YANMAR
SERVICE MANUAL
MARINE DIESEL ENGINE

MODEL

2TD
3TD
4TD

FOREWORD

YANMAR's TD series engine is a vertical in-line type marine propulsion diesel engine with 2, 3 or 4 cylinders and overhead valves. It has been developed with a completely new design in the 1980's and is suited for heavy duty use in all kinds of boats. It is similar to the YANMAR T-series engines which have been popular for commercial boats of every type for the last twenty years.

In compliance with keen demand from our customers many features of the existing engines have been retained. These include the independent provision of cylinder heads and fuel injection pumps to each cylinder, the reciprocating type cooling water pump and the mechanical big disc plate type marine gear. These offer easy maintenance and high durability.

But besides these the new series also employs the most advanced technologies such as YANMAR's uniquely developed direct fuel injection system, high-grade heat treatment of the major parts and qualitative improvement of the materials used. These will be of primary importance in minimizing operational costs, (fuel and maintenance), for the boat owner.

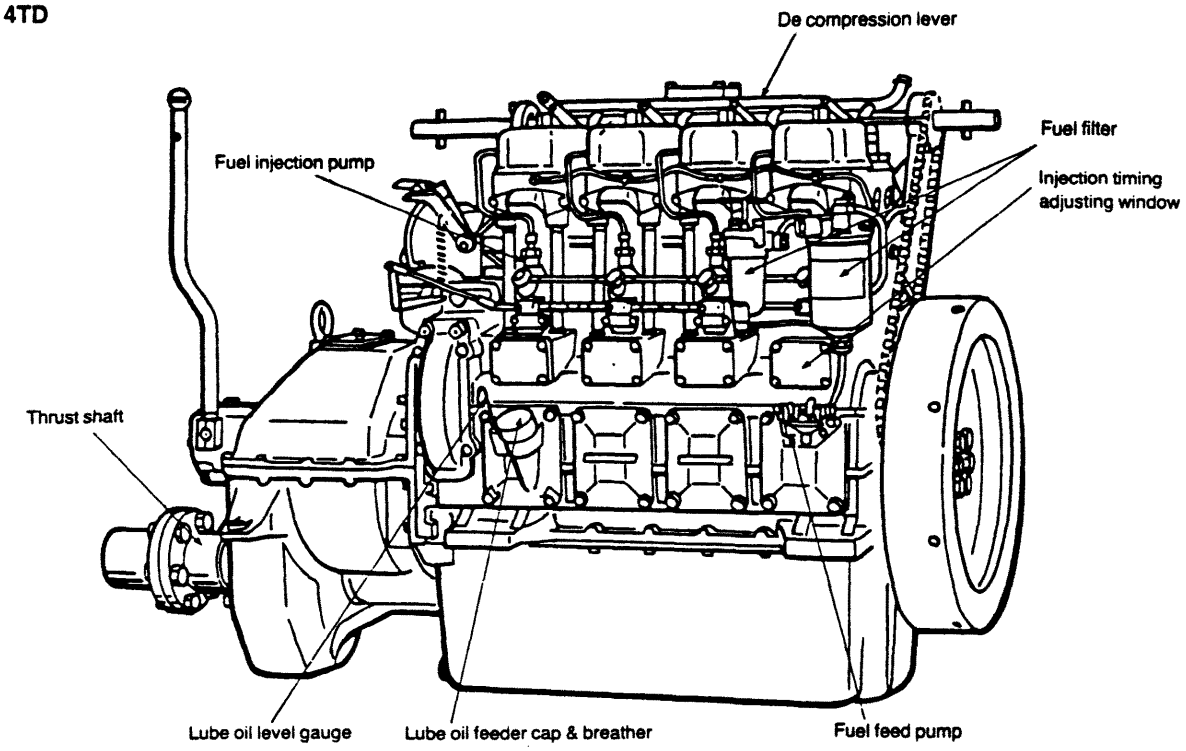
Models 2TD·3TD·4TD

CHAPTER 1

GENERAL

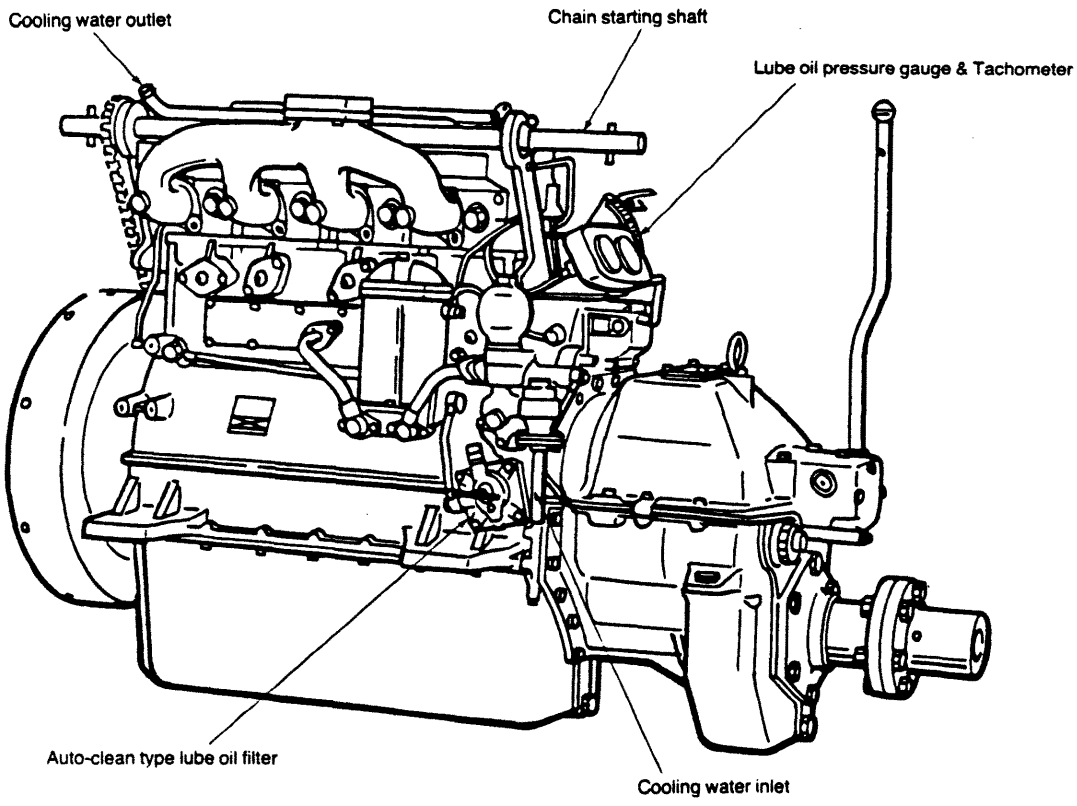
1. External View

1-1 4TD



TD0001

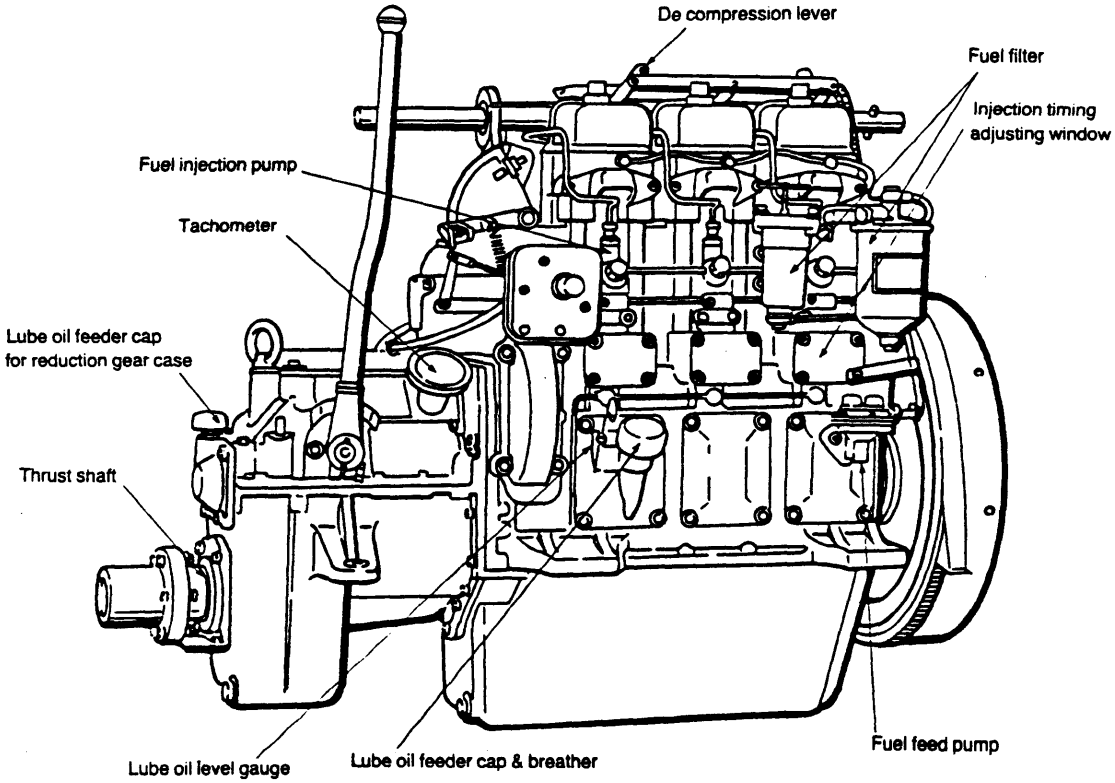
Operation side of 4TD (Chain starting)



Exhaust side of 4TD (Chain starting)

