⚠ WARNING

High-Pressure Hazard!



- Avoid skin contact with the high-pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High-pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high-pressure fuel spray, obtain prompt medical treatment.
- Never check for a fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized YANMAR industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

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.

⚠ 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.

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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Glow Plugs

3TNV82A-B, 3TNV88-B, 3TNV88-Z, 3TNV88-U, 4TNV88-Z, 4TNV88-B, 4TNV88-U

Glow plugs help make the engine easy to start at cold temperatures. During the engine starting sequence, the glow plugs are activated for approximately 4 seconds. After the pre-heat indicator goes out, the engine can be started.

These plugs are installed in the cylinder head swirl chambers for IDI engines or in the combustion chambers for DI engines.

Inlet Air Heater

3TNV84T-Z, 3TNV84T-B, 4TNV84T-Z, 4TNV84T-B, 4TNV98-Z, 4TNV98-E, 4TNV98T-Z, 3TNV82A, 3TNV84, 3TNV84T, 3TNV88, 4TNV84, 4TNV84T, 4TNV88, 4TNV94L, 4TNV98, 4TNV98T, 4TNV106, 4TNV106T

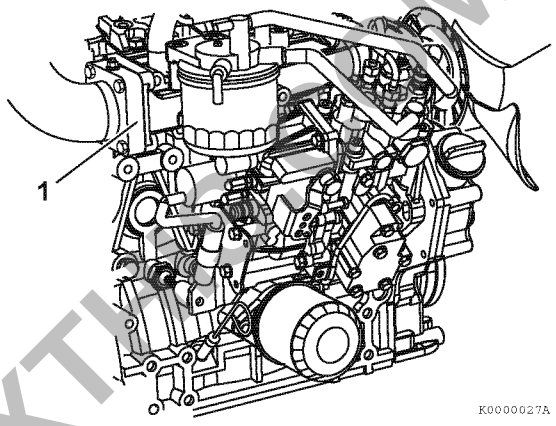


Figure 14

The inlet air heater (1, **Figure 14**) is located on the intake manifold. Heated inlet air helps the engine to start easier in cold weather. During the engine starting sequence the inlet air heater is activated for approximately 15 seconds. After the pre-heat indicator goes out, the engine can be started.

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STARTING ENGINE

Use the following procedure to start the engine. Note that two typical operator's consoles are shown for illustrative purposes only.

1. Make sure you follow the procedures stated in the *Daily Checks on page 68*.
2. Before first starting electronically controlled engines 3TNV84T-Z, 4TNV84T-Z, 3TNV88-Z, 4TNV88-Z, 4TNV98-E, 4TNV98-Z, 4TNV98T-Z: The E-ECU of the electronically controlled engines shown above needs to be initialized at initial power up. When the fault indicator comes on at initial power up, the E-ECU has finished initialization. Then always turn the key switch to the OFF position once before starting the engine. (The E-ECU has usually been initialized before the driven machine is delivered). From the second power up, make sure the fault indicator is on for 2 sec. when turning the key switch to the ON position.
3. Make sure the fuel filter/water separator fuel cock (1, **Figure 1**) is in the ON position (2, **Figure 1**).

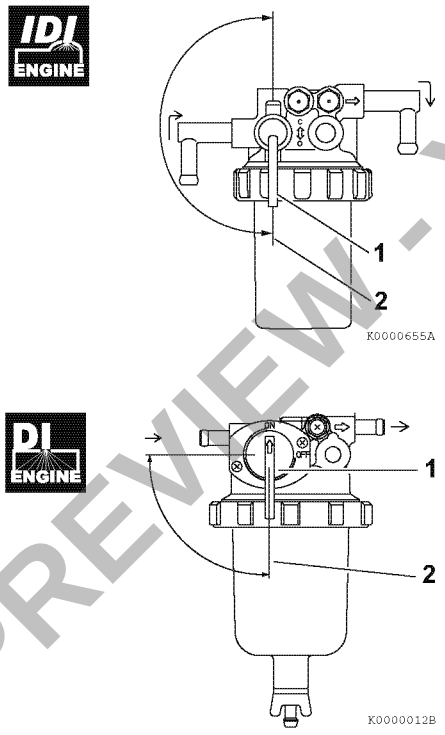


Figure 1

4. Set the transmission (if equipped) in the NEUTRAL position.
5. Disengage the PTO (if equipped).
6. Set the engine speed control to the mid-position.

