TNV series

SERVICE MANUAL

3TNV82A(-B) • 3TNV84 • 3TNV84T(-B) •
3TNV88(-B)(-U)
4TNV84 • 4TNV84T(-Z) •
4TNV88(-B)(-U)
4TNV94L
4TNV98(-Z)(-E) • 4TNV98T(-Z)
4TNV106 • 4TNV106T

P/N: 0BTNV-G00101

YANMAR®

INDUSTRIAL ENGINES

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Section 1

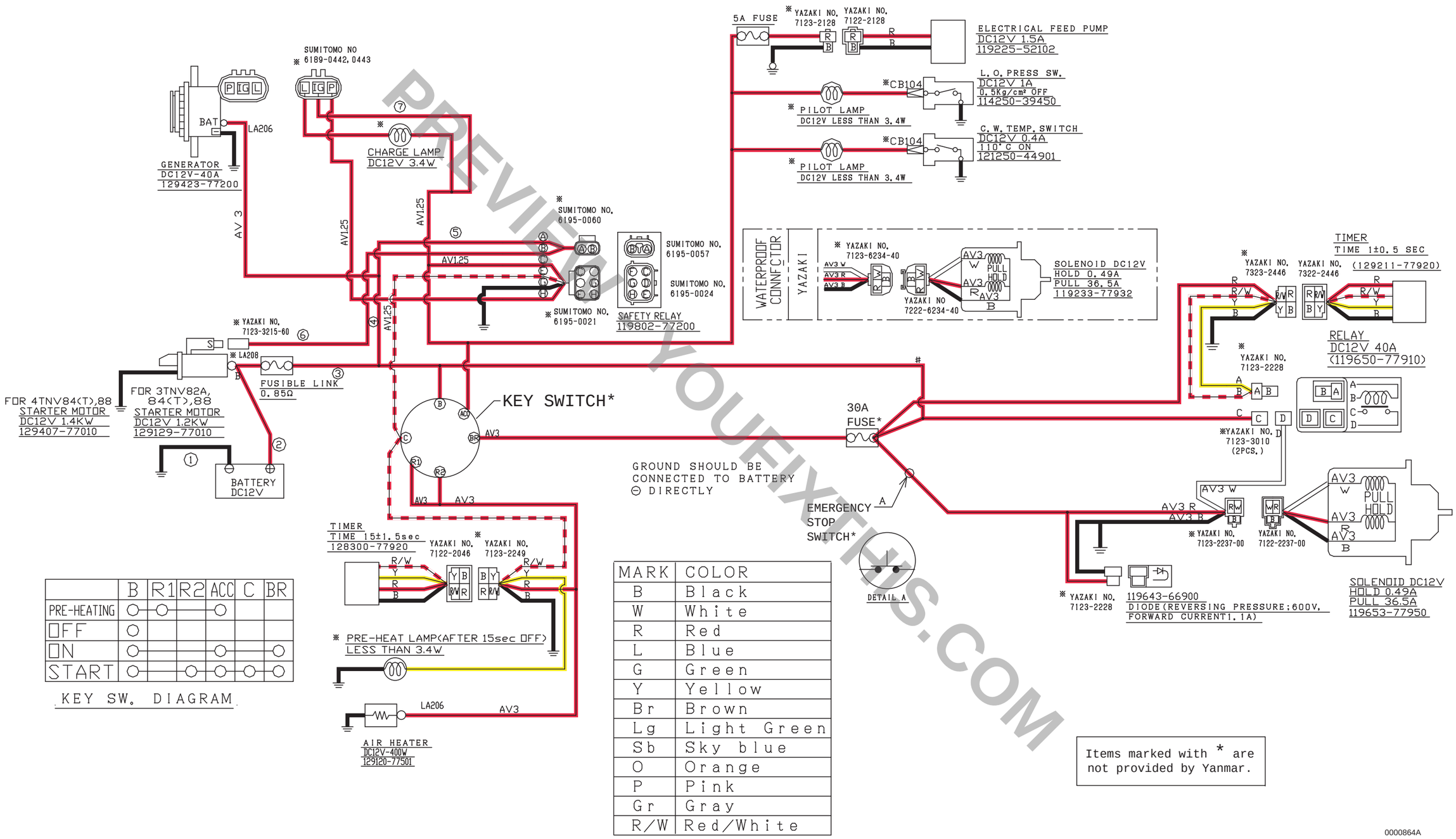
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ELECTRICAL WIRING

Note: The following wiring diagram is “representative” of a common installation using a Yanmar engine. The actual installation may be equipped with a variety of electrical components and wiring harnesses. Contact the machine manufacturer for specific information.



	B	R1	R2	ACC	C	BR
PRE-HEATING	○	○		○		
OFF	○					
ON	○			○		○
START	○		○	○	○	○

KEY SW. DIAGRAM

MARK	COLOR
B	Black
W	White
R	Red
L	Blue
G	Green
Y	Yellow
Br	Brown
Lg	Light Green
Sb	Sky blue
O	Orange
P	Pink
Gr	Gray
R/W	Red/White

Items marked with * are not provided by Yanmar.

