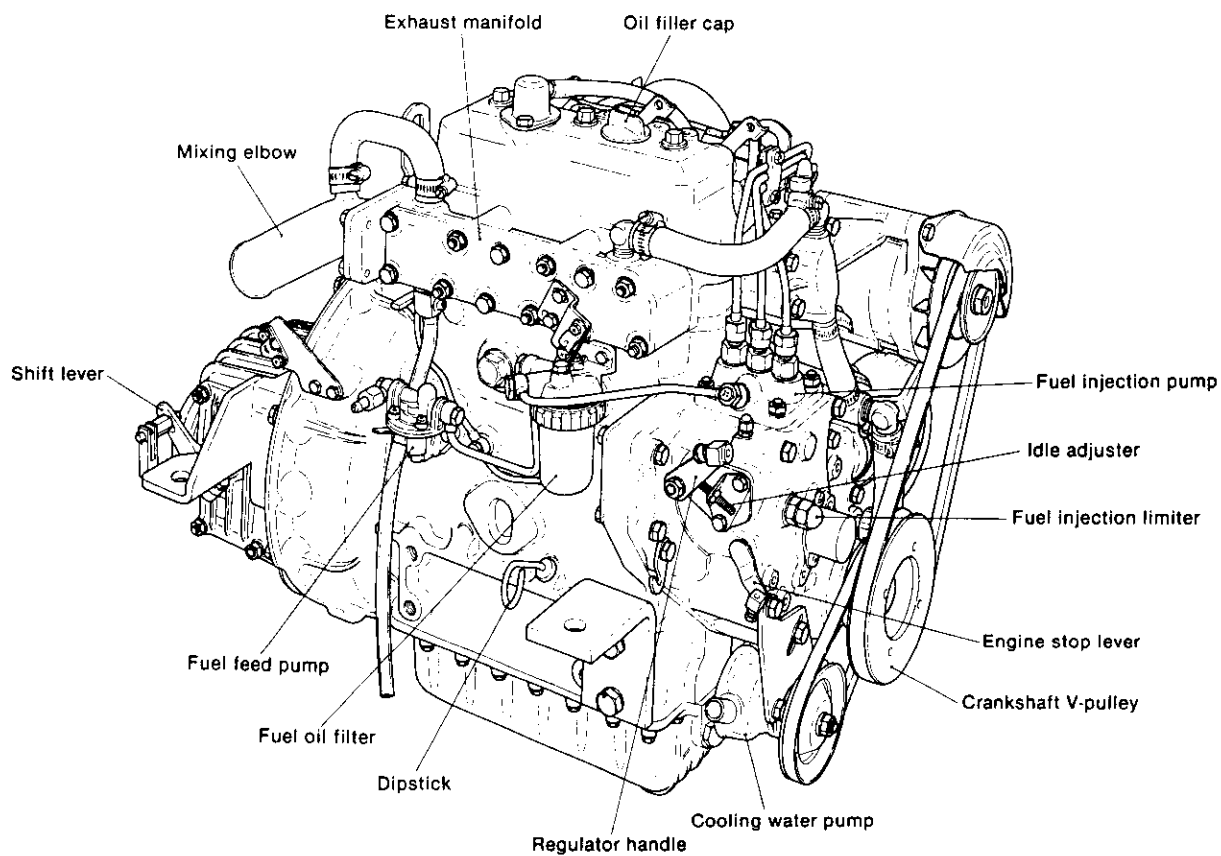


1-4 3HM

1-4.1 Intake side viewed from stern



1-4.2 Exhaust side viewed from bow



2. Specifications

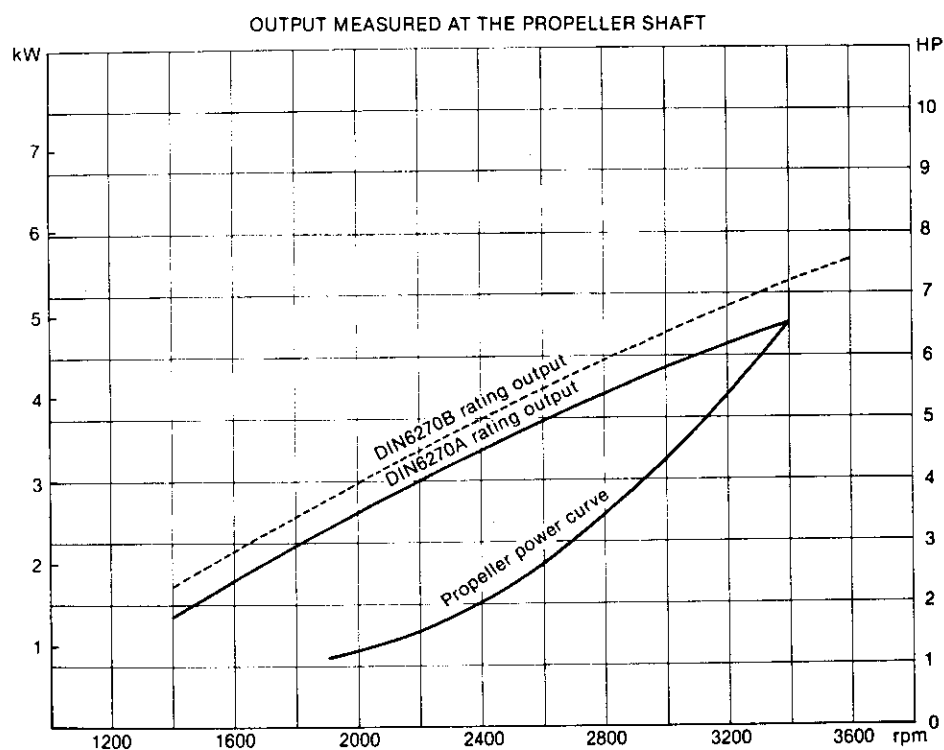
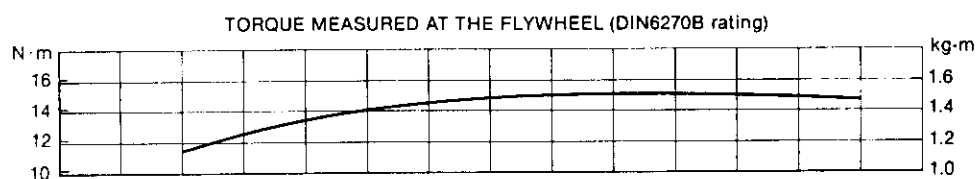
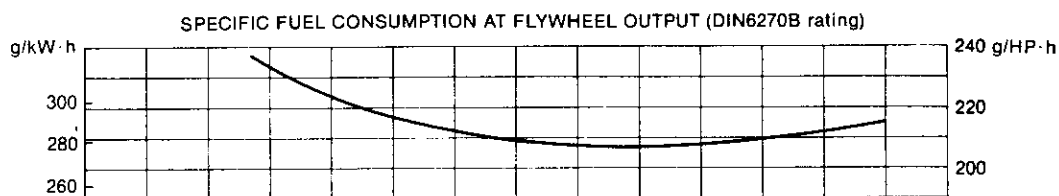
| Model | | | 1GM | | | 2GM | | | 3GMD | | | 3GM | | | 3HM | | | | | | | | | | | | | | | | | |
|-------------------------------------|--|--------|--|-----|-----------|----------|-----------|---------|-----------|-----|-----------|----------|-----------|--------------------------------|-----------|-----|-----------|--------|-----------|--|-----------|--|-----------|--|-----------|--|-----------|--|-----------|--|-----------|--|
| Type | | | Vertical 4-cycle water cooled diesel engine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Combustion chamber | | | Swirl pre-combustion chamber | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Number of cylinders | | | 1 | | | 2 | | | 3 | | | 3 | | | | | | | | | | | | | | | | | | | | |
| Bore × stroke | | mm | | | | | | | 72 × 72 | | | | | | 75 × 85 | | | | | | | | | | | | | | | | | |
| Displacement | | l | 0.293 | | | 0.586 | | | | | | 0.879 | | | 1.126 | | | | | | | | | | | | | | | | | |
| Continuous rating output (DIN6270A) | Output/Crankshaft speed | | HP/rpm | | 6.5/3400 | | | 13/3400 | | | 20/3400 | | | 27/3200 | | | | | | | | | | | | | | | | | | |
| | Brake mean effective pressure | | kg/cm² | | 5.87 | | | 5.87 | | | 6.02 | | | 6.74 | | | | | | | | | | | | | | | | | | |
| | Piston speed | | m/sec. | | | | | 8.16 | | | | | | 9.07 | | | | | | | | | | | | | | | | | | |
