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(1) 3TNV82A

Engine name		Unit	3TNV82A								
Engine specification class		-	CL	VM							
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine								
Combustion chamber		-	Direct injection								
Number of cylinders		-	3								
Cylinder bore×stroke		mm×mm	82×84								
Displacement		L	1.331								
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-						
	Output	kW (ps)	9.9 (13.5)	12.0 (16.3)	-						
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500	2600	2800	3000
	Output	kW (ps)	11.0 (14.9)	13.2 (17.9)	14.6 (19.9)	16.0 (21.8)	17.5 (23.8)	18.2 (24.8)	19.0 (25.8)	20.4 (27.8)	21.9 (29.8)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2375	2570	2675	2780	2995	3180
Ignition order		-	1-3-2-1(No.1 cylinder on flywheel side)								
Power take off		-	Flywheel								
Direction of rotation		-	Counterclockwise (viewed from flywheel)								
Cooling system		-	Radiator								
Lubrication system		-	Forced lubrication with trochoid pump								
Starting system		-	Electric								
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)								
Applicable lubricant		-	API grade class CD or CF								
Lubricant capacity (oil pan) *	Total	L	5.5								
	Effective	L	1.9								
Cooling water capacity (engine only)		L	1.8								
Engine Dimensions ** (with flyw Crankshaft V pulley diameter & heel housing) *	Overall length	mm	553	528							
	Overall width	mm	489								
	Overall height	mm	565								
Engine mass (dry) *,** (with flywheel housing)		kg	138	128							
Cooling fan (std.) *		mm	335 mm O/D, 6 blades pusher type F								
Fun V pulley diameter (std.) *		mm	120×90	110×110							

* Items marked * may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

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3.2 Quick Reference Table for Troubleshooting

The following table summarizes the general trouble symptoms and their causes. If any trouble symptom occurs, take corrective action before it becomes a serious problem so as not to shorten the engine service life.

Trouble symptom / Cause		Starting failure				Insufficient engine output			Poor exhaust color		High knocking sound during combustion	Abnormal engine sound	Uneven combustion sound	Hunting		Large engine vibration	Difficulty in returning to low speed	Excessive fuel consumption	Lubricating oil				Much blow-by gas	Cooling water		Air intake		Exhaust temperature rise	Corrective action
			Engine starts but stops soon.			Exhaust color			During work																					
		Engine does not start.	Exhaust smoke: None	Exhaust smoke: Little	Exhaust smoke: Much	Ordinary	White	Black	White	Black				During idling	During work				Excessive consumption	Dilution by fuel oil	Mixture with water	Low L.O. pressure		Overheat	Low water temperature	Pressure drop	Pressure rise		
Engine system	Improper clearance of intake/exhaust valve	○	○			○																				○		○	Adjust the valve clearance. (See 2.2.6(4) in Chapter2.)
	Compression leakage from valve seat					○		○		○		○						○					○			○		○	Lap the valve seat. (See 4.2.6 in Chapter4.)
	Seizure of intake/exhaust valve	○			○	○		○		○		○			○	○				○			○			○			Correct or replace.
	Blowout from cylinder head gasket					○															○			○					Replace the gasket. (See 4.2.2-12) in Chapter4.)
	Seized or broken piston ring	○			○		○		○			○		○		○			○	○			○	○				○	Replace the piston ring. (See 4.4.2-5) & 10) in Chapter4.)
	Worn piston ring, piston or cylinder	○			○		○		○										○	○			○						Perform honing and use oversize parts. (See 4.4.5-1)4) and 4.4.6 in Chapter4.)
	Seized crankpin metal or bearing	○	○									○		○	○	○							○						Repair or replace.
	Improper arrangement of piston ring joints		○				○												○				○						Correct the ring joint positions. (See 4.4.4-point 6 in Chapter4.)
	Reverse assembly of piston rings						○		○										○				○						Reassemble correctly. (See 4.4.4-point 6 in Chapter4.)
	Worn crankpin and journal bearing					○						○		○	○	○						○							Measure and replace. (See 4.4.5-(2) in Chapter4.)
	Loosened connecting rod bolt											○				○						○							Tighten to the specified torque. (See 4.4.4-point 2 in Chapter4.)
	Foreign matter trapped in combustion chamber	○										○							○				○						Disassemble and repair.
	Excessive gear backlash											○																	Adjust gear meshing. (See 4.3.4-point 2 in Chapter4.)
	Worn intake/exhaust valve guide						○												○				○						Measure and replace. (See 4.2.5-(2) and 4.2.7 in Chapter4.)
	Defective governor		○											○	○	○	○												Make adjustment.
	Improper open/close timing of intake/exhaust valves	○					○	○	○	○		○																	Adjust the valve clearance. (See 2.2.6-(4) in Chapter2.)
Turbocharger	Fouled blower							○		○																			Wash the blower.
	Waste gate malfunction							○		○																			Disassemble and inspect.
	Worn floating bearing						○		○																				Disassemble and inspect.

