YANMAR

HINSHI-H10-001-2

SERVICE MANUAL

MARINE DIESEL ENGINE

6LP-DTE/-DTZE(1)
6LPA-DTP/-DTZP
6LP-STE/-STZE(1)
6LPA-STP/-STZP

2001.6

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MODEL

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6LP-STE/-STZE(1)
6LPA-STP/-STZP

YANMAR DIESEL ENGINE CO.,LTD.

Publication No.	HINSHI-H10-001-2

History of Revision	Page No.	1

Manual Name	Yanmar Service Manual for Marine Diesel Engine
Engine Model:	6LP-DTE/DTZE/DTZE1, 6LPA-DTP/DTZP, 6LP-STE/STZE/STZE1, 6LPA-STP/STZP

Number of revision	Date of revision	Reason for correction	Outline of correction	Correction item No.(page)	Corrected by
●	New edition	July 1998			
●	1st revised edition	April 1999	(Publication No. HINSHI-H10-001-1) 6LP-DTZE1, 6LP-STZE1 (less power steering oil pump) added		
●	2nd revised edition	Jun., 2001	(Publication No. HINSHI-H10-001-2) 6LPA-DTP/DTZP/STP/STZP added. Revised pages: -ii-, -iii-, -iv-, -vi-, -v-, -vii-, -viii-, -ix-, -x-, -xi-, -xii-, -xiii-, -xiv, -xv-, -xvi-, -xvii-, 2-1, 2-2, 2-3, 2-4, 2-5, 2-10, 2-11, 3-1, 3-75, 3-132, 5-1, 5-2, 5-3(E), 6-1, 6-2, 6-3(E), 7-3, coverpages and back pages Added pages: 2-1-2, 2-1-3, 2-7-2, 2-7-3, 2-7-4 and 2-7-5		

FOREWORD

This manual describes the service procedures for the 6LP and 6LPA series marine diesel engine.

Please use this manual for accurate, quick and safe servicing of the respective engine. Since the explanation herein assumes the standard type engine, the specifications and components may partially be different from the engine installed on each boat. Please also refer to the service manual for each boat for details.

The specifications and components are subject to change for improvement of the engine quality. If any modification of the contents described in this manual becomes necessary, it will be notified in the form of a correction notice each time.

California
Proposition 65 Warning

Diesel engine exhaust and some of its constitutions are known to the State of California to cause cancer, birth defects, and other reproductive harm.

California
Proposition 65 Warning

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm.

CONTENTS

Notice: *The descriptions for the 6LP-DTE series also apply to 6LPA-DTP series. The descriptions for the 6LP-STE series also apply to 6LPA-STP series.*

1. For Safe Operation

1.1 Warning Symbols

- Most accidents are caused by negligence of basic safety rules and precautions.
  For accident prevention, it is important to avoid such causes before development to accidents.
  Please read this manual carefully before starting repair or maintenance to fully understand safety precautions and appropriate inspection and maintenance procedures.
  Attempting a repair or maintenance job without sufficient knowledge may cause an unexpected accident.

- It is impossible to cover every possible danger in repair or maintenance in the manual.
  Sufficient consideration for safety is required in addition to the matters marked ⚠ CAUTION.
  Especially for safety precautions in a repair or maintenance job not described in this manual, receive instructions from a knowledgeable leader.

- Warning Symbols used in this manual and their meanings are as follows:

⚠ DANGER	***DANGER - Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.***
⚠ WARNING	***WARNING - Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.***
⚠ CAUTION	***CAUTION - Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.***

- Any matter marked **[NOTICE]** in this manual is especially important in serving. If not observed, the product performance and quality may not be guaranteed.

1.2 Precautions for Safe Servicing

(1) Service Shop (Place)

⚠ WARNING

● **Place allowing sufficient ventilation**

Jobs such as engine running, part welding and polishing the paint with sandpaper should be done in a well-ventilated place.

[Otherwise]

Very dangerous for human body due to the possibility of poisonous gas or dust inhalation.

⚠ CAUTION

● **Sufficiently wide and flat place**

The floor space of the service shop for inspection and maintenance shall be sufficiently wide and flat without any hole.

[Otherwise]

An accident such as a violent fall may be caused.

⚠ CAUTION

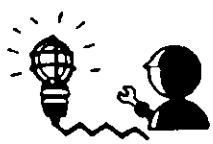
● **Clean, orderly arranged place**

No dust, mud, oil or parts shall be left on the floor surface.

[Otherwise]

An unexpected accident may be caused.

⚠ CAUTION



● **Bright, safety illuminated place**

The working place should be illuminated sufficiently and safely. For a job in a dark position involving difficulty in observation, use a portable safety lamp. The bulb shall be covered with a wire cage.

[Otherwise]

The bulb may be broken accidentally to cause ignition of leaking oil.

⚠ CAUTION

● **Place equipped with a fire extinguisher**

Keep a first aid kit and fire extinguisher close at hand in preparation for an emergency of fire.

(2) Working Wear

⚠ CAUTION

● **Wears for safe operation**

Wear a helmet, working clothes, safety shoes and other safety protectors matching each job. Especially, wear well-fitting working clothes.

[Otherwise]

A serious accident such as trapping by a machine may arise.

(3) Tools to Be Used

⚠ WARNING

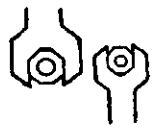
● **Appropriate holding and lifting**

Never operate when the engine is supported with blocks or wooden pieces or only with a jack. To lift and hold the engine, always use a crane with a sufficient allowance in limit load or a rigid jack.

[Otherwise]

A serious accident may arise.

⚠ WARNING



● **Use of appropriate tools**

Use tools matching the jobs to be done. Use a correctly sized tool for loosening or tightening a machine part.

[Otherwise]

A serious injury or engine damage may arise.

(4) Use of Genuine parts, Oil and Grease

⚠ CAUTION

● **Always use genuine product**

[Otherwise]

Shortening of engine life or an unexpected accident may arise.

(5) Bolt and Nut Tightening Torques

⚠ WARNING

● **Always tighten to the specified torque if designated in the manual**

[Otherwise]

Loosening or falling may cause parts damage or an injury.

(6) Handling Of Product

⚠ WARNING

● **Pay attention to hot portions**

Do not touch the engine during running or immediately after it is stopped.

[Otherwise]

Scalding may be caused by a high temperature.

⚠ WARNING

● **Pay attention to the rotating part**

Never bring clothes or a tool close to the rotating part during engine running.

[Otherwise]

Injury may be caused by entrapping.

⚠ WARNING

● **Harness short-circuit**

Disconnect the battery negative (–) terminal before starting the service job.

[Otherwise]

Shorting of a harness may occur to start a fire.

⚠ WARNING

● **Battery charging**

Since flammable gas is generated during battery charging, keep any fire source away.

[Otherwise]

Explosion may arise.

⚠ WARNING

● **Battery electrolyte**

Since the electrolyte is diluted sulfuric acid, do not let it be splashed onto clothes or skin.

[Otherwise]

The clothes or skin may be burnt.

(7) Waste Disposal

⚠ CAUTION

Observe the following instructions with regard to waste disposal. Negligence of each instruction will cause environmental pollution.

- Waste fluids such as engine oil and cooling water shall be discharged into a container without spillage onto the ground.
- Do not let waste fluids be discharged into the sewerage, a river or the sea.
- Harmful wastes such as oil, fuel, coolants, solvents, filter elements and battery shall be disposed according to the relevant laws and regulations. Ask a qualified disposal company for example.

(8) Safety Lable Check

⚠ CAUTION

● Pay attention to the product safety label.

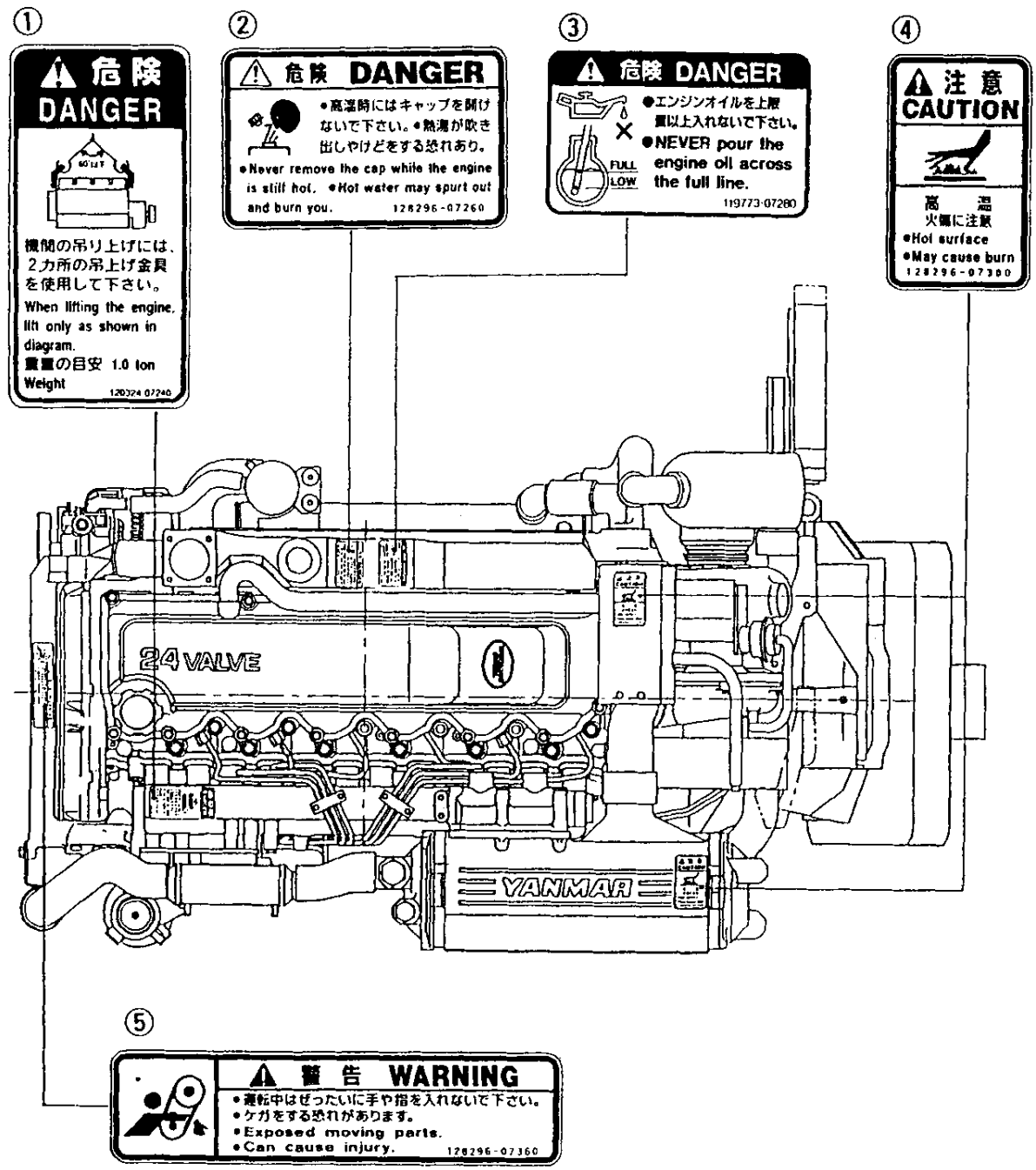
A safety label (caution plate) is affixed on the product for calling special attention to safety.