| One hour rating output (DIN6270B) | Output/crankshaft speed | | HP/rpm | | 7.5/3600 | | | 15/3600 | | | 22.5/3600 | | | 30/3400 | | | | | | | | | | | | | | | | | | |
| | Brake mean effective pressure | | kg/cm² | | | | | 6.40 | | | | | | 7.05 | | | | | | | | | | | | | | | | | | |
| | Piston speed | | m/sec. | | | | | 8.64 | | | | | | 9.63 | | | | | | | | | | | | | | | | | | |
| Compression ratio | | | 23.0 | | | | | | | | | | | 22.7 | | | | | | | | | | | | | | | | | | |
| Fuel injection timing (FID) | | degree | bTDC15±1 | | | bTDC15±1 | | | bTDC18±1 | | | bTDC18±1 | | | bTDC±21 | | | | | | | | | | | | | | | | | |
| Fuel injection pressure | | kg/cm² | 170 | | | | | | | | | | | 160 | | | | | | | | | | | | | | | | | | |
| Main power take off | | | at Flywheel side | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Front power take off | | | at Crankshaft V-pulley side | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Direction of rotation | Crankshaft | | Counter-clockwise viewed from stern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Propeller shaft (A head) | | Clockwise viewed from stern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cooling system | | | Direct sea water cooling (rubber impeller water pump) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lubrication system | | | Complete enclosed forced lubrication | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Starting system | | | Electric and/or manual | | | | | | | | | | | Electric | | | | | | | | | | | | | | | | | | |
| Clutch | Model | | KM2A | | | | | | | | | KM3A | | | KBW10D | | | KBW10E | | | | | | | | | | | | | | |