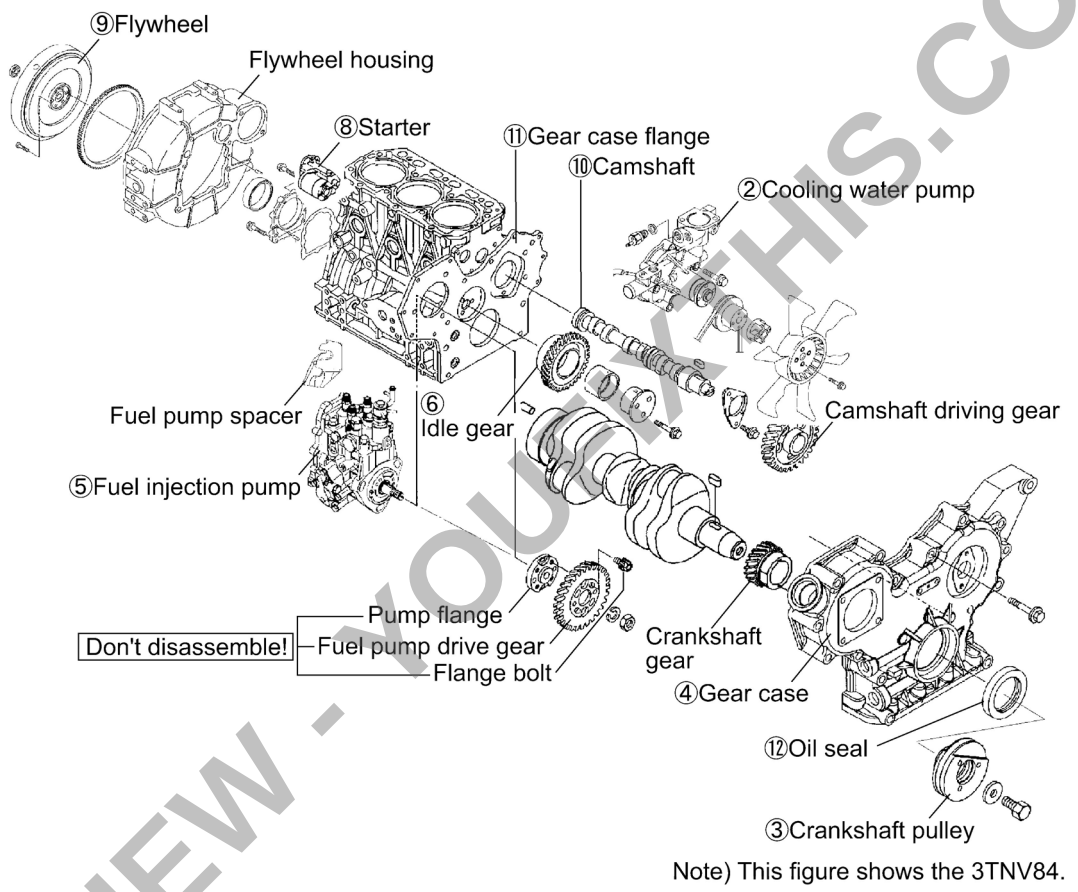
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(2) How to Read the Explanations

- An exploded view, sectional views, a system diagram, etc. are shown at the beginning of each section as required for easy understanding of the mounted states of the components.
- For the removal/installation of each part, the procedure is shown with the procedural step No. in the illustration.
- Precautions and key points for disassembly and reassembly of parts are described as **points**. In the explanation for each point, detailed operation method, information, standard and precautions are described.

Description Example



Note) This figure shows the 3TNV84.

The job contents are described in the disassembly procedure for Nos. not shown in the illustration.

- Disassembly procedure

1) Follow steps (1) to (15) of the cylinder head disassembly procedure.
2) Remove the cooling water pump.
3) Remove the crankshaft pulley. (**Point 1**) ← Operation point to be explained on a later page.

- Operation points

Disassemble: Service point for removal
Reassemble: Service point for installation
Disassemble-Reassemble: Service point required in both removal and installation.

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4.1.3 Complete disassembly

Peripheral parts such as air cleaner, muffler and radiator differ in installation and types for each application. Therefore, description in this Chapter is started with the steps to be taken just after the peripheral parts have been removed.

