

**OPERATION MANUAL**

***INDUSTRIAL ENGINES***

**TNM SERIES**

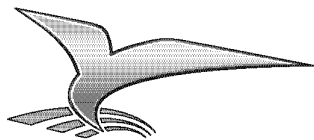
**3TNM68  
3TNM72**

**California  
Proposition 65 Warning**

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

**California  
Proposition 65 Warning**

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer and reproductive harm.  
Wash hands after handling.



**YANMAR**<sup>®</sup>

**TNM**  
**series**  
**OPERATION MANUAL**

**3TNM68 • 3TNM72**

**P/N: 0ATNM-G00100**

**INDUSTRIAL**  
**ENGINES**

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# YANMAR WARRANTIES

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## YANMAR LIMITED WARRANTY

### What is Covered by this Warranty?

Yanmar warrants to the original retail purchaser that a new Yanmar TNM Series Industrial Engine will be free from defects in material and / or workmanship for the duration of the warranty period.

Note: Yanmar engines may be equipped with external components including, but not limited to: wiring harnesses, electrical devices, control panels, radiators, air filters, fuel filters, and / or exhaust systems that are supplied and / or installed by manufacturers other than Yanmar. For warranty information on such external components, please contact the machine or component manufacturer directly or see your authorized Yanmar dealer or distributor.

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### How Long is the Warranty Period?

The Yanmar standard limited warranty period runs for a period of **twenty-four (24) months or two-thousand (2000) engine operation hours**, whichever occurs first. An extended limited warranty of thirty-six (36) months or three thousand (3000) engine operating hours, whichever occurs first, is provided for these specific parts only: the cylinder block, cylinder head, crankshaft forging, connecting rods, flywheel, flywheel housing, camshaft, timing gear and gear case. The Warranty Period for both the standard Limited Warranty and the extended Limited Warranty (by duration or operation hours) begins on the date of delivery to the original retail purchaser and is valid only until the applicable warranted duration has passed or the operation hours are exceeded, whichever comes first.

# YANMAR WARRANTIES

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## *Yanmar Limited Warranty - Continued*

### **What the Engine Owner Must Do:**

If you believe your Yanmar engine has experienced a failure due to a defect in material and / or workmanship, you must contact an authorized Yanmar Industrial engine dealer or distributor within thirty (30) days of discovering the failure. You must provide proof of ownership of the engine, proof of the date of the engine purchase and delivery, and documentation of the engine operation hours. Acceptable forms of proof of delivery date include, but are not limited to: the original warranty registration or sales receipts or other documents maintained in the ordinary course of business by Yanmar dealers and / or distributors, indicating the date of delivery of the Yanmar product to the original retail purchaser. This information is necessary to establish whether the Yanmar product is still within the warranty period. Thus, Yanmar strongly recommends you register your engine as soon as possible after purchase in order to facilitate any future warranty matters.

You are responsible for the transportation of the engine to and from the repair location as designated by Yanmar.

### **To Locate an Authorized Yanmar Industrial Engine Dealer or Distributor:**

You can locate your nearest authorized Yanmar Industrial engine dealer or distributor by visiting the Yanmar Corp., LTD. website at:

<http://www.yanmar.co.jp> (The Japanese language page will be displayed.) For English language “click” on “English Page.”)

- “Click” on “Network” in the website heading to view the “Yanmar Worldwide Network.”
- Choose and “Click” on the desired product group.
- “Click” on the Icon closest to your region.
- “Click” on the desired country or Associate company to locate your nearest authorized Yanmar Industrial engine dealer or distributor.
- You may also contact Yanmar by clicking on “Inquiry” in the website heading and typing in your question or comment.

### **What Yanmar Will Do:**

Yanmar warrants to the original retail purchaser of a new Yanmar engine that Yanmar will make such repairs and / or replacements at Yanmar’s option, of any part(s) of the Yanmar product covered by this Warranty found to be defective in material and / or workmanship. Such repairs and / or replacements will be made at a location designated by Yanmar at no cost to the purchaser for parts or labor.