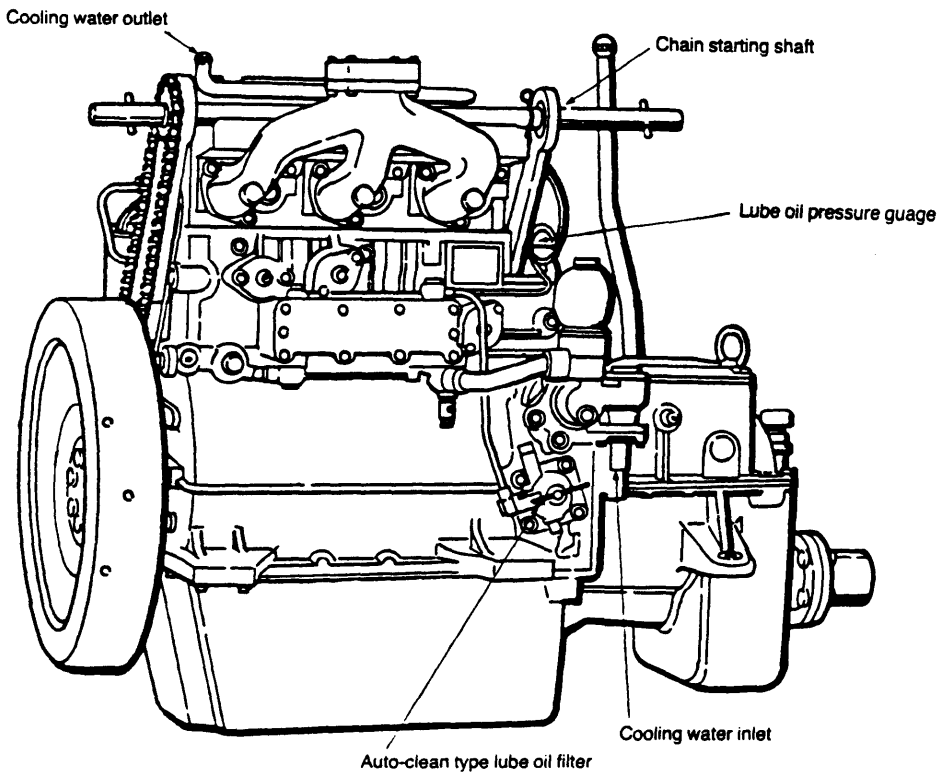
TD0002

1-2 3TD



TD0003

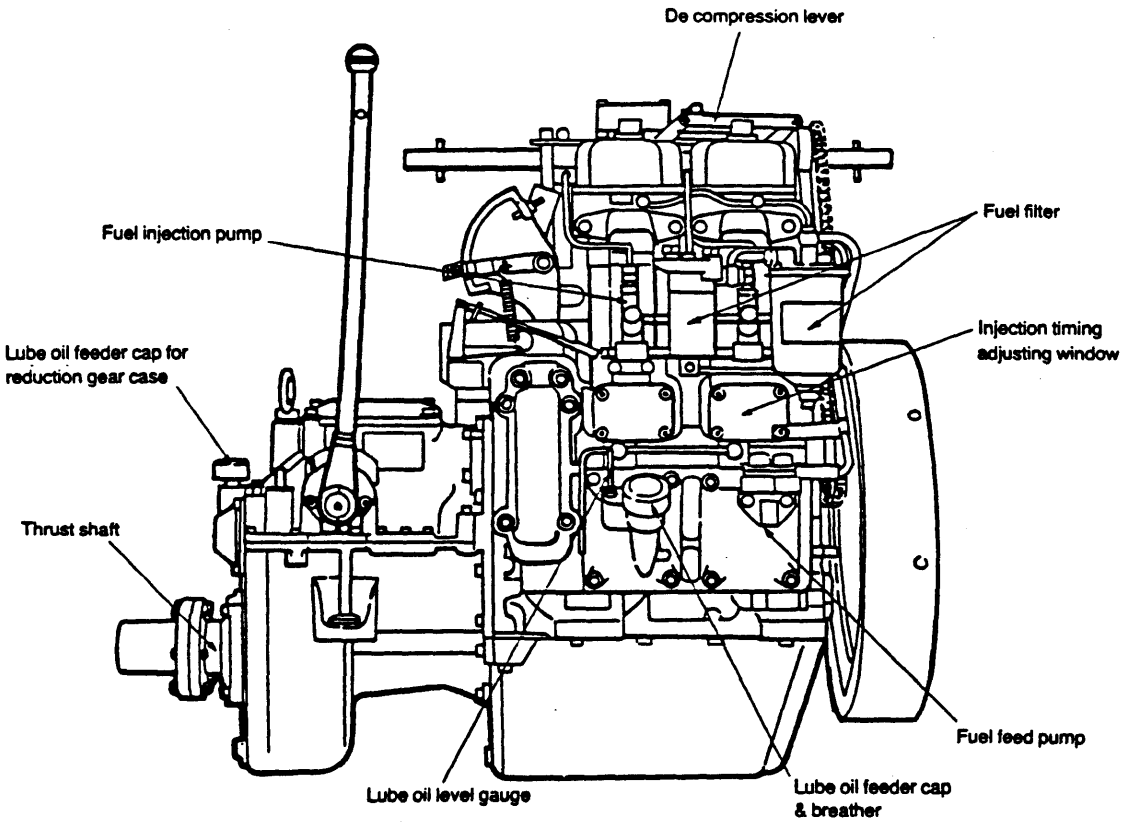
Operation side of 3TD (Electric and Chain Starting)



Exhaust side of 3TD (Electric and Chain starting)

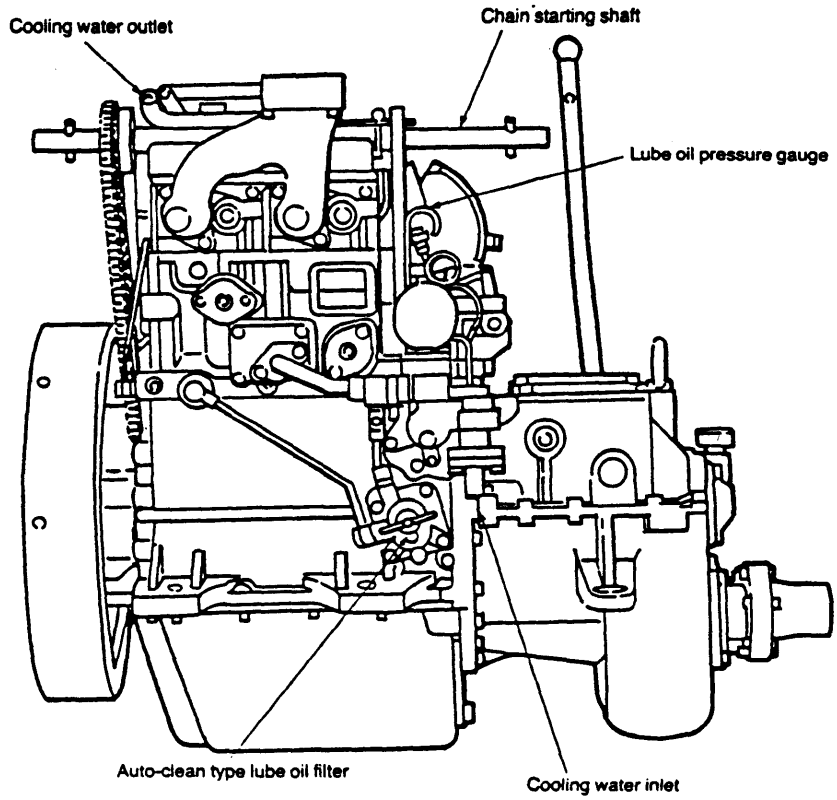
TD0004

1-3 2TD



TD0005

Operation side of 2TD (Chain Starting)



Exhaust side of 2TD (Chain Starting)

TD0006

2. Specifications

2-1 Engine

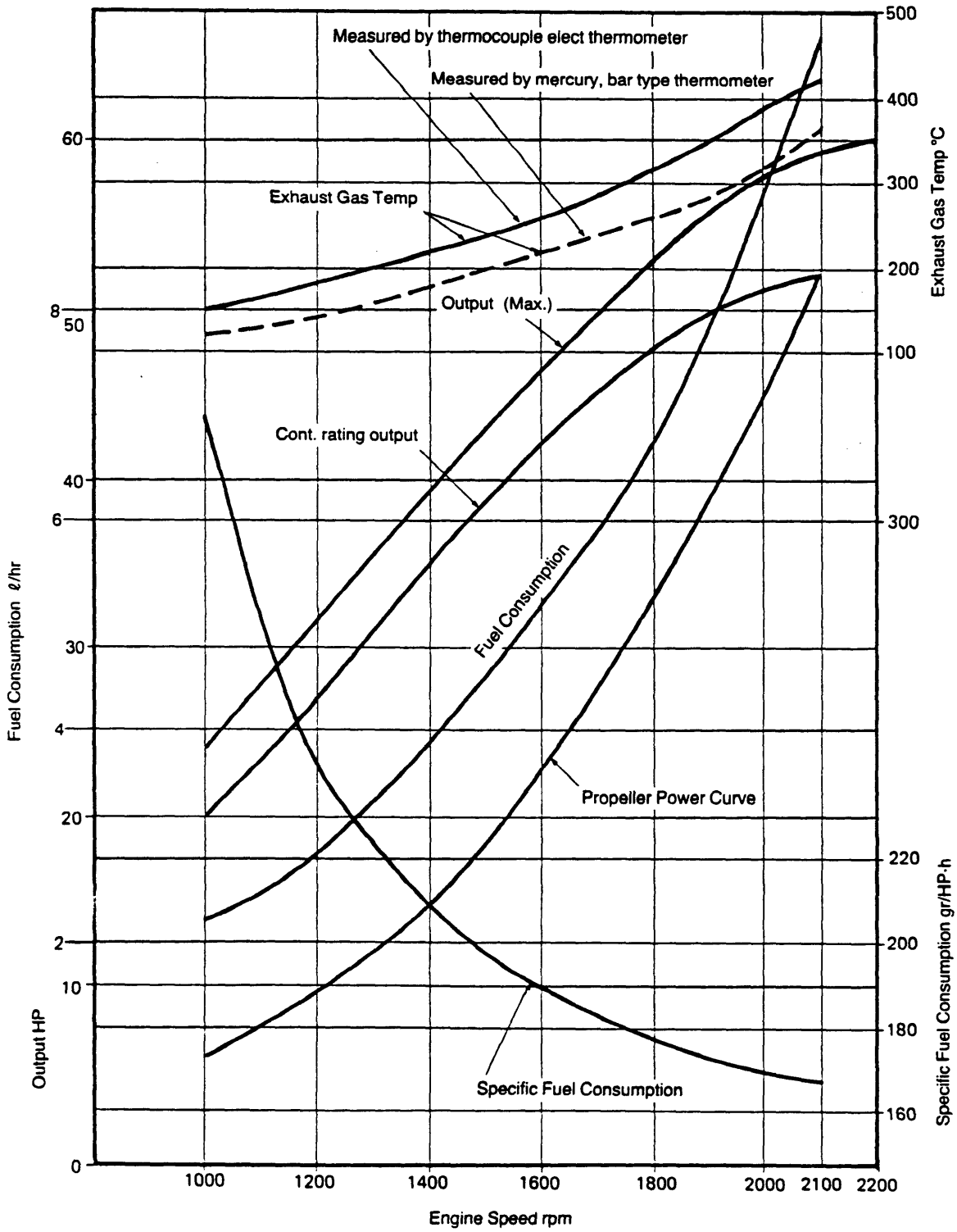
Model name			2TD (G, GG)	3TD (G, GG)	4TD (G, GG, GGG)
Type			4-cycle, vertical, natural aspirated diesel engine		
Combustion system			Direct injection		
No. of cylinders			2	3	4
Piston bore × stroke		mm	Ø100 × 115		
Displacement		ℓ	1.806	2.710	3.613
Continuous rating output		HP/rpm	26/2100	39/2100	52/2100
Max. output		HP/rpm	30/2200	45/2200	60/2200
Idling speed	High	rpm	2400 ~ 2450		
	Low	rpm	450		
Starting system			Manual chain (Electric, Electric with manual available as optional)		
Firing order			1-2-1	1-2-3-1	1-2-4-3-1
Operation side			Starboard of engine		
Direction of rotation	Crankshaft		Counterclockwise viewed from stern		
	Propeller shaft		Clockwise viewed from stern		
Engine lube oil sump	Total	ℓ	8	12	18
	Effective	ℓ	4	5.5	9
Fuel injection pump type			Bosch type, each cylinder individual		
Fuel injection timing		b.T.D.C.	18 ~ 20 deg. (19 ± 1 deg.)		
Fuel injection valve			Hole valve (5-0.27Ø-140°)		
Fuel injection pressure		kg/cm²	200 ~ 210		
Lubrication system			Forced lubrication with trochoid pump		
Lube oil pressure		kg/cm²	3 ~ 4 at 2200 rpm		
Cooling system			Raw water cooling with reciprocating type pump		
Cooling water capacity at 2,100 rpm point		ℓ/Hr	1,350	1,700	
Bilge pump			Manual type		
Dry weight (approx.)	Manual start	kg.	330	400	510
	Electric start	kg.	345	415	525
Dimension manual st. (electric st.)	Length	mm	874 (936)	1,010 (1072)	1,236 (1,298)
	Breadth	mm	526 (602)	526 (602)	526 (602)
	Height	mm	805 (805)	825 (825)	526 (855)