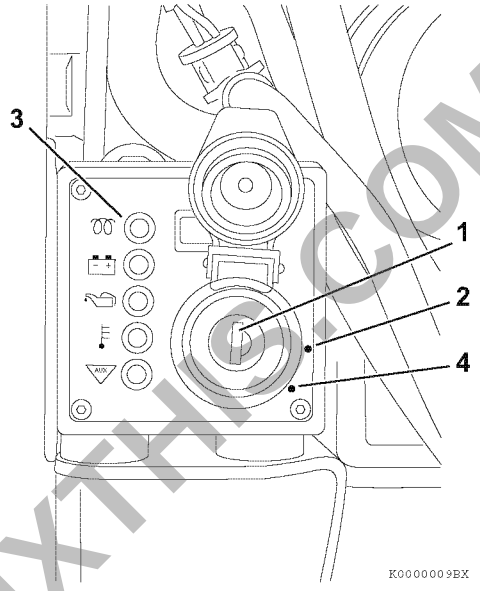


Figure 2

NOTICE

Never use an engine starting aid such as ether. Engine damage will result.

7. Insert the key into the key switch (1, **Figure 2**) or (1, **Figure 3**).

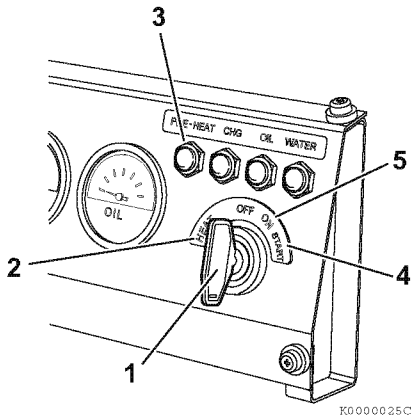


Figure 3

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7. After all oil has been drained from the engine, reinstall the oil drain plug (1, **Figure 20**) and tighten to 40 - 47 ft-lb (53.9 - 63.7 N·m, 5.5 - 6.5 kgf·m).
8. Dispose of used oil properly.

Remove the engine oil filter as follows:

1. Turn the engine oil filter (2, **Figure 20**) counterclockwise (3, **Figure 20**) using an oil filter wrench.
2. Clean the engine oil filter mounting face.
3. Lightly coat the gasket on the new oil filter with engine oil. Install the new engine oil filter manually by turning it clockwise (4, **Figure 20**) until it contacts the mounting surface. Tighten to 14 - 17 ft-lb (19.6 - 23.5 N·m, 2.0 - 2.4 kgf·m) or one additional turn using the oil filter wrench.

Engine oil filter Part No.

	Standard	Dust proof*
3TNV82A, 3TNV84 - 4TNV98, 3TNV82A-B, 3TNV88-B - 4TNV98-Z, 4TNV98-E	129150-35153	119005-35151
4TNV98T, 4TNV98T-Z, 4TNV106, 4TNV106T	119005-35151	

** Consult the operation manual for the driven machine for applicability of the dust proof filter.*

4. Add new engine oil to the engine through either of the oil filler ports as specified in *Adding Engine Oil on page 63*.

NOTICE

- Never overfill the engine with engine oil.
- Always keep the oil level between the upper and lower lines on the oil cap/dipstick.

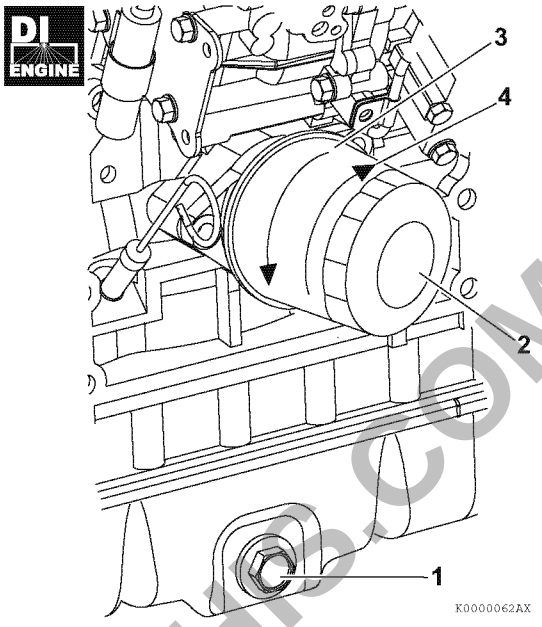


Figure 20

5. Warm up the engine by running it for 5 minutes and check for any engine oil leaks.
6. After engine is warm, shut it off and let it sit for 10 minutes.
7. Recheck the engine oil level.
8. Add engine oil to engine oil filler port (5, **Figure 21**) as needed until the level is between the upper (2, **Figure 21**) and lower lines (3, **Figure 21**) shown on the dipstick (1, **Figure 21**).
9. Reinstall the oil filler cap (4, **Figure 21**). If any engine oil is spilled, wipe it away with a clean cloth.