## *Yanmar Limited Warranty - Continued*

### **What is Not Covered by this Warranty?**

This Warranty does not cover parts affected by or damaged by any reason other than defective materials or workmanship, including, but not limited to, accident, misuse, abuse, "Acts of God," neglect, improper installation, improper maintenance, improper storage, the use of unsuitable attachments or parts, the use of contaminated fuels, the use of fuels, oils, lubricants, or fluids other than those recommended in your Yanmar Operation Manual, unauthorized alterations or modifications, ordinary wear and tear, and rust or corrosion. This Warranty does not cover the cost of parts and / or labor required to perform normal / scheduled maintenance on your Yanmar engine. This Warranty does not cover consumable parts such as, but not limited to, filters, belts, hoses, fuel injector nozzles, lubricants and cleaning fluids. This Warranty does not cover the cost of shipping the product to or from the Warranty repair facility.

### **Warranty Limitations:**

**The foregoing is Yanmar's only obligation to you and your exclusive remedy for breach of warranty.** Failure to follow the requirements for submitting a claim under this Warranty may result in a waiver of all claims for damages and other relief. **In no event shall Yanmar or any authorized Industrial engine dealer or distributor be liable for incidental, special or consequential damages.** Such consequential damages may include, but not be limited to, loss of revenue, loan payments, cost of rental of substitute equipment, insurance coverage, storage, lodging, transportation, fuel, mileage, and telephone costs. The limitations in this Warranty apply regardless of whether your claims are based on breach of contract, tort (including negligence and strict liability) or any other theory. Any action arising hereunder must be brought within one (1) year after the cause of action accrues or it shall be barred. Some states and countries do not allow certain limitations on warranties or for breach of warranties. **This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state and country to country.** Limitations set forth in this paragraph shall not apply to the extent that they are prohibited by law.

### **Warranty Modifications:**

Except as modified in writing and signed by the parties, this Warranty is and shall remain the complete and exclusive agreement between the parties with respect to warranties, superseding all prior agreements, written and oral, and all other communications between the parties relating to warranties. **No person or entity is authorized to give any other warranty or to assume any other obligation on behalf of Yanmar, either orally or in writing.**

### **Questions:**

If you have any questions or concerns regarding this Warranty, please call or write to the nearest authorized Yanmar Industrial engine dealer or distributor or other authorized facility.

## YANMAR WARRANTIES

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*Yanmar Limited Warranty - Continued*

### **Retail Purchaser Registration**

**It is very important for the original retail purchaser to register the Yanmar product. Registration enables Yanmar to provide the best support for your Yanmar product.**

At the time of purchase, Yanmar highly recommends registering the retail purchaser's information through website <http://www.yanmar.co.jp> as soon as possible.

*If it is not possible to access the website, please contact the nearest authorized Yanmar Industrial engine dealer or distributor.*



**EMISSION SYSTEM WARRANTY**

**YANMAR CO., LTD. LIMITED EMISSION CONTROL SYSTEM WARRANTY - USA ONLY**

**Your Warranty Rights and Obligations:**

**California**

The California Air Resources Board (CARB), the Environmental Protection Agency (EPA) and Yanmar Co., Ltd. hereafter referred to as Yanmar, are pleased to explain the **emission control system warranty** on your industrial compression-ignition engine. In California, model year 2000 or later off-road compression-ignition engines must be designed, built and equipped to meet the State’s stringent anti-smog standards. In all states, 1998 and later non-road compression-ignition engines must be designed, built and equipped to meet the United States EPA emissions standards. Yanmar warrants the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Yanmar will repair your non-road compression-ignition engine at no charge to you including diagnosis, parts and labor.

**Manufacturer’s Warranty Period:**

The model year 1998 or later certified and labeled non-road compression-ignition engines are warranted for the periods listed below. If any emission-related part on your engine is found to be defective during the applicable warranty period, the part will be replaced by Yanmar.