Step	Removal Parts	Remarks
1	1) Thoroughly remove sand, dust, dirt and soil from the surface of the engine. 2) Drain cooling water and lubricating oil from the engine.	
2	1) Remove turbocharger and exhaust manifold. 2) Remove intake manifold and surge tank.	
3	1) Close the fuel cock valve of the fuel tank. 2) Remove high-pressure fuel pipe. 3) Remove fuel return pipe. 4) Loosen the tightening nut on fuel injection nozzle retainer and extract the retainer and fuel injection nozzle. *) Fuel injection nozzle for Indirect injection system is screwed type.	1) If nozzle seat is left on the cylinder head, remove the cylinder head before extracting nozzle seat. 2) To prevent dust from entering fuel injection nozzle, fuel injection pump and high-pressure fuel pipe, seal their respective threads with a tape or the like. 3) Whenever extracting fuel injection nozzle, replace nozzle protector with a new one.
4	1) Remove rocker arm cover assembly.	
5	1) Remove valve rocker arm shaft assembly. 2) Remove push rod.	1) Attach a tag to push rod for each cylinder No. to put the push rod in order. 2) Remove valve cap from the intake/exhaust valve head. 3) Note that tappet of the indirect injection system can be removed at the same time when push rod is extracted. 4) Attach a tag to tappet for each cylinder No. to put the tappet in order.
6	1) Remove fan mounting bolt, and then remove fan. 2) Loosen adjusting bolt for the V-belt adjuster, and then remove V-belt. 3) Remove alternator. 4) Remove the spacer for cooling fan and V-pulley.	1) Never turn down alternator vigorously toward the cylinder block. Otherwise, your finger may be nipped and alternator broken.
7	1) Remove lubricating oil filter assembly. 2) Extract dipstick form the oil dip-stick hole.	
8	1) Disconnect fuel return pipes to. 2) Remove fuel filter.	

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2. Inspection and Adjustment

2.1 Periodic Maintenance Schedule

The engine periodic inspection timing is hard to determine as it varies with the application, load status, qualities of the fuel and lubricating oils used and handling status. General rules are described here.

○: User-maintenance ◎: Parts replacement ●: Shop-inspection

Classification	Item	Daily	Maintenance period				
			Every 50 hours	Every 250 hours or 3 months	Every 500 hours or 6 months	Every 1000 hours or one year	Every 2000 hours or two years
Whole	Visual check around engine	○					
Fuel oil system	Fuel tank level check and fuel supply	○					
	Fuel tank draining		○				
	Water separator (Option) draining		○				
	Bleeding the fuel system		○				
	Water separator cleaning				○		
	Fuel filter element replacement				◎		
Lubricating oil system	Lube oil level check and replenishment	○					
	Lube oil replacement		◎ 1st time	◎ 2nd time and thereafter			
	Lube oil filter replacement						
Cooling water system	Coolant water level check and replenishment	○					
	Radiator fin cleaning			○			
	V-belt tension check		○ 1st time	○ 2nd time and thereafter			
	Coolant water replacement					◎	
	Coolant/water path flushing and maintenance						●
Rubber house	Fuel pipe and coolant water pipe inspection and maintenance	○					●
Governor	Inspection and adjustment of governor lever and accelerator	○		○			
Air intake system	Air cleaner cleaning and element replacement			○	◎		
	Diaphragm assy inspection					● (2 years)	
	Turbocharger blower cleaning*					●*	
Electrical system	Warning lamp & instruments function check	○					
	Battery electrolyte level check and battery recharging		○				
Cylinder head	Intake/exhaust valve head clearance adjustment					●	
	Intake/exhaust valve seat lapping						●
Fuel injection pump and nozzle	Fuel injection nozzle pressure inspection					●*	
	Fuel injection timing adjustment Fuel injection pump inspection and adjustment						●*

