YANMAR

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SERVICE MANUAL

MARINE DIESEL ENGINE

2QM20(H),3QM30(H)

1990.8

YANMAR

SERVICE MANUAL

MARINE DIESEL ENGINE

MODEL

2QM20(H)

3QM30(H)

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.

Model 2QM20(H)·3QM30(H)

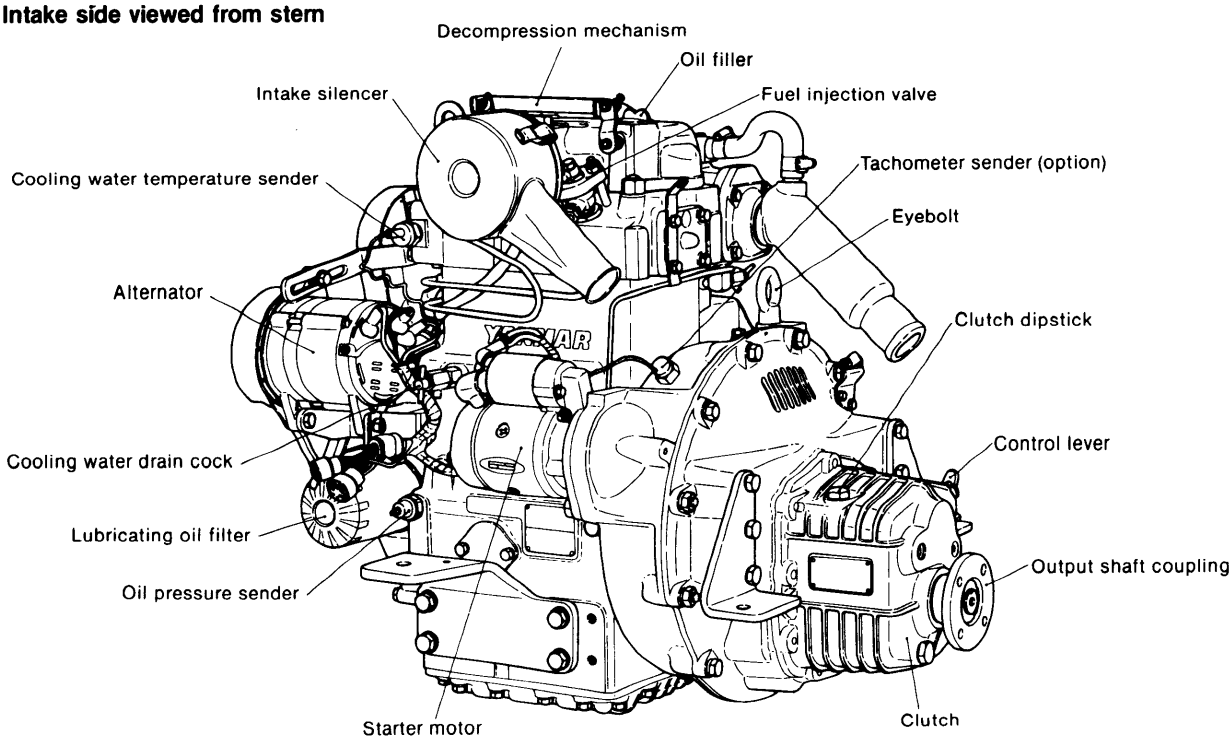
CHAPTER 1

GENERAL

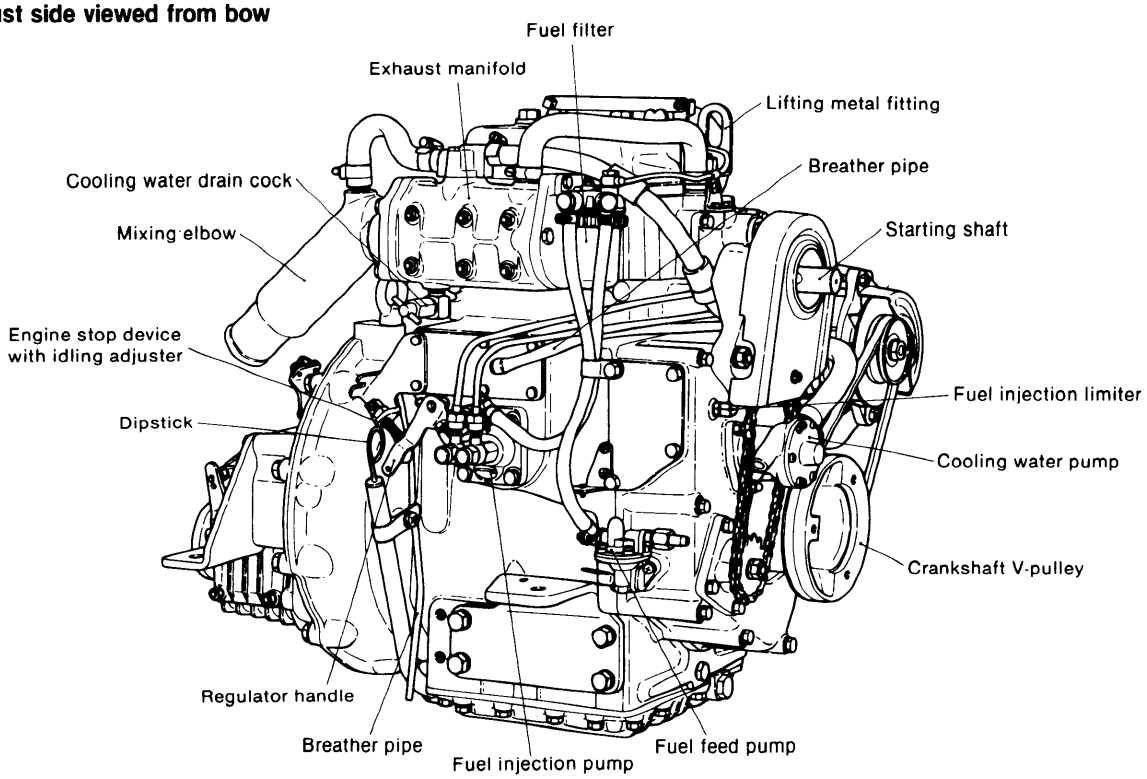
1. Exterior Views

1-1 2QM20H

1-1.1 Intake side viewed from stern

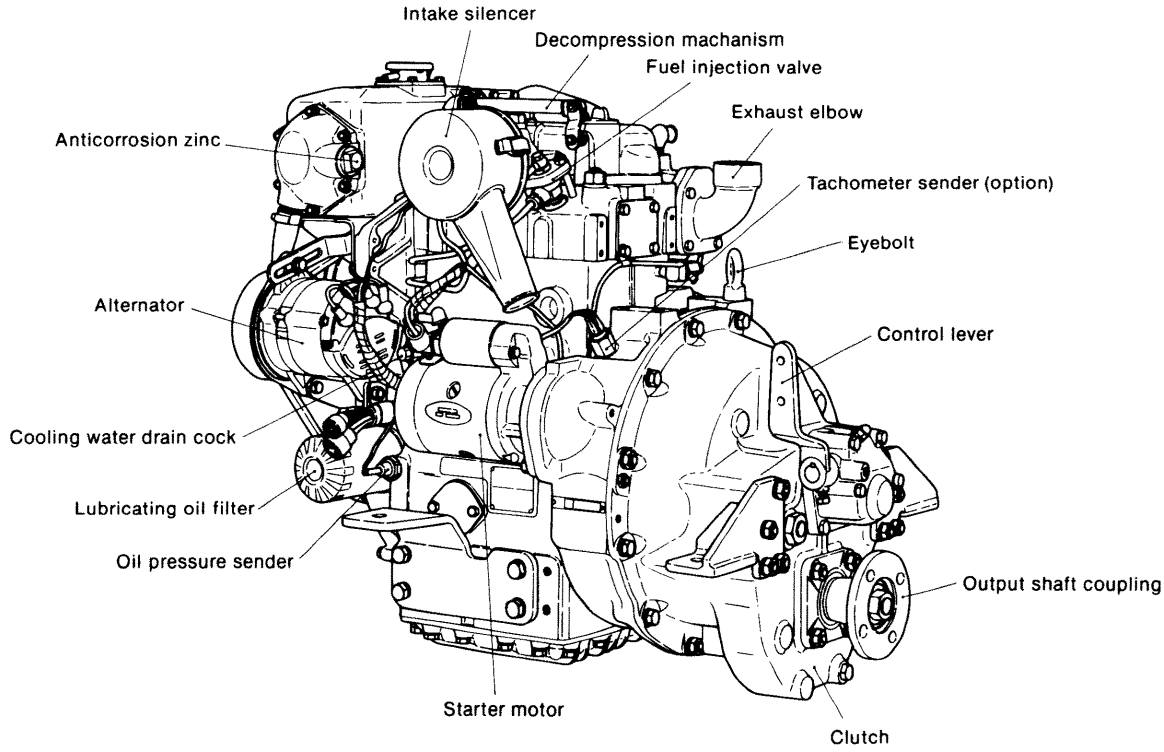


1-1.2 Exhaust side viewed from bow

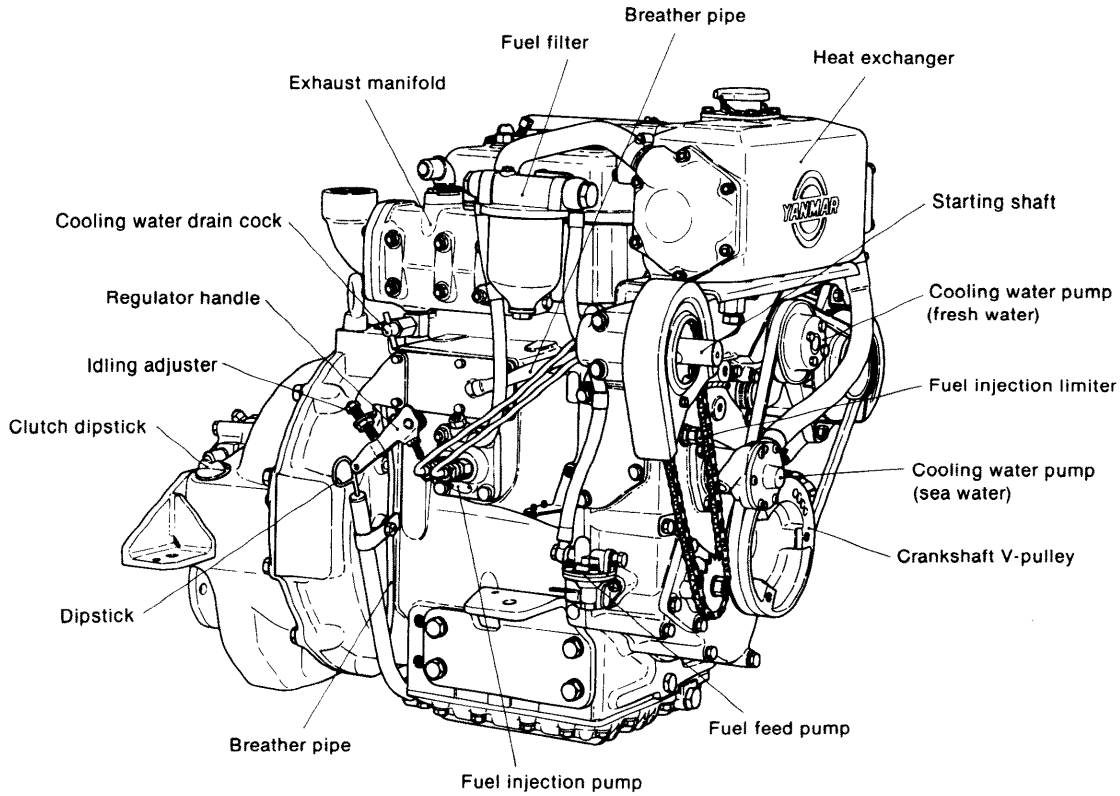


1-2 2QM20Y

1-2.1 Intake side viewed from stern

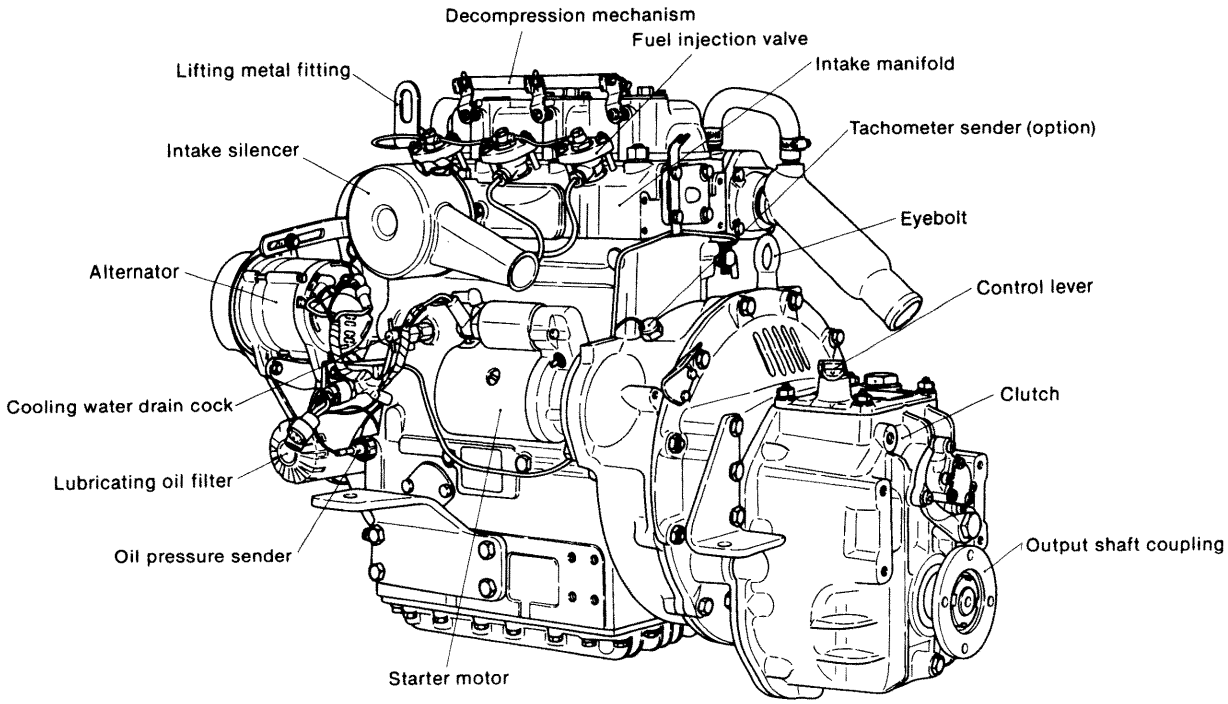


1-2.2 Exhaust side viewed from bow

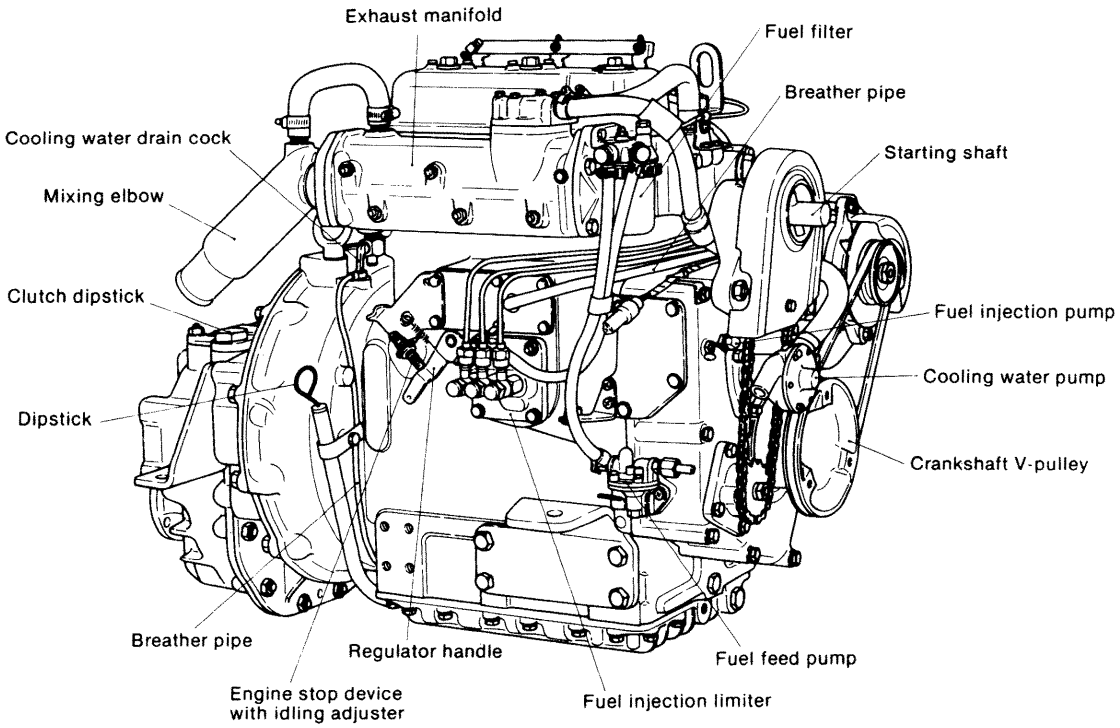


1-3 3QM30H

1-3.1 Intake side viewed from stern

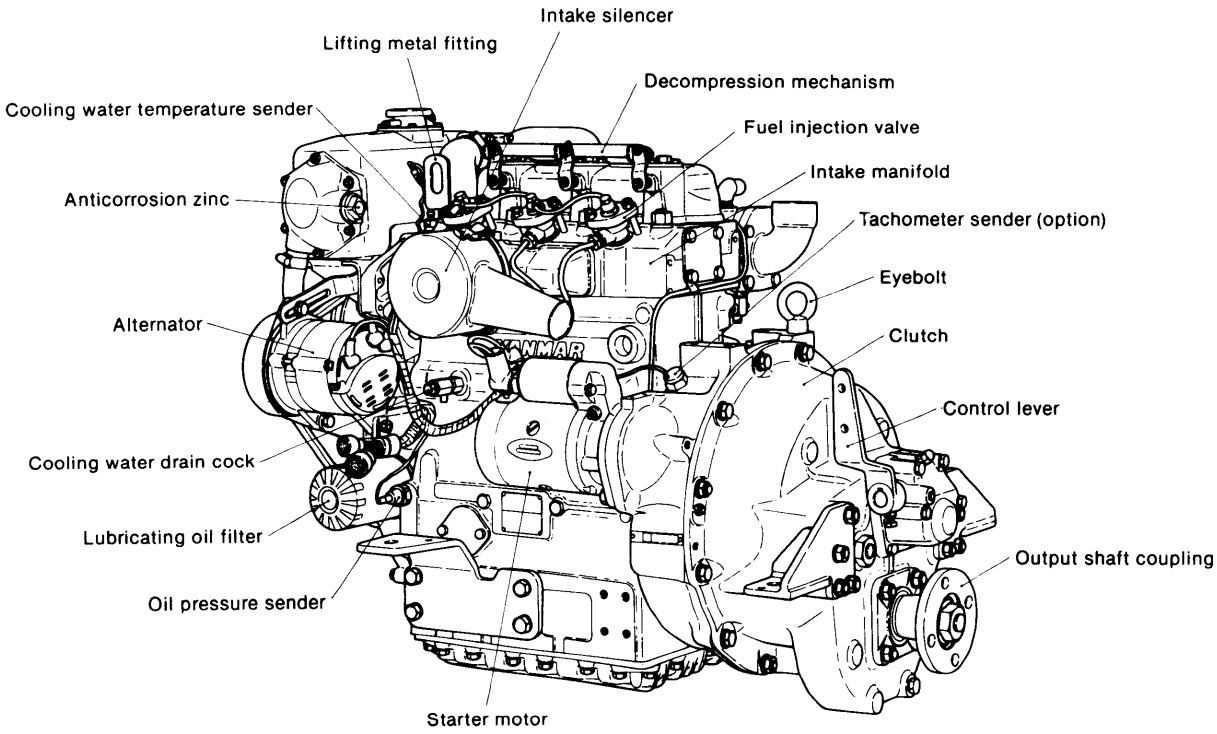


1-3.2 Exhaust side viewed from bow

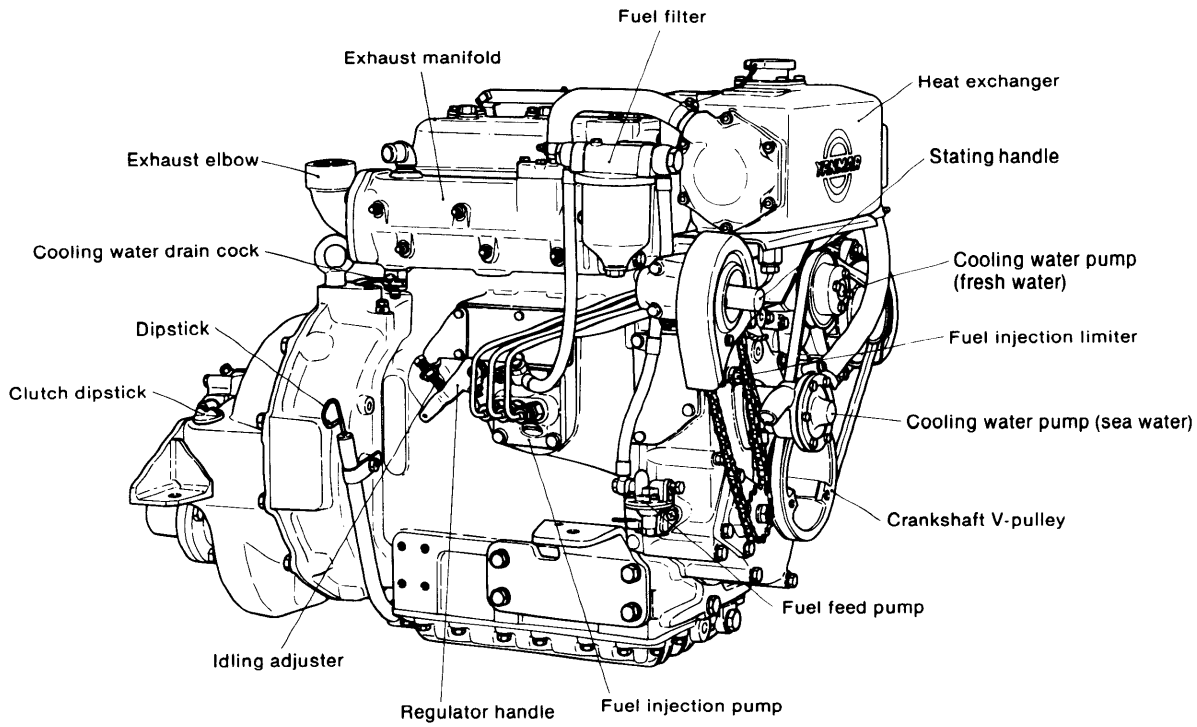


1-4 3QM30Y

1-4.1 Intake side viewed from stern



1-4.2 Exhaust side viewed from bow



2. Specifications

Model			2QM20[2QM20B]		2QM20H		2QM20Y		2QM20F	
Type			Vertical 4-cycle water cooled diesel engine							
Combustion chamber			Swirl pre-combustion chamber							
Number of cylinders			2							