| | Type | | Mechanical cone clutch with single stage for both ahead and astern | | | | | | | | | | | Wet multi-disc mechanical type | | | | | | | | | | | | | | | | | | |
| | Reduction ratio (Ahead/Astern) | | 2.21/3.06 | | 2.62/3.06 | | 3.22/3.06 | | 2.21/3.06 | | 2.62/3.06 | | 3.22/3.06 | | 2.36/3.16 | | 2.61/3.16 | | 3.20/3.16 | | 2.14/2.50 | | 2.63/2.50 | | 2.83/2.50 | | 2.14/2.50 | | 2.83/2.50 | | | |
| | Propeller speed DINA rating (Ahead/Astern) | | rpm | | 1540/1113 | | 1298/1113 | | 1055/1113 | | 1540/1113 | | 1298/1113 | | 1055/1113 | | 1441/1076 | | 1303/1076 | | 1062/1076 | | 1591/1360 | | 1292/1360 | | 1200/1360 | | 1498/1280 | | 1129/1280 | |
| | Lubricating oil capacity | | l | | 0.25 | | | | | | 0.3 | | | | | | 0.7 | | | | | | | | | | | | | | | |
| | Clutch weight | | kg | | 9.3 | | | | | | 10.8 | | | | | | 17 | | | | | | 19 | | | | | | | | | |
| Dimensions | Overall length | | mm | | 527 | | | 623 | | | 740 | | | 755 | | | 791 | | | | | | | | | | | | | | | |
| | Overall width | | mm | | 410 | | | 410 | | | 410 | | | 410 | | | 451 | | | | | | | | | | | | | | | |
| | Overall height | | mm | | 485 | | | 495 | | | 495 | | | 502 | | | 612 | | | | | | | | | | | | | | | |
| | Lubricating oil capacity (rake angle 8°) | | l | | 1.3 | | | 2.0 | | | 2.7 | | | | | | 5.5 | | | | | | | | | | | | | | | |
| Effective | | l | | 0.6 | | | 1.3 | | | 1.6 | | | | | | 3.0 | | | | | | | | | | | | | | | | |
| Engine weight with clutch (dry) | | kg | | 70 | | | 100 | | | 130 | | | 130 | | | 158 | | | | | | | | | | | | | | | | |