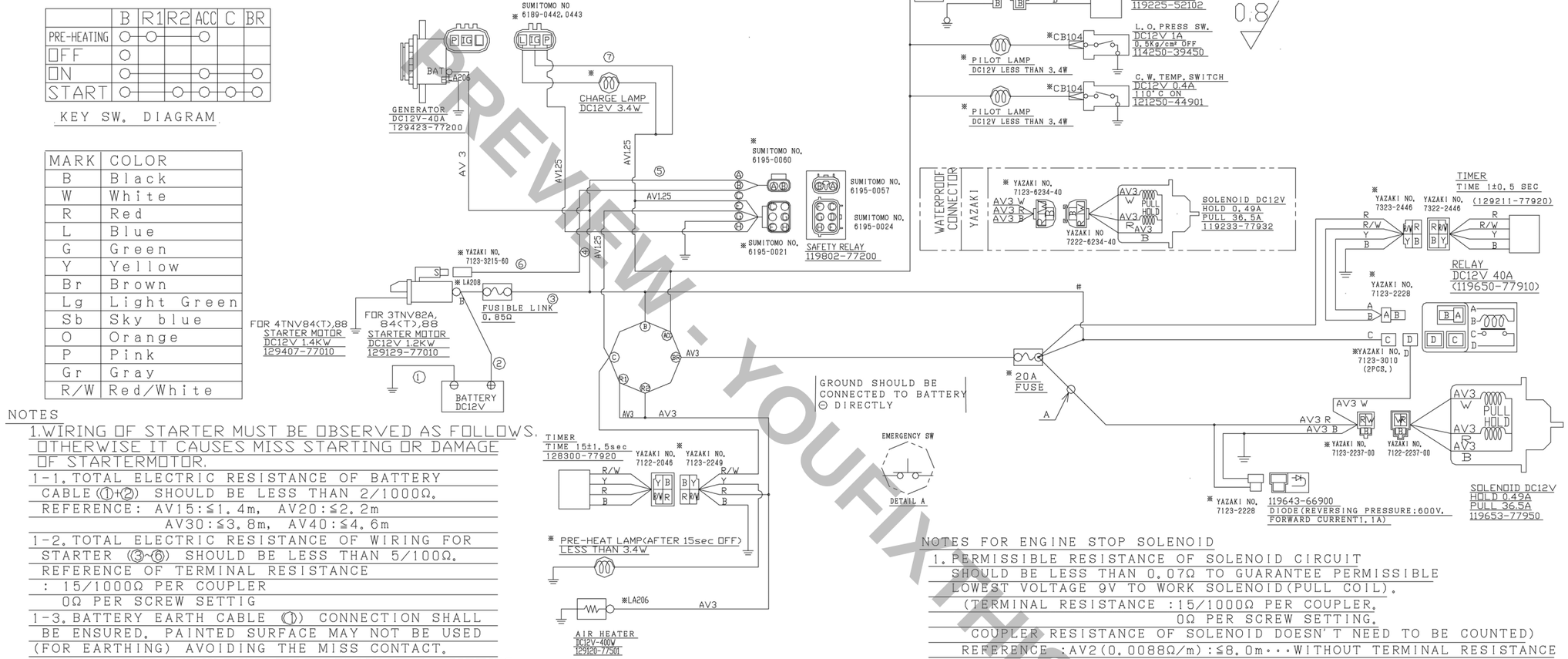
*) EPA allows to maintain the emission related parts every 1,500 or 3,000 hours as shown in 1.6.3 of chapter1.

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11. ELECTRIC WIRING

11.1 Electric Wiring Diagram



NOTES

1. WIRING OF STARTER MUST BE OBSERVED AS FOLLOWS, OTHERWISE IT CAUSES MISS STARTING OR DAMAGE OF STARTERMOTOR.
   1-1. TOTAL ELECTRIC RESISTANCE OF BATTERY CABLE (①+②) SHOULD BE LESS THAN 2/1000Ω.
   REFERENCE: AV15: ≦1.4m, AV20: ≦2.2m
   AV30: ≦3.8m, AV40: ≦4.6m
   1-2. TOTAL ELECTRIC RESISTANCE OF WIRING FOR STARTER (③~⑥) SHOULD BE LESS THAN 5/100Ω.
   REFERENCE OF TERMINAL RESISTANCE
   : 15/1000Ω PER COUPLER
   0Ω PER SCREW SETTIG
   1-3. BATTERY EARTH CABLE (①) CONNECTION SHALL BE ENSURED. PAINTED SURFACE MAY NOT BE USED (FOR EARTHING) AVOIDING THE MISS CONTACT.
2. BATTERY TREATMENT MUST BE OBSERVED AS FOLLOWS, OTHERWISE IT MAY CAUSE BURNING OF ELECTRIC EQUIPMENTS OR COMPONENTS. ALTERNATOR (DIODES) BURNING CAUSED BY BATTERY CABLE CONNECTION REVERSELY IS NOT WARRANTED.
   2-1. BATTERY SHOULD BE FIXED BY FITTING. (NOT TO MOVE)
   2-2. BATTERY CABLE LENGTH SHOULD BE ADJUSTED PROPERLY AND CLAMPED NOT TO BE CONNECTED REVERSELY.
   2-3. NOT LOOSE THE BATTERY CABLE TERMINAL, NOR TURN THE BATTERY SWITCH OFF DURING THE ENGINE RUNNING.
3. ONLY THE SPECIFIED LOAD SHOULD BE APPLIED ON THE ALTERNATOR "L" AND "P" LINE. IT IS NOT ALLOWED TO CONNECT ANY LOAD UNSPECIFIED WITHOUT YANMAR APPROVAL.
4. CHECK ANY SURGE CURRENT OR VOLTAGE OCCURED UNDER NORMAL OPERATIONS AND EXPECTIVE ERRONEOUS OPERATIONS, AND CONFIRM THE CIRCUIT NO SURGE OCCURS. ESPECIALLY PROVIDE THE FLYWHEEL DIODE FOR "C-LOAD" AND DIODE FOR "L-LOAD".