Bore × stroke		mm	88 × 90							
Displacement		cc	1094							
Continuous rating output (DIN6270A)	Output/Crankshaft speed	HP/rpm	20/2600							
	Brake mean effective pressure	kg/cm²	6.33							
	Piston speed	m/sec.	7.80							
	Propeller speed (Ahead)	rpm	1182	810	1215	919	1182	810	1215	919
One hour rating output (DIN6270B)	Output/crankshaft speed	HP/rpm	22/2800							
	Brake mean effective pressure	kg/cm²	6.46							
	Piston speed	m/sec.	8.40							
	Propeller speed (Ahead)	rpm	1273	872	1308	989	1273	872	1308	989
Compression ratio			20:1							
Fuel injection timing		degree	bTDC 25							
Fuel injection pressure		kg/cm²	160±10							
Engine weight (dry)		kg	220		190		260		230	
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		Clockwise viewed from stern							
Cooling system			Direct sea water cooling				Fresh water cooling			
Lubrication system			Complete enclosed forced lubrication							
Starting system			Electric and/or manual							
Reduction gear system			Constant-mesh spur gear		Constant-mesh helical gear		Constant-mesh spur gear		Constant-mesh helical gear	
Clutch	Type of clutch		Mechanical wet type single disc		Mechanical wet type multi disc		Mechanical wet type single disc		Mechanical wet type multi disc	