If it is missing or illegible, always affix a new one.

1.3 Location for Product Safety Labels

To insure safe operation, product safety labels have been attached. Their location is shown in the diagram below. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also replace labels when parts are replaced, ordering them in the same way parts are ordered.

Product Safety Labels, Parts Code Numbers	
①	120324-07240
②	128296-07260
③	119773-07280
④	128296-07300
⑤	128296-07360



The above diagram shows an overhead view of the engine.

2. General

2.1 Specifications

Engine model		6LP-DTE	6LP-STE	6LP-DTZE (1) ※	6LP-STZE (1) ※
Type		Vertical water-cooled 4-cycle diesel engine			
Number of cylinders – Bore × stroke mm		6 – ϕ 94 × 100			
Displacement ℓ		4.163			
Aspiration system		Turbocharger, intercooler			
Cont. rating output kW{hp}/rpm (Output/Flywheel)		154 {210}/3600	188 {255}/3600	154 {210}/3600	188 {255}/3600
Max. output kW{hp}/rpm (Output/Flywheel)		184 {250}/3800	221 {300}/3800	184 {250}/3800	221 {300}/3800
High idling (rpm)		4200 ± 25			
Low idling (rpm)		750 ± 25			
Combustion system		Direct injection			
Starting system		Electric starting			
Cooling system		Constant high temperature fresh water cooling (2 cooling systems: seawater & fresh water)			
Lubrication system		Forced lubrication system with gear pump			
Direction of rotation (Crankshaft)		Clockwise when viewed from stern side			
Fuel injection pump		BOSCH-distributor type Model VE6 (DENSO Co.)			
Fuel injection nozzle		Dual spring type Pinhole injection nozzle 6LP-DTE/-DTZE/-DTZE1: DLLA141P678 (5-0.30 × 140°) 6LP-STE/-STZE/-STZE1: DLLA141P677 (5-0.32 × 141°)			
Turbocharger		RHE62W(IHI)Water cooling and forced lubrication system with waste gate			
Elec. devices	Starter	DC12V - 2.5kW			
	Alternator	DC12V - 80A			
Lube oil capacity ℓ	Engine oil	10.0	10.5	10.0	10.5
Cooling water capacity ℓ	Fresh water tank	13.5			
	Subtank	1.6			
Dimensions (L × W × H) mm		1065 × 671 ×729	1065 × 671 × 729	1145 × 699 × 729	1145 × 699 × 729
Dry weight (engine only) kg (N)		380 (3724)	408 (3998)	400 (3920)	428 (4194)
On-board marine drive	Maker	[Note] Marine drive with SAE#3 structure can be used. Example : HURTH (Italy) HSW630A1 Marine gear		MERCRUISER (USA)	
	Type			BRAVO-1	BRAVO-2 / BRAVO-3
	Speed ratio Ahead/Astern			1.36 1.50	1.50 1.65 1.81 / 1.36 1.50 1.65 1.81
Engine installation style		Rubber vibro-isolating mount			
Recommended battery capacity		12V-80Ah(5HR) or greater			
Recommended engine room ventilator		20m^3/ min. or greater			

※ -DTZE1/-STZE1 : less power steering oil pump (Engine name designated by the engine manufacturer)
(Shown as 6LP-DTZE/STZE in the name plate)

Engine model		6LPA-DTP	6LPA-DTZP
Type		Vertical water-cooled 4-cycle diesel engine	
Number of cylinders – Bore × stroke mm		6– ϕ 94 × 100	
Displacement ℓ		4.164	
Fuel stop power at crankshaft kW{hp}/rpm		*191 {260} / 3800 **182 {248) / 3800	
Cont. power at crankshaft kW{hp}/rpm		154 {210} / 3600	
High idling (rpm)		4200 ± 25	
Low idling (rpm)		750 ± 25	
Combustion system		Direct injection	
Starting system		Electric starting (12V-2.5kW)	
Charging system		Regulator built in Alternator DC12V-80A	
Cooling system		Constant high temperature fresh water cooling (2 systems: sea & fresh water)	
Lubrication system		Forced lubrication system with trochoidal gear pump	
Direction of rotation (Crankshaft)		Counter-clockwise (Viewed from flywheel side)	
Lube oil capacity	All ℓ	10.0	
	Oil pan ℓ	8.4	
Cooling water capacity ℓ		13.5 (Engine), 1.6 (Sub-tank)	
Turbocharger	Model	RHE62W (IHI made)	
	Type	Water cooled turbine housing	
Dimensions (L × W × H) (gear less) mm		1065 × 671 × 729	1145 × 752 × 799
Dry mass (gear less) kg		380	400
Recommended battery capacity		12V × 120Ah	
Recommended type of remote control handle		Single lever type only	
Engine installation style		On the flexible engine mount	

(Note) 1. Rating condition: ISO 3046-1, 8665 2. 1hp=0.7355 kW
3. Fuel condition: Density at 15°C=0.860, Fuel oil temperature *: 25°C at the fuel injection pump inlet
**: ISO 8665 (Fuel oil temp. 40°C at the fuel injection pump inlet)

● Marine gear (Option)

Model	HURTH HSW630A1	MERCRUISER		
		Bravo X-1	Bravo X-2	Bravo X-3
Type	8° down Hydraulic	Stern drive		
Available engine	6LPA-DTP	6LPA-DTZP		
Reduction ratio HSW630A: Ahead/Astem Bravo X-1, 2, 3: Both Ahead and Astem	1.22/1.21	1.36	1.50	1.36
	1.56/1.58	1.50	1.65	1.50
	2.04/2.10	1.65	1.81	1.65
	2.52/2.53		2.00	1.81
			2.20	2.00
For further detail, refer to the maker's manual				

Engine model		6LPA-STP	6LPA-STZP
Type		Vertical water-cooled 4-cycle diesel engine	
Number of cylinders – Bore × stroke mm		6– ϕ 94 × 100	
Displacement ℓ		4.164	
Fuel stop power at crankshaft kW{hp}/rpm		*232 {315} / 3800 **222 {301} / 3800	
Cont. power at crankshaft kW{hp}/rpm		188 {255} / 3600	
High idling (rpm)		4200 ± 25	
Low idling (rpm)		750 ± 25	
Combustion system		Direct injection	
Starting system		Electric starting (12V-2.5kW)	
Charging system		Regulator built in Alternator DC12V-80A	
Cooling system		Constant high temperature fresh water cooling (2 systems: sea & fresh water)	
Lubrication system		Forced lubrication system with trochoidal gear pump	
Direction of rotation (Crankshaft)		Counter-clockwise (Viewed from flywheel side)	
Lube oil capacity	All ℓ	10.5	
	Oil pan ℓ	8.4	
Cooling water capacity ℓ		13.5 (Engine), 1.6 (Sub-tank)	
Turbocharger	Model	RHE62W (IHI made)	
	Type	Water cooled turbine housing	
Dimensions (L × W × H) (gear less) mm		1065 × 671 × 729	1145 × 752 × 799
Dry mass (gear less) kg		408	428
Recommended battery capacity		12V × 120Ah	
Recommended type of remote control handle		Single lever type only	
Engine installation style		On the flexible engine mount	

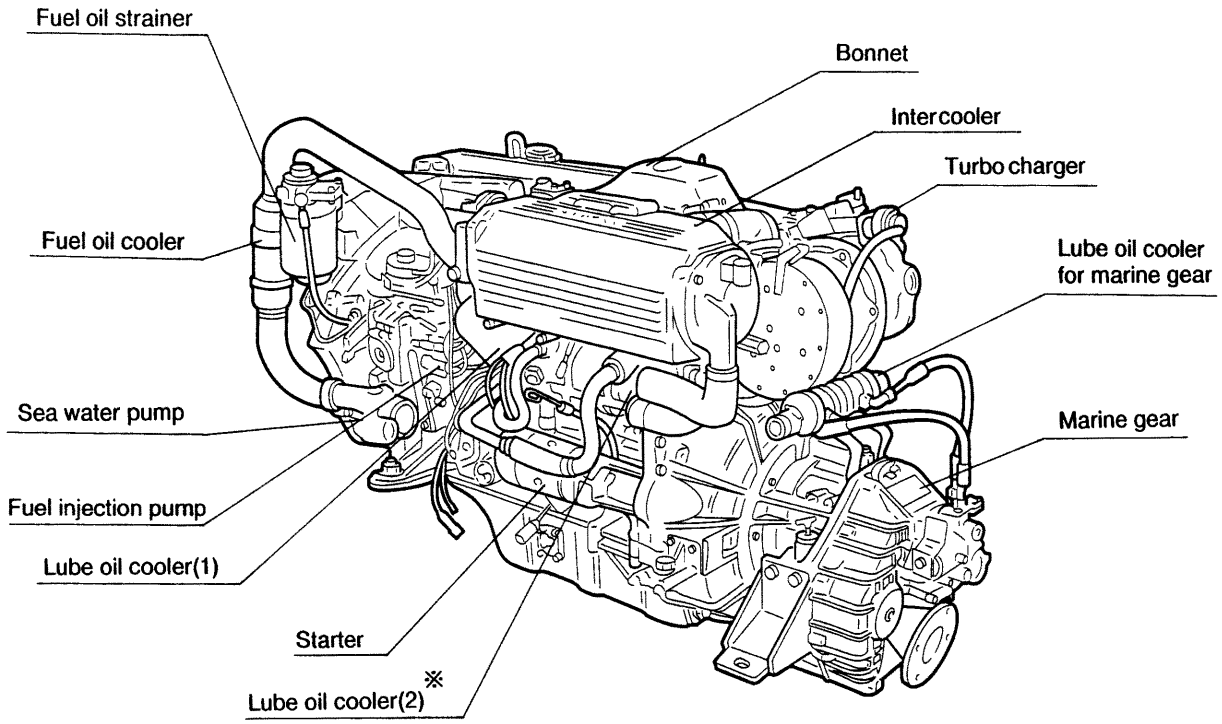
(Note) 1. Rating condition: ISO 3046-1, 8665 2. 1hp=0.7355 kW
3. Fuel condition: Density at 15°C=0.860, Fuel oil temperature *: 25°C at the fuel injection pump inlet
**: ISO 8665 (Fuel oil temp. 40°C at the fuel injection pump inlet)

