

## **SERVICE MANUAL**

## MARINE DIESEL ENGINE

2QM20(H),3QM30(H)

# YARAAAA SERVICE MANUAL

MARINE DIESEL ENGINE

MODEL 2QM2O(H) 3QM3O(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)

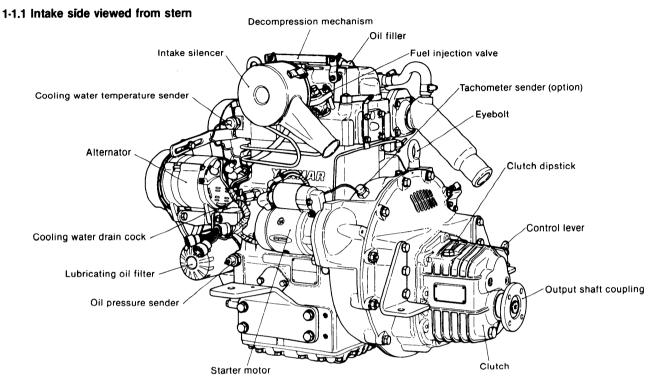
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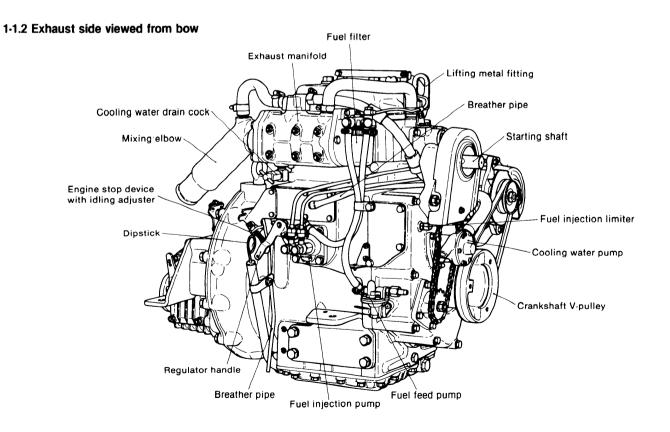
## GENERAL