NOTES FOR ENGINE STOP SOLENOID

1. PERMISSIBLE RESISTANCE OF SOLENOID CIRCUIT SHOULD BE LESS THAN 0.07Ω TO GUARANTEE PERMISSIBLE LOWEST VOLTAGE 9V TO WORK SOLENOID(PULL COIL).
   (TERMINAL RESISTANCE :15/1000Ω PER COUPLER, 0Ω PER SCREW SETTING.
   COUPLER RESISTANCE OF SOLENOID DOESN'T NEED TO BE COUNTED)
   REFERENCE :AV2(0.0088Ω/m): ≦8.0m・・・WITHOUT TERMINAL RESISTANCE
   AV3(0.0056Ω/m): ≦12.5m・・・SAME AS ABOVE
   WHEN YOU EXCEED PERMISSIBLE RESISTANCE, ADOPT THE CIRCUIT IMPRESSED FROM THE POWER SUPPLY TO THE SOLENOID DIRECTLY USING A RELAY ・・・REFER TO #
2. HIGH TEMPERATURE PARTS, SUCH AS AN EXHAUST PIPE, SHOULD NOT APPROACH FOR THE PULL POWER FALL OF SOLENOID, AND HEATING PREVENTION OF INNER COIL TEMPERATURE. (PERMISSIBLE AMBIENT TEMPERATURE: -30~100℃)
3. INSTALL FUSE TO PROTECT THE HARNESS AGAINST TROUBLES SUCH AS SHORT CIRCUIT OR CONTINUOUS DRIVE OF PULL-COIL.
4. THE POWER SUPPLY OF SOLENOID MAY NOT BE COMMON WITH THE LINE OF ALTERNATOR INITIAL EXCITATOR AS SHOWN IN THIS DRAWING. (OTHERWISE, SOLENOID MAY LOOSE STOP FUNCTION DUE TO THE POWER SUPPLY FROM ALTERNATOR "L" TERMINAL.)
5. IN CASE OF WATERPROOF CONNECT OR APPLICATION, CONNECTOR SHOULD BE FIXED BY FITTING TO PREVENT LEAD WIRE BREAK.
6. IN CASE OF EMARGENCY STOP OF MACHINE FOR SAFETY WILL BE APPLIED, SWITCH LOCATION SHOULD BE SHOWN AS A.
7. IN CASE OF THE SOLENOID CIRCUIT RESISTANCE WOULD BE LIMIT, # WIRING IS APPLICABLE.

REMARKS

1. ※ MARKED PARTS ARE NOT PROVIDED BY YANMAR.

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SAFETY LABELS

- 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 at 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.

- Safety marks 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.

- **NOTICE**-indicates that if not observed, the product performance or quality may not be guaranteed.

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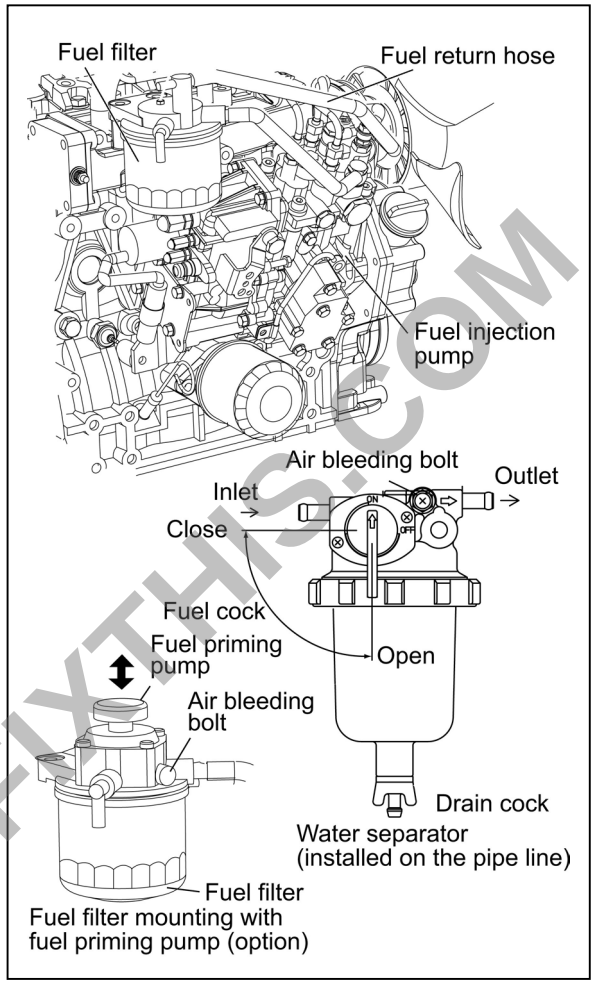
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(3) Bleeding the fuel system

Bleed the fuel system according to the following procedures. When there is air in the fuel system, the fuel injection pump will not be able to function.