<b>Engine Type</b>	<b>Warranty Period by Number of Years or Hours of Operation</b>
Constant speed engines rated at or above 50 hp SAE (37 kW)	The warranty period is five (5) years or 3,000 hours of use, whichever occurs first. In the absence of a device to measure the hours of use, the engine has a warranty period of five (5) years.
Constant speed engines rated under 50 hp SAE (37 kW) with rated speeds greater than or equal to 3,000 rpm	The warranty period is two (2) years or 1,500 hours of use, whichever occurs first. In the absence of a device to measure the hours of use, the engine has a warranty period of two (2) years.
Constant speed engines rated under 50 hp SAE (37 kW) and engines rated at or above 26 hp SAE (19 kW) with rated speeds less than 3,000 rpm	The warranty period is five (5) years or 3,000 hours of use, whichever occurs first. In the absence of a device to measure the hours of use, the engine has a warranty period of five (5) years.
Engines rated at or above 26 hp SAE (19 kW)	The warranty period is five (5) years or 3,000 hours of use, whichever occurs first. In the absence of a device to measure the hours of use, the engine has a warranty period of five (5) years.
Engines rated under 26 hp SAE (19 kW)	The warranty period is two (2) years or 1,500 hours of use, whichever occurs first. In the absence of a device to measure the hours of use, the engine has a warranty period of two (2) years.

# YANMAR WARRANTIES

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## *Limited Emission Control System Warranty - USA Only - Continued*

### **Warranty Coverage:**

This warranty is transferable to each subsequent purchaser for the duration of the warranty period. Repair or replacement of any warranted part will be performed at an authorized Yanmar Industrial engine dealer or distributor.

Warranted parts not scheduled for replacement as required maintenance in the *Operation Manual* shall be warranted for the warranty period. Warranted parts scheduled for replacement as required maintenance in the *Operation Manual* are warranted for the period of time prior to the first scheduled replacement. Any part 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:

- Fuel Injection System
- Intake Manifold
- Exhaust Manifold
- Positive Crankcase Ventilation System
- Hoses, belts, connectors and assemblies associated with emission control systems

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.

## ***Limited Emission Control System Warranty - USA Only - Continued***

### **Exclusions:**

Failures other than those arising from defects in material and / or workmanship are not covered by this warranty. The warranty does not extend to the following: malfunctions caused by abuse, misuse, improper adjustment, modification, alteration, tampering, disconnection, improper or inadequate maintenance or use of non-recommended fuels and lubricating oils accident-caused damage, and replacement of expendable items made in connection with scheduled maintenance. Yanmar disclaims any responsibility for incidental or consequential damages such as loss of time, inconvenience, loss of use of equipment / engine or commercial loss.

### **Owner's Warranty Responsibilities:**

**As the engine owner, you are responsible for the performance of the required maintenance listed in your *Operation Manual*.** Yanmar recommends that you retain all documentation, including receipts, covering maintenance on your non-road compression-ignition engine, but Yanmar cannot deny warranty solely for the lack of receipts, or for your failure to ensure the performance of all scheduled maintenance.

Yanmar may deny your warranty coverage of your non-road compression-ignition engine if a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with applicable emissions requirements.

You are responsible for initiating the warranty process. You must present your engine to a Yanmar dealer as soon as a problem exists. The warranty repairs should be completed by the dealer as expeditiously as possible. If you have any questions regarding your warranty rights and responsibilities, or would like information on the nearest Yanmar dealer or authorized service center, you should contact Yanmar America Corporation at 1-800-872-2867.

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# INTRODUCTION

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Welcome to the world of Yanmar Engines! Yanmar has been the leader in industrial diesel engines for over 90 years. We developed the world's first practical, small-sized diesel engine in 1933. Our engineers are continuously developing new technology to keep Yanmar on the leading-edge of the industry. The TNM engine is only one example of the new technology we have developed. We are committed to maintaining our environment, and are proud of our history of innovation, quality and respect for operator safety.

To help you enjoy your Yanmar TNM engine for many years to come, please follow these recommendations:

- Read and understand this *Operation Manual* before you operate the machine to ensure that you follow safe operating practices and maintenance procedures.
  - Keep this *Operation Manual* in a convenient place for easy access.
  - If this *Operation Manual* is lost or damaged, order a new one from your authorized Yanmar Industrial engine dealer or distributor.
  - Make sure this manual is transferred to subsequent owners. This manual should be considered a permanent part of the engine and remain with it.
- Constant efforts are made to improve the quality and performance of Yanmar products, so some details included in this *Operation Manual* may differ slightly from your engine. If you have any questions about these differences, please contact your authorized Yanmar Industrial engine dealer or distributor.
  - The specifications and components (instrument panel, fuel tank, etc.) described in this manual may differ from ones installed on your machine. Please refer to the manual provided by the manufacturer of these components.