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### 1. Exterior Views

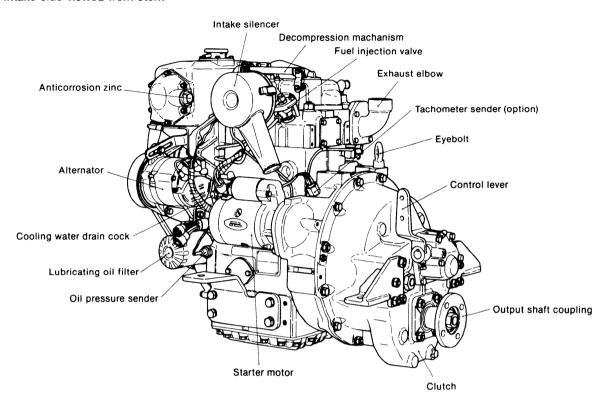
#### 1-1 2QM20H



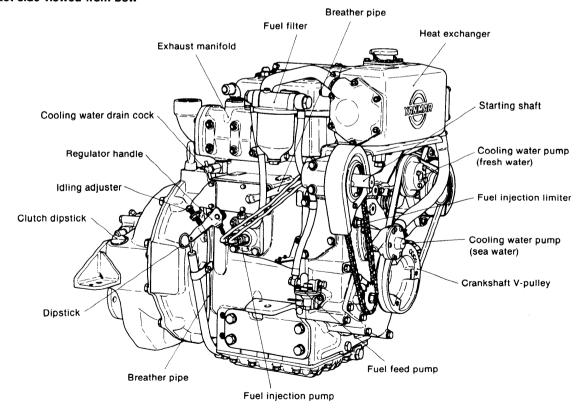


#### 1-2 2QM20Y

#### 1-2.1 Intake side viewed from stern

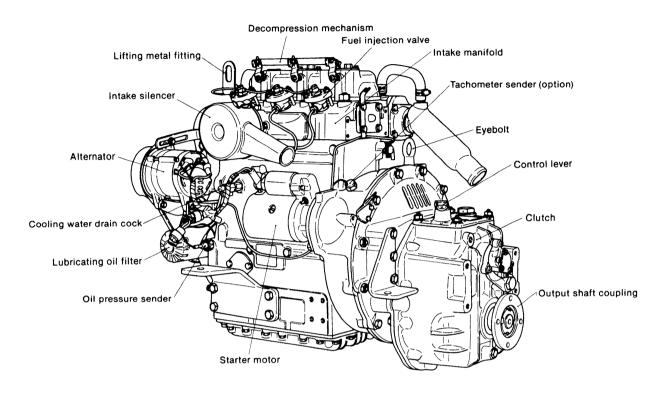


#### 1-2.2 Exhaust side viewed from bow

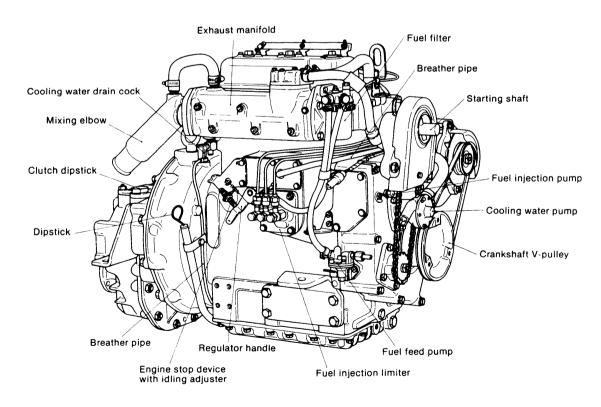


#### 1-3 3QM30H

#### 1-3.1 Intake side viewed from stern

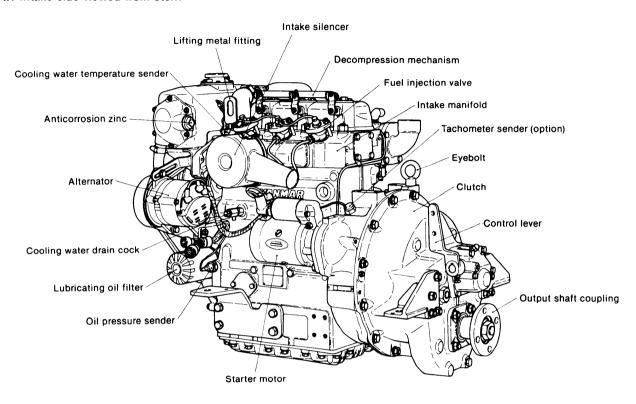


#### 1-3.2 Exhaust side viewed from bow

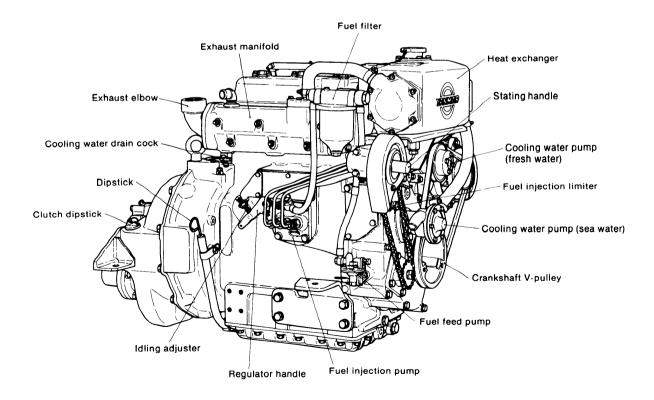


#### 1-4 3QM30Y

#### 1-4.1 Intake side viewed from stern



#### 1-4.2 Exhaust side viewed from bow



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## 2. Specifications

		2QM20[2	QM20B]	2QI	M20H	2Q	M20Y	2QN	/20F			
Туре				Vertical 4-cycle water cooled diesel engine								
Combustion chamber				Swirl pre-combustion chamber								
Number of cylinders				2								
Bore × stroke		mm	88×90									
Displacement		СС	1094									
	Output/Crankshaft speed	HP/rpm	20/2600									
Continuous rating	Brake mean effective pressure	kg/cm²	6.33									
output (DIN6270A)	Piston speed	m/sec.	7.80									
	Propeller speed (Ahead)	rpm	1182	810	1215	919	1182	810	1215	919		
	Output/crankshaft speed	HP/rpm	22/2800									
One hour rating	Brake mean effective pressure	kg/cm²				6	.46					
output (DIN6270B)	Piston speed	m/sec.	8.40									
	Propeller speed (Ahead)	rpm	1273	872	1308	989	1273	872	1308	989		
Compression ra	tio			•	•	2	0:1					
Fuel injection timing de						bTE	OC 25					
Fuel injection pr	essure	kg/cm²		160±10								
Engine weight (d	ry)	kg	2:	220 190 260 230								
Main power take off			at Flywheel side									
Front power take	off		at Crankshaft V-pulley side									
Discotion of anti-tion	Crankshaft		Counter-clockwise viewed from stern									
Direction of rotation	Propeller shaft		Clockwise viewed from stern									
Cooling system			Direct sea water cooling Fresh water cooling									
Lubrication syste	em		Complete enclosed forced lubrication									
Starting system			Electric and/or manual									
Reduction gear s	system			Constant-mesh spur gear Constant-mesh helical gear spur gear					h 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[Y	'P-10M]	KBV	V10A	YP-	10M	KBW	10A		