2-2 Marine Gear

Engine model		2TD	2TDG	2TDGG	3TD	3TDG	3TDGG	4TD	4TDG	4TDGG	4TDGGG
Type		Wet, single friction plate (ahead)						Wet, friction plates (V-lever type)			
Reduction ratio	Ahead	2.14	2.50	3.14	2.14	2.50	3.14	2.13	2.59	3.22	3.80
	Astern	2.53	2.95	3.71	2.53	2.95	3.71	2.20	2.68	3.33	3.93
Propeller shaft speed at engine 2,100 rpm	Ahead rpm	982	840	670	982	840	670	986	810	653	553
	Astern rpm	831	711	567	831	711	567	953	783	631	534
Lubrication system		Forced lubrication									
Reduction gear case lube oil sump	Total ℓ	1.5						Common oil with engine oil sump			
	Effective ℓ	0.5									

3. Performance Curves

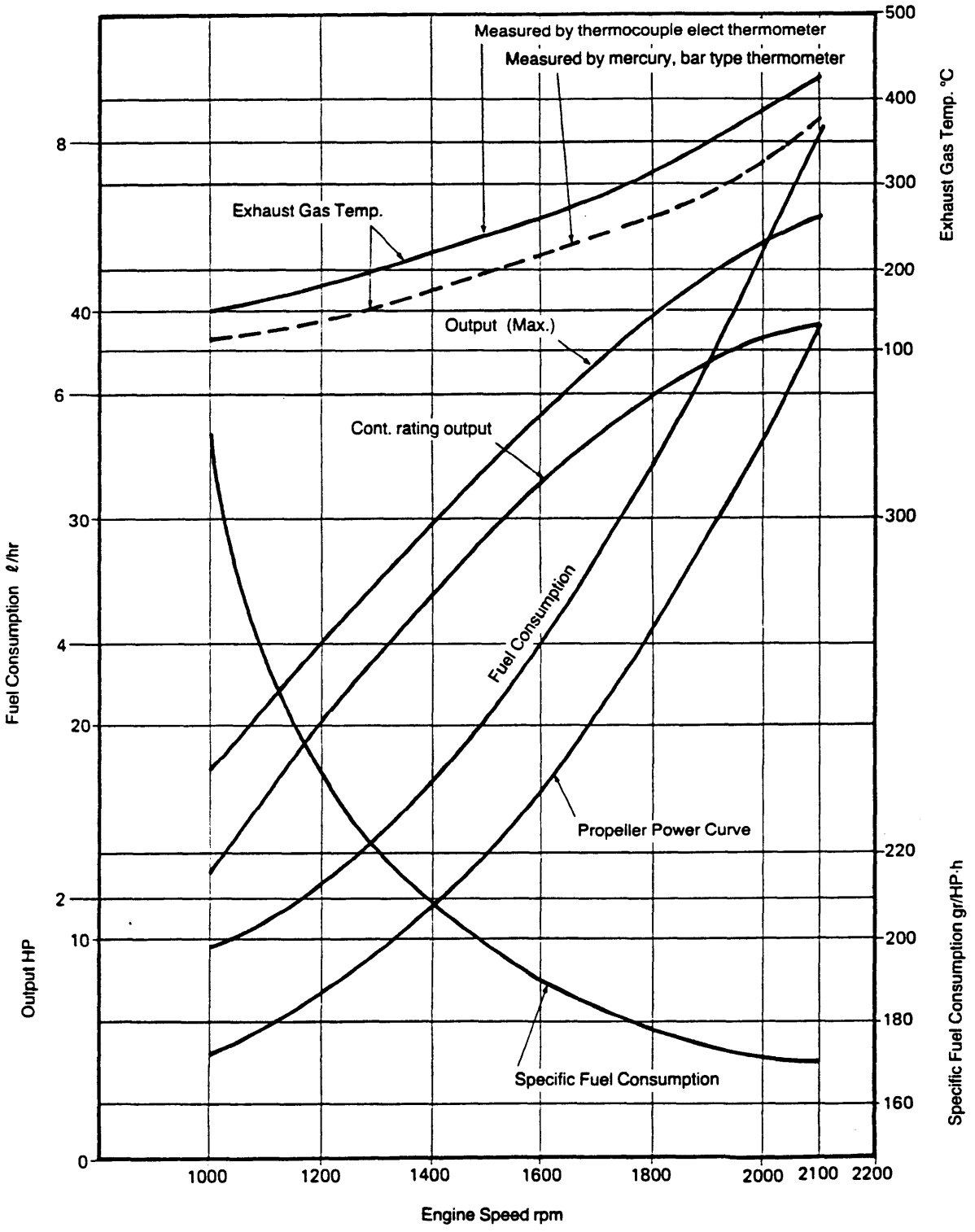
3-1 4TD



TD0007

4TD Performance curves

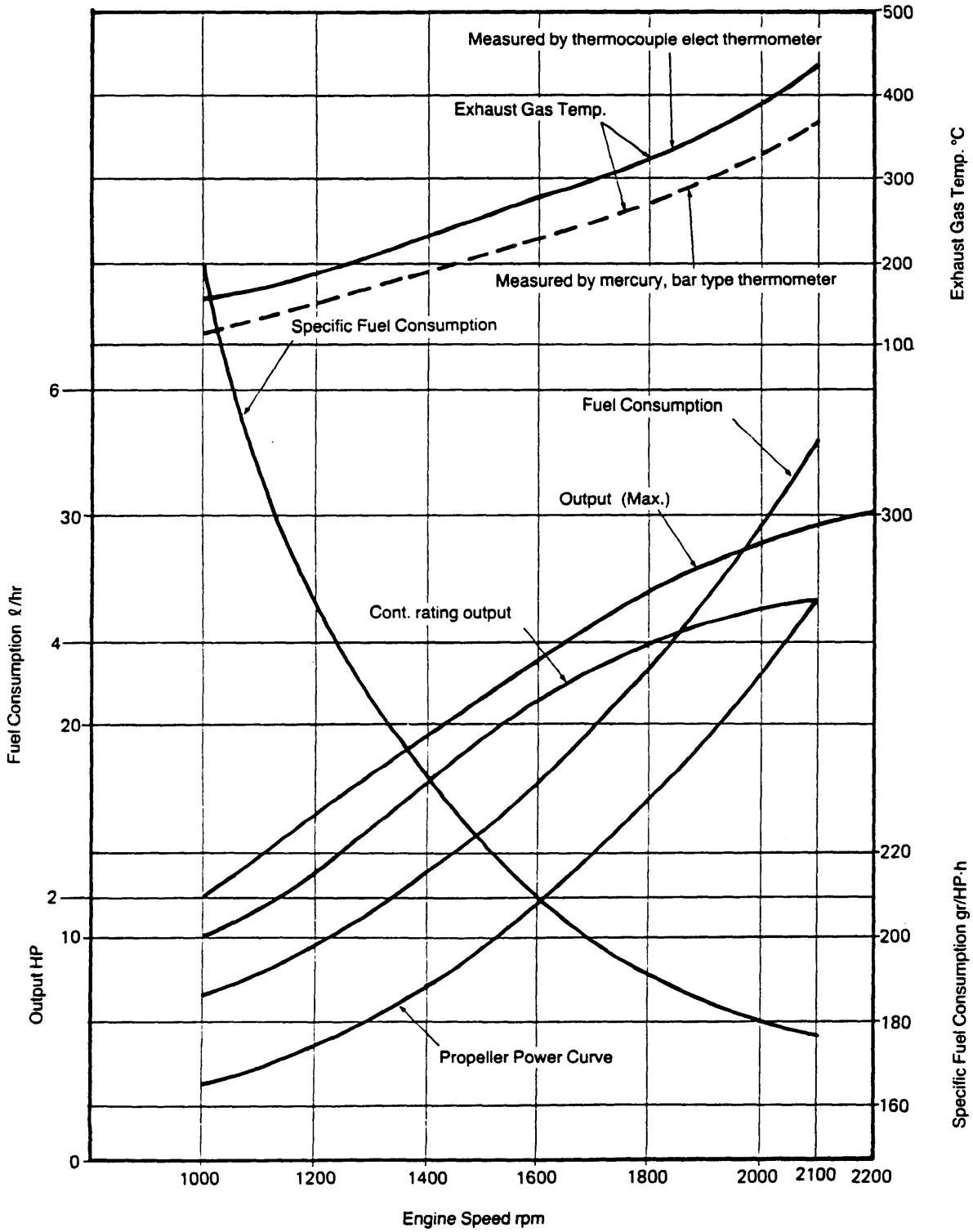
3-2 3TD



TD0008

3TD Performance curves

3-3 2TD

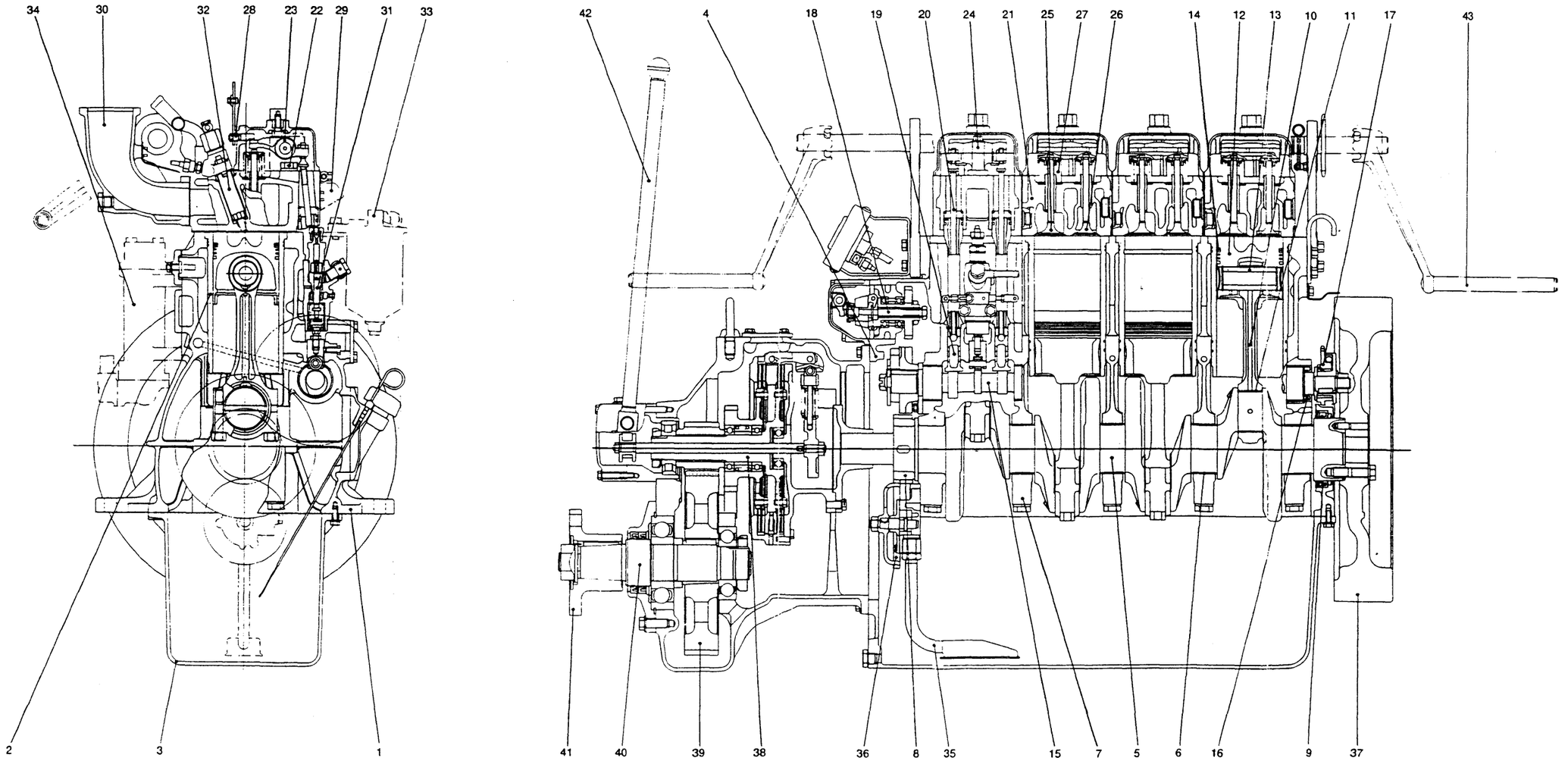


TD0009

2TD Performance curves