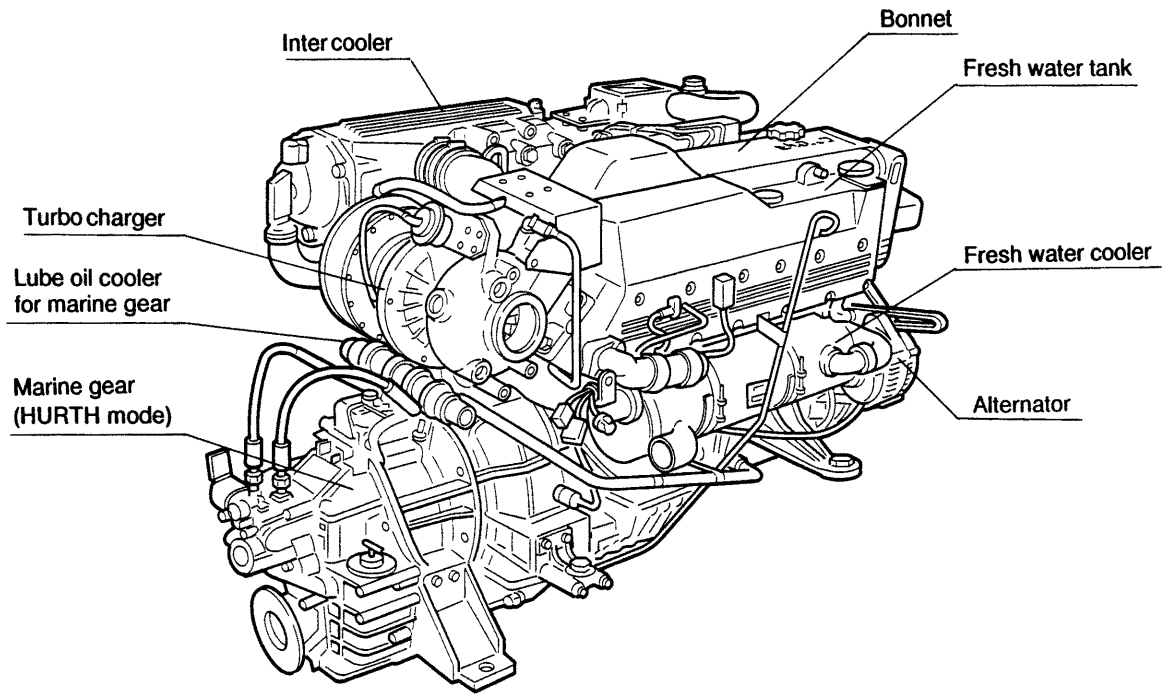
● Marine gear (Option)

Model	HURTH HSW630A1	MERCRUISER		
		Bravo X-1	Bravo X-2	Bravo X-3
Type	8° down Hydraulic	Stern drive		
Available engine	6LPA-STP	6LPA-STZP		
Reduction ratio HSW630A1: Ahead/Astem Bravo X-1, 2, 3: Both Ahead and Astem	1.22/1.21	1.36	1.50	1.36
	1.56/1.58	1.50	1.65	1.50
	2.04/2.10		1.81	1.65
	2.52/2.53		2.00	1.81
For further detail, refer to the maker's manual				

2.2 External Views

- **6LP-DTE/-STE, 6LPA-DTP/-STP**

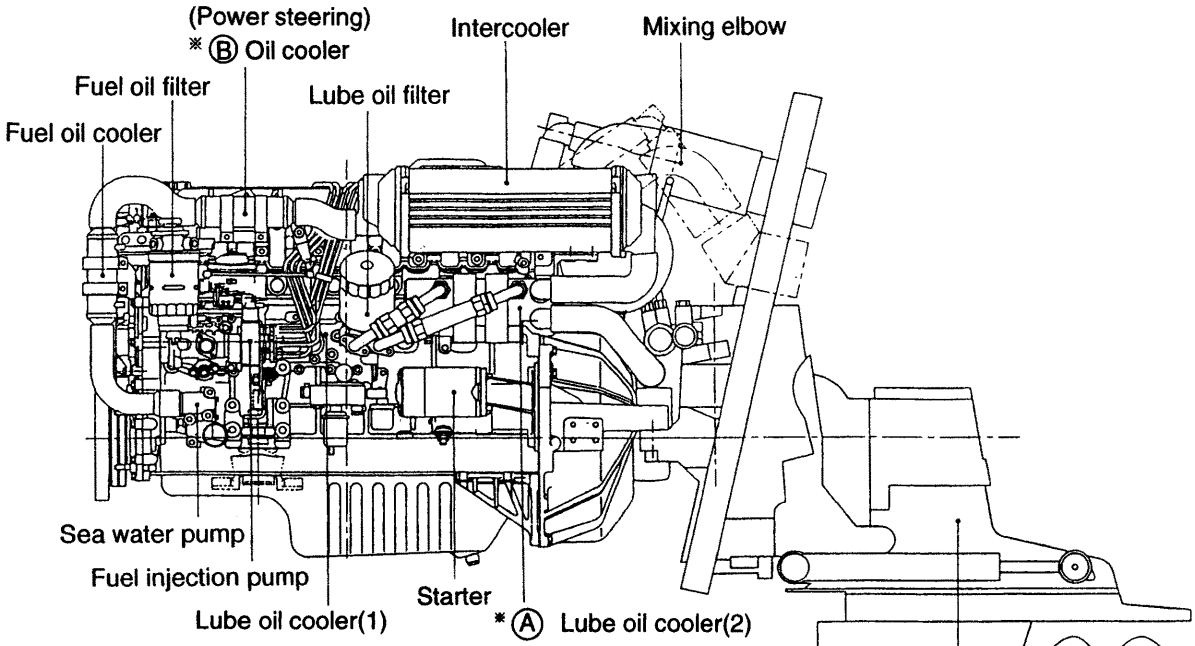




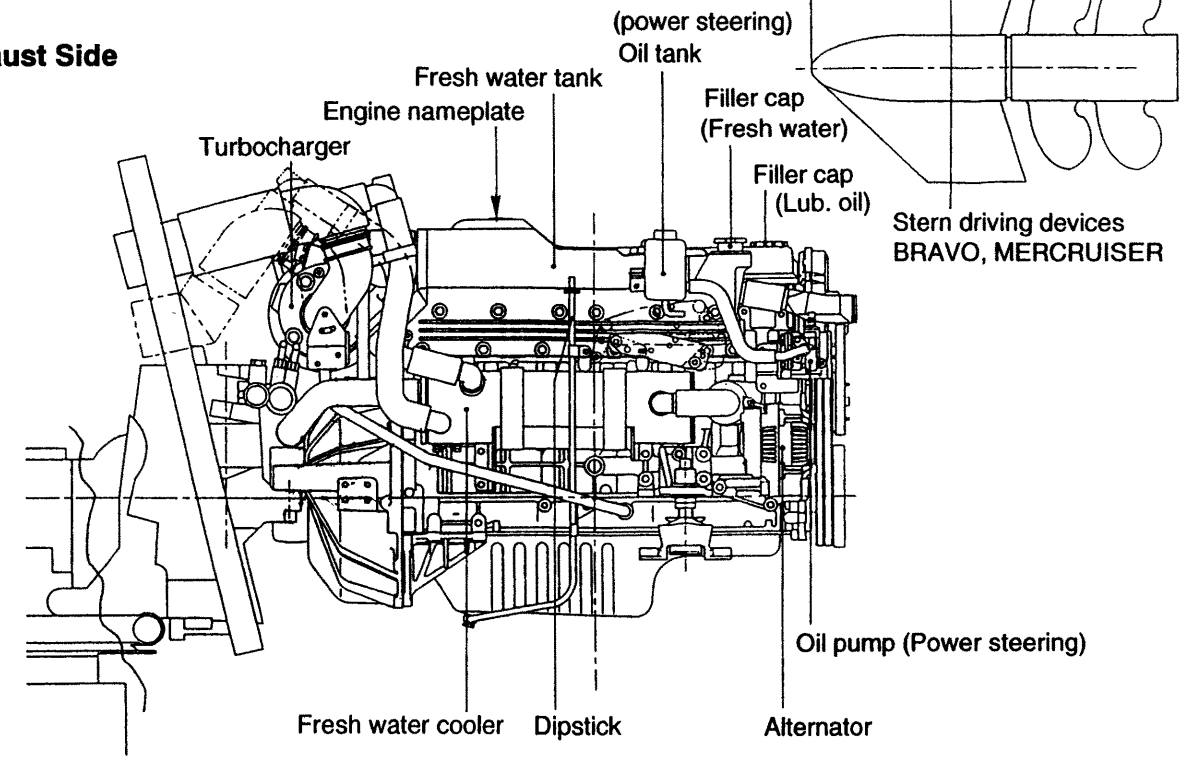
Note: **6LP-DTE** has almost same external shape as **6LP-STE** but it does not include a lube oil cooler(2). (※ mark) The above illustrations show the **6LP-STE** attaching the HURTH marine gear. The external shape of the **6LPA-DTP/-STP** is identical with that of **6LP-DTE/-STE**.