Deduction action	Ahead		2.20	3.21	2.14	2.83	2.20	3.21	2.14	2.83		
Reduction ratio	Astern		2.30	3.46	2.	50	2.30	3.46	2.5	50		
	Overall length	mm	825 [810]		821.5		810		821.5			
Dimensions	Overall height	mm	675 [673]		665		714		706			
	Overall width	mm	501		501		562		562			
	Total	1	5.1									
Lubricating oil capacity	Effective	1	3.3									
· , ,	Clutch	1	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			3Q	M30	3QI	изон	3QI	M30Y	3QN	И30F		
		Vertical 4-cycle water cooled diesel engine										
Combustion chamber			Swirl pre-combustion chamber									
Number of cylinders							3					
Bore × stroke		mm	88×90									
Displacement		СС	1642									
	Output/Crankshaft speed	HP/rpm	30/2600									
Continuous rating	Brake mean effective pressure	kg/cm²	6.32									
output (DIN6270A)	Piston speed	m/sec.	7.80									
	Propeller speed (Ahead)	rpm	1182	810	1281	867	1182	810	1281	867		
to where the	Output/crankshaft speed	HP/rpm				33/	2800					
One hour rating	Brake mean effective pressure	kg/cm²	6.46									
output (DIN6270B)	Piston speed	m/sec.	8.40									
	Propeller speed (Ahead)	rpm	1273	872	1379	933	1273	872	1379	933		
Compression r	atio				-	20	0:1	•		•		
Fuel injection timing						bTD	C 28					
Fuel injection p	kg/cm²		160±10									
Engine weight	(dry)	kg	2	280 260 310 290								
Main power tak		at Flywheel side										
Front power ta	ke off		at Crankshaft V-pulley side									
Direction of rotation	Crankshaft		Counter-clockwise viewed from stern									
Direction of rotation	Propeller shaft			Clockwise viewed from stern								
Cooling systen	1		Direct sea water cooling Fresh water cooling									
Lubrication sys	stem		Complete enclosed forced lubrication									
Starting system	n		Electric and/or manual									
Reduction gear system			Constar spur	nt-mesh 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		
	Overall length	mm	92	924		952.5		924		966.5		
Dimensions	Overall height	mm	673		692		714		733			
	Overall width	mm	501		501		562		562			
	Total	l		6.5								
Lubricating oil capacity	Effective	1	2.2									
•	Clutch		1.	1.2		*1.7		1,2		*1.7		