4. Engine Cross-section

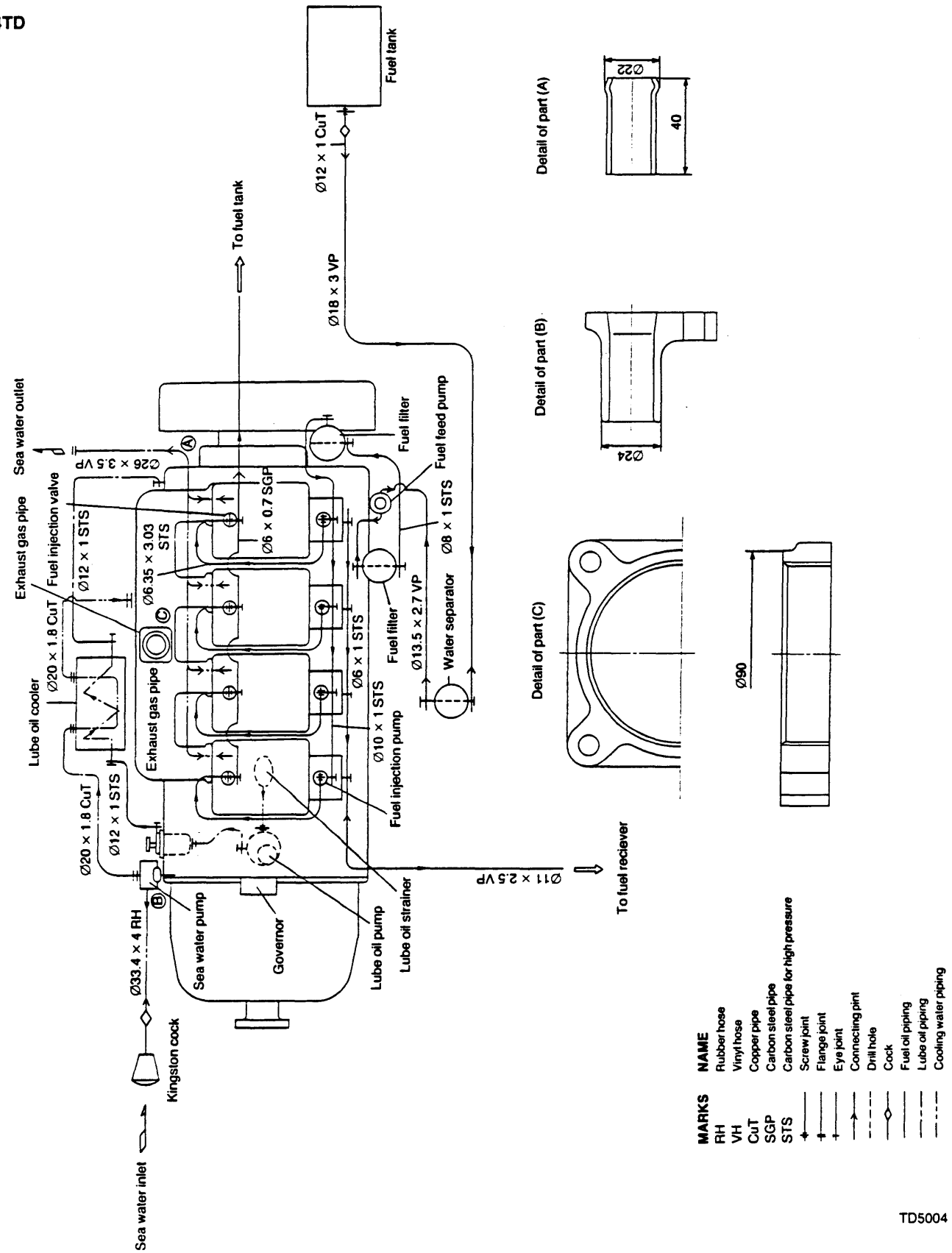
4-1 4TD



1. Cylinder block
2. Cylinder liner
3. Oil pan
4. Timing gear case
5. Crankshaft
6. Main bearing bushing
7. Main bearing cap
8. Crankshaft gear
9. Crankshaft oil seal
10. Connecting rod
11. Crank pin bushing
12. Piston
13. Piston pin
14. Piston ring
15. Camshaft
16. Camshaft oil seal
17. Free wheel
18. Governor assembly
19. Tappet
20. Push rod
21. Cylinder head
22. Cylinder head bolt
23. Valve rocker arm
24. Rocker arm support
25. Suction valve
26. Exhaust valve
27. Valve spring
28. Decompression shaft
29. Intake port
30. Exhaust manifold
31. Fuel injection pump
32. Fuel injection nozzle
33. Fuel filter
34. Lub. oil cooler
35. Lub. oil suction tube
36. Lub. oil pump
37. Flywheel
38. Forward shaft
39. Thrust gear
40. Thrust shaft
41. Output coupling
42. Clutch lever
43. Start handle