3. Principal Construction

| Engine model | | 1GM | 2GM | 3GMD | 3GM | 3HM |
|--|---------------------------|--|------------------------|-----------------------------|--------------------------------|----------------------------|
| Group | Part | Construction | | | | |
| Engine block | Cylinder block | Integrally-cast water jacket and crankcase | | | | |
| | Cylinder liner | Sleeveless | Dry sleeve type | | | |
| | Main bearing | Metal housing type | | | | |
| | Oil sump | Oil pan | | | | |
| Intake and exhaust systems and valve mechanism | Cylinder head | Integrated type cylinders | | | | |
| | Intake and exhaust valves | Poppet type, seat angle 90° | | | | |
| | Exhaust manifold | — | | Separated water-cooled type | | Integral water-cooled type |
| | Exhaust silencer | Water-cooled mixing elbow type | | | | |
| | Valve mechanism | Overhead valve push rod, rocker arm system | | | | |
| | Intake silencer | Round polyurethane sound absorbing type | | | | |
| Main moving elements | Crankshaft | Stamped forging | | | | |
| | Flywheel | Attached to crankshaft by flange, with ring gear | | | | |
| | Piston | Oval type | | | | |
| | Piston pin | Floating type | | | | |
| | Piston rings | 2 compression rings, 1 oil ring | | | | |
| Lubrication system | Oil pump | Trochoid pump | | | | |
| | Oil filter | Full-flow cartridge type, paper element | | | | |
| | Oil level gauge | Dipstick | | | | |
| Cooling system | Water pump | Rubber impeller type S | Rubber impeller type A | | | Rubber impeller type B |
| | Thermostat | Wax pellet type | | | | |
| Fuel system | Fuel injection pump | YPFR-0707-1 | YPFR-0707-2 | YPFR-0707 | | |
| | Fuel injection valve | 530 semi-throttle valve | | | | |
| | Fuel strainer | Filter paper | | | | |
| Governor | Governor | Centrifugal all-speed mechanical type | | | | |
| Starting system | Electric | Pinion ring gear type starter motor | | | | |
| | Manual | Camshaft starting | | | | — |
| Electrical system | Charger | Alternator (with built-in IC regulator) | | | | |
| Reduction reversing | Reduction gear | Helical gear constant-mesh system | | | | |
| Clutch system | Clutch | Servo-cone type | | | Wet multi-disc mechanical type | |