1) Check the fuel oil level in the fuel tank. Refuel if insufficient.
2) Open the cock of the water separator.
3) Loosen the air bleeding bolt on the water separator by turning 2~3 times to the counter-clockwise using screw driver or spanner.
4) When the fuel coming out is clear and not mixed with any bubble, tighten the air bleeding bolt.
5) Feed the fuel with the fuel priming pump or electro-magnetic fuel feed pump.

- In case of the engine using the electro-magnetic fuel feed pump.
  Turn the starter switch to the ON position and hold it in the position for 10~15 seconds to operate the fuel feed pump.
- In case of the engine installed the fuel filter mounting with the fuel priming pump.
  The priming pump is on the top of the fuel filter mounting. Move the priming pump up and down to feed fuel until feel your hand slightly heavy.



(4) Battery electrolyte level check and battery recharging

⚠ WARNING



Fire due to electric short-circuit

- Make sure to turn off the battery switch or disconnect the negative cable (-) before inspecting the electrical system. Failure to do so could cause short-circuiting and fires.
- Always disconnect the (-) Negative battery cable first before disconnecting the battery cables from battery. An accidental "Short circuit" may cause damage, fire and or personal injury.
  And remember to connect the (-) Negative battery cable (back onto the battery) LAST.



Proper ventilation of the battery area

Keep the area around the battery well ventilated, paying attention to keep away any fire source. During operation or charging, hydrogen gas is generated from the battery and can be easily ignited.



Do not come in contact with battery electrolyte

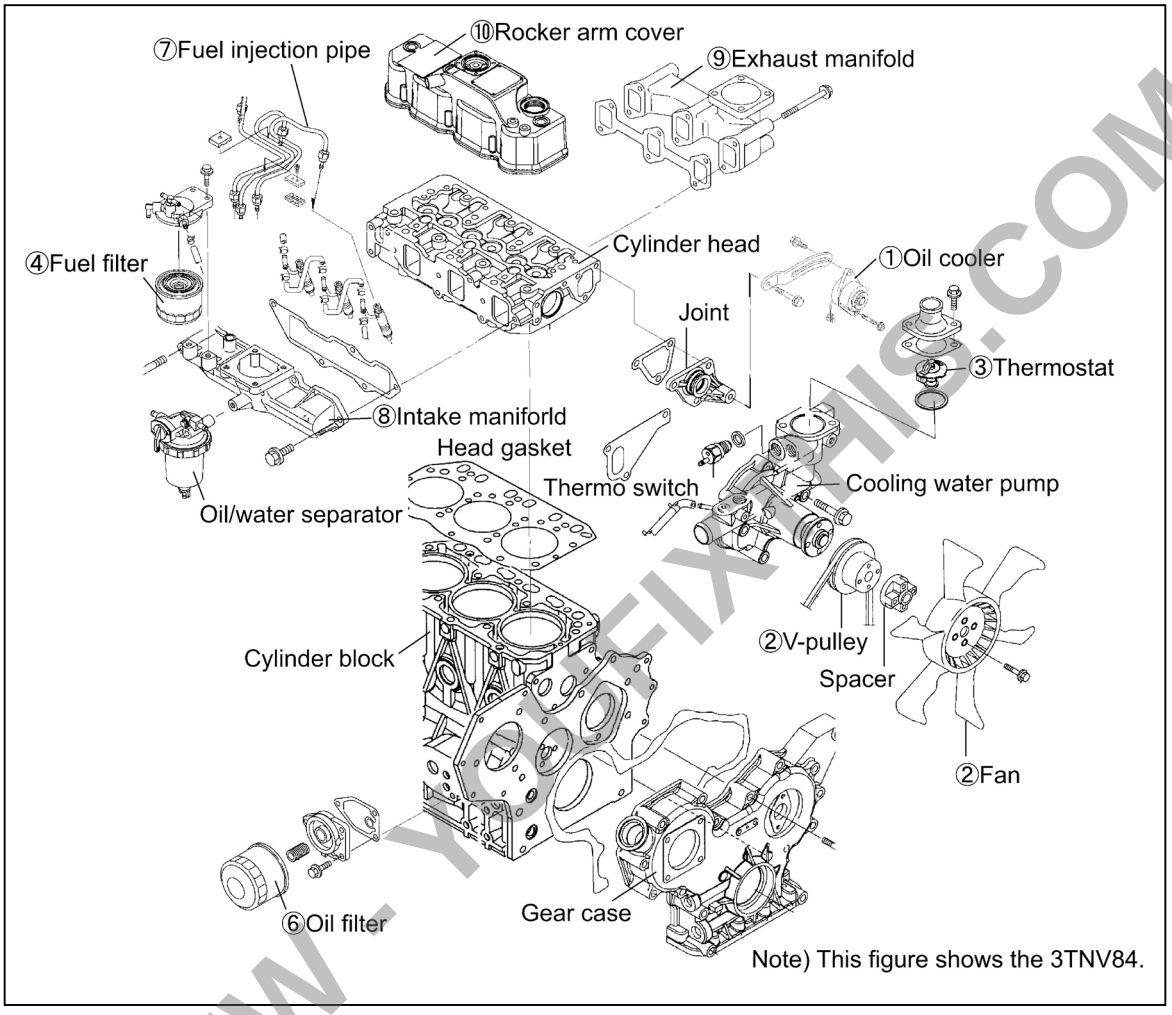
Pay sufficient attention to avoid your eyes or skin from being in contact with the fluid. The battery electrolyte is dilute sulfuric acid and causes burns. Wash it off immediately with a large amount of fresh water if you get any on you.