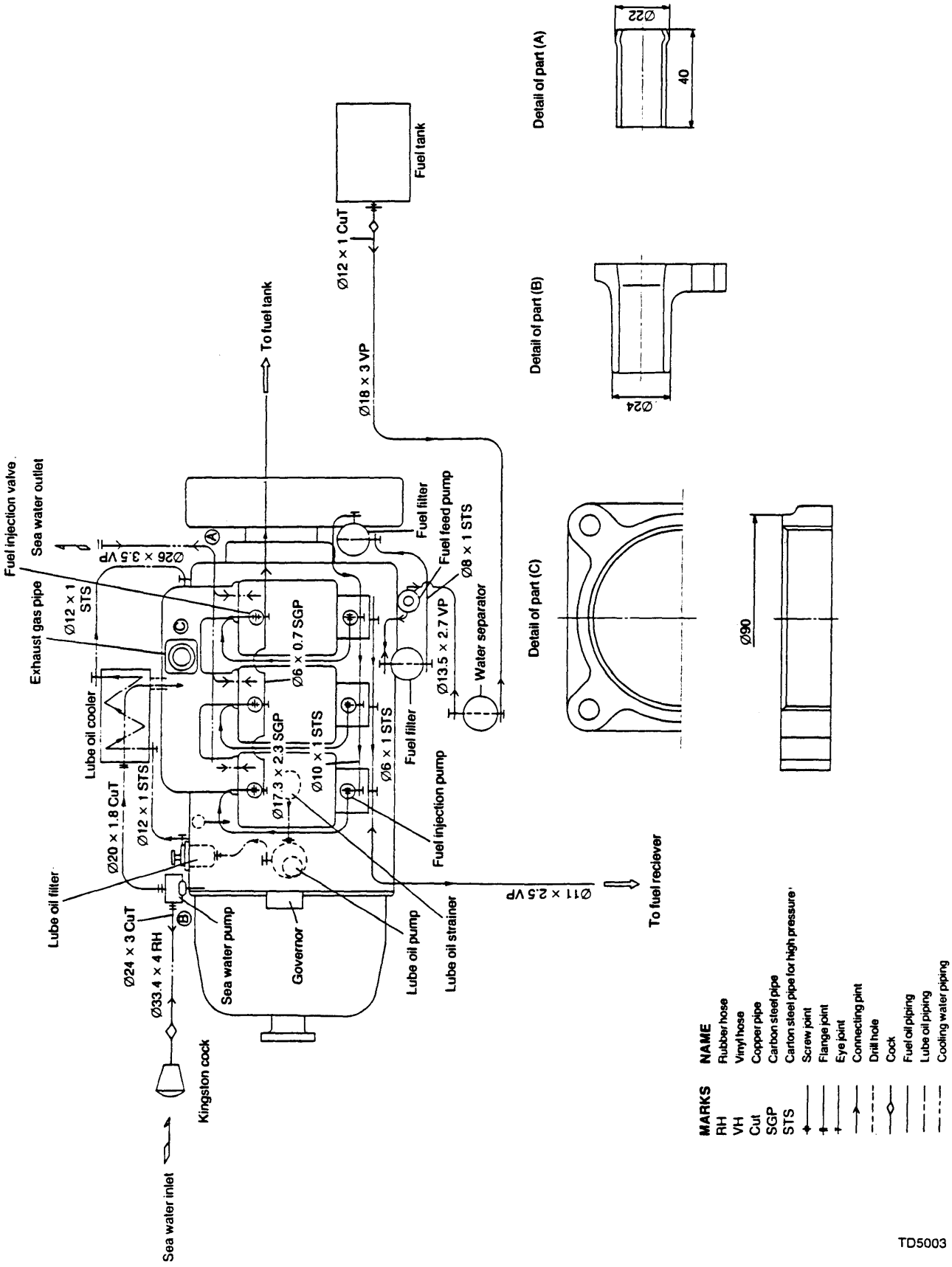
5. Piping Diagram

5-1 4TD

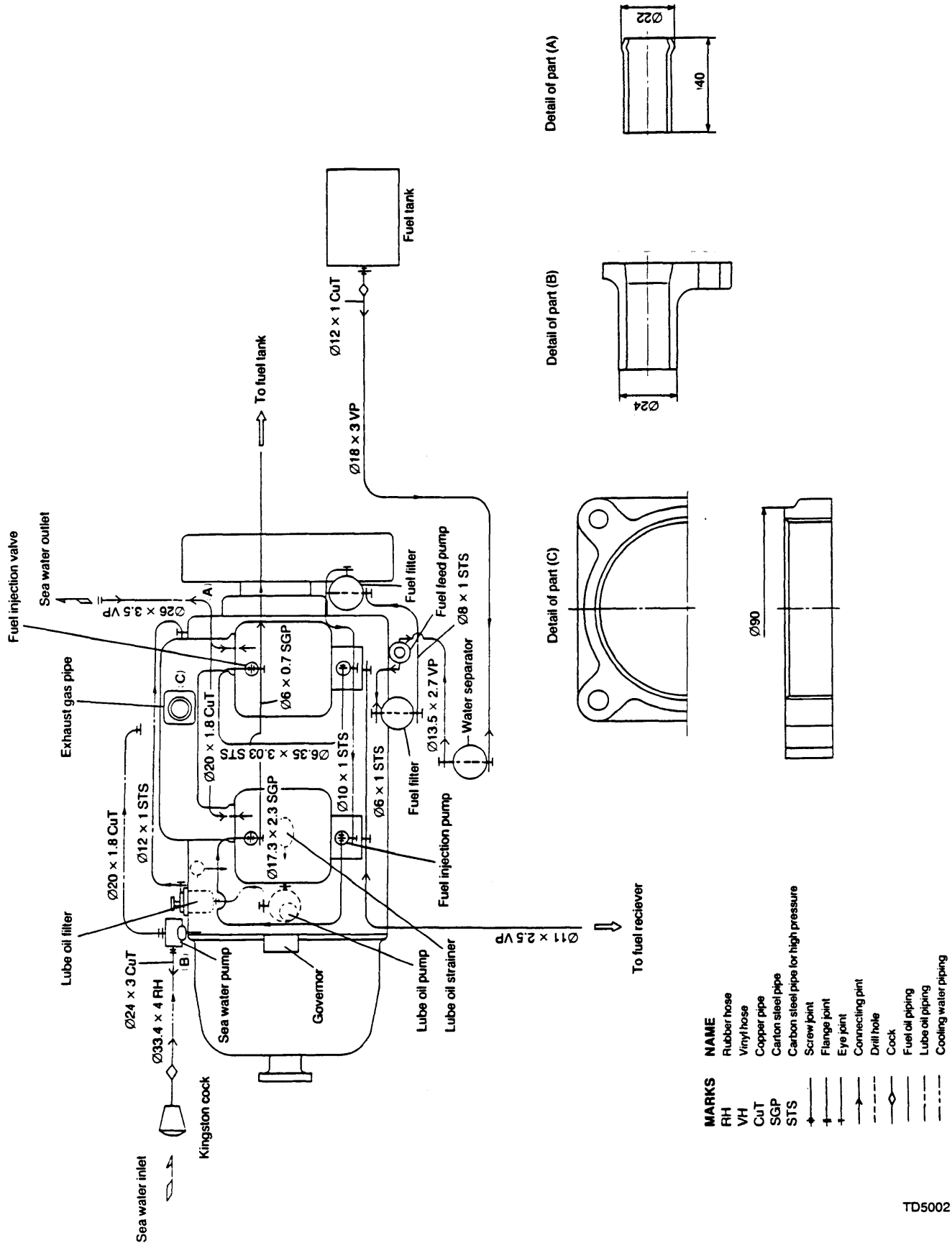


TD5004

5-2 3TD


Fuel injection valve
Sea water outlet
Exhaust gas pipe
Ø12 × 1 STS
Ø26 × 3.5 VP
Lube oil cooler
Ø20 × 1.8 CuT
Ø12 × 1 STS
Lube oil filter
Ø24 × 3 CuT
Ø33.4 × 4 RH
Kingston cock
Sea water inlet
Sea water pump
Governor
Lube oil pump
Lube oil strainer
Ø6 × 0.7 SGP
Ø17.3 × 2.3 SGP
Ø10 × 1 STS
Ø6 × 1 STS
Fuel filter
Fuel injection pump
Ø11 × 2.5 VP
To fuel reciever
To fuel tank
Ø12 × 1 CuT
Ø18 × 3 VP
Fuel tank
Fuel filter
Fuel feed pump
Ø8 × 1 STS
Ø13.5 × 2.7 VP
Water separator
Detail of part (A)
Ø22
40
Detail of part (B)
Ø24
Detail of part (C)
Ø90
MARKS
RH Rubber hose
VH Vinyl hose
Cut Copper pipe
SGP Carbon steel pipe
STS Carbon steel pipe for high pressure
NAME
Screw joint
Flange joint
Eye joint
Connecting pint
Drill hole
Cock
Fuel oil piping
Lube oil piping
Cooling water piping
TD5003

5-3 2TD

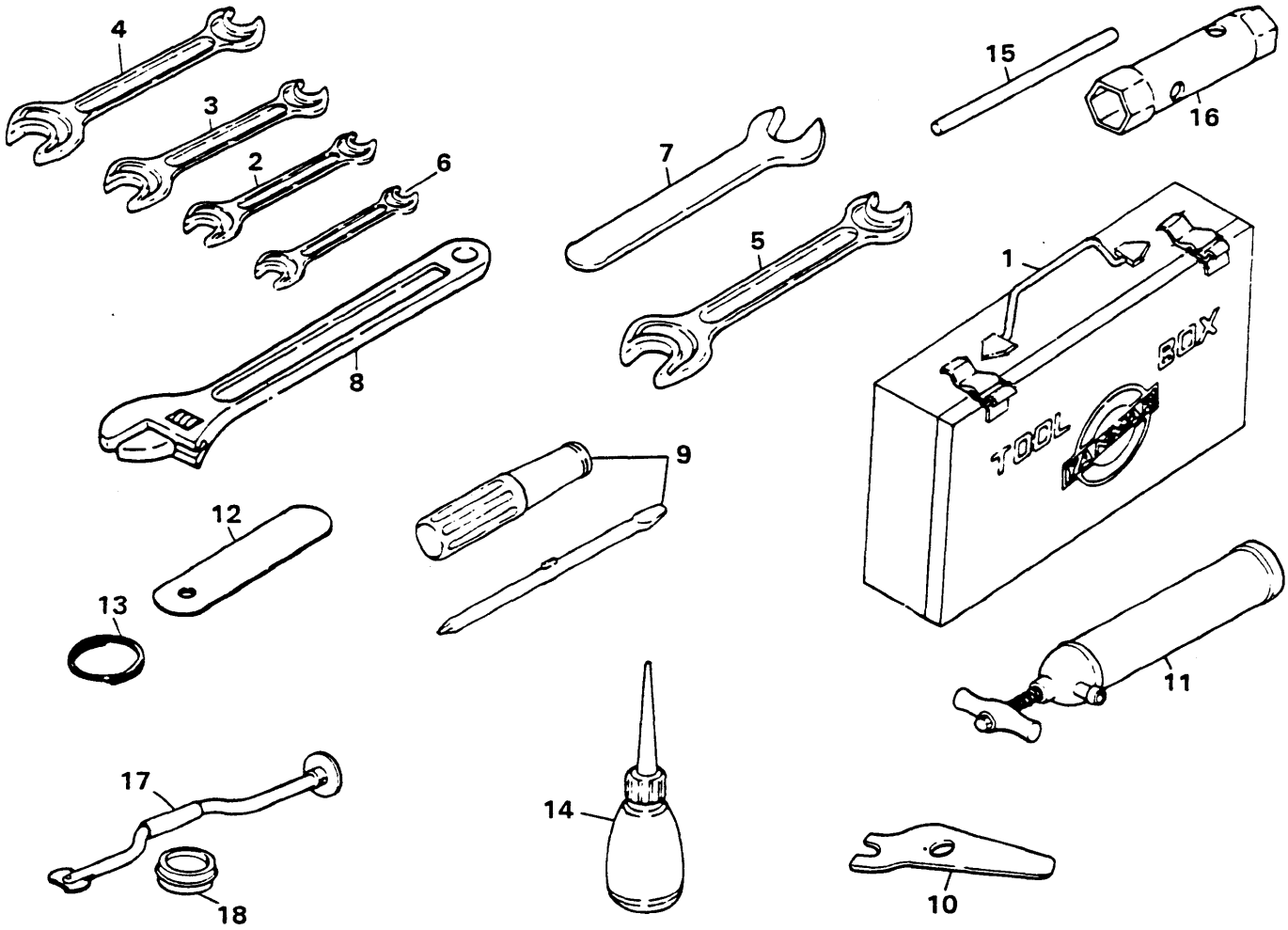

Detail of part (A)
Ø22
40
Detail of part (B)
Ø24
Detail of part (C)
Ø90
Fuel tank
Ø12 × 1 CuT
Ø18 × 3 VP
To fuel tank
Fuel injection valve
Sea water outlet
Ø26 × 3.5 VP
Exhaust gas pipe
Fuel filter
Fuel feed pump
Ø8 × 1 STS
Water separator
Ø13.5 × 2.7 VP
Ø6 × 0.7 SGP
Ø20 × 1.8 CuT
Ø6.35 × 3.03 STS
Ø10 × 1 STS
Ø6 × 1 STS
Fuel filter
Fuel injection pump
Ø20 × 1.8 CuT
Ø12 × 1 STS
Ø17.3 × 2.3 SGP
Lube oil filter
Ø11 × 2.5 VP
To fuel reciever
Ø24 × 3 CuT
Ø33.4 × 4 RH
Sea water pump
Governor
Lube oil pump
Lube oil strainer
Kingston cock
Sea water inlet
MARKS
RH Rubber hose
VH Vinyl hose
CuT Copper pipe
SGP Carton steel pipe
STS Carbon steel pipe for high pressure
Screw joint
Flange joint
Eye joint
Connecting pint
Drill hole
Cock
Fuel oil piping
Lube oil piping
Cooling water piping
TD5002

6. Disassembly and Reassembly Tools

6-1 Standard Tools

Daily maintenance tools
YANMAR's TD-series models contain, as a standard accessory, a complete tool kit for daily maintenance work.
These tools are arranged so as to enable the owner or operator of the boat to do daily maintenance in the engine room by himself.

Advise your customers to take anticorrosive measures and store the tools carefully in the boat. Otherwise, they may become rusted and unusable when needed.