## INTRODUCTION

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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:** \_\_\_\_\_

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# SAFETY

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## SAFETY STATEMENTS

Yanmar is concerned for your safety and your machine's condition. Safety statements are one of the primary ways to call your attention to the potential hazards associated with Yanmar TNM engine operation. Follow the precautions listed throughout the manual before operation, during operation and during periodic maintenance procedures for your safety, the safety of others and to protect the performance of your engine. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also, if you need to replace a part that has a label attached to it, make sure you order the new part and label at the same time.



This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

### DANGER

Indicates a hazardous situation which, if not avoided, *will* result in death or serious injury.

### WARNING

Indicates a hazardous situation which, if not avoided, *could* result in death or serious injury.

### CAUTION

Indicates a hazardous situation which, if not avoided, *could* result in minor or moderate injury.

### NOTICE

Indicates a situation which can cause damage to the machine, personal property and / or the environment or cause the equipment to operate improperly.

# SAFETY

## SAFETY PRECAUTIONS

There is no substitute for common sense and careful practices. Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation, other bodily injury or death. This information contains general safety precautions and guidelines that must be followed to reduce risk to personal safety. Special safety precautions are listed in specific procedures. Read and understand all of the safety precautions before operation or performing repairs or maintenance.

### Before You Operate

#### DANGER

The safety messages that follow have **DANGER** level hazards.

**These safety messages describe hazardous situations which, if not avoided, will result in death or serious injury.**



NEVER permit anyone to operate the engine or driven machine without proper training.

- Read and understand this *Operation Manual* before you operate or service the machine to ensure that you follow safe operating practices and maintenance procedures.
- Machine safety signs and labels are additional reminders for safe operating and maintenance techniques.
- See your authorized Yanmar Industrial engine dealer or distributor for additional training.

#### **Crush Hazard**



NEVER stand under a hoisted engine.

- If the hoist mechanism fails, the engine will fall on you.
- When you need to transport an engine for repair, have a helper assist you to attach it to a hoist and load it on a truck.

#### WARNING

The safety messages that follow have **WARNING** level hazards.

**These safety messages describe hazardous situations which, if not avoided, could result in death or serious injury.**

#### **Fire and Explosion Hazard**



Diesel fuel is flammable and explosive under certain conditions.

- Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire and will damage the engine.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) well away when refueling.
- ALWAYS put the diesel fuel container on the ground when transferring the diesel fuel from the pump to the fuel tank. Hold the hose nozzle firmly against the side of the container while filling it to prevent static electricity buildup. This prevents static electricity buildup, which could cause sparks and ignite fuel vapors.
- NEVER place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shutdown.
- ALWAYS store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.
- NEVER use a shop rag to catch spilled fuel.
- NEVER use diesel fuel as a cleaning agent.

**WARNING****Explosion Hazard**

While the engine is running or the battery is charging, hydrogen gas is being produced and can be easily ignited. Keep the area around the battery well-ventilated and keep sparks, open flame and any other form of ignition out of the area.

**Exhaust Hazard**

All internal combustion engines create carbon monoxide (CO) gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.

- NEVER operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- NEVER block windows, vents or other means of ventilation if the engine is operating in an enclosed area.
- ALWAYS ensure that all connections are tightened to specifications after repair is made to the exhaust system.

**Sever Hazard**

ALWAYS keep hands and other body parts away from moving / rotating parts such as the flywheel or PTO shaft.

- ALWAYS wear tight-fitting clothing and keep your hair short or tie it back while the engine is running.
- ALWAYS remove all jewelry before you operate or service the engine.
- NEVER start the engine in gear.
- NEVER operate the engine without the guards in place.

- Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.
- Before you start the engine, make sure that all bystanders are clear of the area.
- Keep children and pets away while the engine is operating.