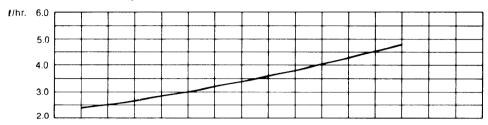
## 3. Principal Construction

Group	Part	Construction	2QM20 2QM20B	2QM20H	2QM20Y	2QM20F	3QM30	3QM30H	3QM30Y	3QM30F
	Cylinder block	Integrally-cast water jacket and crankcase	0	0	0	0	0	0	0	0
Engine block	Cylinder liner	Wet type coated with anticorrosion point	0	0	0	0	0	0	0	0
	Main bearing	Bearing housing type without intermediate bearing	0	0	0	0				
	Main bearing	Bearing housing type with intermediate bearing					0	0	0	0
	Oil sump	Bottom cover (Oil pan)	0	0	0	0	0	0	0	0
	Cylinder head	Integrated two-cylinder	0	0	0	0				
	Cylinder flead	Integrated three-cylinder					0	0	0	0
Intake and	Intake and exhaust valves	Poppet type, seat angle 90°	0	0	0	0	0	0	0	0
exhaust systems	Exhaust manifold	Integral water-cooled type	0	0	0	0	0	0	0	0
and valve mechanism	Exhaust silencer	Water-cooled mixing elbow	0	0	0	0	0	0	0	0
	Valve mechanism	Overhead valve push rod, rocker arm system	0	0	0	0	0	0	0	0
	Intake silencer	Polyurethane filter, sound absorbing type	0	0	0	0	0	0	0	0
	Crankshaft	Stamped forging	0	0	0	0	0	0	0	0
	Flywheel	Cast iron with ring gear	0	0	0	0	0	0	0	0
Main moving elements	Piston	Oval type	0	0	0	0	0	0	0	0
	Piston pin	Full floating type	0	0	0	0	0	0	0	0
	Piston rings	3-cornpression rings, 1-oil ring	0	0	0	0	0	0	0	0
Lubrication system	Oil pump	Trochoid pump	0	0	0	0	0	0	0	0
	Oil filter	Full-flow, spin-on cartridge type	0	0	0	0	0	0	0	0
	Oil level gauge	Dipstick	0	0	0	0	0	0	0	0
Cooling system	Water pump	Rubber impeller type	0	0	0	0	0	0	0	0
	Thermostat	Wax pellet type	0	0	0	0	0	0	0	0
	Fresh water cooling	Heat exchanger			0	0			0	0
Bilge system	Bilge pump	Rubber impeller combined with cooling water pump	0	0	0	0	0	0	0	0
	Fuel injection	Integral 2-cylinder type	0	0	0	0				
	pump	Integral 3-cylinder type					0	0	0	0
Fuel system	Fuel injection valve	Throttle type	0	0	0	0	0	0	0	0
	Fuel strainer	Paper element type	0	0	0	0	0	0	0	0
	Fuel feed pump	Mechanical camshaft driven	0	0	0	0	0	0	0	0
Governor	Governor	Centrifugal all speed mechanical type	0	0	0	0	0	0	0	0
	Electric	Pinion shift type starter motor	0	0	0	0	0	0	0	0
Starting system	Manual	Cranking handle with chain sprocket	0	0	0	0	0	0	0	0
Electrical system	Charger	Alternator with built-in IC regulator	0	0	0	0	0	0	0	0
Reduction reversing	Reduction gear	Constant mesh spur gear	0		0		0		0	
		Constant mesh helical gear		0		0		0		0
Clutch system	Clutch	Wet type single disc, mechanical	0		0		0		0	
-,		Wet type multi disc, mechanical		0		0		0		0
	Decompression	Boden wire	0	0	0	0	0	0	0	
	Engine stop	Boden wire	0	0	0	0	0	0	0	<u> </u>
Remote control	One-handle remote control	Speed and Clutch control		0		0		0		0
	Two-handle	Speed control	0		0		0		0	
	remote control	Clutch control	0		0		0		0	
	Electric wiring	Extension wireharness	0	0	0	0	0	0	0	0