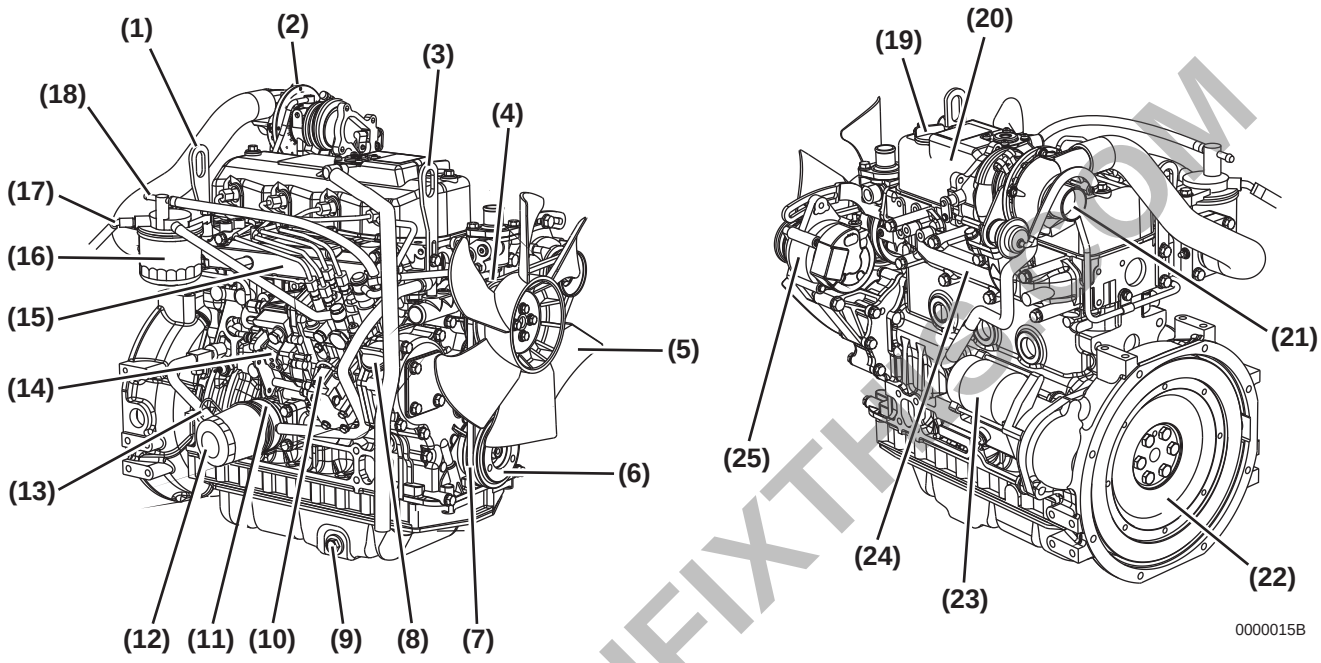
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COMPONENT IDENTIFICATION

Figure 4-1 shows where the major engine components are located.

3TNV82A(-B),3TNV84,3TNV84T(-B),3TNV88(-B)(-U),4TNV84,4TNV88(-B)(-U), 4TNV94L,4TNV984TNV106,4TNV106T



1 – Lifting Eye (Flywheel End)
2 – Turbocharger*
3 – Lifting Eye (Engine Cooling Fan End)
4 – Engine Coolant Pump
5 – Engine Cooling Fan
6 – Crankshaft V-Pulley
7 – V-Belt
8 – Side Filler Port (Engine Oil)
9 – Drain Plug (Engine Oil)**
10 – Fuel Injection Pump
11 – Engine Oil Cooler***
12 – Engine Oil Filter
13 – Dipstick (Engine Oil)
14 – Governor Lever
15 – Intake Manifold
16 – Fuel Filter
17 – Fuel Inlet
18 – Fuel Return to Fuel Tank
19 – Top Filler Port (Engine Oil)
20 – Rocker Arm Cover
21 – Air Intake Port (From Air Cleaner)
22 – Flywheel
23 – Starter Motor
24 – Exhaust Manifold
25 – Alternator

Figure 4-1

* Only applies to 3TNV84T, 4TNV84T, 4TNV98T, 4TNV106T
** The engine oil drain plug location may vary based on oil pan options.
*** Not standard on all direct injection models