**Alcohol and Drug Hazard**

NEVER operate the engine while you are under the influence of alcohol or drugs or feeling ill.

**Exposure Hazard**

ALWAYS wear personal protective equipment such as gloves, work shoes and eye and hearing protection as required by the task at hand.

- NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.

**Piercing Hazard**

Avoid skin contact with 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.

# SAFETY

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## **WARNING**

### **Entanglement Hazard**

Rotating parts can cause severe injury or death.



NEVER wear jewelry, unbuttoned cuffs, ties or loose-fitting clothing and ALWAYS tie long hair back when working near moving / rotating parts such as the flywheel or PTO shaft.

- Keep hands, feet and tools away from all moving parts.
- 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.
- Stop the engine before you begin to service it.

---

### **Burn Hazard**



ALWAYS keep hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut down the engine.

- ALWAYS handle hot components with heat-resistant gloves.

---

### **Fire Hazard**



Undersized wiring systems can cause an electrical fire.

ALWAYS read and follow safety-related precautions found on containers of hazardous substances like parts cleaners, primers, sealants and sealant removers.

### **Shock Hazard**



Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. ALWAYS keep the connectors and terminals clean.

Make welding repairs safely:

- ALWAYS turn off the battery switch (if equipped) or disconnect the negative battery cable and the leads to the alternator when welding on the equipment.
- Connect the weld clamp to the component to be welded and as close as possible to the welding point.
- When welding is completed, reconnect the leads to the engine charging system prior to reconnecting the battery.

**CAUTION**

The safety messages that follow have CAUTION level hazards.

These safety messages describe hazardous situations which, if not avoided, could result in minor or moderate injury.

**Exposure Hazard**

ALWAYS wear eye protection when servicing the engine or when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.

**Poor Lighting Hazard**

Ensure that the work area is adequately illuminated. ALWAYS install wire cages on portable safety lamps.

**Coolant Hazard**

ALWAYS wear eye protection and rubber gloves when you handle Long Life or Extended Life engine coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.

**NOTICE**

The safety messages that follow describe NOTICE level hazards which, if not avoided, can cause damage to the machine, personal property and / or the environment or cause equipment to operate improperly.



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 and diesel fuel. 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.

NEVER expose the engine to the elements.

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# PRODUCT OVERVIEW

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## YANMAR TNM ENGINE FEATURES AND APPLICATIONS

Yanmar's series of TNM engines are environmentally friendly and are designed to:

- Lower the amount of exhaust gas emissions
- Reduce engine noise and vibration
- Be easy to start thanks to the specially designed fuel injection pump and combustion system
- Be economical to run because diesel fuel and engine oil consumption are reduced
- Be easy to operate due to the minimum amount of required maintenance and their compact design
- Be durable and reliable due in part to the newly designed fuel injection valve and fuel injection pump

Yanmar TNM engines are designed to supply power to a wide variety of driven machines including:

- Lawn and Garden Equipment
- Agricultural Equipment
- Power Generation Equipment

We are sure that you will agree these features provide excellent value in an industrial diesel engine.

These engines are designed to deliver power to driven machines by means of a "direct coupled drive," or "belt drive." In direct coupled drive engine applications, the engine's flywheel housing or end plate is coupled directly to the driven machine. In belt drive engine applications, a belt drive is used to power the driven machine. If you have applications that require a belt drive and / or front power take-off (PTO), please contact your authorized Yanmar Industrial engine dealer or distributor.

The engine is designed for a wide range of applications. Options, such as fuel tank, control panel, indicators, gauges and alarms, are available to customize the application.