- **6LP-DTZE/-DTZE1/-STZE/-STZE1, 6LPA-DTZP/STZP**

F.I. Pump Side



Exhaust Side



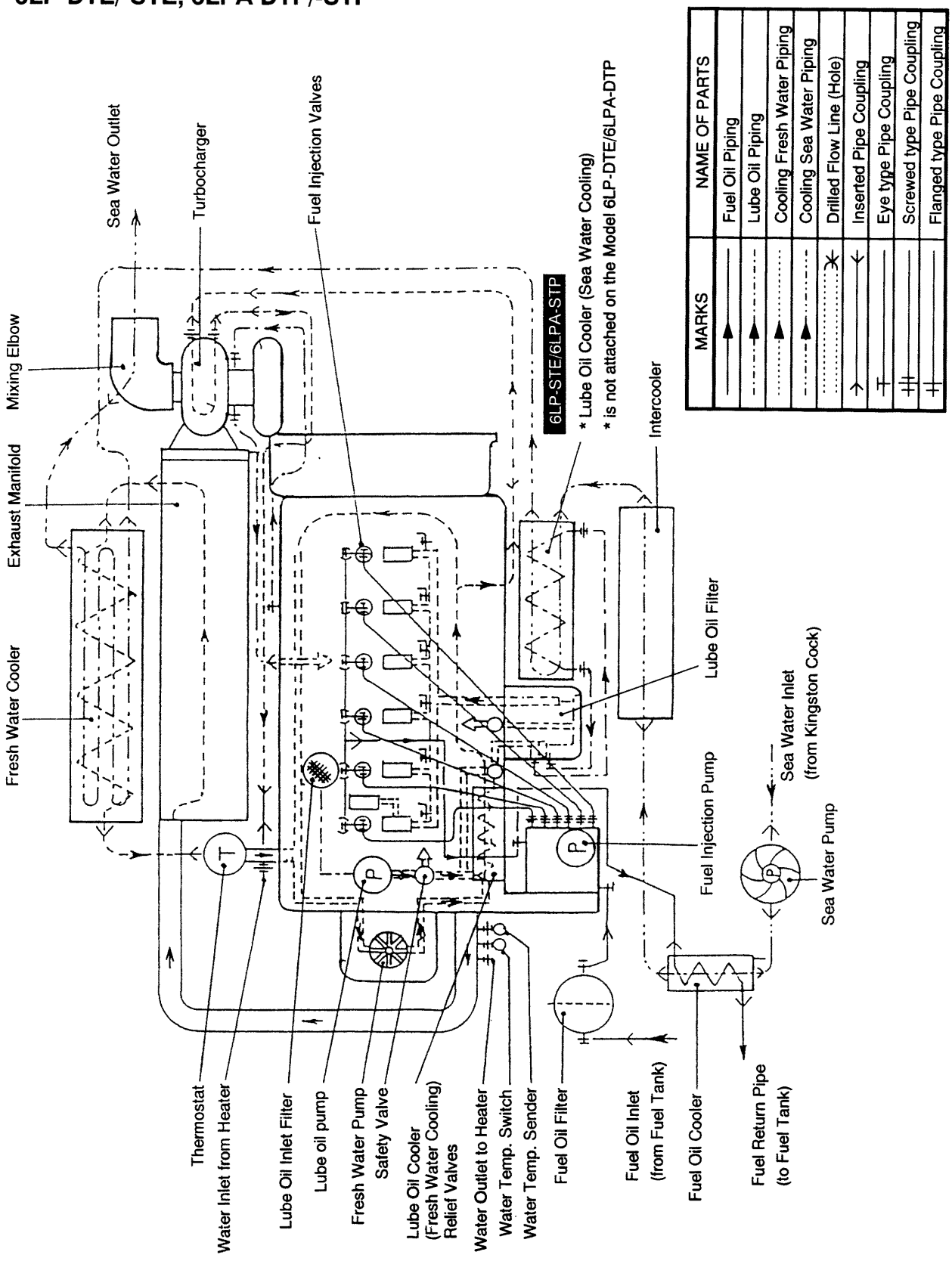
Note: The **6LP-STZE** engine (stern driving device : **BRAVO, MERCRUISER**) is used as the example for the above drawings.

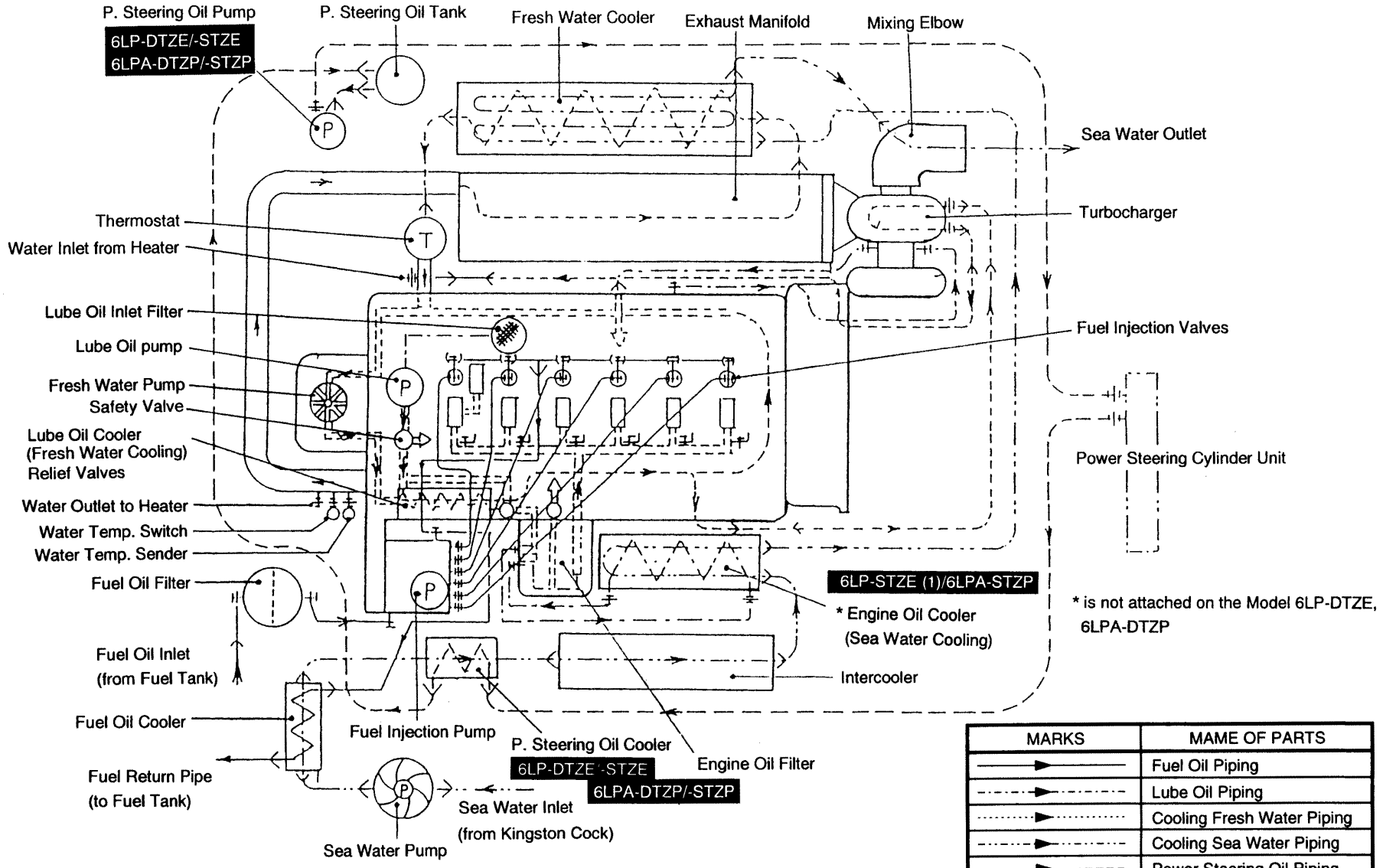
※ Ⓐ (indicated) oil cooler (2) is for the **6LP-STZE/-STZE1, 6LPA-STZP** engines.
6LP-DTZE/-DTZE1, 6LPA-DTZP engines do not have one.

※ Ⓑ (indicated) power steering oil pump, oil tank, oil cooler are parts for **6LP-DTZE/-STZE, 6LPA-DTZP/-STZP** engines.
6LP-DTZE1/-STZE1 engines do not have these.
6LP-DTZE and **6LP-STZE** are the same outline as **6LPA-DTZP** and **6LPA-STZP** respectively.
6LP-DTZE1/-STZE1 are the name designated by the engine manufacturer to identify the less power steering engine .(**6LP-DTZE, 6LP-STZE** in the nameplate)