	Model		YP-7M[YP-10M]		KBW10A		YP-10M		KBW10A	
Reduction ratio	Ahead		2.20	3.21	2.14	2.83	2.20	3.21	2.14	2.83
	Astern		2.30	3.46	2.50		2.30	3.46	2.50	
Dimensions	Overall length	mm	825 [810]		821.5		810		821.5	
	Overall height	mm	675 [673]		665		714		706	
	Overall width	mm	501		501		562		562	
Lubricating oil capacity	Total	ℓ	5.1							
	Effective	ℓ	3.3							
	Clutch	ℓ	0.8 [1.2]		*0.6		1.2		*0.6	

Model YP-7M clutch equipped on 2QM20 will be changed to model YP-10M, which is a standard clutch for 3QM30. Please notice that YP-10M clutch is equipped on "2QM20B".
The engine output of model "2QM20B" is the same output as model 2QM20.

Model			3QM30		3QM30H		3QM30Y		3QM30F	
Type			Vertical 4-cycle water cooled diesel engine							
Combustion chamber			Swirl pre-combustion chamber							
Number of cylinders			3							
Bore × stroke		mm	88 × 90							
Displacement		cc	1642							
Continuous rating output (DIN6270A)	Output/Crankshaft speed	HP/rpm	30/2600							
	Brake mean effective pressure	kg/cm²	6.32							
	Piston speed	m/sec.	7.80							
	Propeller speed (Ahead)	rpm	1182	810	1281	867	1182	810	1281	867
One hour rating output (DIN6270B)	Output/crankshaft speed	HP/rpm	33/2800							