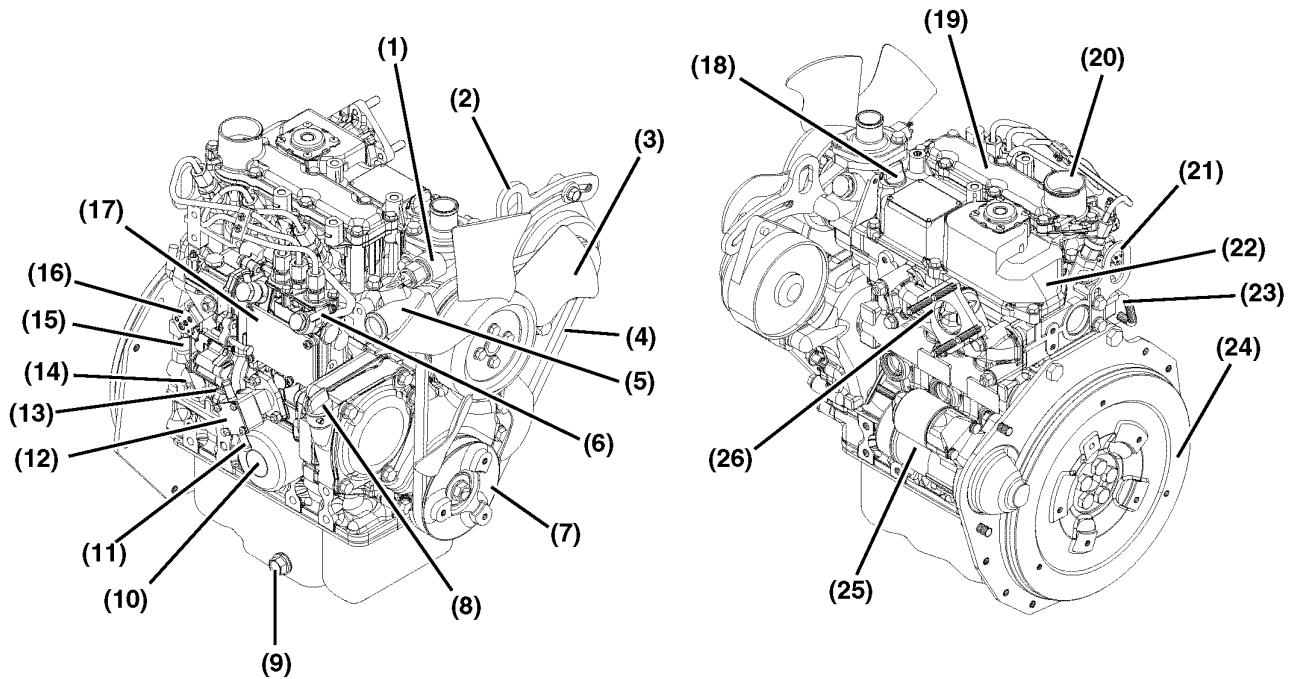
Since designing the application and installing the engine require special knowledge and skill, always consult your authorized Yanmar Industrial engine dealer or distributor for these services. They will help you:

- Select optional equipment. Optional equipment should be selected to match the work conditions and environment.
- Maximize engine performance with a minimum amount of downtime and safety-related incidents by carefully matching the characteristics of the engine with the driven machine.
- Plan for safe fuel piping, exhaust piping, electrical wiring, ventilation and accurate engine installation.
- Design your applications so they meet requirements of the local authorities.

## PRODUCT OVERVIEW

### COMPONENT IDENTIFICATION

Figure 1 shows where major engine components are located.



0006458

Figure 1

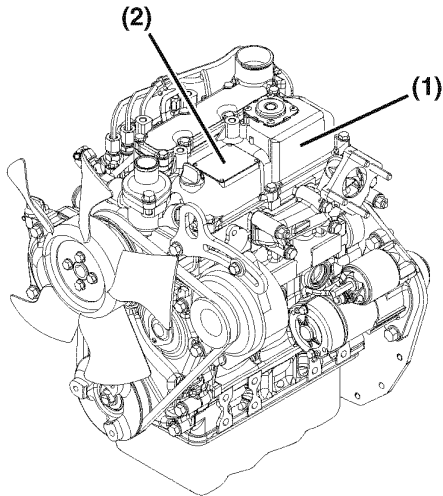
- |  |   |
|--|---|
| 1 – Coolant Temperature Sensor           | 14 – Oil Pressure Switch                |
| 2 – Lifting Eye (engine cooling fan end) | 15 – Dipstick (engine oil)              |
| 3 – Engine Cooling Fan                   | 16 – Governor Lever                     |
| 4 – V-Belt                               | 17 – Fuel Injection Pump                |
| 5 – Engine Coolant Pump                  | 18 – Top Filler Port (engine oil)       |
| 6 – Fuel Return to Fuel Tank             | 19 – Intake Manifold                    |
| 7 – Crankshaft V-Pulley                  | 20 – Air Intake Port (from air cleaner) |
| 8 – Side Filler Port (engine oil)        | 21 – Lifting Eye (flywheel end)         |
| 9 – Drain Plug (engine oil)*             | 22 – Rocker Arm Cover                   |
| 10 – Engine Oil Filter                   | 23 – Stop Solenoid                      |
| 11 – Fuel Inlet                          | 24 – Flywheel                           |
| 12 – Mechanical Fuel Pump                | 25 – Starter Motor                      |
| 13 – Fuel Priming Lever                  | 26 – Exhaust Manifold                   |