2.3 Piping Diagram

- **6LP-DTE/-STE, 6LPA-DTP/-STP**

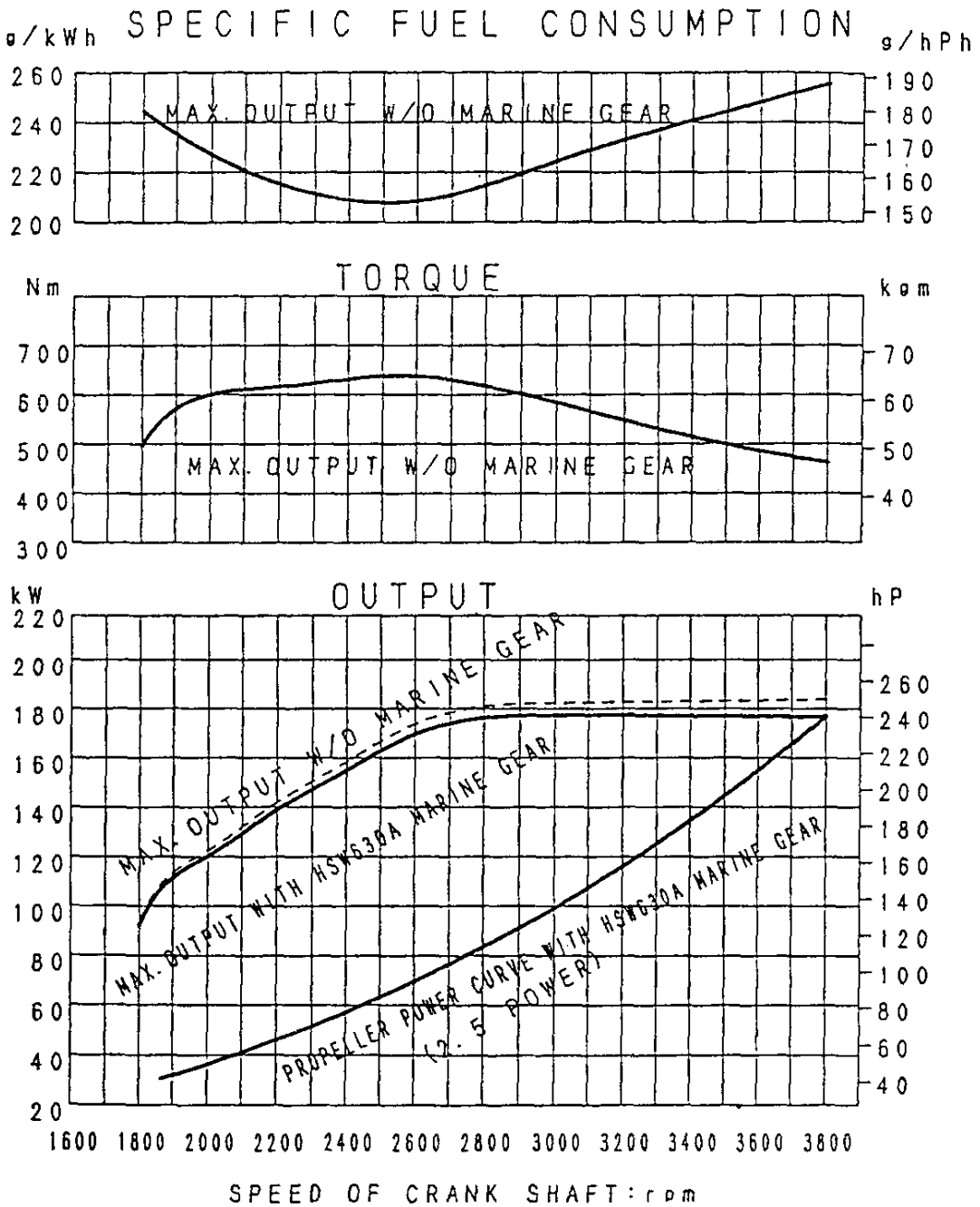




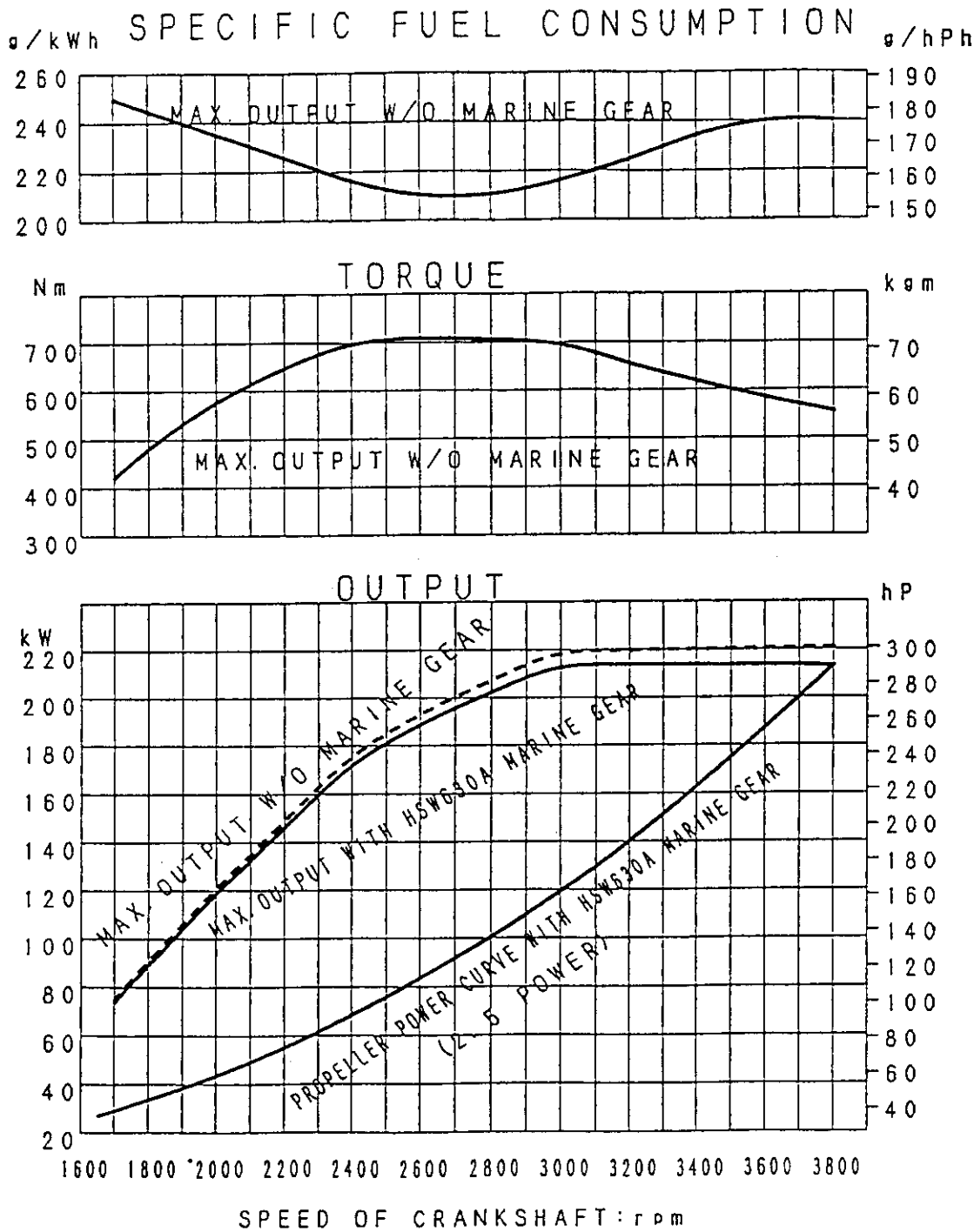
MARKS	MAME OF PARTS
	Fuel Oil Piping
	Lube Oil Piping
	Cooling Fresh Water Piping
	Cooling Sea Water Piping
	Power Steering Oil Piping
	Drilled Flow Line (Hole)
	Inserted Pipe Coupling
	Eye type Pipe Coupling
	Screwed type Pipe Coupling
	Flanged type Pipe Coupling

2.4 Performance Curves

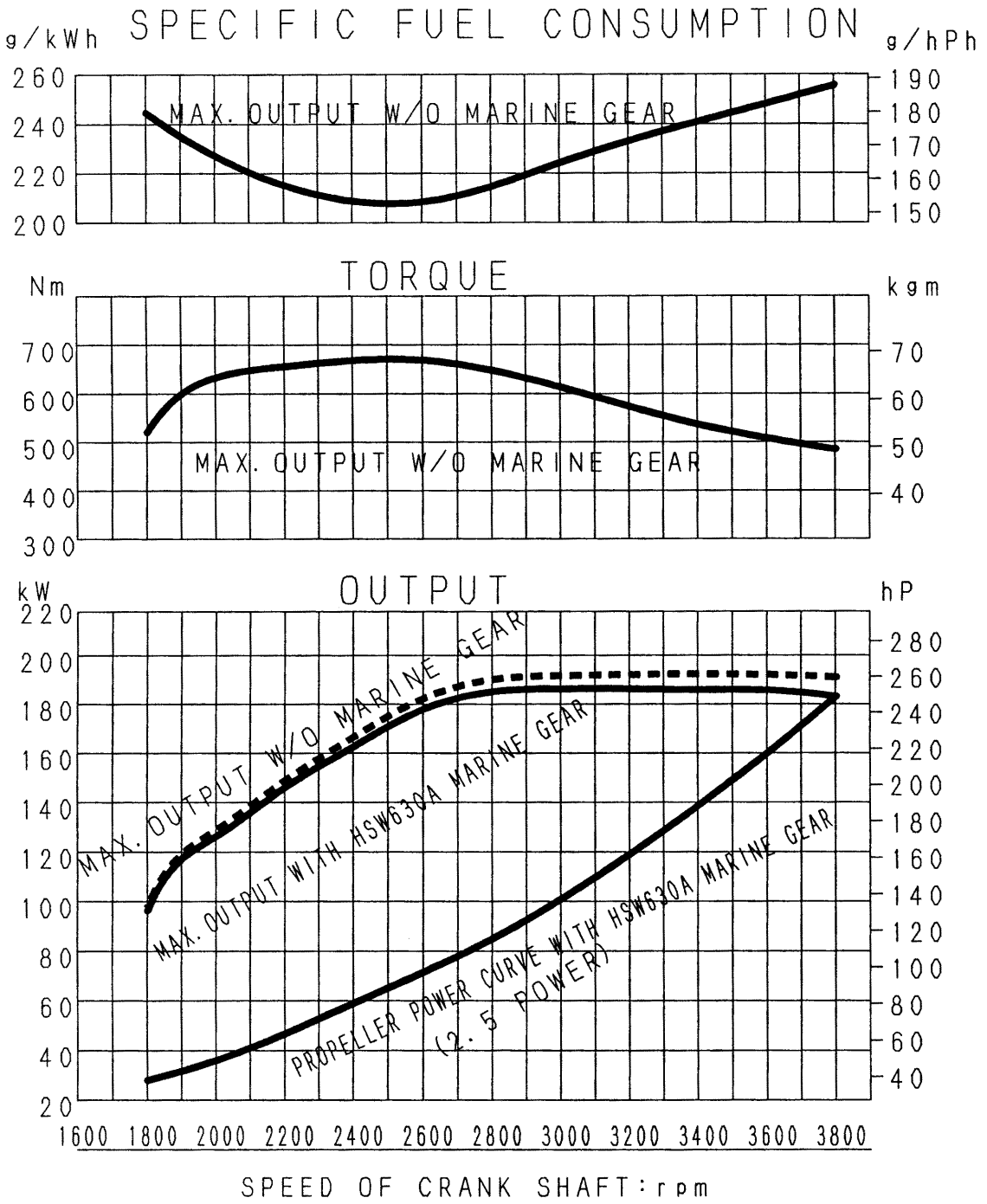
- **6LP-DT(Z)E/-DTZE1 (Max. output : 184 kW/3800 rpm)**