## 4. Performance Curves

4-1 2QM20(H)

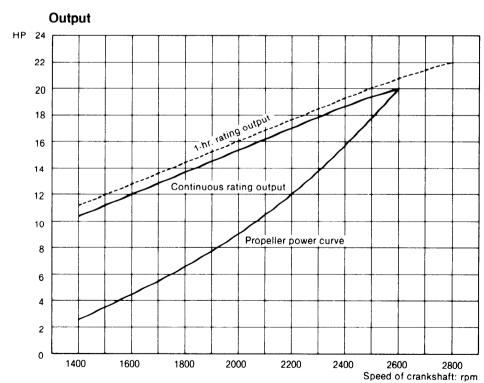




#### Specific fuel consumption



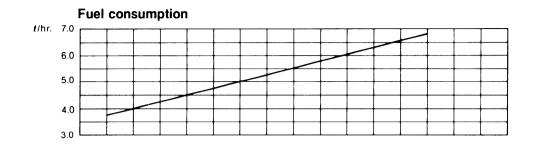
## Kg·m 6.0 5.5 5.0 4.5

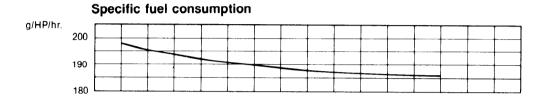


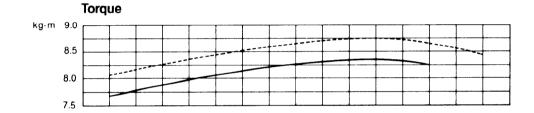
Note: These curves show the average performance of respective engines in test operation at our plant.

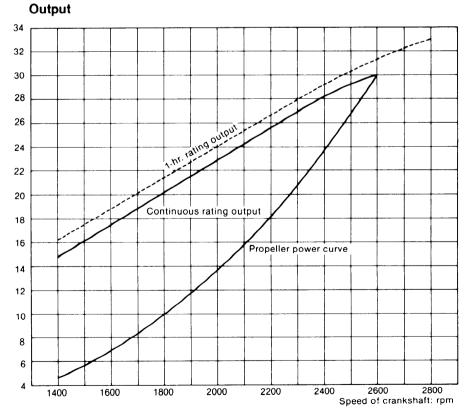
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#### 4-2 3QM30(H)









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.