	Brake mean effective pressure	kg/cm²	6.46							
	Piston speed	m/sec.	8.40							
	Propeller speed (Ahead)	rpm	1273	872	1379	933	1273	872	1379	933
Compression ratio			20:1							
Fuel injection timing		degree	bTDC 28							
Fuel injection pressure		kg/cm²	160±10							
Engine weight (dry)		kg	280		260		310		290	
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		Clockwise viewed from stern							
Cooling system			Direct sea water cooling				Fresh water cooling			
Lubrication system			Complete enclosed forced lubrication							
Starting system			Electric and/or manual							
Reduction gear system			Constant-mesh spur gear		Constant-mesh helical gear		Constant-mesh spur gear		Constant-mesh helical gear	
Clutch	Type of clutch		Mechanical wet type single disc		Mechanical wet type multi disc		Mechanical wet type single disc		Mechanical wet type multi disc	
	Model		YP-10M		KH18		YP-10M		KH18	
Reduction ratio	Ahead		2.20	3.21	2.13	3.00	2.20	3.21	2.13	3.00
	Astern		2.30	3.46	1.96	3.06	2.30	3.46	1.96	3.06
Dimensions	Overall length	mm	924		952.5		924		966.5	
	Overall height	mm	673		692		714		733	
	Overall width	mm	501		501		562		562	
Lubricating oil capacity	Total	ℓ	6.5							
	Effective	ℓ	2.2							
	Clutch	ℓ	1.2		*1.7		1.2		*1.7	