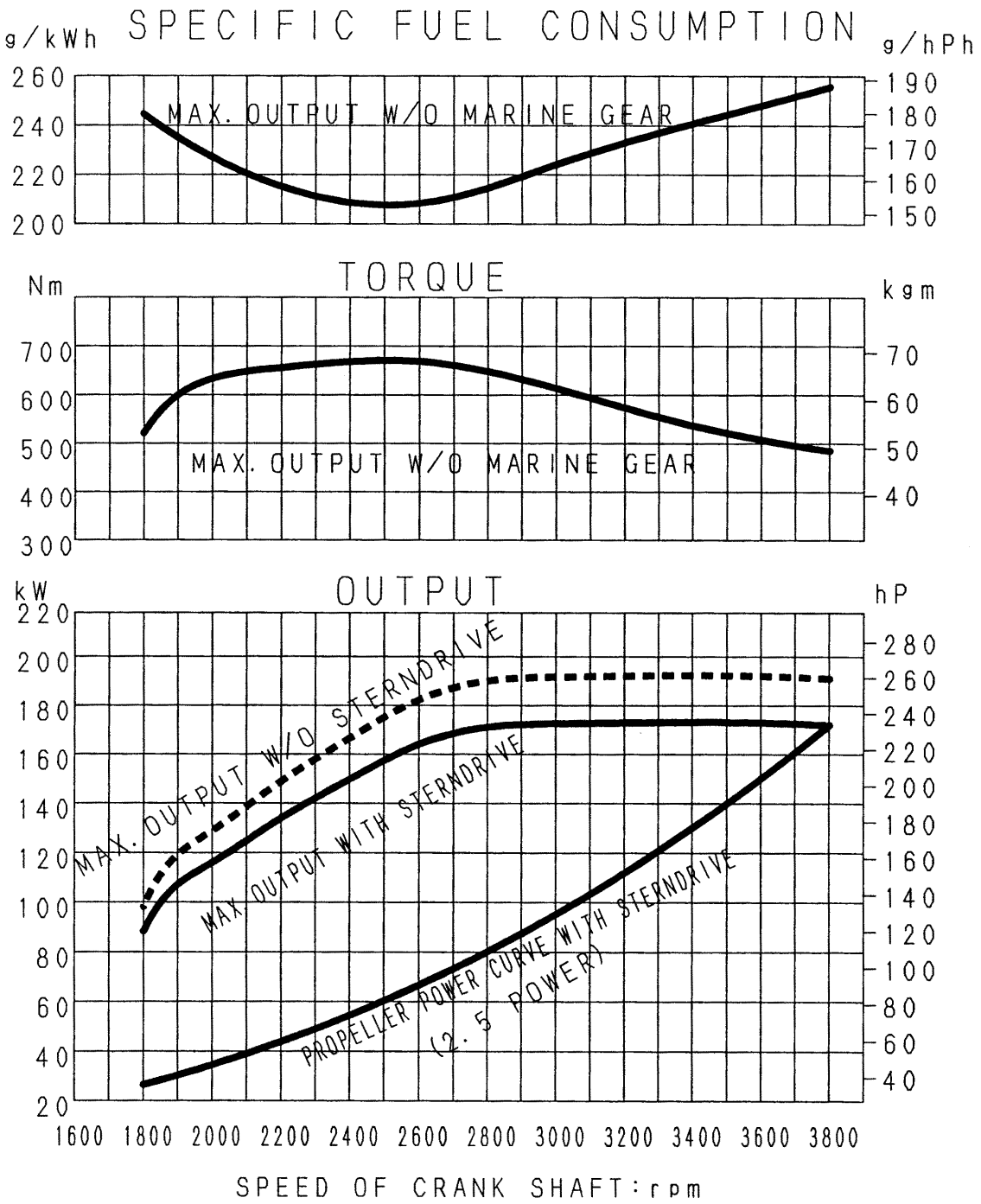
- **6LP-ST(Z)E/-STZE1 (Max. output : 221 kW/3800 rpm)**



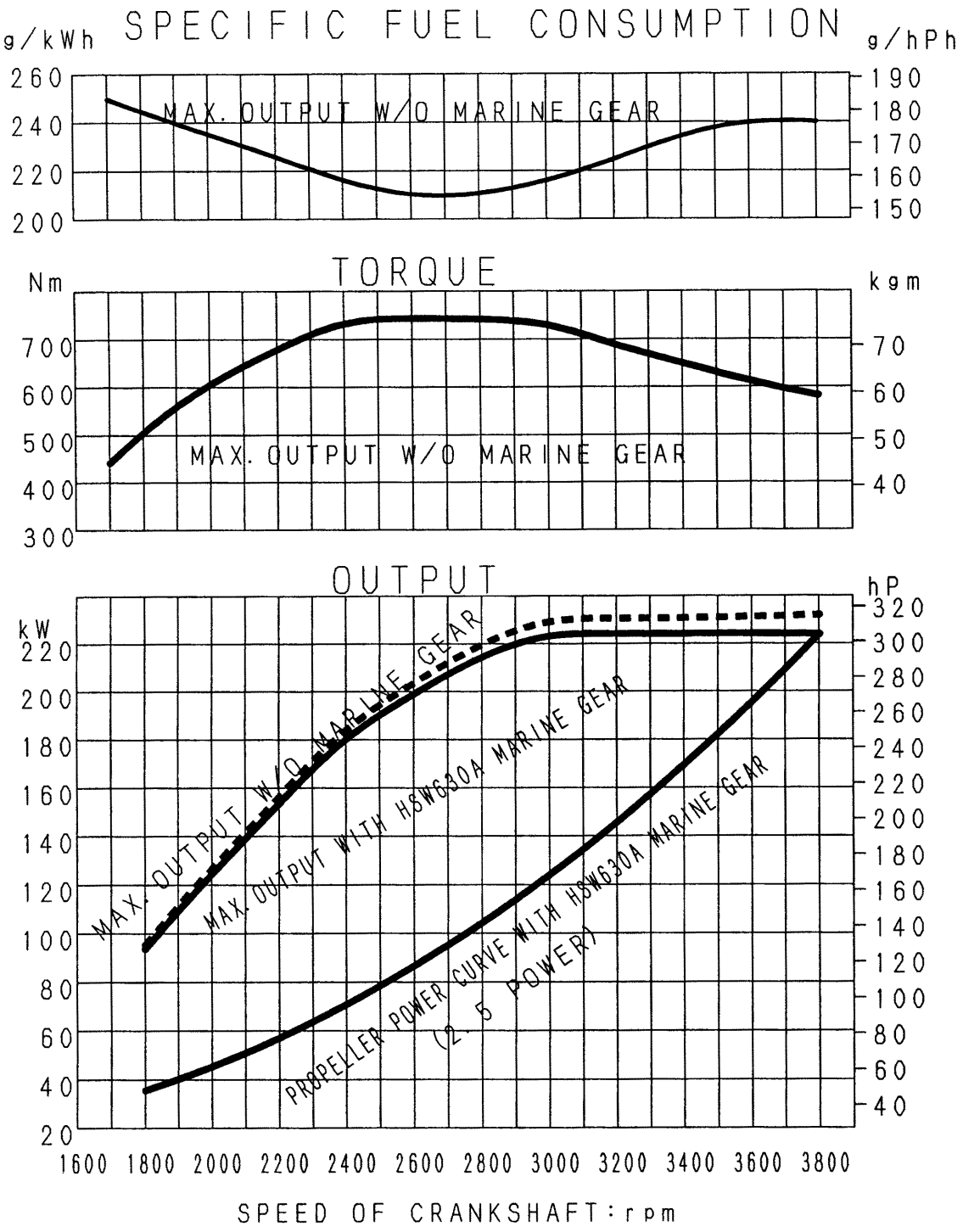
- **6LPA-DTP (Fuel stop power : 191 kW/3800 rpm)**



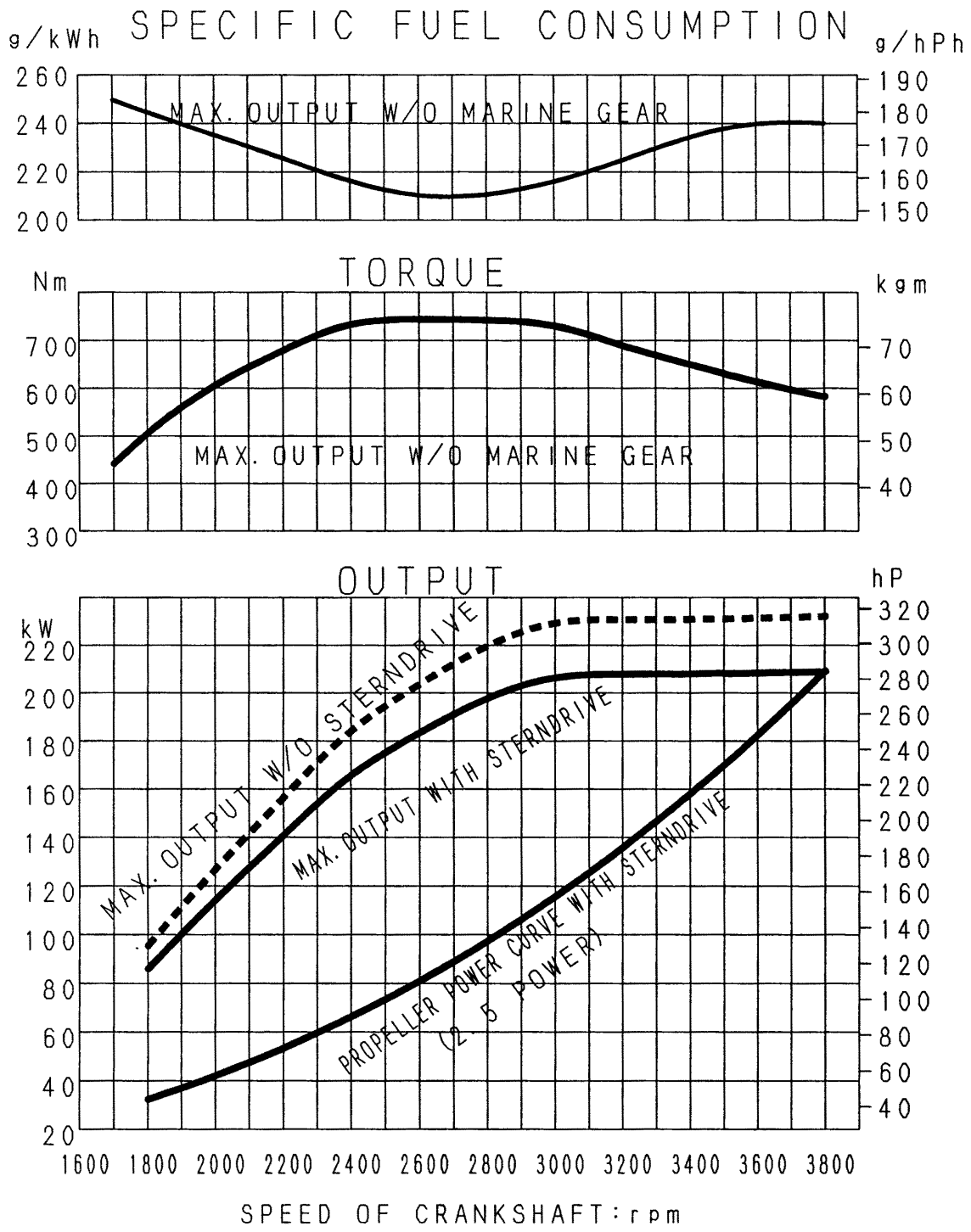
- **6LPA-DTZP (Fuel stop power : 191 kW/3800 rpm)**