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SPECIAL TORQUE CHART

Torque for Bolts and Nuts

Component	Model	Thread Diameter and Pitch	Torque	Lubricating Oil Application (Thread Portion and Seat Surface)
Cylinder Head Bolt	3TNV82A	M9 x 1.25 mm	46 - 49 ft·lb (61.7 - 65.7 N·m; 6.3 - 6.7 kgf·m)	Applied
	3TNV82A, 3TNV84, 3TNV84T, 3TNV88, 4TNV84, 4TNV84T, 4TNV88	M10 x 1.25 mm	63 - 67 ft·lb (85.3 - 91.1 N·m; 8.7 - 9.3 kgf·m)	
	4TNV94L, 4TNV98, 4TNV98T	M11 x 1.25 mm	76 - 83 ft·lb (103.1 - 112.9 N·m; 10.5 - 11.5 kgf·m)	
	4TNV106, 4TNV106T	M13 x 1.5 mm	139 - 146 ft·lb (188.0 - 112.9 N·m; 19.0 - 20.0 kgf·m)	
Connecting Rod Bolt	3TNV82A	M8 x 1.0 mm	27 - 30 ft·lb (37.2 - 41.2 N·m; 3.8 - 4.2 kgf·m)	Applied
	3TNV82A, 3TNV84, 3TNV84T, 3TNV88, 4TNV84, 4TNV84T, 4TNV88	M9 x 1.0 mm	33 - 36 ft·lb (44.1 - 49.0 N·m; 4.5 - 5.0 kgf·m)	
	4TNV94L, 4TNV98, 4TNV98T	M10 x 1.0 mm	40 - 43 ft·lb (53.9 - 58.8 N·m; 5.5 - 6.0 kgf·m)	
	4TNV106, 4TNV106T	M11 x 1.0 mm	58 - 62 ft·lb (78.5 - 83.4 N·m; 8.0 - 8.5 kgf·m)	
Flywheel Bolt	3TNV82A, 3TNV84, 3TNV84T, 3TNV88, 4TNV84, 4TNV84T, 4TNV88	M10 x 1.25 mm	61 - 65 ft·lb (83.3 - 88.2 N·m; 8.5 - 9.0 kgf·m)	Applied
	4TNV94L, 4TNV98, 4TNV98T, 4TNV106, 4TNV106T	M14 x 1.5 mm	137 - 152 ft·lb (186.2 - 205.8 N·m; 19 - 21 kgf·m)	
EPA Flange Bolt	4TNV106, 4TNV106T	M8 x 1.5 mm	83 - 91 ft·lb (113 - 123 N·m; 11.5 - 12.5 kgf·m)	Not Applied

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Failure Diagnosis Table

Symptoms and conditions of failure / Possible causes		Starting failure					Engine stall after start up			Speed control error						Engine output low			Noise and vibration				Lubricating oil				Cooling water		Intake air		Exhaust gas				Fuel			Electrical parts					Corrective Action	Referenced page number
		Starter does not rotates		Starter rotates			Smoke				No load				Workload	Smoke color															Workload													
		ECU failure lamp does not go on immediately after turning on the key	ECU failure lamp goes on immediately (within 2 seconds) after turning on the key	Engine does not start up (without initial ignition)	Engine does not start up (it stops immediately after initial ignition)	It takes longer than before to start up engine	None	Slight	Remarkable	Revolution speed cannot be changed with accelerator (stays at a constant speed)	Cannot be set to particular speed	Poor acceleration	Does not smoothly return to low speed	Hunting occurs	Hunting occurs	Normal	White	Black	High knocking sound at combustion time	Uneven combustion sound	Abnormal sound (other than combustion sound) from engine	Engine vibrates heavily	Too much lubricating oil consumed	Lubricating oil diluted with fuel	Lubricating oil mixed with water	Oil pressure low (oil pressure warning lamp lit)	Overheat (water temperature warning lamp lit)	Water temperature low	Pressure low (air cleaner warning lamp lit)	Pressure high	White exhaust gas	Black exhaust gas	Too much blow-bye	Exhaust gas temperature high	Too much fuel consumed	Fuel mixed with water (oil-water separator warning lamp lit)	Fuel filter fouled shortly	Battery charge error (charge lamp lit)	ECU failure lamp flashes	ECU failure lamp stops flashing immediately (within 2 seconds) after turning off the key	Specific ECU control functions fail.	Fuses get blown or broken (repeatedly)		
Engine system	Intake/exhaust valves with improper clearances			○			○									○					○								○				○										Adjust the valve clearances.	See "Measuring and Adjusting Valve Clearances" (on page 6-50).
	Compressed air leaks from a valve seat			●												○		○			○									○			○	○	○	○								Lap the valve seat.	See "Correcting the Valve Seats" (on page 6-30) for two-valve head or "Correcting The Valve Seats" (on page 6-44) for four-valve head.
	Intake/exhaust valve seized			○					○						○	○		○			○	○		○					○			○	○										Repair or replace the intake/exhaust valves.	See "Removing the Intake/Exhaust Valves" (on page 6-26).
	Cylinder head gasket blown															○								○		○			○														Replace the gasket.	See "Removing the Cylinder Head" (on page 6-40).
	Piston ring stuck or broken			○					○					○			○				○	○	○	○				○			○		○	○									Replace the piston rings.	See "Installing the Pistons" (on page 6-70).
	Piston rings piston, or cylinder worn			○					○								○					○	○						○			○										Apply honing, and use oversized parts.	See "Honing and Boring" (on page 6-69).
	Crank pin metal and bearing seized			○			○						○	○							○	○										○										Repair or replace.	See "Inspecting the Crank Shaft" (on page 6-67).
	Piston ring joint not correctly positioned						○										○					○										○										Correct the joint position.	See "Installing the Pistons" (on page 6-70).
	Piston ring reverse-installed																○					○									○	○										Reinstall.	See "Installing the Pistons" (on page 6-70).
	Crank pin metal and journal metal worn												○	○	○						○	○				○																Measure and replace.	See "Inspecting the Crank Shaft" (on page 6-67).
	Connecting rod bolt loose																				○	○				○																Tighten with specified torque.	See "Tightening Torques for Main Bolts and Nuts" (on page 6-15).
	Foreign matter in a combustion chamber			○																	○		○										○										Disassemble and repair.	See "Disassembling the Engine" (on page 6-55).
	Gear backlash too large																				○																						Adjust the gear engagement.	See "Inspecting the Timing Gear Backlash" (on page 6-70).
	Intake/exhaust valve guide worn																○					○												○										Measure and replace.	See "Inspecting the Valve Guide" (on page 6-29).
	Governor not properly adjusted			●			○					○	○	○								○																						Adjust.	See "Inspecting and Adjusting Governor Lever and Accelerator" (on page 5-27).
	Intake/exhaust valves with improper opening/closing timings			○													○	○			○												○	○										Adjust the valve clearances.	See "Measuring and Adjusting Valve Clearances" (on page 6-50).
	Engine's mounting loosened or damaged												○	○							●	●																						Repair or replace the faulty part(s).	