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No.	Fault (alarm) location	Fault/alarm condition	Engine status	Reset condition	Availability of detection features	No. of flashes/flashing pattern of fault indicator
9	Main relay	Power cannot be turned off even though main relay is off	Continues to run normally	Relay returns to normal. This fault will persist even if key switch is turned to OFF.	Default	1-6
10	Rack actuator	LOW status was detected even though port was off	Is shut down	Key switch is	Standard	1-7

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GAUGES AND INDICATORS OF ELECTRONIC CONTROL SYSTEM

4TNV84T-Z, 4TNV98-E, 4TNV98-Z, 4TNV98T-Z

Gauges

The following gauges are located on a typical operator's console of the electronically controlled engines. Some operator's consoles may not have the gauges described here or may have different gauges.

NOTICE

The illustrations and descriptions of optional equipment in this manual, such as the operator's console, are for a typical engine installation. Refer to the documentation supplied by the optional equipment manufacturer for specific operation and maintenance instructions.

Indicators

The following indicators are located on a typical operator's console.

See the *Gauges and Indicators* section for description of indicators that are not described below.

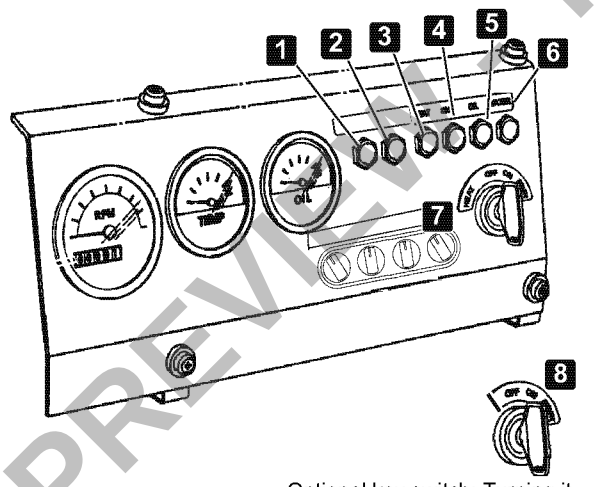


Figure 11

Figure 11 Typical Operator's Console

1 Fault (optional)

This indicator will flash if a fault occurs in the E-ECU or Eco-governor. The number of flashes and/or the flashing pattern vary depending on the type or source of the fault. *See Troubleshooting Chart on page 108.*

2 Auxiliary

Reserved as an optional fault indicator.

3 HEAT

This indicator will come on when the key switch is turned to the HEAT position 7 and stay on as long as the glow plugs (of model 3TN84T-Z only) or air heater are/is energized (15 sec. for models with glow plugs or air heater) during engine cold start. When the indicator goes out, you can turn the key switch to START.

Turning the optional key switch 8 to ON allows you to energize the glow plugs for up to 15 sec. or the air heater up to 23 sec. depending on the engine coolant temperature.

When an optional after heater is installed, it is energized for up to 80 sec. after the engine has started, during which, however, the indicator is not on.

■ Others (optional)

Other optional indicators including those for indicating the air cleaner is clogged or the water separator is filled with water can also be installed on the console. See the operation manual for the driven machine for details.

Machine events including alarms and faults are all stored in memory of the E-ECU and can be loaded into the service tool.

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ELECTRONIC CONTROL SYSTEM

4TNV84T-Z, 4TNV98-E, 4TNV98-Z, 4TNV98T-Z

⚠ WARNING

- **Never use the E-ECU for other purposes than intended or in other ways than specified by YANMAR. Doing so could result in the violation of emission control regulations and will void the product warranty.**
- **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.
- **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.**
- **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.**

NOTICE

Shut down the engine if the fault indicator comes on.

Continuing running the engine with the fault indicator being on may result in a serious malfunction of or damage to the engine, and will void the engine warranty.

NOTICE

Do not energize the starter for a period of longer than 15 seconds.

Take a pause of at least 30 seconds between energization of the starter.

Otherwise the starter could suffer damage.

NOTICE

- High-pressure washing not recommended..
- Avoid using high-pressure washing for electronic or electric devices installed in, on or around the engine, including the E-ECU, relays and harness couplers.

Otherwise such devices may suffer malfunction due to water ingress into them.

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Emission control system warranty - USA only - continued

Warranty Coverage:

This warranty is transferable to each subsequent purchaser for the duration of the warranty period. YANMAR recommends that repair or replacement of any warranted part will be performed at an authorized YANMAR dealer.

Warranted parts not scheduled for replacement as required maintenance in the owner's manual shall be warranted for the warranty period. Warranted parts scheduled for replacement as required maintenance in the owner's manual are warranted for the period of time prior to the first scheduled replacement. Any warranted parts scheduled for replacement as required maintenance that are repaired or replaced under warranty shall be warranted for the remaining period of time prior to the first scheduled replacement. Any part not scheduled for replacement that is repaired or replaced under warranty shall be warranted for the remaining warranty period.

During the warranty period, YANMAR is liable for damages to other engine components caused by the failure of any warranted part during the warranty period.