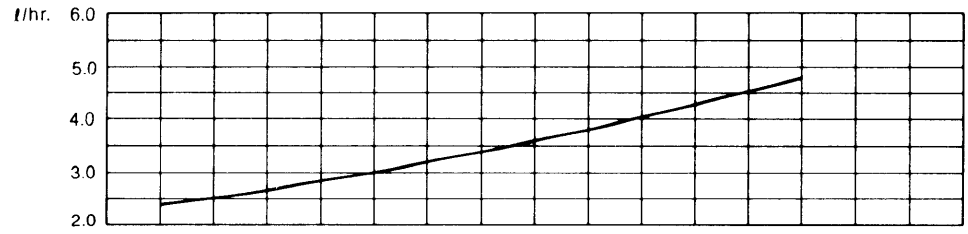
3. Principal Construction

Group	Part	Construction	2QM20 2QM20B	2QM20H	2QM20Y	2QM20F	3QM30	3QM30H	3QM30Y	3QM30F
	Cylinder block	Integrally-cast water jacket and crankcase	○	○	○	○	○	○	○	○
Engine block	Cylinder liner	Wet type coated with anticorrosion point	○	○	○	○	○	○	○	○
	Main bearing	Bearing housing type without intermediate bearing	○	○	○	○				
		Bearing housing type with intermediate bearing					○	○	○	○
	Oil sump	Bottom cover (Oil pan)	○	○	○	○	○	○	○	○
Intake and exhaust systems and valve mechanism	Cylinder head	Integrated two-cylinder	○	○	○	○				
		Integrated three-cylinder					○	○	○	○
	Intake and exhaust valves	Poppet type, seat angle 90°	○	○	○	○	○	○	○	○
	Exhaust manifold	Integral water-cooled type	○	○	○	○	○	○	○	○
	Exhaust silencer	Water-cooled mixing elbow	○	○	○	○	○	○	○	○
	Valve mechanism	Overhead valve push rod, rocker arm system	○	○	○	○	○	○	○	○
	Intake silencer	Polyurethane filter, sound absorbing type	○	○	○	○	○	○	○	○
Main moving elements	Crankshaft	Stamped forging	○	○	○	○	○	○	○	○
	Flywheel	Cast iron with ring gear	○	○	○	○	○	○	○	○
	Piston	Oval type	○	○	○	○	○	○	○	○
	Piston pin	Full floating type	○	○	○	○	○	○	○	○
	Piston rings	3-cornpression rings, 1-oil ring	○	○	○	○	○	○	○	○
Lubrication system	Oil pump	Trochoid pump	○	○	○	○	○	○	○	○
	Oil filter	Full-flow, spin-on cartridge type	○	○	○	○	○	○	○	○
	Oil level gauge	Dipstick	○	○	○	○	○	○	○	○
Cooling system	Water pump	Rubber impeller type	○	○	○	○	○	○	○	○
	Thermostat	Wax pellet type	○	○	○	○	○	○	○	○
	Fresh water cooling	Heat exchanger			○	○			○	○
Bilge system	Bilge pump	Rubber impeller combined with cooling water pump	○	○	○	○	○	○	○	○
Fuel system	Fuel injection pump	Integral 2-cylinder type	○	○	○	○				
		Integral 3-cylinder type					○	○	○	○
	Fuel injection valve	Throttle type	○	○	○	○	○	○	○	○
	Fuel strainer	Paper element type	○	○	○	○	○	○	○	○
	Fuel feed pump	Mechanical camshaft driven	○	○	○	○	○	○	○	○
Governor	Governor	Centrifugal all speed mechanical type	○	○	○	○	○	○	○	○
Starting system	Electric	Pinion shift type starter motor	○	○	○	○	○	○	○	○
	Manual	Cranking handle with chain sprocket	○	○	○	○	○	○	○	○
Electrical system	Charger	Alternator with built-in IC regulator	○	○	○	○	○	○	○	○
Reduction reversing	Reduction gear	Constant mesh spur gear	○		○		○		○	
		Constant mesh helical gear		○		○		○		○
Clutch system	Clutch	Wet type single disc, mechanical	○		○		○		○	
		Wet type multi disc, mechanical		○		○		○		○
Remote control	Decompression	Boden wire	○	○	○	○	○	○	○	○
	Engine stop	Boden wire	○	○	○	○	○	○	○	○
	One-handle remote control	Speed and Clutch control		○		○		○		○
	Two-handle remote control	Speed control	○		○		○		○	
		Clutch control	○		○		○		○	
	Electric wiring	Extension wireharness	○	○	○	○	○	○	○	○

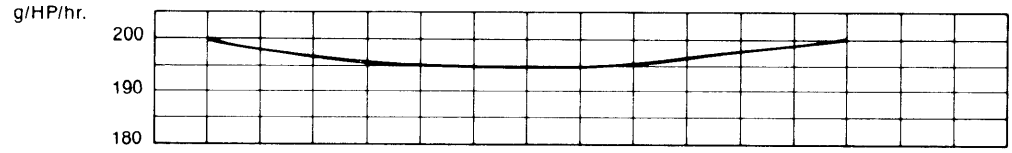
4. Performance Curves

4-1 2QM20(H)

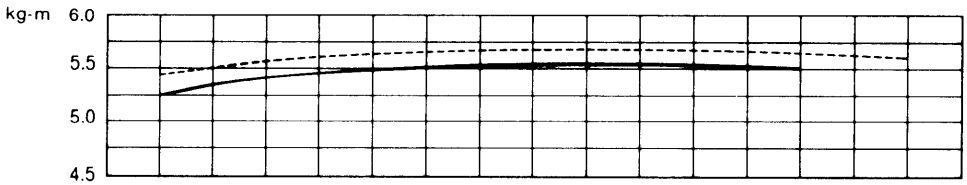
Fuel consumption



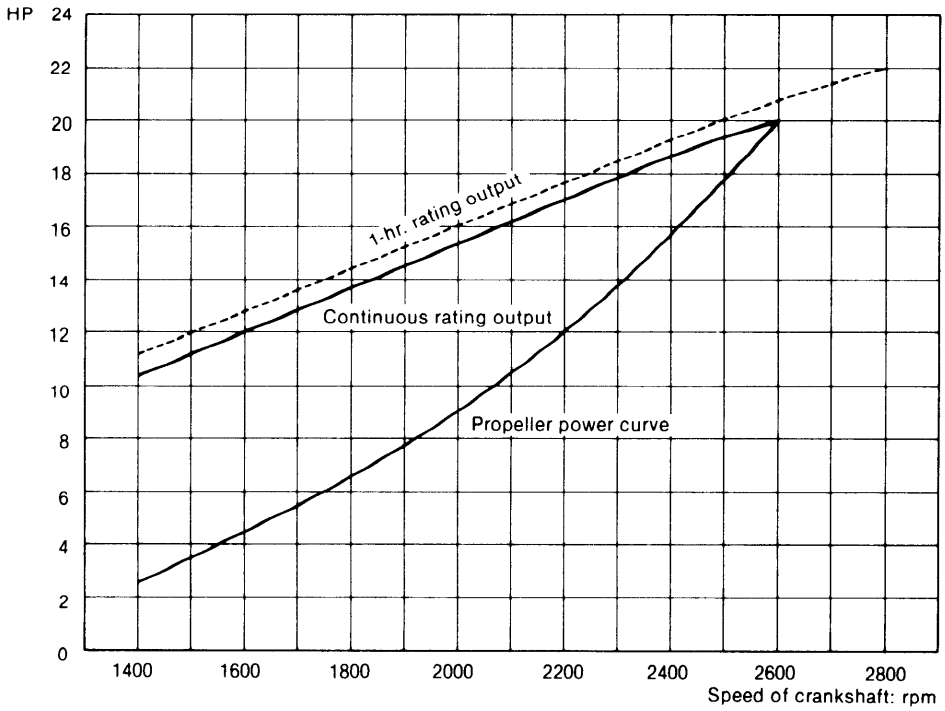
Specific fuel consumption



Torque



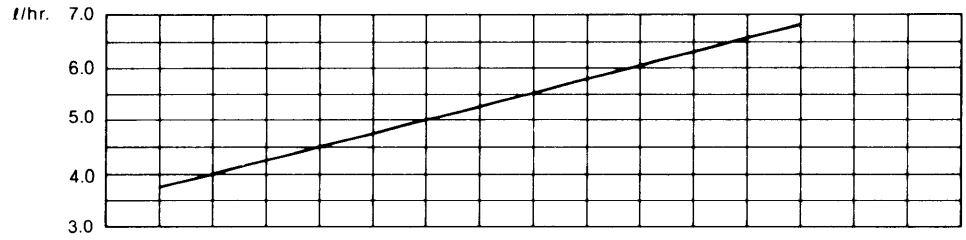
Output



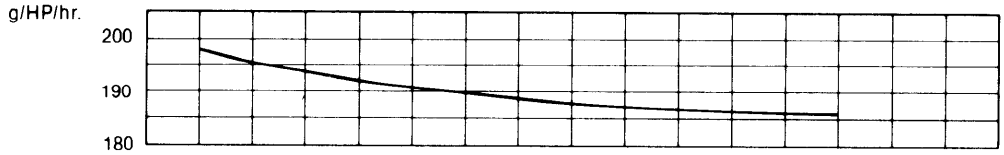
Note: These curves show the average performance of respective engines in test operation at our plant.