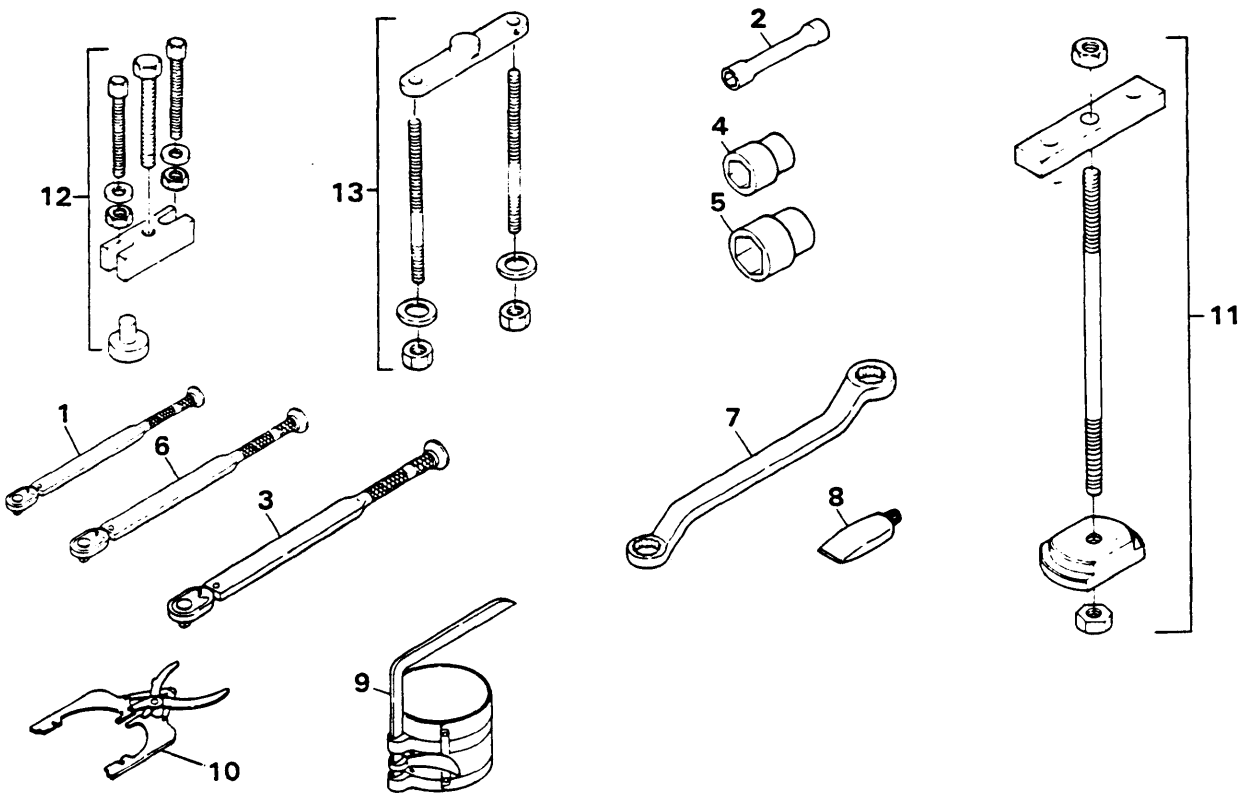
TD0010

STANDARD TOOLS LIST

No.	Part Name	2TD	3TD	4TD	No.	Part Name	2TD	3TD	4TD
1	Tool box	1	1	1	10	Valve Pull-out device	1	1	1
2	Wrench 12 × 14	1	1	1	11	Manual pump (w/pipe)	1	1	1
3	Wrench 17 × 19	1	1	1	12	Thickness gauge 0.25	1	1	1
4	Wrench 22 × 24	1	1	1	13	Ring (gauge)	1	1	1
5	Wrench 26 × 32	1	1	1	14	Oiler	1	1	1
6	Wrench 10 × 13	1	1	1	15	Turning bar	1	1	1
7	Wrench 27	1	1	1	16	Box wrench 12 × 300	1	1	1
8	Monkey wrench 250	1	1	1	17	Valve lapping tool	1	1	1
9	Screwdriver (replaceable)	1	1	1	18	Lapping powder	1	1	1

6-2 Workshop Tools

For more important overhaul work, use the tools specified by YANMAR or the equivalent. YANMAR engines are designed so that even untrained local mechanics can usually check and maintain them with tools for general use, without using any special disassembly tools. However, workshops which undertake major overhauling work for TD-series engines should be furnished with at least the following tools.



TD0011

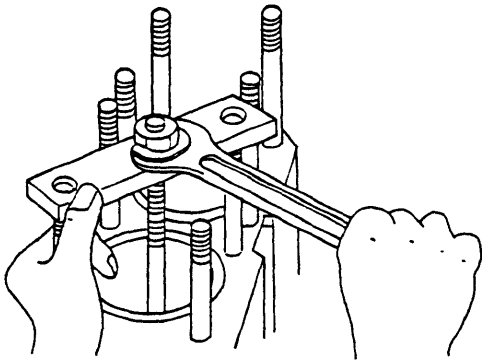
WORKSHOP TOOLS LIST

No.	Yanmar Part No.	Description	No.	Yanmar Part No.	Description
1	123340-92600	Torque wrench 230 QLK 0.7 ~ 2.3 kg-m for F.O. injectionvalve	7	28160-190220	Eye wrench 19 × 22 for F.O. injection
2	123340-92620	Socket B = 12 for F.O. inj. valve torque wrench	8	97775-500050	Paste type lubricant containing MOS_2 (MOS_2 = Molibdenum disulfide) for injection valve etc. 50 gr.
3	123340-92630	Torque wrench 2,800 QLK 6 ~ 28 Kg-m for bearing cap bolt.	9	95550-002476	Piston with ring insert tool 2476N
4	12330-92640	Socket B = 19 VS4190 for con-rod bolt	10	95550-002468	Piston ring removal & insertion tool 2467C
5	123340-92650	Socket B = 22 VS6620 for head nut, bearing cap bolt	11	723340-93590	Cylinder liner remover assy.
6	123340-92670	Torque wrench 1,800 QLK Max. 18 Kg-m for head, con-rod bolt	*12	723210-92530	Clutch spline metal puller assy.
			*13	723210-92540	Reverse gear box puller assy.

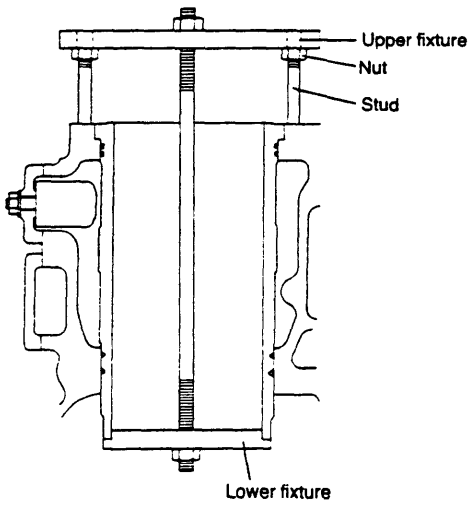
Note: * Reverse gear box puller and clutch spline metal puller are only used for 2 & 3TD series.

6-2.1 Puller application

(1) Cylinder liner remover

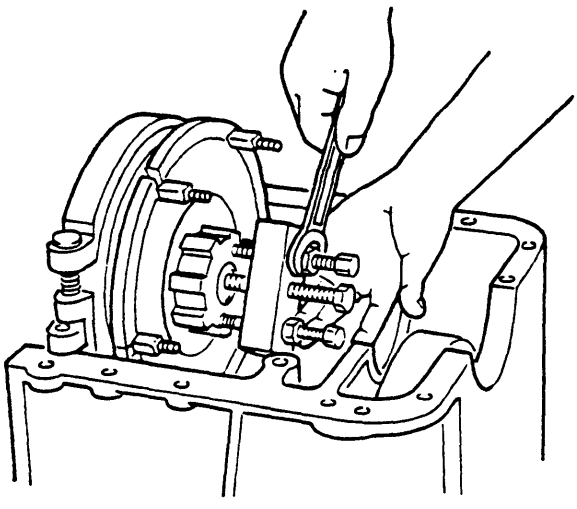


TD5075



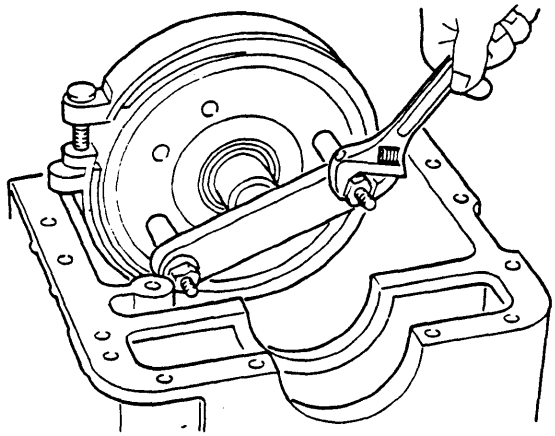
TD5141

(2) Spline metal puller



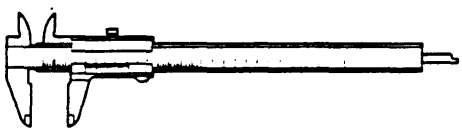
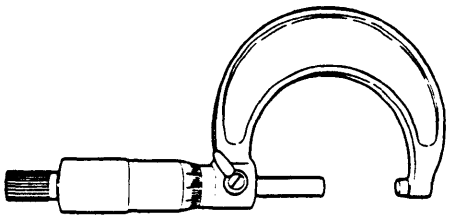
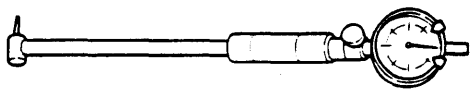
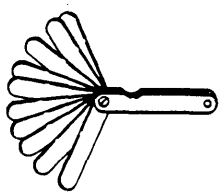
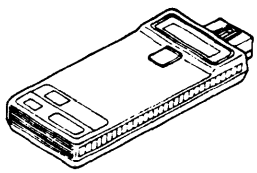
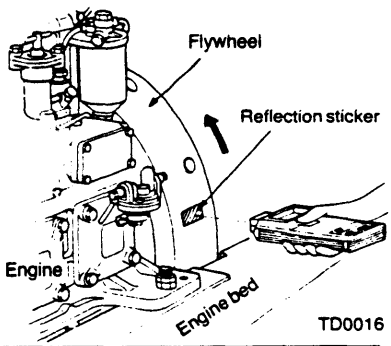
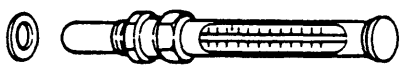
TD5031

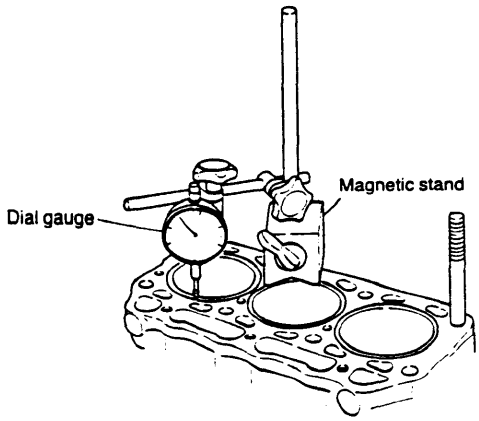
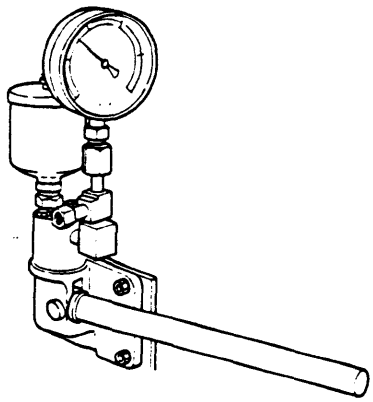
(3) Reverse gear box puller



TD5034

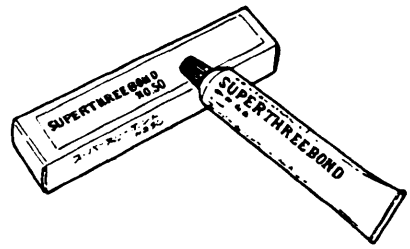
6-3 Measuring Instruments

Name of tool	Shape and size	Application
Vernier Calipers	 TD0012	0.05mm (0.0020 in.), 0 ~ 150mm (0 ~ 5.9055 in).
Micrometer	 TD0013	0.01mm (0.0004 in.), 0 ~ 25mm (0 ~ 0.9843 in.), 25 ~ 50mm (0.9843 ~ 1.9685 in.), 50 ~ 75mm (1.9685 ~ 2.9528 in.), 75 ~ 100mm (2.9528 ~ 3.9370 in.), 100 ~ 125mm (3.9730 ~ 4.9213 in.), 125 ~ 150mm (4.9213 ~ 5.9055 in.).
Cylinder gauge	 TD0014	0.01mm (0.0004 in.), 18 ~ 35mm (0.7087 ~ 1.3780 in.), 35 ~ 60mm (1.3780 ~ 2.3622 in.), 50 ~ 100mm (1.9685 ~ 3.9370 in.).
Thickness gauge	 TD0015	Adjusting cylinder head valve clearance 0.05 ~ 2mm (0.0020 ~ 0.0787 in.).
Hand tachometer electric, reflect type	 TD5130	Checking engine RPM  TD0016
Exhaust gas thermometer bar type. mercury 28573-500050	 TD5131	

Name of tool	Shape and size	Application
Dial Gauge	 TD0017	Measuring cylinder liner projection and gear backlash 0 ~ 1.0mm (0 ~ 0.4 in.).
Nozzle tester	 TD0018	0 ~ 500kg/cm^2 (0 ~ 7111.7 lb/in.^{2}).