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SPECIFICATIONS

Description of Model Number



Governor Type Symbol	Governor Type	Applicable engine
Z	Electronic Governor (Eco-governor)	Non-derated engine
B	Mechanical Governor	
E	Electronic Governor (Eco-governor)	Derated engine
U	Mechanical Governor	

Engine Speed Specifications

Notation	Available Engine Speed	Intended Uses
VH	3200 - 3600 RPM (min^{-1})	Lawn Mower, Construction, Industrial Machine
VM	2000 - 3000 RPM (min^{-1})	Agricultural, Construction, Industrial Machines
CH	3000 or 3600 RPM (min^{-1})	2-pole Generator Sets, Irrigation Pumps
CL	1500 or 1800 RPM (min^{-1})	4-pole Generator Sets, Irrigation Pumps

VH: Variable High Speed
VM: Variable Medium Speed
CH: Constant High Speed
CL: Constant Low Speed

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○: Check ◇: Replace ●: Contact your authorized Yanmar industrial engine dealer or distributor

System	Check Item	Daily	Periodic Maintenance Interval					
			Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours	Every 1500 hours	Every 2000 hours
Cooling System	Check and Refill Engine Coolant	○						
	Check and Clean Radiator Fins		○					
	Check and Adjust Cooling Fan V-belt		○ 1st time	○ 2nd and after				
	Drain, Flush and Refill Cooling System With New Coolant					◇ or every 1 year which-ever comes first		
Cylinder Head	Adjust Intake / Exhaust Valve Clearance					●		
	Lap Intake / Exhaust Valve Seats. If necessary							●
Electrical Equipment	Check Indicators	○						
	Check Battery		○					
Engine Oil	Check Engine Oil Level	○						
	Drain and Fill Engine Oil		◇ 1st time	◇ 2nd and after				
	Replace Engine Oil Filter							
Engine Speed Control	Check and Adjust Governor Lever and Engine Speed Control	○		○				
Emission Control Warranty	Inspect, Clean And Test Fuel Injectors						●	
	DI ENGINE Inspect Turbocharger (Blower Wash as Necessary) 3TNV84T, 4TNV84T, 4TNV98T, 4TNV106T, 3TNV84T-B, 4TNV84T-Z, 4TNV98T-Z						●	
	DI ENGINE Inspect, Clean and Test EGR Valve 4TNV84T, 4TNV98T						●	
	DI ENGINE Clean EGR Lead Valve 4TNV84T, 4TNV98T						●	
	DI ENGINE Clean EGR Cooler (Clean to Blow Water/Air Passages) 4TNV84T, 4TNV98T						●	
	Inspect Crankcase Breather System						●	
Fuel	Check and Refill Fuel Tank Level	○						
	Drain Fuel Tank			○				
	Drain Fuel Filter / Water Separator		○					
	Check Fuel Filter / Water Separator	○						
	Clean Fuel Filter / Water Separator				○			
	Replace Fuel Filter				◇			
Hoses	Replace Fuel System and Cooling System Hoses							◇ or every 2 yrs.

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PERIODIC MAINTENANCE PROCEDURES

After Initial 50 Hours of Operation

Perform the following maintenance after the initial 50 hours of operation.

- **Replace Engine Oil and Engine Oil Filter**
- **Check and Adjust Cooling Fan V-Belt**

Replace Engine Oil and Engine Oil Filter

WARNING



BURN HAZARD!

- **If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.**
- **ALWAYS wear eye protection.**
- **Failure to comply could result in death or serious injury.**

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WARNING

SUDDEN MOVEMENT HAZARD!