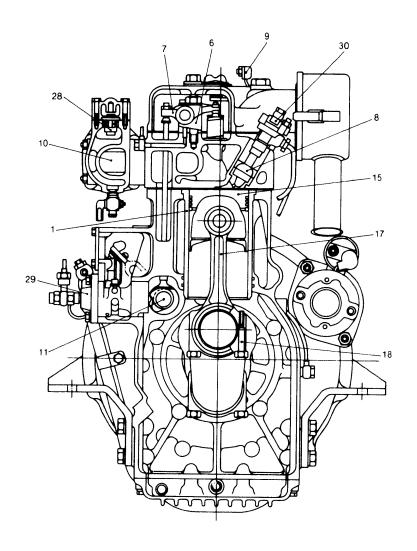
#### 8. Easy to operate

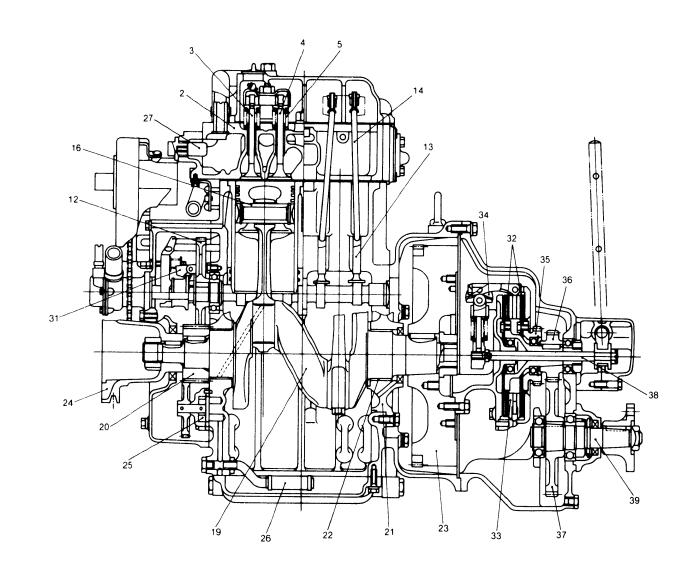
- (1) Cooling water temperature switch and lubricating oil pressure switch are provided, and alarm lamps and buzzer are mounted on the instrument panel.
- (2) Threaded hole in the V-pulley permits front power takeoff.
- (3) Manual starting handle permits manual starting.
- (4) Positive clutch engagement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

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## 6. Engine Cross-Section

6-1 2QM20





- Cylinder liner
   Cylinder head
   Exhaust valve
- 4. Intake valve

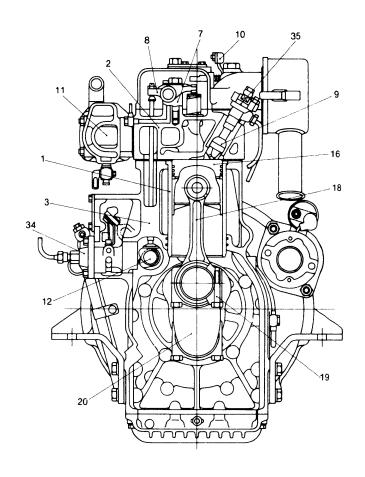
- 5. Valve spring6. Valve rocker arm support7. Valve rocker arm
- 8. Precombustion chamber
- 9. Decompression lever
- 10. Exhaust manifold
- 11. Camshaft 12. Camshaft gear
- 13. Tappet
- 14. Push rod

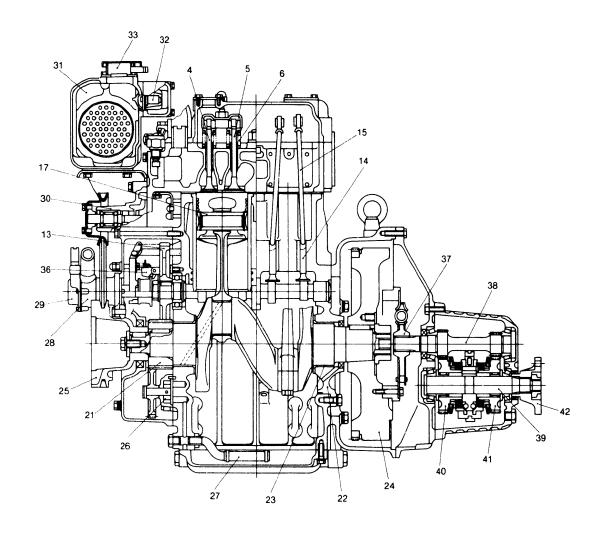
- 14. Push rod15. Piston16. Piston pin17. Connecting rod18. Connecting rod bolt19. Crankshaft20. Crankshaft gear

- 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

#### 6-2 2QM20F





- Cylinder liner
   Cylinder head
   Cylinder block
   Exhaust valve

- 5. Intake valve
- 6. Valve spring

- valve spring
   valve rocker arm support
   Valve rocker arm
   Precombustion chamber
   Decompression lever