6-4 Others

(1) Supplementary packing agent

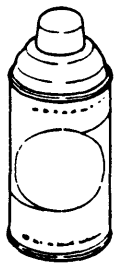


TD0019

The surface to be coated must be thoroughly cleaned with thinner or benzene and completely dry. The coating must be thin and uniform.
The packing used in this engine is asbestos sheet sealed at both mating faces.
Be sure to use the correct supplement in accordance with the table below.

Location	Packing (coated)	Packing agent and adhesive
Cylinder head	Both sides of cylinder head side cover packing Cylinder head top and bottom casting sand hole plug Rocker arm chamber packing (rocker arm chamber side) Both sides of cylinder head gasket packing	"Three Bond No.4" "Three Bond No.50"
Timing gear	Both sides of timing gear case packing	"Three Bond 3B8-005"
Cylinder block	Both sides of oil pan packing Outside surface of cylinder liner Cooling water pipe joint threads Lubricating oil suction pipe threads Lubricating oil intake pipe blind plug threads Oil pressure regulator valve threads Oil pressure switch threads Cylinder head bolt stud	"Three Bond 3B8-005" White paint "Three Bond No.20" "Screw Lock Super 203M" "Three Bond 3B8-005"
Cooling system	Water drain joint (cylinder, exhaust pipe)	"Three Bond No.4"

(2) Paint



Color spray

Only Metallic Ecole Silver is used on this engine.

TD0020

Wipe the surface to be painted with thinner or benzene, shake the spray can well, push the button at the top of the can and spray the paint onto the surface from a distance of 30 ~ 40 cm.

Type	Use
White paint (Mixed oil paint)	Paint parts that contact with the cylinder body when inserting the cylinder liner to prevent rusting and water leakage.

(3) Yanmar cleaner (Ref.)

TD0021

Cooling passage cleaner is mixed by adding one part "Unicon 146" to about 16 parts water (specific gravity ratio). To use, drain the water from the cooling system, fill the system with cleaner, allowing it to stand overnight (10 ~ 15 hours). Then drain out the cleaner, refill the system with water, and operate the engine for at least one hour.

(4) NEJI LOCK SUPER 203M: a locking agent for screws (Ref.)

TD0022

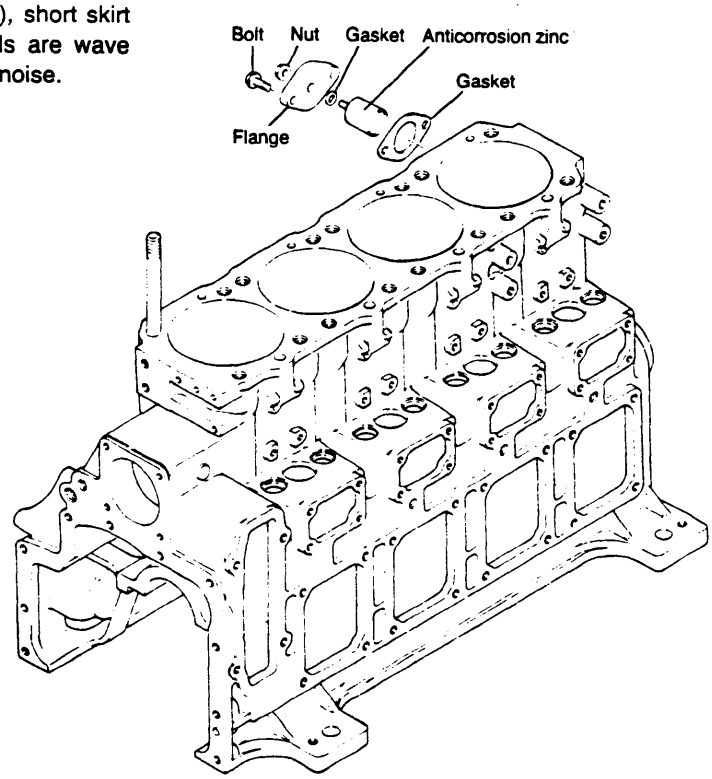
For coating on screws and bolts to prevent loosening, rusting, and leaking. To use, wipe off all oil and water on the threads of the studs, coat the threads with screw lock, tighten the stud bolt, and allow them to stand until the screw lock hardens. Use screw lock on the oil intake pipe threads, oil pressure switch threads, fuel injection timing shim faces, and front axle bracket mounting bolts.

CHAPTER 2

BASIC ENGINE

1. Cylinder Block

The cylinder block is thin-skinned, (low-weight), short skirt type with rationally placed ribs. The side walls are wave shaped to maximize ridigity for strength and low noise.



TD5088

1-1 Inspection

1-1.1 Inspection of parts

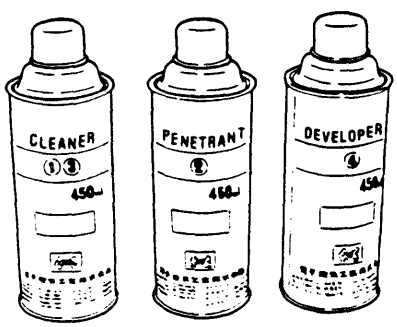
Make a visual inspection to check for cracks on engines that have frozen up, overturned or otherwise been subjected to undue stress. Perform a color check on any portions that appear to be cracked, and replace the cylinder block if the crack is not repairable.

1-1.2 Cleaning of oil holes

Clean all oil holes, making sure that none are clogged up and the blind plugs do not come off.

Color check kit
Part code No.97550-004560

	Quantity
Penetrant	1
Developer	2
Cleaner	3



TD0021

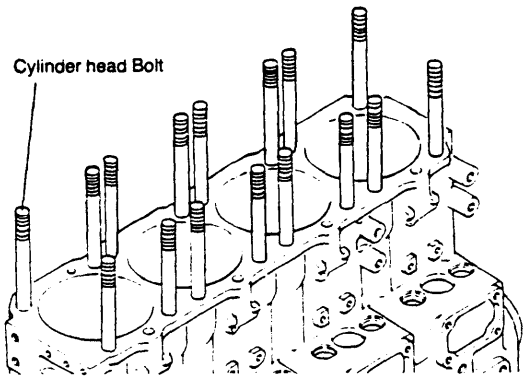
1-1.3 Color check procedure

(1) Clean the area to be inspected.
(2) Color check kit
The color check test kit consists of an aerosol cleaner, penetrant and developer.
(3) Clean the area to be inspected with the cleaner.
Either spray the cleaner on directly and wipe, or wipe the area with a cloth moistened with cleaner.
(4) Spray on red penetrant
After cleaning, spray on the red penetrant and allow 5 ~ 10 minutes for penetration. Spray on more red penetrant if it dries before it has been able to penetrate.
(5) Spray on developer.
Remove any residual penetrant on the surface after the penetrant has penetrated, and spray on the developer. If there are any cracks in the surface, red dots or a red line will appear several minutes after the developer dries. Hold the developer 300 ~ 400mm (11.8110 ~ 15.7480 in.) away from the area being inspected when spraying, making sure to coat the surface uniformly.
(6) Clean the surface with the cleaner.

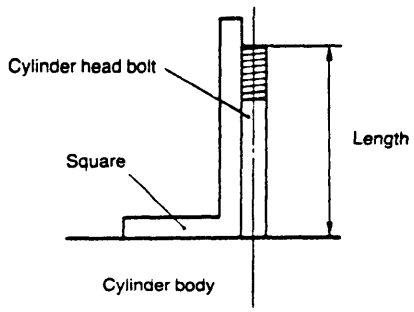
NOTE: Without fail, read the instructions for the color check kit before use.

1-1.4 Cylinder head bolts

Check for loose cylinder head bolts and for cracking caused by abnormal tightening, either by visual inspection or by a color check.
Replace the cylinder block if cracked.



TD5089



TD0022

kg-m

Tightening torque	13.5 ~ 14.5

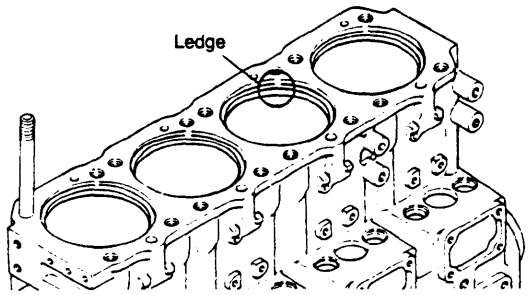
Model	Cylinder Head Bolt Parts No.	Length mm (in.)	Quantity
2TD	120445-01230	About 125 (4.921)	8
3TD			12
4TD			16

1-1.5 Oil and water passages

Check the oil and water passages for clogging and build-up of foreign matter.

1-1.6 Cylinder bore and ledge

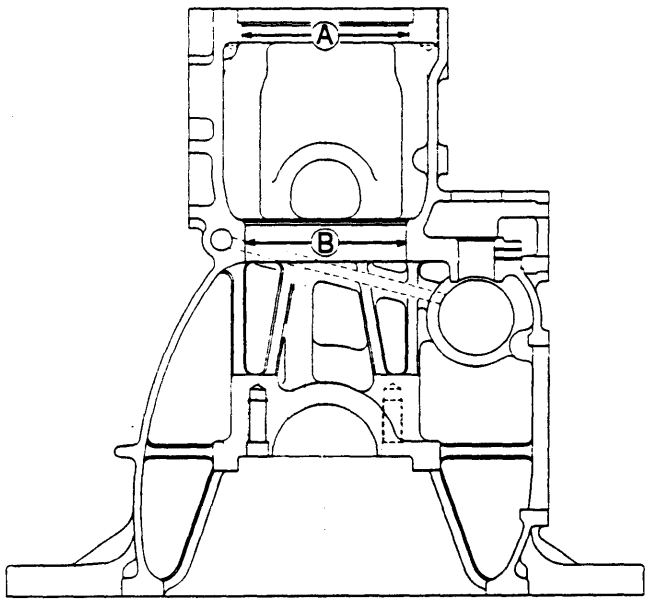
Perform a color check on the ledge at the top of the cylinder bore, and replace the cylinder block if any cracks are detected.



TD5090

1-1.7 Cylinder bore measurement

Measure the inside diameter of the part which contacts the cylinder liner, and repair or replace if it is severely distorted.