- **Engaging the transmission or PTO at an elevated engine speed could result in unexpected movement of the equipment.**
- **Failure to comply could result in death or serious injury.**

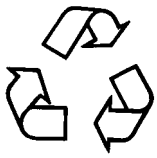
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CAUTION

- **Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize and / or shorten engine life.**
- **Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap / dipstick and the surrounding area before you remove the cap.**
- **NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.**
- **NEVER overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.**

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CAUTION

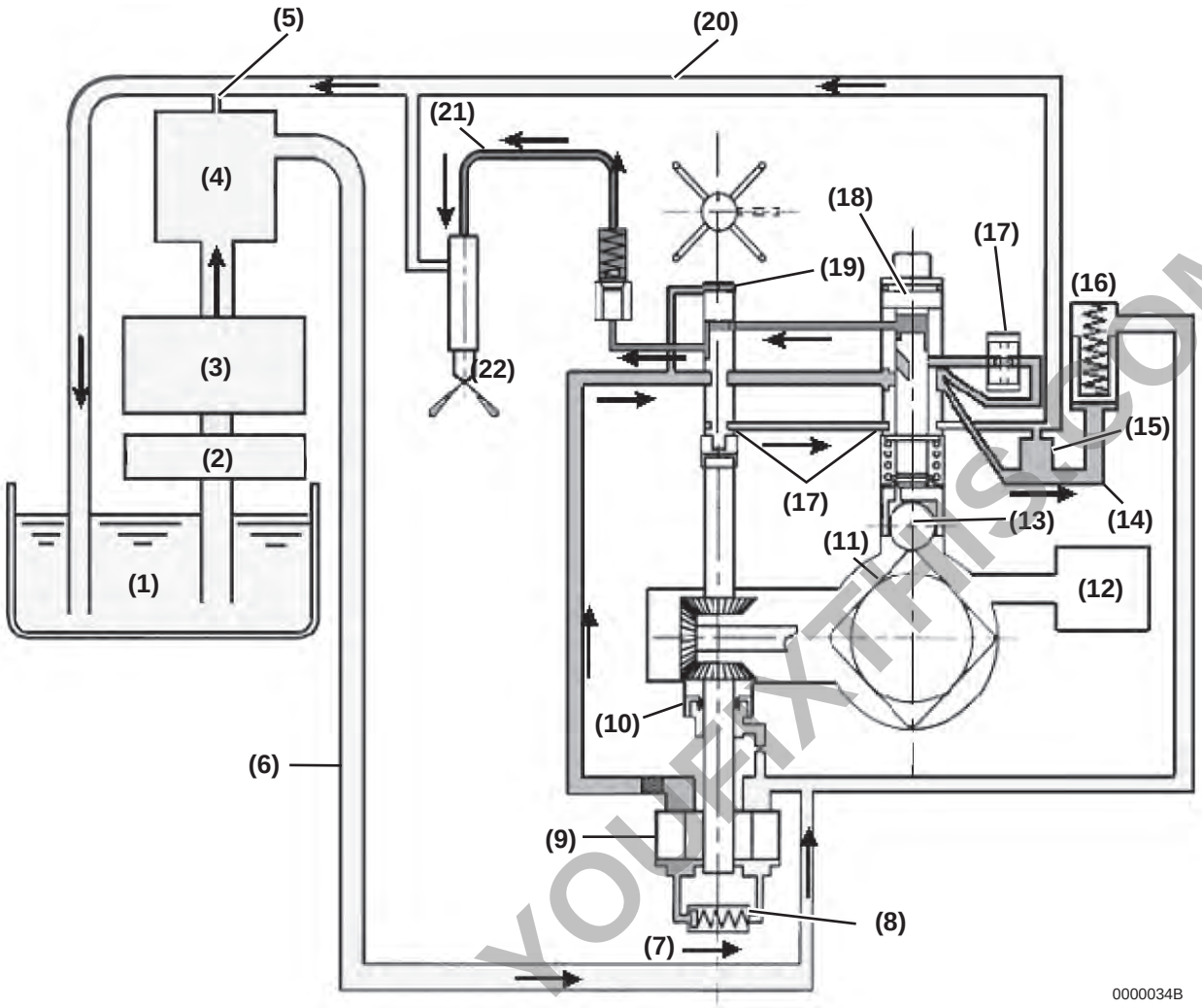


- **ALWAYS be environmentally responsible.**
- **Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.**
- **NEVER dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground, or into ground water or waterways.**
- **Failure to follow these procedures may seriously harm the environment.**

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FUEL SYSTEM DIAGRAM



1 – Diesel Fuel Tank
2 – Fuel Filter / Water Separator
3 – Electric Fuel Pump
4 – Fuel Filter
5 – Air Bleed Orifice
6 – Fuel Supply Line
7 – Low Pressure Gallery
8 – Pressure Control Valve
9 – Trochoid Pump
10 – Oil Seal
11 – Fuel Injection Pump Cam
12 – Engine Crankcase
13 – Tappet
14 – High Pressure Gallery
15 – Overflow Orifice
16 – Accumulator
17 – Timer Piston
18 – Mono-Plunger
19 – Distributor Shaft
20 – Fuel Return Line
21 – High-Pressure Fuel Injection Lines
22 – Fuel Injector

Figure 7-4

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This *Service Manual* has been developed for the exclusive use of service and repair professionals such as Yanmar authorized Distributors and Yanmar authorized Dealers. It is written with these professionals in mind and may not contain the necessary detail or safety statements that may be required for a non-professional to perform the service or repair properly and / or safely. Please contact an authorized Yanmar repair or service professional before working on your Yanmar product.