Any replacement part which is functionally identical to the original equipment part in all respects may be used in the maintenance or repair of your engine, and shall not reduce YANMAR's warranty obligations. Add-on or modified parts that are not exempted may not be used. The use of any non-exempted add-on or modified parts shall be grounds for disallowing a warranty.

Warranted Parts:

This warranty covers engine components that are a part of the emission control system of the engine as delivered by YANMAR to the original retail purchaser. Such components may include the following:

(A) Fuel injection system
(B) Cold start enrichment system
(C) Intake manifold
(D) Turbocharger systems
(E) Exhaust manifold
(F) Positive crankcase ventilation system
(G) Exhaust Gas Recirculation (EGR) systems
(H) Electronic Control units, sensors, solenoids and wiring harnesses used in above systems
(I) Hoses, belts, connectors and assemblies used in above systems
(J) Emission Control Information Labels

Since emissions related parts may vary slightly between models, certain models may not contain all of these parts and other models may contain the functional equivalents.

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RECORD OF OWNERSHIP

Take a few moments to record the information you need when you contact YANMAR for service, parts or literature.

Engine model: _____

Engine serial No.: _____

Date purchased: _____

Dealer: _____

Dealer phone: _____

SYMBOL EXPLANATION

The following symbols are used throughout this manual to identify specific engine model information



This symbol indicates information pertaining to the following indirect injection engines:

- 2TNV70*1*3
- 3TNV70*1*3
- 3TNV76*1*3

*1: Indicates the engines conform to the engine emission regulations (EPA 2008 rules).



This symbol indicates information pertaining to the following direct injection engines:

- 3TNV82A
- 3TNV84
- 3TNV84T
- 3TNV88
- 4TNV84
- 4TNV84T
- 4TNV88
- 4TNV94L
- 4TNV98
- 4TNV98T
- 4TNV106
- 4TNV106T
- 3TNV82A-B*1*3
- 3TNV84T-Z*2
- 3TNV84T-B*1
- 3TNV88-Z*2
- 3TNV88-B*1*3
- 3TNV88-E*2*3
- 3TNV88-U*1
- 4TNV84T-Z*2
- 4TNV84T-B*1
- 4TNV88-Z*2
- 4TNV88-B*1
- 4TNV88-U*1
- 4TNV98-Z*2
- 4TNV98-E*2
- 4TNV98T-Z*2

*1: Indicates the engines conform to the engine emission regulations (EPA 2008 rules).

*2: Indicates the engines are electronically controlled and conform to the engine emission regulations (EPA 2008 rules).

*3: Indicated that the engines comply with EU emission regulations (EU2016/1628). Some engines might not comply with the emission regulations depending on the engine rated speed. This emission regulation is an update from 97/68/EC Directive as Stage V.

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8. Turn the key to the ON position (2, **Figure 2**) or the HEAT position (2, **Figure 3**). The pre-heat indicator (3, **Figure 2**) flashes for several seconds and then goes out. After the pre-heat indicator goes out you can start the engine.

   Note: The glow plugs, and the air heater, are used to assist starting in cold weather conditions. If you are operating your engine in normal or warm weather conditions, you may bypass the Pre-Heat/Heat functions and go directly to Start.

NOTICE

Never hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

9. Turn the key clockwise to the START position (4, **Figure 2**) or (4, **Figure 3**). Release the key as soon as the engine starts. It will return to the ON position (2, **Figure 2**) or (5, **Figure 3**).

   Note: The starter of electronically controlled engines 3TNV84T-Z, 4TNV84T-Z, 3TNV88-Z, 4TNV88-Z, 4TNV98-E, 4TNV98-Z, 4TNV98T-Z will start with a delay of approx. 0.5 sec. after the key switch has been turned to the ON position. This is because the E-ECU self-diagnostics has run and is not a failure.

10. If the engine fails to start:

    1- Wait until the engine comes to a complete stop before you attempt to start it again. Engaging the starter while the engine is still rotating will result in damage to the starter and flywheel.

    Note: Some key switches are equipped with an interlock that will not allow you to re-engage the starter without first turning the key to the OFF position.

    2- Wait at least 30 seconds before you attempt to start the engine again. This procedure will allow the battery voltage to recover and prevent damage to the starter motor due to the low battery voltage.

COLD START DEVICE

⚠ 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.**

The cold start device on direct injection models improves engine starting at lower temperatures.

- If the engine cooling system temperature is below 5 °C (41 °F), the cold start device automatically advances the fuel injection timing and slightly increases the fuel injection volume.
- The engine idle speed will be slightly elevated for approximately the first 5 minutes of operation.
- When the cold start device is activated, you may notice a slight increase in the amount of exhaust smoke. This is normal.
- Never engage the transmission or PTO while the cold start device is activated or unexpected movement of the machine may result.

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