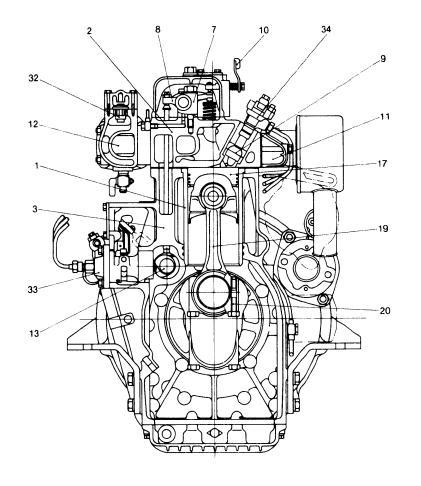
- 11. Exhaust manifold
  12. Camshaft
  13. Camshaft gear
  14. Tappet
  15. Push rod
  16. Piston
  17. Piston pin
  18. Connecting rod
  19. Connecting rod bolt
  20. Crankshaft

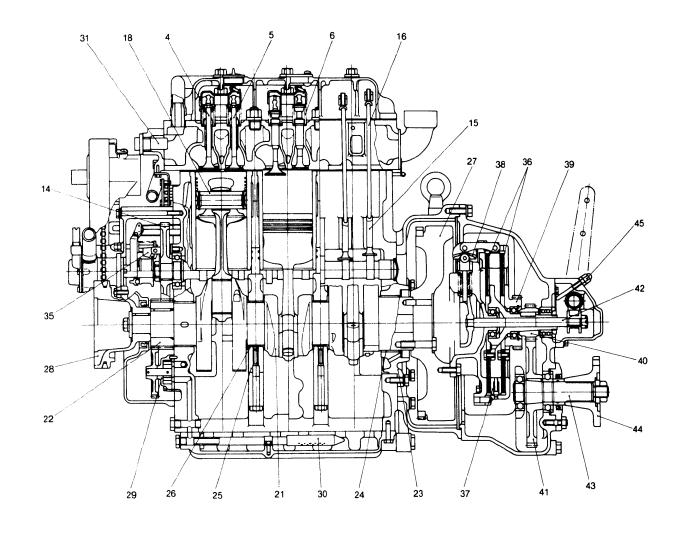
- 21. Crankshaft gear
  22. Main bearing housing
  23. Main bearing
  24. Flywheel
  25. Crankshaft V-pulley
  26. Lubricating oil pump
  27. Lubricating oil inlet pipe
  28. Cooling water pump (sea water)
  29. Bilge pump (option)
  30. Cooling water pump (fresh water)

- 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
  8. Valve rocker arm

- 8. Valve rocker arm
  9. Precombustion chamber
  10. Decompression lever

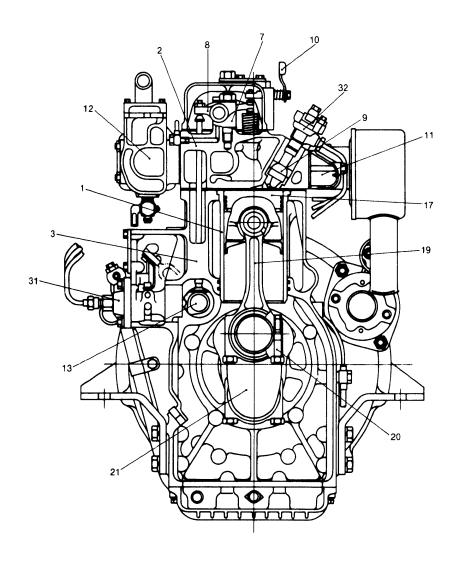
- 11. Intake manifold
  12. Exhaust manifold
  13. Camshaft
  14. Camshaft gear
  15. Tappet
  16. Push rod
  17. Piston
  18. Piston pin
  19. Connecting rod
  20. Connecting rod bolt