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DIESEL FUEL

Diesel Fuel Specifications

Diesel fuel should comply with the following specifications. The table lists several worldwide specifications for diesel fuels.

Diesel Fuel Specification	Location
No. 2-D, No. 1-D, ASTM D975-94	USA
EN590:96	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No. 2	Japan
KSM-2610	Korea
GB252	China

Additional Technical Fuel Requirements

- The fuel cetane number should be equal to 45 or higher.
- The sulfur content must not exceed 0.5% by volume. Less than 0.05% is preferred.
  For electronically controlled engines 4TNV84T-Z, 4TNV98-Z, 4TNV98-E, and 4TNV98T-Z, it is mandatory to use fuel that does not contain 0.05% or more sulfur content.
  In general, using a high sulfur fuel may possible result in corrosion inside the cylinder.
- Bio-Diesel fuels. *See Bio-Diesel Fuels on page 4-12*.
- NEVER mix kerosene, used engine oil, or residual fuels with the diesel fuel.
- The water and sediment in the fuel should not exceed 0.05% by volume.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Poor quality fuel can reduce engine performance and / or cause engine damage.
- Fuel additives are not recommended. Some fuel additives may cause poor engine performance. Consult your Yanmar representative for more information.
- The ash content must not exceed 0.01% by volume.
- The carbon residue content must not exceed 0.35% by volume. Less than 0.1% is preferred.
- The total aromatics content should not exceed 35% by volume. Less than 30% is preferred.
- The PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.
- The metal content of Na, Mg, Si, and Al should be equal to or lower than 1 mass ppm. (Test analysis method JPI-5S-44-95)
- Lubricity: The wear mark of WS1.4 should be Max. 0.018 in (460 µm) at HFRR test.

Bio-Diesel Fuels

In Europe and in the United States, as well as some other countries, non-mineral oil based fuel resources such as RME (Rapeseed Methyl Ester) and SOME (Soybean Methyl Ester), collectively known as FAME (Fatty Acid Methyl Esters), are being used as extenders for mineral oil derived diesel fuels.

Yanmar approves the use of bio-diesel fuels that do not exceed a blend of 5% (by volume) of FAME with 95% (by volume) of approved mineral oil derived diesel fuel. Such bio-diesel fuels are known in the marketplace as B5 diesel fuels.

These B5 diesel fuels must meet certain requirements.

1. The bio-fuels must meet the minimum specifications for the country in which they are used.
   - In Europe, bio-diesel fuels must comply with the European Standard EN14214.
   - In the United States, bio-diesel fuels must comply with the American Standard ASTM D-6751.
2. Bio-fuels should be purchased only from recognized and authorized diesel fuel suppliers.

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⚠ WARNING



SHOCK HAZARD!

- Turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the electrical system.
- Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. ALWAYS keep the connectors and terminals clean.
- Failure to comply could result in death or serious injury.

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⚠ WARNING



ENTANGLEMENT HAZARD!

- Stop the engine before you begin to service it.
- NEVER leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it. This could result in a serious injury.
- If you must service the engine while it is operating, remove all jewelry, tie back long hair, and keep your hands, other body parts and clothing away from moving / rotating parts.
- Failure to comply could result in death or serious injury.

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⚠ WARNING



BURN HAZARD!

- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.
- ALWAYS wear eye protection.
- Failure to comply could result in death or serious injury.

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⚠ WARNING



BURN HAZARD!

- Wait until the engine cools before you drain the engine coolant. Hot engine coolant may splash and burn you.
- Failure to comply could result in death or serious injury.

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Piston

Inspection Item		Standard	Limit	Reference Page
Piston Outside Diameter (Measure at 90° to the Piston Pin.)	3TNV82A	3.2264 - 3.2275 in. (81.950 - 81.980 mm)	3.2246 in. (81.905 mm)	*See Inspection of Pistons, Piston Rings and Wrist Pin on page 6-83.*
	3TNV84, 3TNV84T, 4TNV84, 4TNV84T	3.3047 - 3.3059 in. (83.940 - 83.970 mm)	3.3029 in. (83.895 mm)	
	3TNV88,4TNV88	3.4622 - 3.4634 in. (87.940 - 87.970 mm)	3.4604 in. (87.895 mm)	
	4TNV94L	3.6982 - 3.6994 in. (93.935 - 93.965 mm)	3.6968 in. (93.900 mm)	
	4TNV98, 4TNV98T	3.8555 - 3.8567 in. (97.930 - 97.960 mm)	3.8541 in. (97.895 mm)	
	4TNV106, 4TNV106T	4.1705 - 4.1716 in. (105.930 - 105.960 mm)	4.1685 in. (105.880 mm)	
Piston Diameter Measure Location (Upward From the Bottom of the Piston.)	3TNV82A	0.6299 in. (16 mm)	-	
	3TNV84, 3TNV84T, 4TNV84, 4TNV84T	0.9449 in. (24 mm)	-	
	3TNV88,4TNV88	0.9449 in. (24 mm)	-	
	4TNV94L	0.8661 in. (22 mm)	-	
	4TNV98, 4TNV98T	0.8661 in. (22 mm)	-	
	4TNV106, 4TNV106T	1.1811 in. (30 mm)	-	