- **6LPA-STP (Fuel stop power : 232 kW/3800 rpm)**

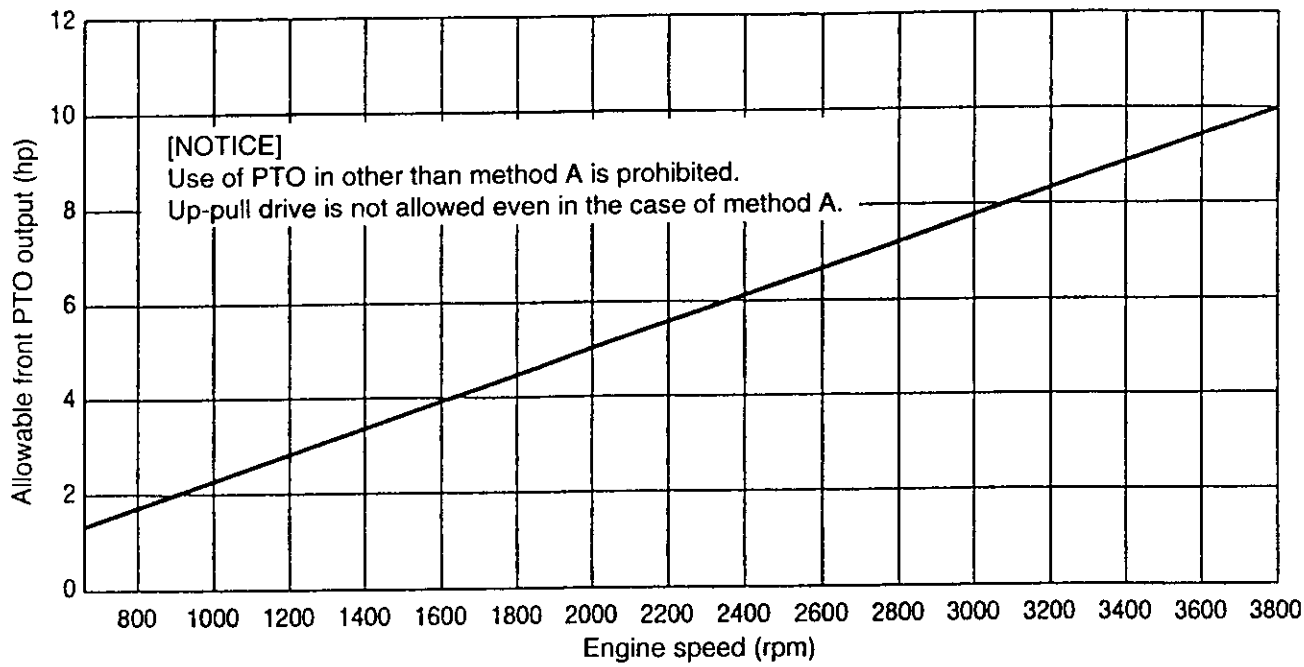


- **6LPA-STZP (Fuel stop power : 232 kW/3800 rpm)**



2.5 Front Power Take-Off (PTO) Output

- **Front PTO diagram**



[Method for Front PTO]

(1) Use type A (Belt drive with no outside bearing). Do not use other types of PTO.

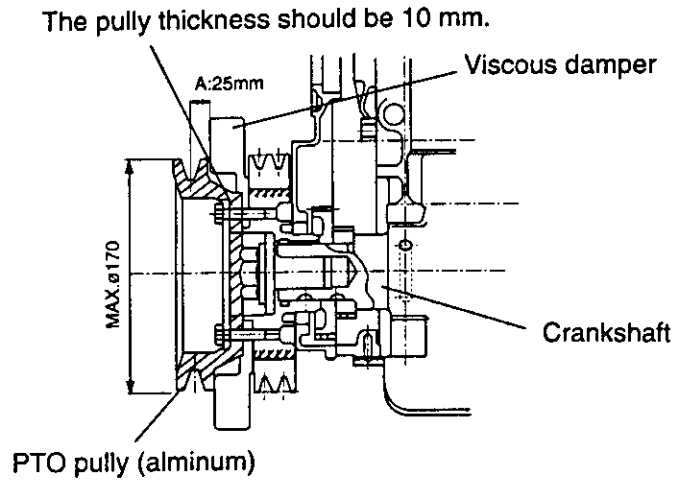
(2) Do not employ the up-pull drive. Use the side pull belt drive.

(3) Use a single V-drive, type A.

(4) The PTO pulley should be aluminum. The outside diameter should be max. ϕ170 mm and the overhang within 25 mm.

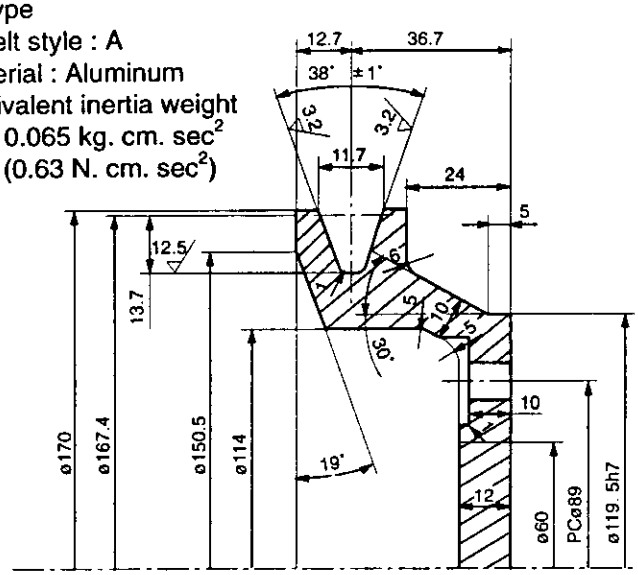
(5) Install the pulley to the exterior of the viscous damper and tighten the pulley and damper with the damper fixing bolts (M8 × 6 pcs.) and the washers.
(Tightening torque: 3.8 ± 0.2 kg-m (37.27 ± 1.96 N·m))

Please note that the crankshaft may break if the front PTO output exceeds the allowable output.



V-pulley overhang

A-Type
V-Belt style : A
Material : Aluminum
Equivalent inertia weight
: 0.065 kg. cm. sec^2
(0.63 N. cm. sec^2)



V-pulley drawing

2.6 Fuel Oil

(1) Selection of Fuel Oil

Use the following diesel fuels and select fuels of a higher quality for best engine performance.

[Diesel fuel standard for various countries]

- ISO 8217 DMA
- JIS K2204 Grade No.2, No.3 or special-No.3
- BS 2869 Part-1 class-A1 or A2

At low temperatures, fuel oil becomes difficult to ignite and will not flow easily, making starting difficult. Select fuel oil of a cetane number of 45 or greater to insure ignitability, and use the outside temperature as a guide for selecting the proper grade to insure fluidity.

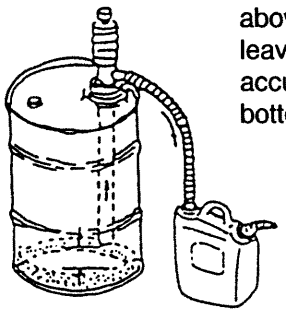
[NOTICE]

When other than the specified fuel oil is used, the engine will not perform to full capacity and parts may be damaged.

Sample for recommended fuel oil	
Standard for fuel oil	JIS K2204
Pour point (Temperature)	
-7.5°C or greater	Grade No.2
-20°C or greater	Grade No.3
-30°C or greater	Grade No.3-Sp.
Cetane fuel number	45 or greater

(2) Handling of Fuel Oil

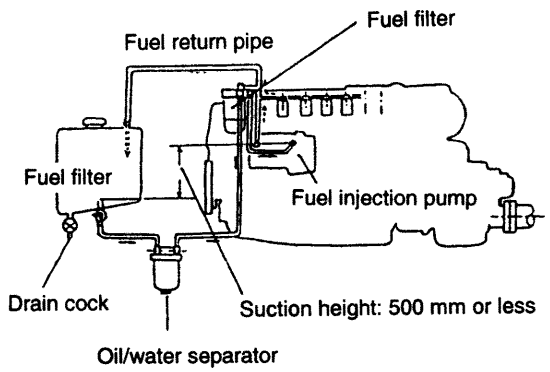
- Keep the fuel oil in a clean container. Store the container in a place away from rain and dirt as water and dust mixed in with the fuel cause engine failure.
- Keep the fuel container stationary for several hours to allow any dirt or water to settle to the bottom. Use a pump to extract the clear, filtered fuel from the top of the container for use.



Pump up only fuel above the down half, leaving dreg accumulated on the bottom.

(3) Fuel Piping

Install the fuel pipe from the fuel tank to the fuel pump in accordance with the diagram to the right. Be sure to attach a drain cock to the fuel tank to enable dirt and water which have settled at the bottom of the tank to be drained off.
The oil/water separator (optional) is placed at the center section of the line.



2.7 Lube Oil

(1) Selection of Engine Lube Oil

Use the following lube oil:
*API Classification ..... CD
(Standards of America Petroleum Institute)
*SAE Viscosity..... 15W40
(Standards of Society of Automotive Engineering)

[NOTICE]
Using other than the specified lube oil will lead to seizure of parts inside the engine and gear device, abnormal wear, and shorten engine life. It will also affect the starting ability and power output.

(2) Selection of Marine Drive Oil

Refer to the operation manual for the marine drive unit for the selection of the proper lube oil.

- For **MERCRUISER's** stern-driven **(BRAVO)** use the following lube oil.