TD5005

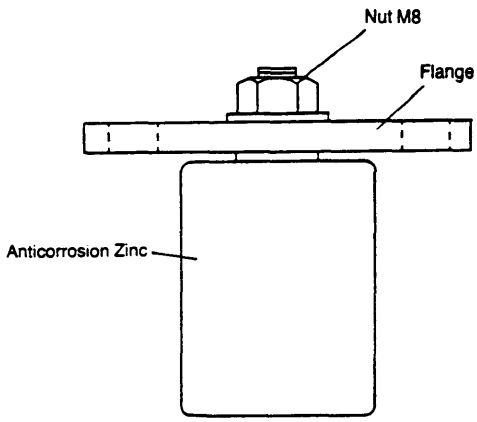
mm (in.)

	Maintenance standard	Roundness
Top A	$\varnothing 118^{+0.035}$ (4.6457~4.6470)	0.02 (0.0008)
Bottom B	$\varnothing 115^{+0.035}$ (4.5276~4.5289	0.02 (0.0008)

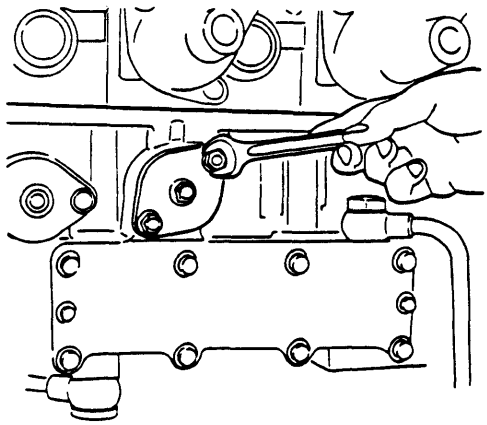
1-2 Anticorrosion Zinc

1-2.1 Principles

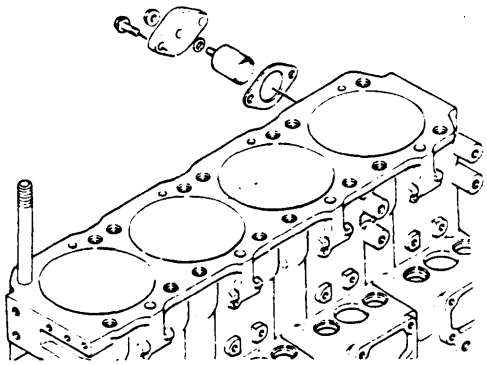
Anticorrosion zinc is installed to prevent electrolytic corrosion by sea water.
When different metals, i.e., iron and copper, are placed in a highly conductive liquid, such as sea water, the iron gradually rusts. The anticorrosion zinc provides protection against corrosion by being corroded in place of the sea water pump, fresh water tank and other iron parts. The anticorrosion zinc for fresh water cooling systems is attached on the cover of the sea water inlet port.



TD5092



TD5148

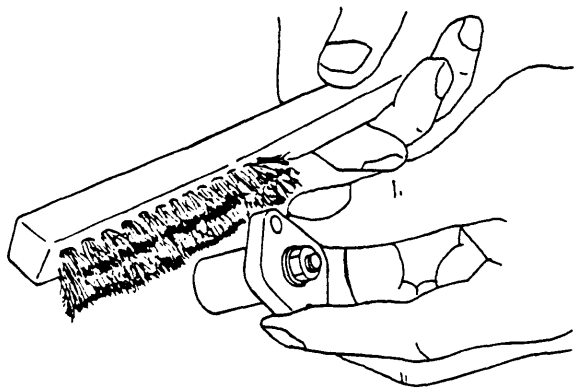


TD5091

1-2.2 Inspection

Generally, replace the anticorrosion zinc every 500 hours of operation. However, since this period depends on the properties of the sea water and operating conditions, periodically inspect the anticorrosion zinc and remove the oxidized film on its surface, using a steel brush.

Volumetric ratio with new zinc = 1/2



TD5080

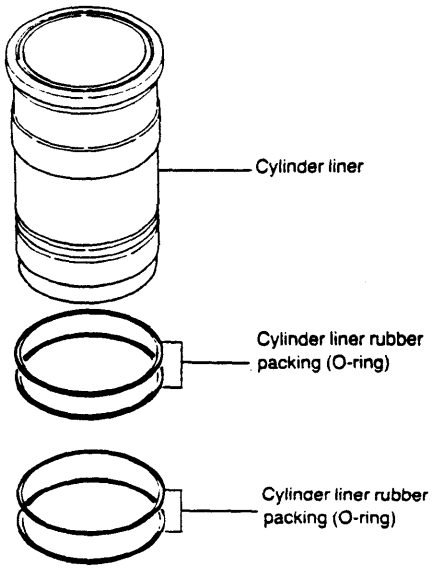
1-2.3 Replacement

Replace the anticorrosion zinc by pulling the old zinc from the zinc mounting plug and screwing in the new zinc.

2. Cylinder Liner

2-1 Construction

High-quality special high-phosphorous cast iron wet type cylinder liners are used. The outside of the cylinder liner is machined to a uniform thickness to prevent local heat expansion and improve durability. Four O-rings (rubber packing) are installed at the cylinder liner neck and skirt to prevent cylinder liner deformation and distortion, and to keep cooling water from leaking into the crankcase.

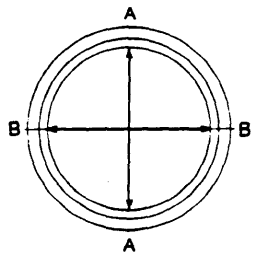


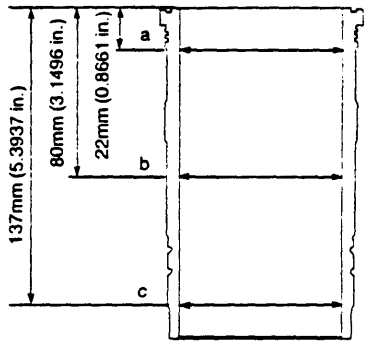
TD5094

Since the piston and piston rings constantly slide against the cylinder liner while the engine is in operation, and side pressure is applied to the cylinder liner by the movement of the crankshaft, eccentric wear occurs easily.
Also, if lubrication and cooling are insufficient, the inner surface will be damaged or rusted. Inspect the inner surface and replace the cylinder liner if the surface is noticeably damaged or rusted.

2-2.1 Cylinder liner bore diameter measurement

Measure the bore diameter of the cylinder liner with a cylinder gauge at the positions shown in the figure.
Replace the cylinder liner when the measured value exceeds the wear limit.



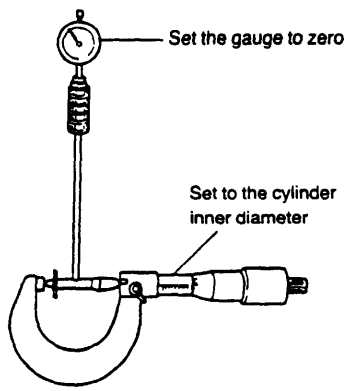


TD5008

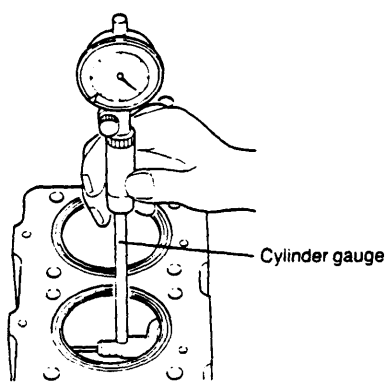
mm (in.)

	Standard	Wear limit
Cylinder liner	Ø100.00~100.03 (Ø3.9370~3.9382)	Ø99.8 (Ø3.9291)

NOTE: Be sure to measure A-A, B-B and a,b and c.



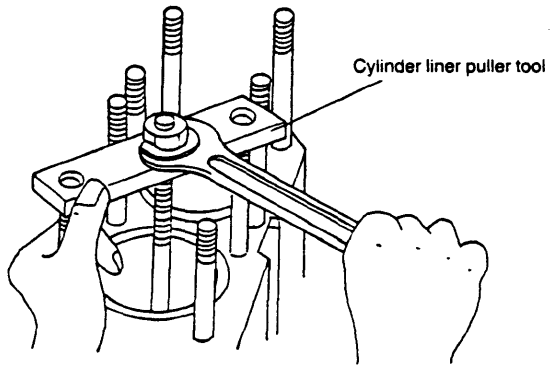
TD0023



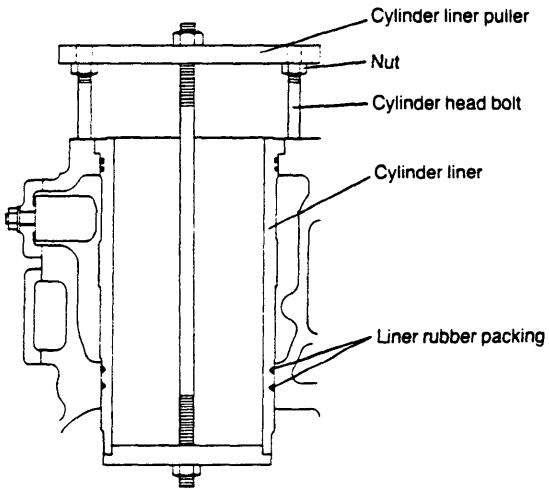
TD5048

2-3 Cylinder liner replacement

(1) Pull the cylinder liner to the top of the cylinder block as shown in the figure, using the special cylinder liner puller tool.

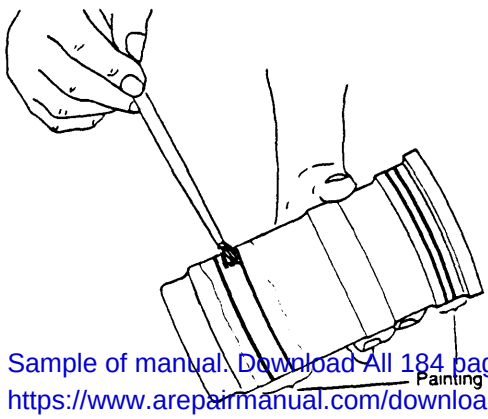


TD5075



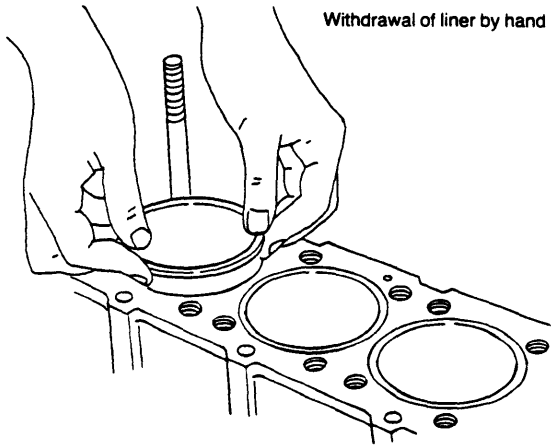
TD5141

(2) Remove the rust from the area where the cylinder liner contacts the cylinder block.
(3) Insert the rubber packing, taking care not to twist it.
(4) Coat the O-rings and the outside of the cylinder liner with waterproof paint or grease.



TD5079

(5) Coat the outside of the liner with oil, and insert lightly by hand. Do not tap it with a wooden hammer as this may deform the liner.



TD5078

(6) After inserting the liner, measure its bore diameter.
(7) Measure the amount of liner projection.