\* Engine oil drain plug location may vary based on oil pan options.

## LOCATION OF LABELS

Figure 2 shows the location of regulatory emission control (Figure 2, (1)) and engine nameplate (Figure 2, (2)) labels on Yanmar TNM series engines.

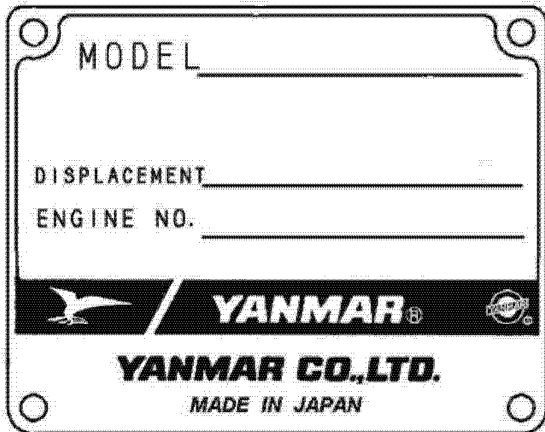
In addition to the engine nameplate, the engine model and serial numbers are stamped on flat pads on the left side of the crankcase.



0006459

Figure 2

### Engine Nameplate (Typical)



0003852

Figure 3

## EPA / CARB EMISSION CONTROL REGULATIONS - USA ONLY

Yanmar TNM engines meet Environmental Protection Agency (EPA) (U. S. Federal) emission control standards as well as the California Air Resources Board (CARB) regulations. Only engines that conform to CARB regulations can be sold in the State of California.

Refer to *EPA / CARB Emission Control Regulations - USA Only* on page 9, and *Required EPA / CARB Maintenance - USA Only* on page 37 in the *Periodic Maintenance* section of this manual. Also refer to the *Yanmar Co., Ltd. Limited Emission Control System Warranty - USA Only* on page vii.

## PRODUCT OVERVIEW

### EMISSION CONTROL LABELS

Since emission control regulations are being issued on a global basis, it is necessary to identify with which regulations a particular engine complies. We have listed several different types of labels you might find on your engine.

#### EPA / CARB Labels (Typical)

EMISSION CONTROL INFORMATION	
THIS ENGINE COMPLIES WITH U.S. EPA REGULATIONS FOR <input type="checkbox"/> M. Y. NONROAD DIESEL ENGINES. LOW SULFUR FUEL OR ULTRA LOW SULFUR FUEL ONLY	
ENGINE FAMILY : <input type="text"/>	DISPLACEMENT : <input type="text"/> LITERS
ENGINE MODEL : <input type="text"/>	EMISSION CONTROL SYSTEM : <input type="text"/>
FUEL RATE : <input type="text"/> MM <sup>3</sup> /STROKE @ <input type="text"/> KW / <input type="text"/> RPM <input type="text"/>	
REFER TO OWNER'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS	
<b>YANMAR. YANMAR CO.,LTD.</b>	

021751-00X

(EPA)