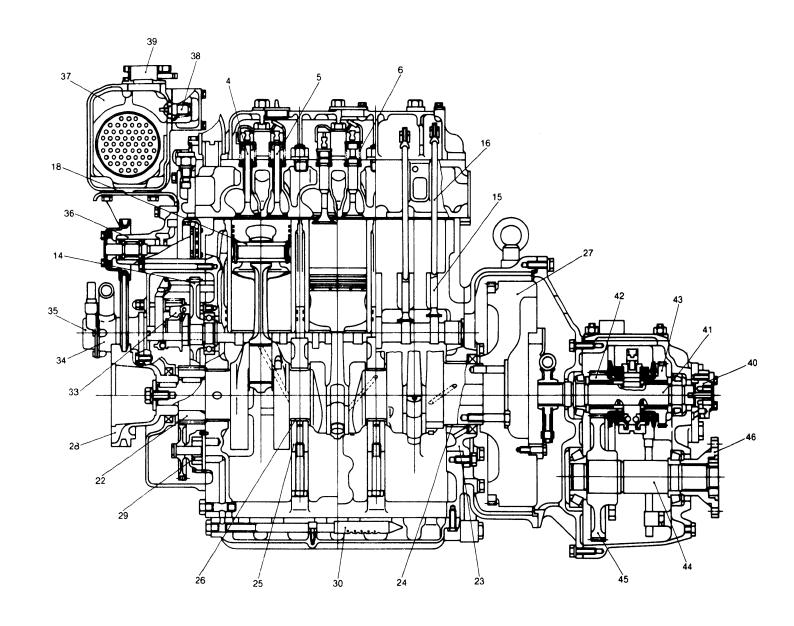
- 21. Crankshaft
  22. Crankshaft gear
  23. Main bearing housing
  24. Main bearing
  25. Intermediate main bearing housing
  26. Intermediate main bearing
  27. Flywheel
  28. Crankshaft V-pulley
  29. Lubricating oil pump
  30. Lubricating oil inlet pipe

- 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.layer

- 38. V-lever 39. Reversing shaft gear 40. Forward small gear
- 41. Forward large gear42. Shifting shaft43. Output shaft44. Output shaft coupling45. Neutral point set claw

#### 6-4 3QM30F





- Cylinder liner
   Cylinder head
   Cylinder block
   Intake valve

- 5. Exhaust valve
- 6. Valve spring
- 7. Valve rocker arm support

- Valve rocker arm
   Precombustion chamber
   Decompression lever

- 11. Intake manifold12. Exhaust manifold13. Camshaft
- 14. Camshaft gear
- 15. Tappet 16. Push rod
- 17. Piston

- 18. Piston pin
  19. Connecting rod
  20. Connecting rod bolt
- 21. Crankshaft22. Crankshaft gear23. Main bearing housing24. Main bearing25. Intermediate main bearing housing26. Intermediate main bearing

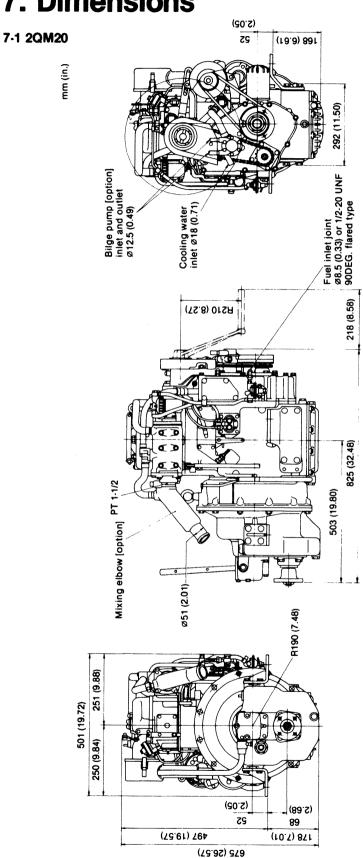
- 20. Intermediate main bearing27. Flywheel.28. Crankshaft V-pulley29. Lubricating oil pump30. Lubricating oil inlet pipe
- 31. Fuel injection pump 32. Fuel injection valve

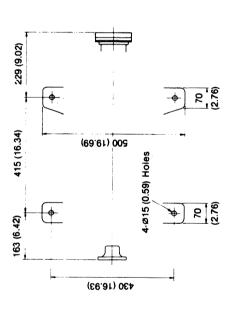
- 33. Governor weight
  34. Cooling water pump (sea water)
  35. Bilge pump (option)
  36. Cooling water pump (fresh water)
  37. Heat exchanger

- 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





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