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IMPORTANT

*The wave washers **(Figure 6-73, (2))** must be installed with the bow facing the rocker arms **(Figure 6-73, (1))**.*

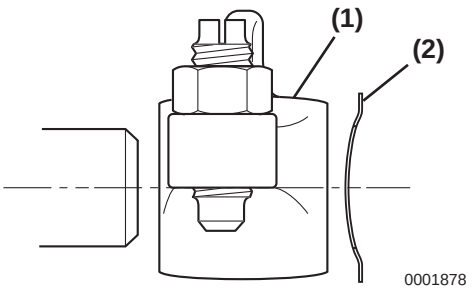


Figure 6-73

IMPORTANT

*Ensure the lubrication holes **(Figure 6-74, (1))** in the rocker arm shaft are oriented correctly with respect to the rocker arms **(Figure 6-74, (2)).***

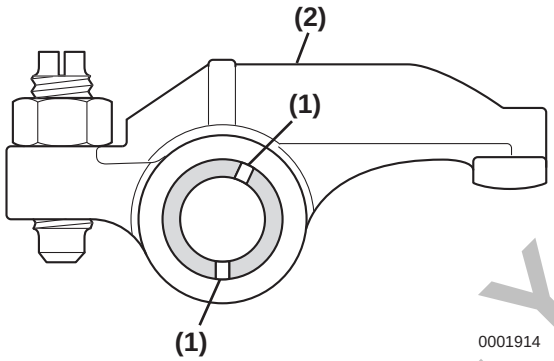


Figure 6-74

3. Lubricate the rocker arm shaft. Slide the rocker arm supports **(Figure 6-75, (6))**, wave washers **(Figure 6-75, (7)),** rocker arms **(Figure 6-75, (8)),** and fuel injector retainers **(Figure 6-75, (4))** onto the shaft.

Note: To properly align the rocker arm shaft with the rocker arm shaft supports, first reinstall one of the end rocker arm supports **(Figure 6-75, (6))** with a hole for the shaft alignment stud **(Figure 6-75, (5))**. Align the hole in the rocker arm shaft and the hole in the rocker arm support bracket. Reinstall the alignment stud.

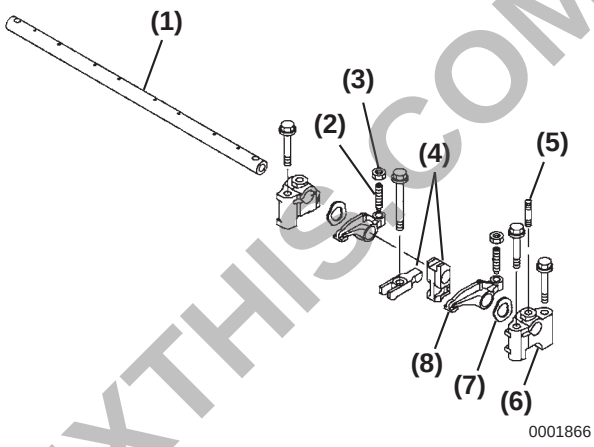


Figure 6-75

Note: **Figure 6-75** shows components for one cylinder. Components for all remaining cylinders are assembled in the same order.

4. Position the rocker arm assembly on a flat surface. Reinstall the alignment studs **(Figure 6-75, (5))**.
5. Place the rocker arm shaft assembly onto the cylinder head.
6. If removed, reinstall the valve adjusting screws **(Figure 6-75, (2))** and lock nuts **(Figure 6-75, (3))**.
7. Align the push rods with their respective rocker arms.
8. Reinstall and tighten the rocker arm shaft retaining bolts to the specified torque.
9. Tighten the rocker arm shaft alignment studs.
10. Adjust the valve clearance.
11. Reinstall the fuel injectors. *See Installation of the Fuel Injectors on page 7-42.*

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⚠ WARNING

- **Be sure to use the E-ECU in conjunction with the engines whose models or serial numbers are specified by Yanmar.**
  Other E-ECU/engine combinations than specified will void the engine warranty.
- **Improper use or misuse of the E-ECU may result in death or serious injury due to an abrupt and unexpected increase in engine speed.**

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⚠ WARNING

- **Replacing the fuel injection pump involves rewriting the fuel injection data in the E-ECU.**
  Be sure to contact your local Yanmar dealer before replacing the fuel injection pump.
  Failure to rewrite the fuel injection data before replacing the fuel injection pump will void the engine warranty.
- **Improper use or misuse of the E-ECU may result in death or serious injury due to an abrupt and unexpected increase in engine speed.**

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⚠ WARNING

- **Replacing the E-ECU involves migrating the fuel injection data to the existing E-ECU to the new unit.**
  Be sure to contact your local Yanmar dealer before replacing the E-ECU.
  Failure to migrate the fuel injection data before replacing the E-ECU will void the engine warranty.
- **Improper use or misuse of the E-ECU may result in death or serious injury due to an abrupt and unexpected increase in engine speed.**

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ENGINE COOLANT SYSTEM CHECK

Check the engine coolant system for leakage.