4-2 3QM30(H)

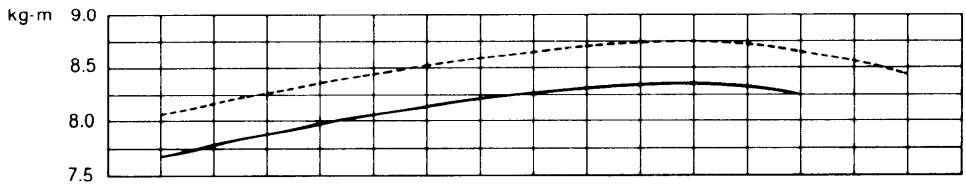
Fuel consumption



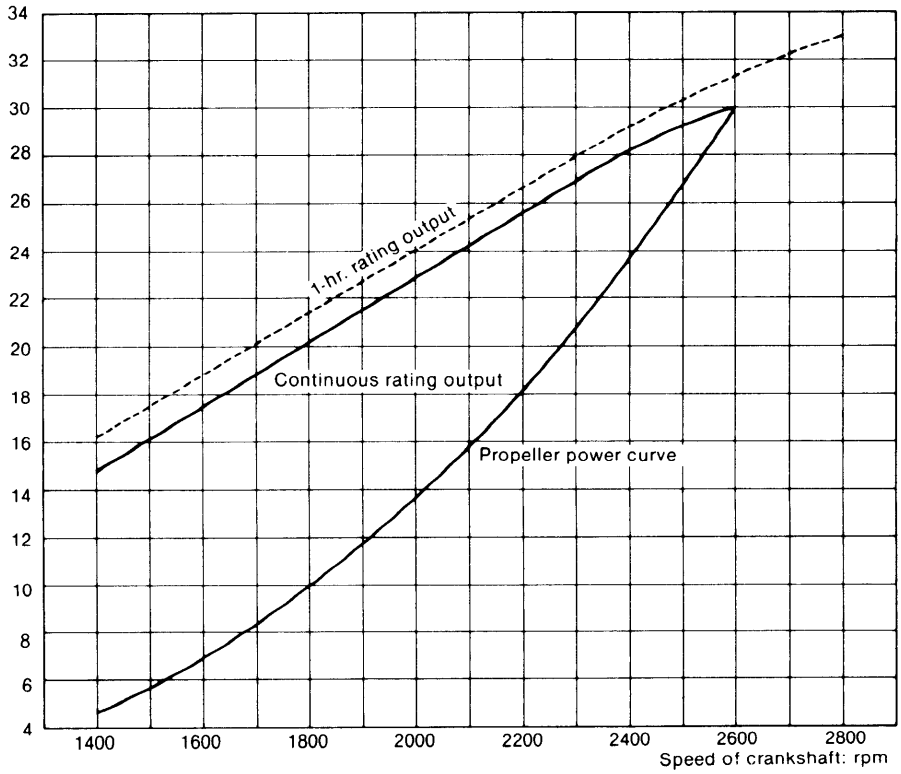
Specific fuel consumption



Torque



Output



Note: These curves show the average performance of respective engines in test operation at our plant.

5. Features

1. Superior combustion performance
The unique Yanmar swirl precombustion chamber combustion system 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.

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.

3. Compact, lightweight
The cylinder head is the integrally-cost 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.

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. 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.

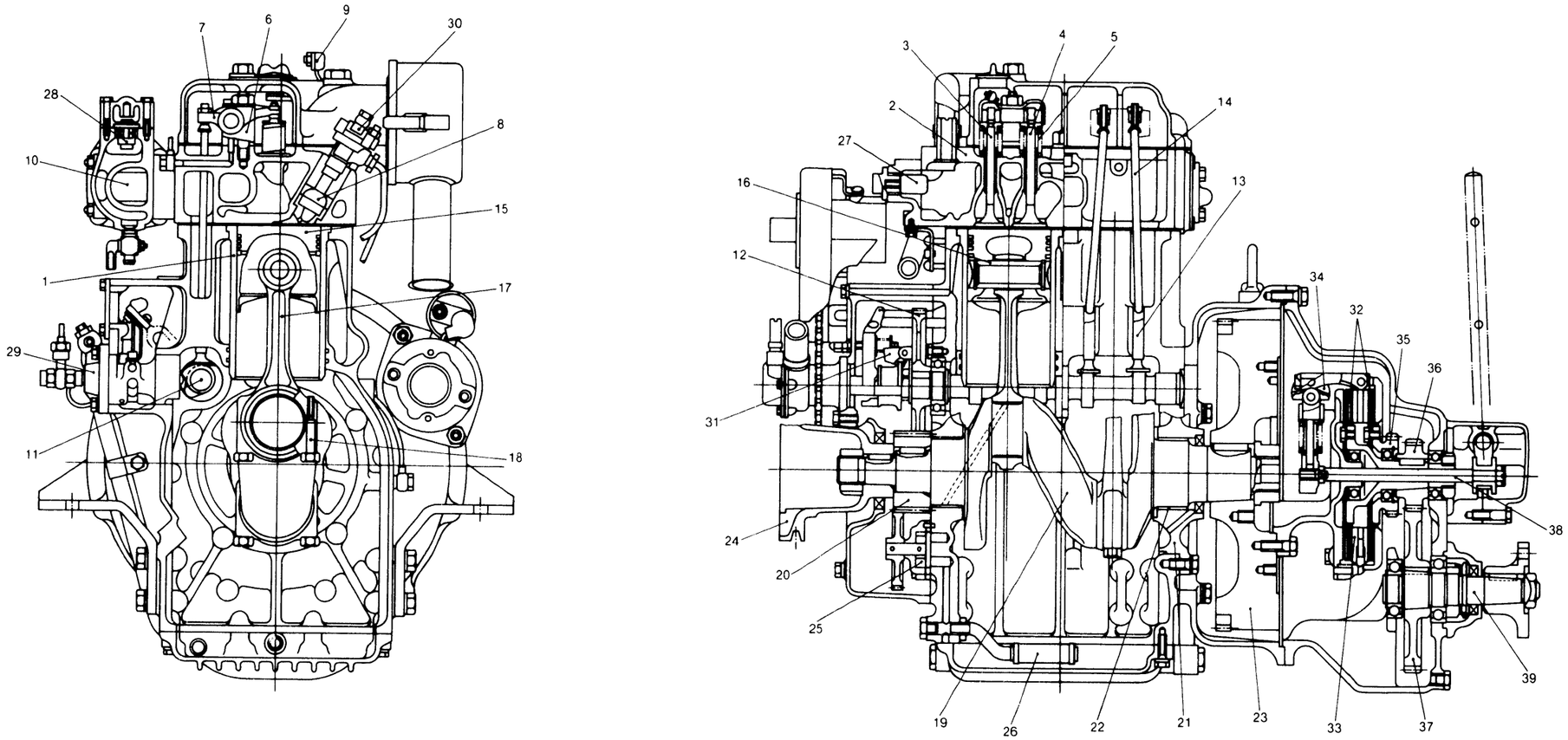
6. Quiet operation
Intake and exhaust noises have been lowered by adopting an intake silencer, water-cooled exhaust manifold and water mixing elbow type exhaust system.
The precombustion chamber system and semi-throttle type injection valve suppress combustion noise substantially.
Moreover, gear noise 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.

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, decompression 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) Tandem type cooling water/bilge pump is available as an option.

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) Threaded hole in the V-pulley permits front power take-off.
(3) Manual starting handle permits manual starting.
(4) Positive clutch engagement and disengagement; propeller shaft does not rotate when clutch is placed in neutral position.