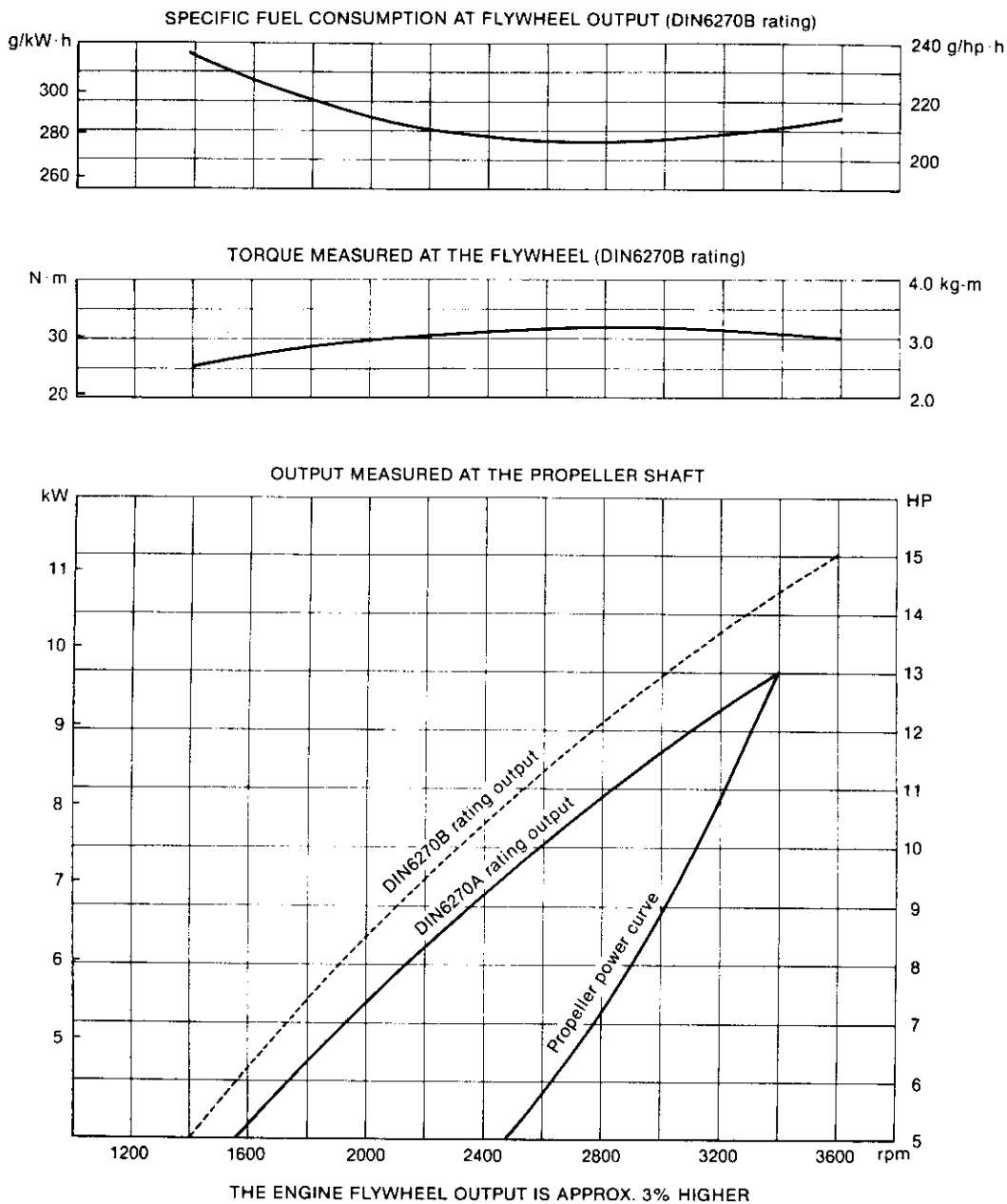
4. Performance Curves

4-1 1GM

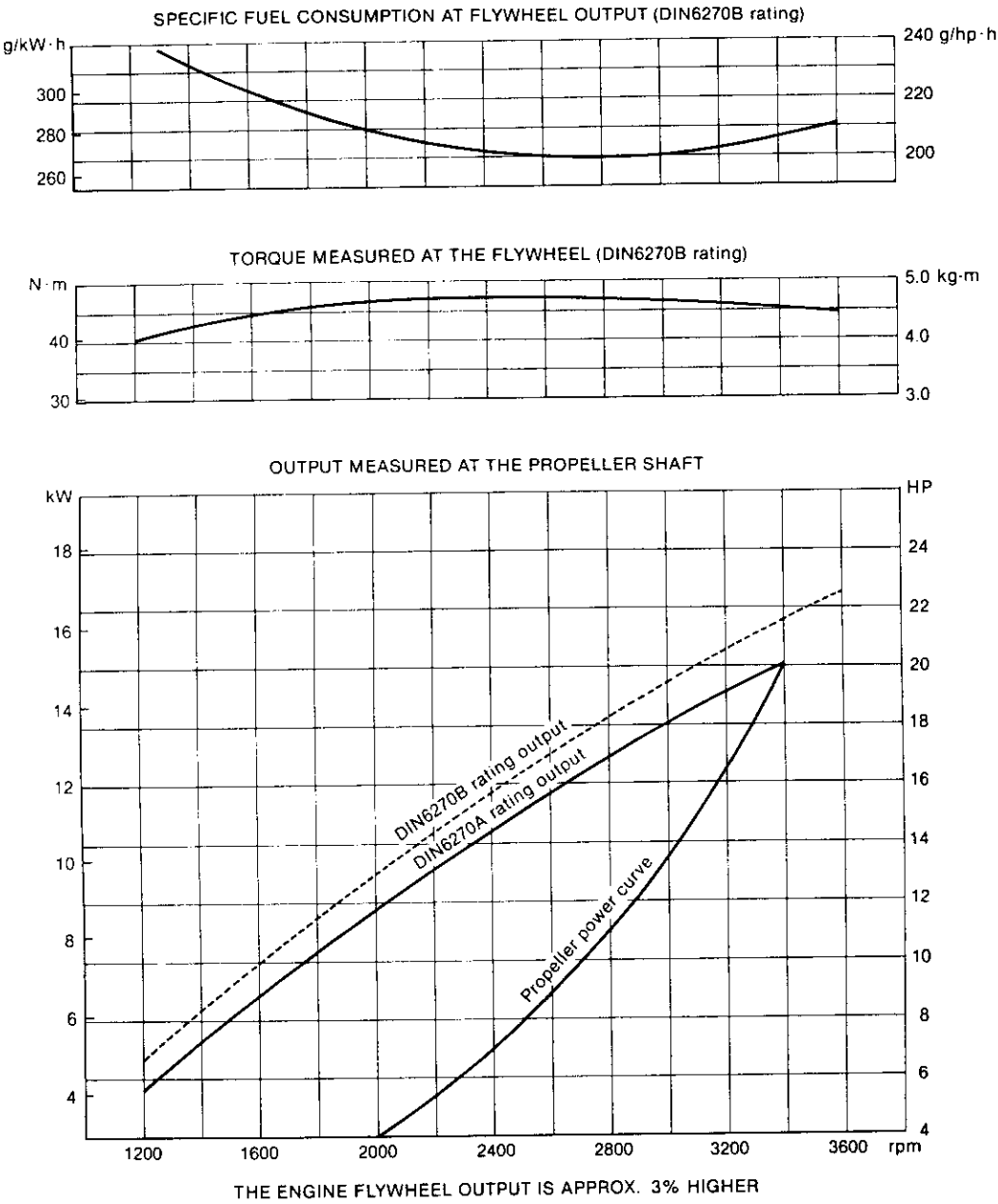


THE ENGINE FLYWHEEL OUTPUT IS APPROX. 5% HIGHER