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4.2 Cylinder Head: Disassembly, Inspection and Reassembly

4.2.1 Components (2-valve cylinder head)



4.2.2 Disassembly procedure:

Disassemble in the order of the numbers shown in the illustration.

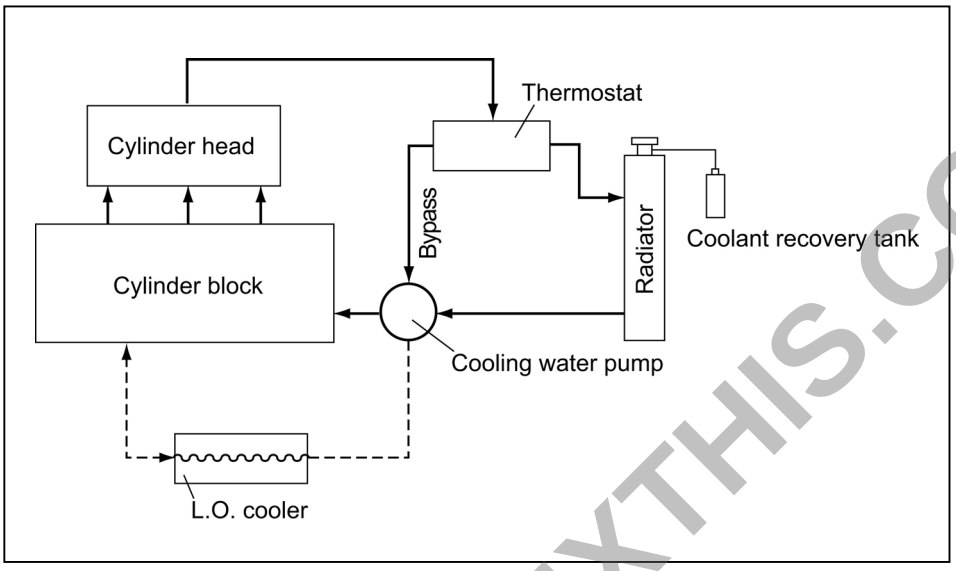
1) Remove the alternator assy. (Point1)
2) Remove the fan, pulley and V belt.
3) Remove the thermostat case. (Point2)
4) Remove the fuel filter and fuel oil piping. (Point3)
5) Remove the oil level gage assy.
6) Remove the oil filter. (Point4)
7) Remove the fuel injection pipes. (Point5)
8) Remove the intake manifold assy.
9) Remove the exhaust manifold assy.
10) Remove the rocker arm cover Assy.
11) Remove the rocker shaft assy, push rods and valve caps. (Point6)
12) Remove the cylinder head assy and head gasket. (Point7)
13) Remove the fuel injection valves and fuel return pipe. (Point8)
14) Remove the intake/exhaust valves, stem seals and valve springs. (Point9)
15) Remove the rocker arms from the rocker shaft.