6LP-DTZE (1) 6LP-STZE (1) 6LPA-DTZP 6LPA-STZP

System Oil	Specified lube oil
Drive oil	Quicksilver High Performance Gear Lube
Power steering oil ※	Quicksilver Power Trim and Steering Fluid or Dexlone- II
Power trim oil	Quicksilver Power Trim and Steering Fluid or SAE 10W-30 or 10W-40 engine oil

※ for 6LP-DTZE/-STZE, 6LPA-DTZP/-STZP

(3) Handling the Lube Oil

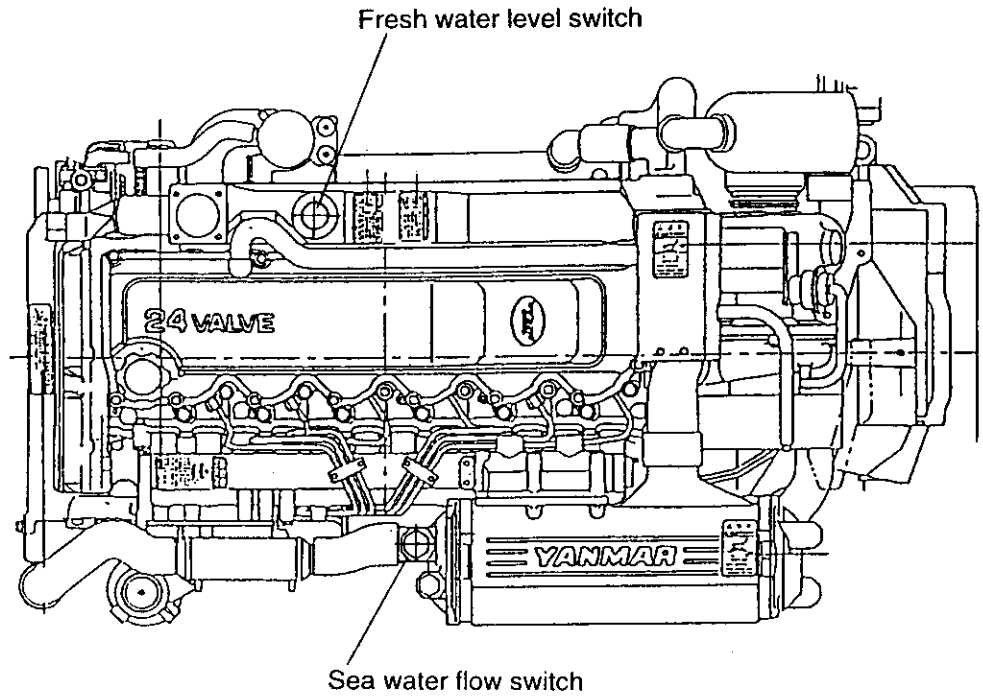
- When handling and storing lube oil, be careful not to allow dust and water to enter the lube oil. Clean around the filter post before refilling.
- Do not mix lube oils of different types or brands.
  Mixing may reduce the lubricating performance. Different oils are used for the engine and the marine drive unit.
  Be careful to use the correct oil for each one and store in separate clearly labeled containers.

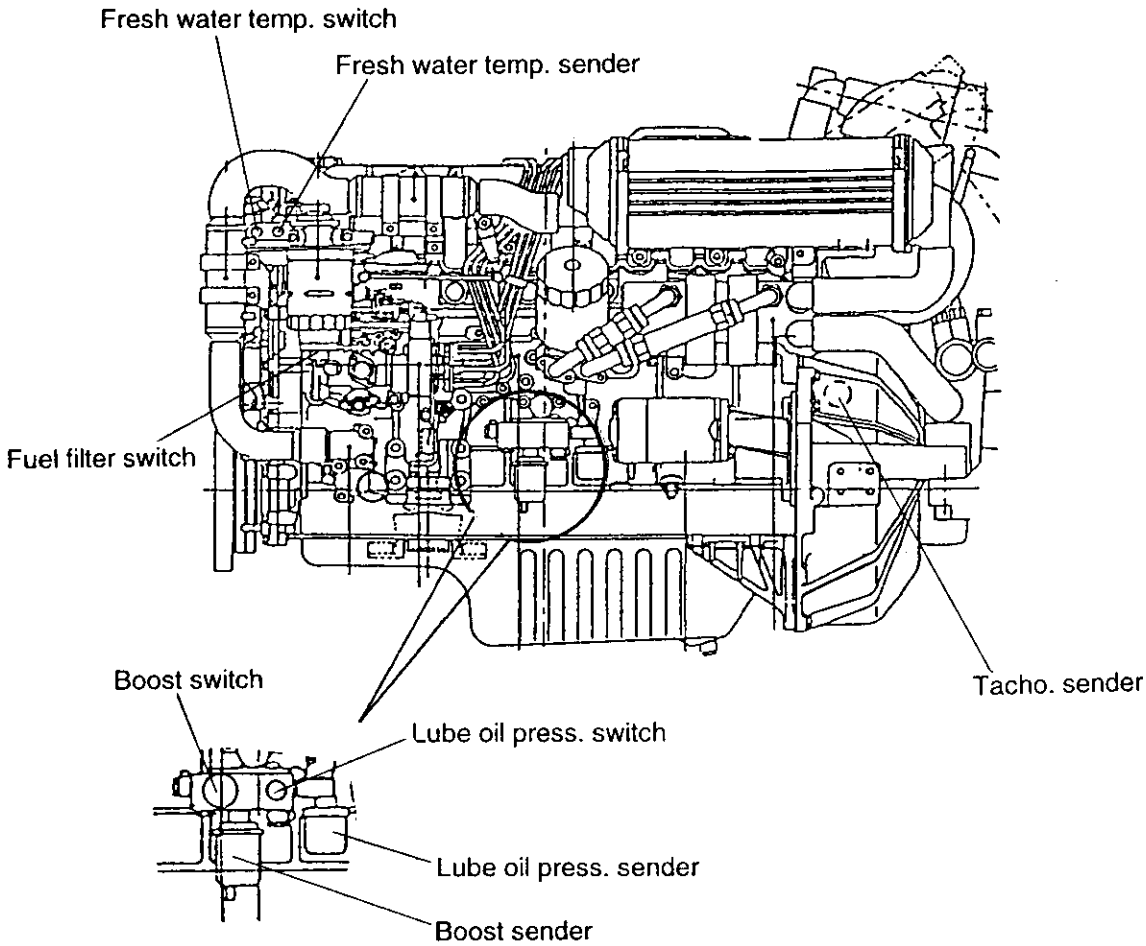
2.8 Cooling Water

- Always use soft water (tap water) for the fresh water. Never use dirty water or hard water. Impurities in the cooling water cause scale and rust to build up in the cooling system reducing cooling efficiency and causing the engine to overheat.
- During the cold season, add antifreeze to the cooling water to prevent freezing.
  Failure to add antifreeze will result in damage to various parts in the cooling water system.
- Consult your Yanmar dealer or distributor on the use of antifreeze, anti-rust, and detergents.

[NOTICE]
- ***Refer to the instructions accompanying the antifreeze for the proper mixing ratio.***
  Select the ratio for the lowest temperature of the cold season. If the mixture is too thick, the cooling efficiency will be reduced.
- ***Do not mix different brands of antifreeze or anti-rust. Mixing reduces cooling efficiency and leads to parts damage.***
- ***When the amount of cooling water is too low, refill with fresh water only.***

2.9 Location of Senders and Warning Switches





3. Engine Overhaul

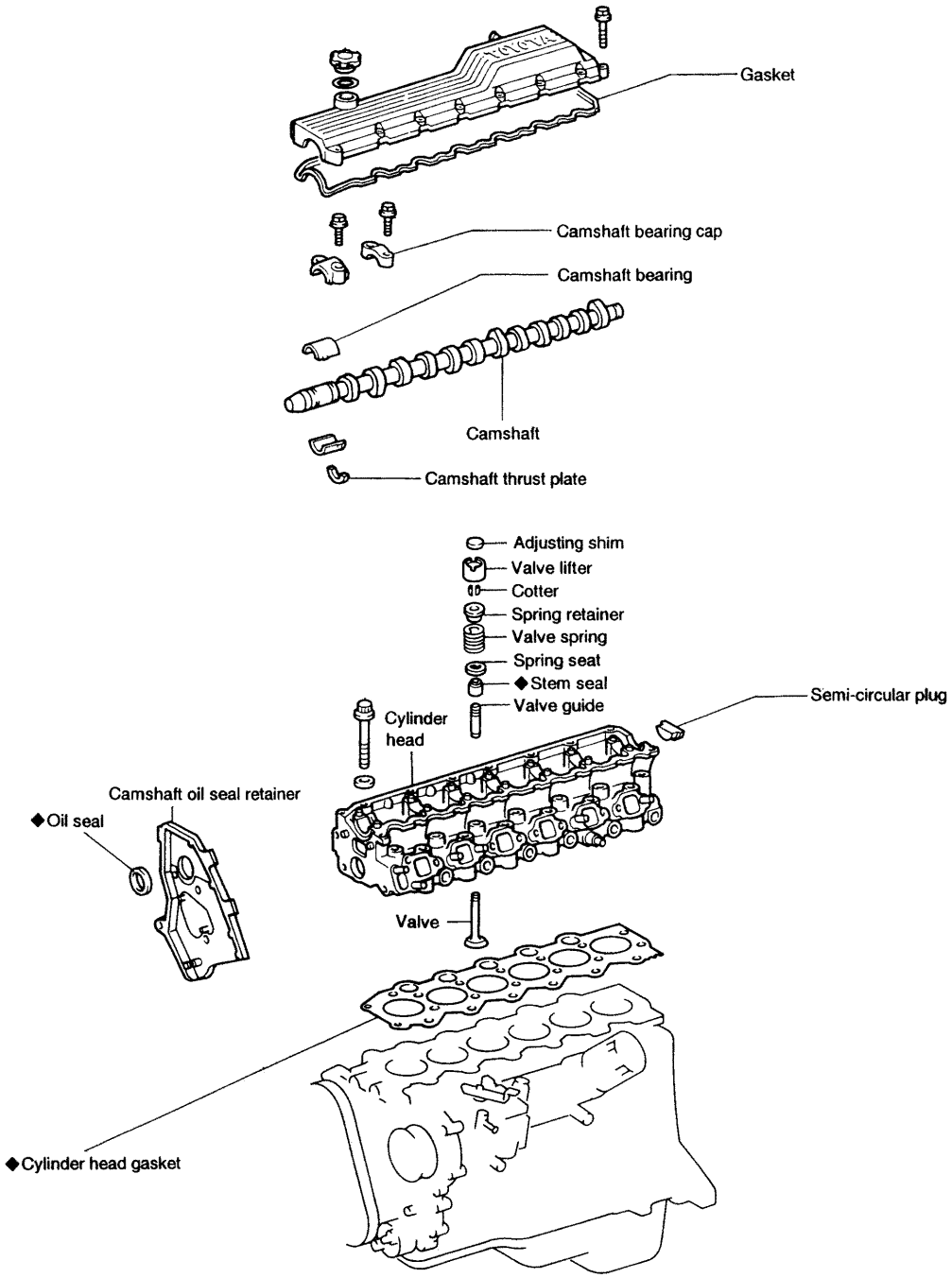
3.1 Cylinder Head

3.1.1 Components

[NOTICE]

- ***Cylinder numbers No.1, No.2 and on are allocated starting from the gear case side.***
- ***Avoid placing the engine body directly on the floor. Otherwise, the oil pan may be bent.***
- ***6LP-DTE series or 6LP-DTE series only includes 6LPA-DTP series.***
- ***6LP-STE series or 6LP-STE series only includes 6LPA-STP series in this descriptions.***

(1) 6LP-DTE series



◆ Non-reusable part

Thank you very much for your reading.

Please Click Here Then Get More Information.