4-2 2GM (F)



4-3 3GM (D)
3GM (F)



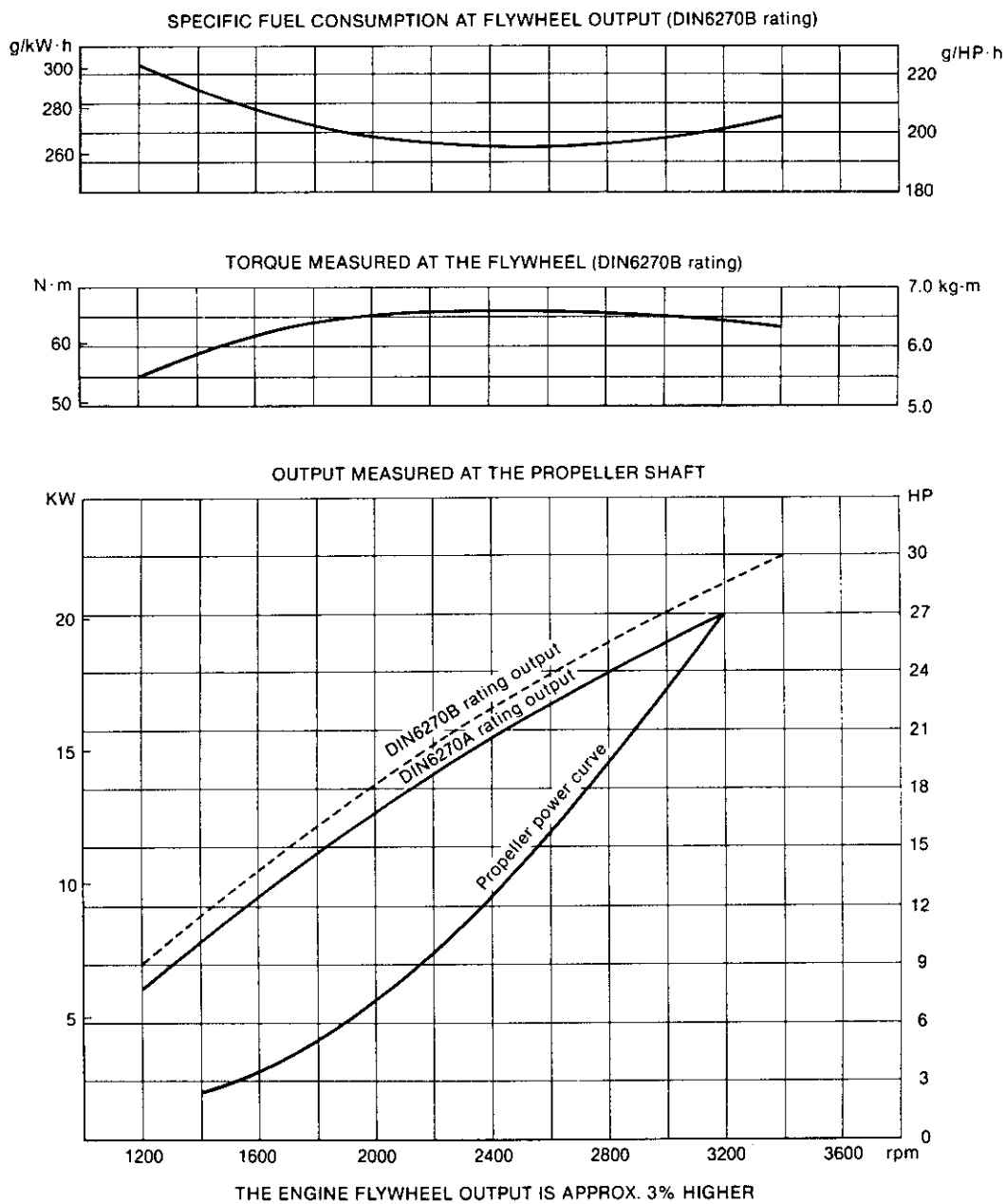
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back to the website.**