6. Engine Cross-Section

6-1 2QM20



1. Cylinder liner
2. Cylinder head
3. Exhaust valve
4. Intake valve
5. Valve spring
6. Valve rocker arm support
7. Valve rocker arm
8. Precombustion chamber
9. Decompression lever
10. Exhaust manifold
11. Camshaft
12. Camshaft gear
13. Tappet
14. Push rod
15. Piston
16. Piston pin
17. Connecting rod
18. Connecting rod bolt
19. Crankshaft
20. Crankshaft gear
21. Main bearing housing
22. Main bearing
23. Flywheel
24. Crankshaft V-pulley
25. Lubricating oil pump
26. Lubricating oil inlet pipe
27. Anticorrosion zinc
28. Thermostat
29. Fuel injection pump
30. Fuel injection valve
31. Governor weight
32. Friction disc
33. Steel disc plate
34. V-lever
35. Reversing shaft gear
36. Forward small gear
37. Forward large gear
38. Shifting shaft
39. Output shaft

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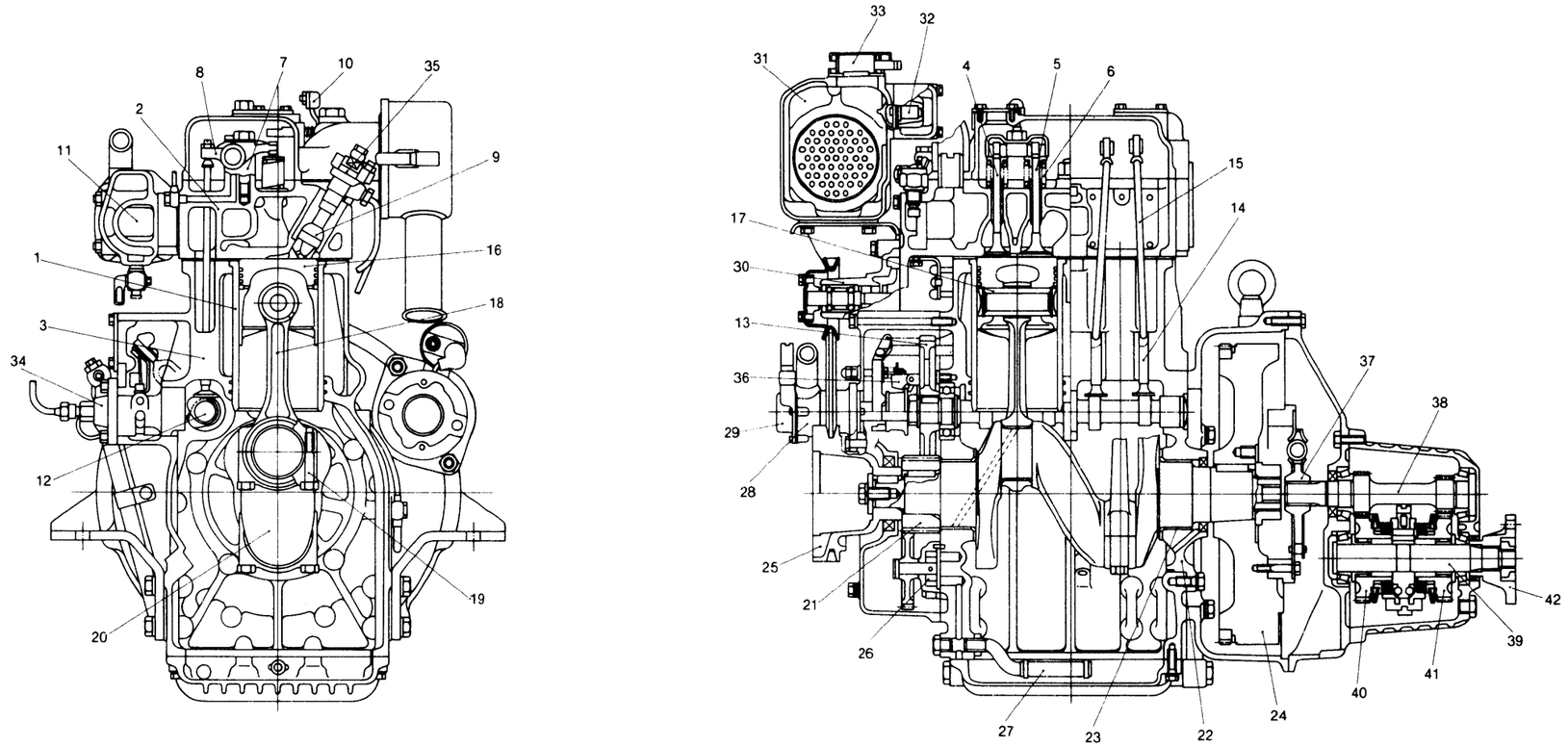
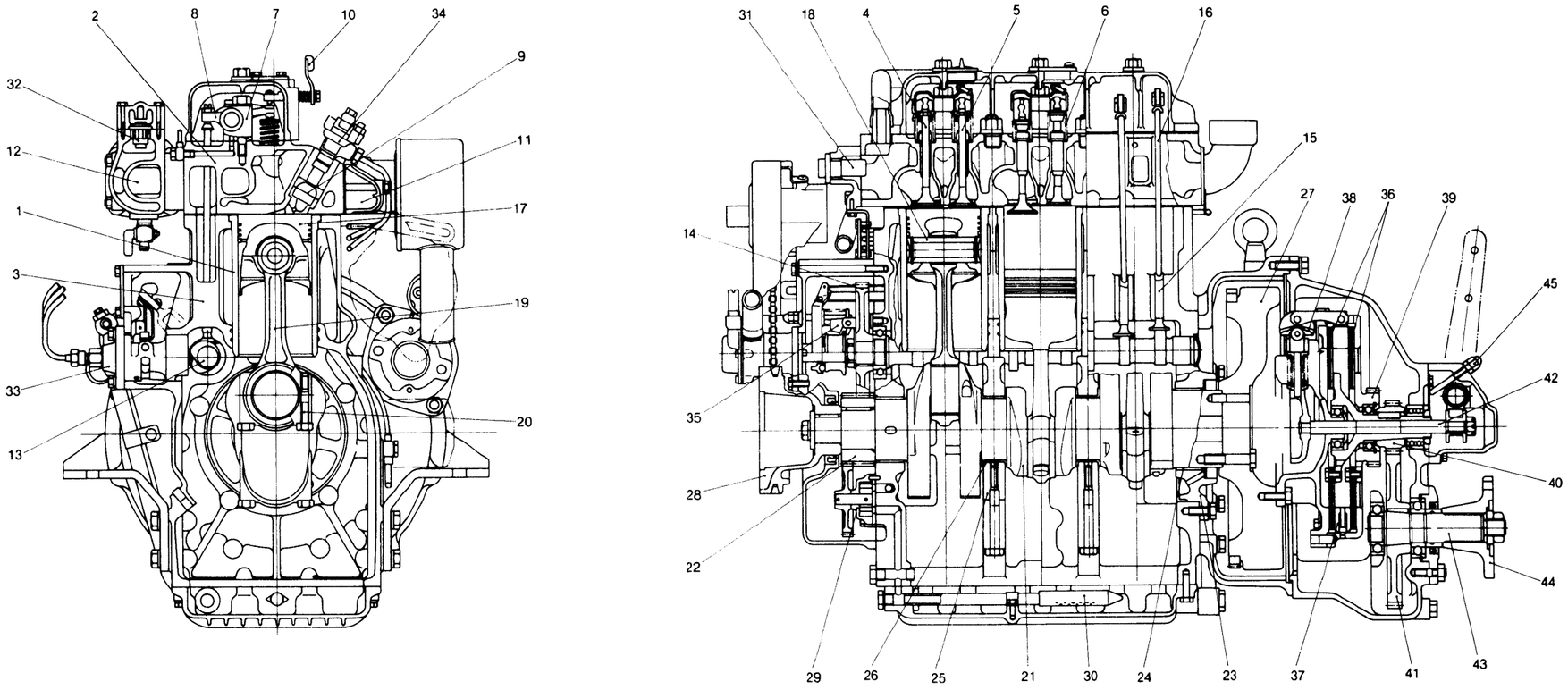
6-2 2QM20F