1. With the radiator properly filled, install a cooling system tester **(Figure 8-3, (1))**.

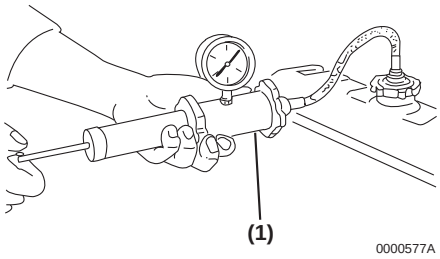


Figure 8-3

2. Apply 10.8 - 14.8 psi (75 - 105 kPa; 0.75 - 1.05 kgf/cm²) to the cooling system. If the pressure reading drops, the engine coolant system is leaking. Identify the source of the leak and repair it.

ENGINE COOLANT PUMP

Removal of Engine Coolant Pump

Verify the condition of the engine coolant pump before disassembling it from the engine. Check the engine coolant pump shaft bearing for abnormal noise, sticking, excessive play and water leakage. Replace the coolant pump if any of these conditions are present.

CAUTION

If the engine coolant pump must be replaced, replace the engine coolant pump as an assembly only. Do not attempt to repair the engine coolant pump or replace individual components.

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IMPORTANT

Make sure the engine and engine coolant are not hot.

1. Before removing the engine coolant pump or thermostat, it will be necessary to drain the engine coolant. Drain the coolant into a clean container if the coolant is to be reused. Otherwise, properly dispose of the coolant.
2. Remove the radiator cap **(Figure 8-4, (1))**.
3. Remove the drain plug or open the drain cock **(Figure 8-4, (1))** at the lower portion of the radiator and drain the coolant.

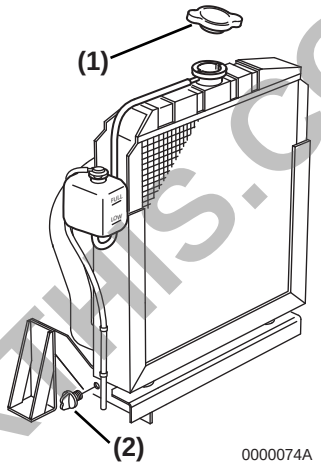


Figure 8-4

4. Drain the coolant from the engine block.
   - On models equipped with an oil cooler, remove the coolant hose **(Figure 8-5, (1))** at the oil cooler.

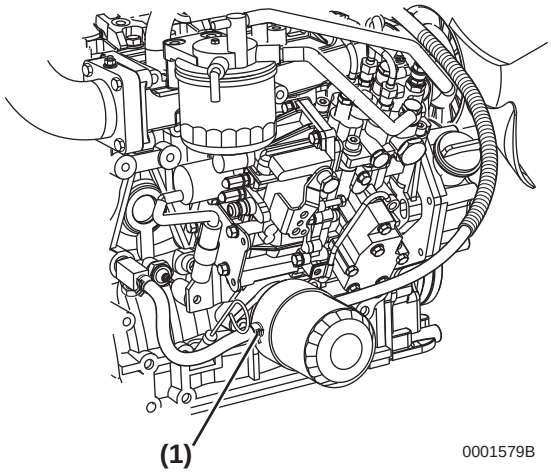


Figure 8-5

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4TNV94L to 4TNV106T - Standard and Optional

YANMAR Part Number	Mfg.	Mfg. Part Number	Specification	No Load			Loaded			
				Terminal Voltage	Amperage Draw	rpm	Terminal Voltage	Amperage Draw	Torque	rpm
129900-77010	Hitachi	S13-204	DC12V-3.1 hp (2.3 kW)	11	140A MAX	4100	7.7	400 Max	97 in.-lb (11.0 N·m; 1.1 kgf·m)	1400
129940-77010	Hitachi	S14-102	DC12V-4.0 hp (3.0 kW)	12	160A MAX	3600	10.85	300 Max	60 in.-lb (6.9 N·m; 0.7 kgf·m)	2000
119131-77010	Hitachi	S24-13	DC24V-4.8 hp (3.5 kW)	23	90A MAX	3100	20.2	250 Max	130 in.-lb (14.7 N·m; 1.5 kgf·m)	1300
129900-77030	Hitachi	S24-14	DC24V-4.8 hp (3.5 kW) Wet	23	90A MAX	3100	20.2	250 Max	130 in.-lb (14.7 N·m; 1.5 kgf·m))	1300
129910-77022	Hitachi	S13-2050	DC12V-3.1 hp (2.3 kW) Wet	11	140A MAX	4100	7.7	400 Max	97 in.-lb (11.0 N·m; 1.1 kgf·m)	1400

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