**Then, you can
download the complete
manual instantly.**

No waiting.

4-4 3HM (F)



5. Features

5-1 Superior combustion performance

The unique Yanmar swirl precombustion chamber and new cooling system display superior combustion performance in all types of operation. Low-speed, low-load combustion performance, especially demanded for marine applications, is also superb, and stable performance is maintained over a wide range of speeds. Since starting characteristics are also excellent and warm-up is fast, full engine performance can be obtained within a short time.

5-2 Low operating costs

Excellent combustion and low friction reduce fuel costs, while the optimized piston shape and ring configuration and improved cooling system reduce oil consumption. Continuous operating time has been extended and operating costs reduced through improved durability.

5-3 Compact, lightweight

The cylinder head is the integrally-cast type, and the crankshaft is the housing type. Minimum weight has been pursued for each engine part, and a reduction reversing gear employing a special new mechanism has been incorporated to obtain revolutionary engine lightness.

5-4 Long term continuous operation

Improved durability has been achieved by adopting special construction and materials for main moving parts and the valve mechanism, which are the areas most subject to trouble in high-speed engines. Moreover, a bypass system with a thermostat maintains the cooling water at a stable high temperature, resulting in reduced cylinder liner and piston ring wear, reduced thermal load around the combustion chamber, and substantially improved durability. Long-term continuous operation is possible by correct operation and proper attention to fuel and lubricating oil.

5-5 Low vibration

Vibration has been reduced by minimizing the weights of the pistons, connecting rods, and other sources of vibration, stringent weight management at assembly, and balancing of the flywheel, V-pulley, etc. Vibration has also been suppressed through the adoption of a special cylinder block rib construction and improved rigidity. Rubber shock mounts are available when the engine is to be used under conditions which may lead to severe vibration.

5-6 Quiet operation

Intake and exhaust noises have been lowered by adopting an intake silencer, water-cooled exhaust manifold and water mixing elbow type exhaust system.

The precombustion chamber system and semi-throttle type injection valve suppress combustion noise substantially.

Moreover, gear noise has been reduced by the use of helical gears around the gear train and clutch gear, and by the buffering effect of a damper disc.

In addition, noise prevention measures have also been taken at the control valve mechanism and other parts.

5-7 Superior matching to the hull

- (1) Four-point support engine installation feet make installation easy.
- (2) Mist intake system prevents contamination of the engine room.
- (3) Since the fuel pump is mounted on the engine, the fuel tank can be installed anywhere.
- (4) Water-cooled manifold prevents a rise in the engine room temperature.
- (5) Independent type instrument panel can be installed wherever it is easiest to see.
- (6) Speed, clutch forward and reverse, and engine stop can all be remotely controlled.
- (7) The use of rubber and vinyl hoses for ship interior piping not only facilitates piping work, but also eliminates brazing faults caused by vibration.
- (8) Electric type bilge pump is available as an option.

5-8 Easy to operate

- (1) Cooling water temperature switch and lubricating oil pressure switch are provided, and alarm lamps and buzzer are mounted on the instrument panel.
- (2) Manual starting handle permits manual starting.
(Except model 3HM.)
- (3) Positive clutch engagement and disengagement; propeller shaft does not rotate when clutch is placed in neutral position.