1. Cylinder liner
2. Cylinder head
3. Cylinder block
4. Exhaust valve
5. Intake valve
6. Valve spring
7. Valve rocker arm support
8. Valve rocker arm
9. Precombustion chamber
10. Decompression lever
11. Exhaust manifold
12. Camshaft
13. Camshaft gear
14. Tappet
15. Push rod
16. Piston
17. Piston pin
18. Connecting rod
19. Connecting rod bolt
20. Crankshaft
21. Crankshaft gear
22. Main bearing housing
23. Main bearing
24. Flywheel
25. Crankshaft V-pulley
26. Lubricating oil pump
27. Lubricating oil inlet pipe
28. Cooling water pump (sea water)
29. Bilge pump (option)
30. Cooling water pump (fresh water)
31. Heat exchanger
32. Thermostat
33. Filler cap (with pressure valve)
34. Fuel injection pump
35. Fuel injection valve
36. Governor weight
37. Damper disc
38. Input shaft
39. Output shaft
40. Forward large gear
41. Reverse large gear
42. Output shaft coupling

6-3 3QM30



1. Cylinder liner
2. Cylinder head
3. Cylinder block
4. Intake valve
5. Exhaust valve
6. Valve spring
7. Valve rocker arm support
8. Valve rocker arm
9. Precombustion chamber
10. Decompression lever
11. Intake manifold
12. Exhaust manifold
13. Camshaft
14. Camshaft gear
15. Tappet
16. Push rod
17. Piston
18. Piston pin
19. Connecting rod
20. Connecting rod bolt
21. Crankshaft
22. Crankshaft gear
23. Main bearing housing
24. Main bearing
25. Intermediate main bearing housing
26. Intermediate main bearing
27. Flywheel
28. Crankshaft V-pulley
29. Lubricating oil pump
30. Lubricating oil inlet pipe
31. Anticorrosion zinc
32. Thermostat
33. Fuel injection pump
34. Fuel injection valve
35. Governor weight
36. Friction disc
37. Steel disc plate
38. V-lever
39. Reversing shaft gear
40. Forward small gear
41. Forward large gear
42. Shifting shaft
43. Output shaft
44. Output shaft coupling
45. Neutral point set claw

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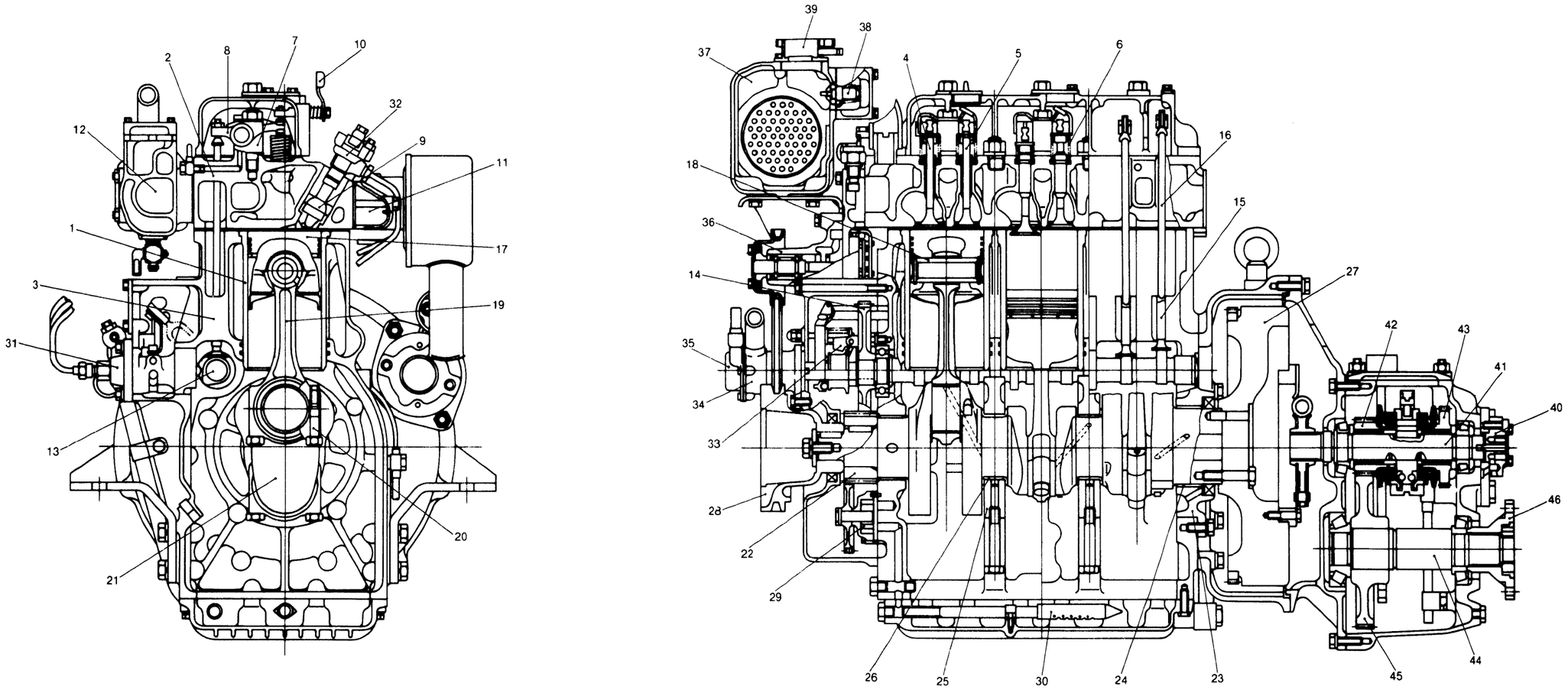
6-4 3QM30F



1. Cylinder liner
2. Cylinder head
3. Cylinder block
4. Intake valve
5. Exhaust valve
6. Valve spring
7. Valve rocker arm support
8. Valve rocker arm
9. Precombustion chamber
10. Decompression lever
11. Intake manifold
12. Exhaust manifold
13. Camshaft
14. Camshaft gear
15. Tappet
16. Push rod
17. Piston
18. Piston pin
19. Connecting rod
20. Connecting rod bolt
21. Crankshaft
22. Crankshaft gear
23. Main bearing housing
24. Main bearing
25. Intermediate main bearing housing
26. Intermediate main bearing
27. Flywheel
28. Crankshaft V-pulley
29. Lubricating oil pump
30. Lubricating oil inlet pipe
31. Fuel injection pump
32. Fuel injection valve
33. Governor weight
34. Cooling water pump (sea water)
35. Bilge pump (option)
36. Cooling water pump (fresh water)
37. Heat exchanger
38. Thermostat
39. Filler cap (with pressure relief valve)
40. Lubricating oil pump (clutch)
41. Input shaft
42. Forward small gear
43. Reverse small gear
44. Output shaft
45. Output shaft large gear
46. Output shaft coupling

7. Dimensions

7-1 2QM20

mm (in.)