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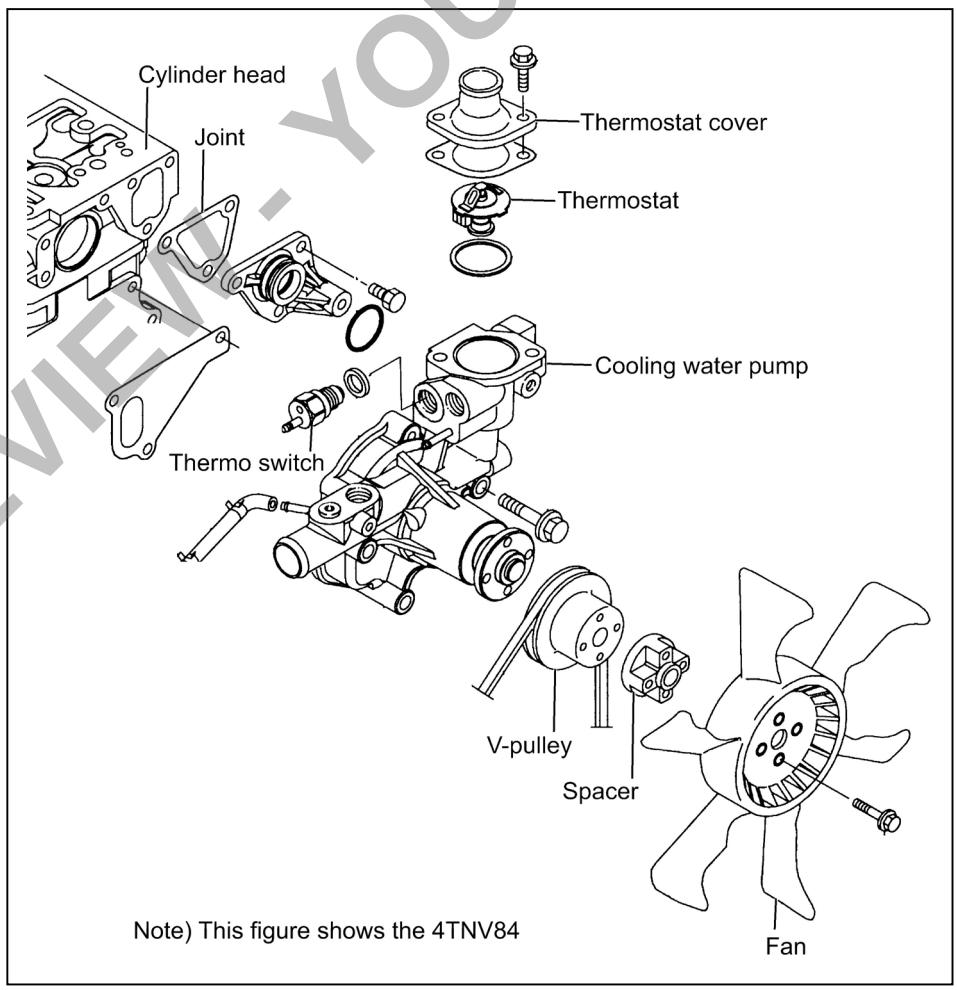
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6. COOLING SYSTEM

6.1 Cooling Water System



6.2 Cooling Water Pump Components



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9.1.7 Assembly

The assembly procedure is the reverse of the disassembly procedure, but pay attention to the following points:

(1) Grease application points

- Gears in the gear case
- Shift lever operating portion
- Pinion sliding portion
- Magnetic switch plunger sliding portion

Use the specified grease as below table at all points.

Pinion and magnetic switch plunger sliding portions	NPCFG-6A
Gears	MALTEMP SRL
Shift lever operating portion	ALBANIA No.1

(2) Magnetic switch assembly

1) Install the shift lever on the magnetic switch with the torsion spring in-between.

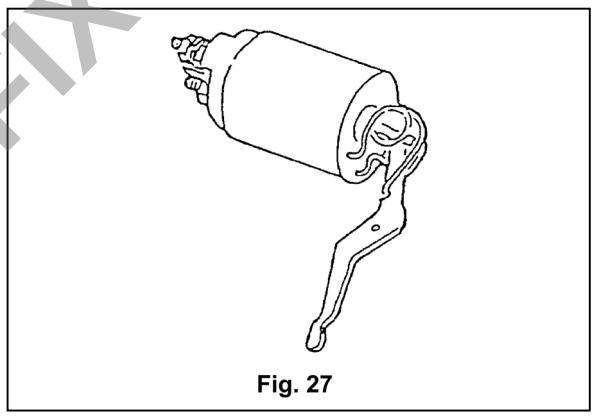


Fig. 27

2) For installation on the gear case, install the magnetic switch with the shift lever on the gear case after pulling the pinion out. Fix the magnetic switch by tightening a built-in bolt M6. Do not forget to install the dust cover (adjusting shim).

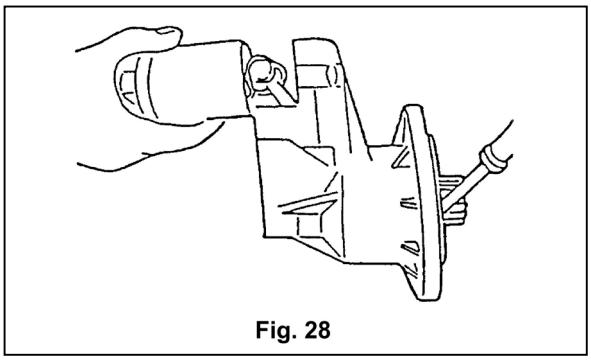


Fig. 28

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