EMISSION CONTROL INFORMATION	
THIS ENGINE COMPLIES WITH U. S. EPA AND CALIFORNIA REGULATIONS FOR <input type="checkbox"/> M. Y. NONROAD/OFF-ROAD DIESEL ENGINES. LOW SULFUR FUEL OR ULTRA LOW SULFUR FUEL ONLY	
ENGINE FAMILY : <input type="text"/>	DISPLACEMENT : <input type="text"/> LITERS
ENGINE MODEL : <input type="text"/>	EMISSION CONTROL SYSTEM : <input type="text"/>
FUEL RATE : <input type="text"/> MM <sup>3</sup> /STROKE @ <input type="text"/> KW / <input type="text"/> RPM <input type="text"/>	
REFER TO OWNER'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS	
<b>YANMAR. YANMAR CO.,LTD.</b>	

021752-00X


(EPA & CARB)

*Figure 4*

### THE 97/68/EC DIRECTIVE CERTIFIED ENGINES

The engines described in this manual have been certified by the 97/68/EC Directive.

To identify the engines that meet this certification, the 97/68/EC emission control label is affixed on the engines.

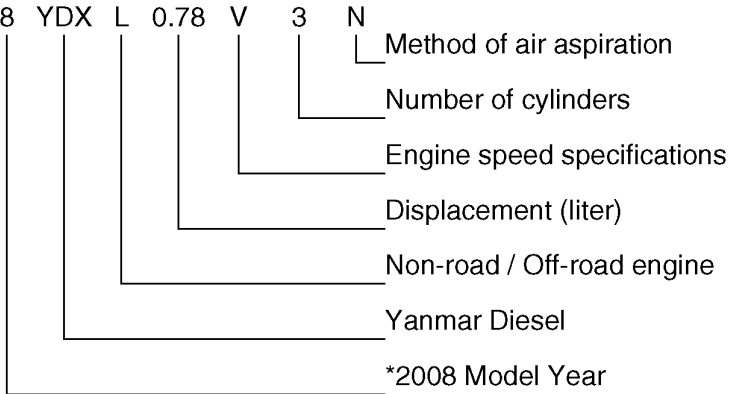
IMPORTANT ENGINE INFORMATION	
THIS ENGINE CONFORMS TO 97/68/EC DIRECTIVE	
ENGINE FAMILY :	<input type="text"/>
ENGINE MODEL :	<input type="text"/>
APPROVAL NUMBER :	<input type="text"/>
 <b>YANMAR CO.,LTD.</b>	

(97/68/EC)

*Figure 5*

**ENGINE FAMILY**

The EPA / CARB labels and the 97/68/EC label all have an *Engine Family* field. The following is an explanation of the *Engine Family* designation:



- \*8: 2008
- 9: 2009
- 10: 2010, etc.

## PRODUCT OVERVIEW

### FUNCTION OF MAJOR ENGINE COMPONENTS

Components	Functions
Air Cleaner	The air cleaner prevents airborne contaminants from entering the engine. Since the air cleaner is application specific, it must be carefully selected by an application engineer. It is not part of the basic engine package as shipped from the Yanmar factory. Periodic replacement of the air cleaner filter element is necessary. See the <i>Periodic Maintenance Schedule on page 38</i> for the replacement frequency.
Alternator	The alternator is driven by a V-belt, which is powered by the crankshaft V-pulley. The alternator supplies electricity to the engine systems and charges the battery while the engine is running.
Dipstick (engine oil)	The engine oil dipstick is used to determine the amount of engine oil in the crankcase.
Electric Fuel Pump	The electric fuel pump makes sure there is a constant supply of diesel fuel to the fuel injection pump. The electric fuel pump is electro-magnetic and runs on 12VDC. An electric fuel pump may be installed as an option or as standard equipment. Standard equipment may vary based on engine model and specification. If an electric fuel pump is installed, turn the key switch to the ON position for 10 to 15 seconds to prime the fuel system.
Engine Oil Filter	The engine oil filter removes contaminants and sediment from the engine oil. Periodic replacement of the engine oil filter is necessary. See the <i>Periodic Maintenance Schedule on page 38</i> for the replacement frequency.
Fuel Filter	The fuel filter removes contaminants and sediments from the diesel fuel. Periodic replacement of the fuel filter is necessary. See the <i>Periodic Maintenance Schedule on page 38</i> for the replacement frequency. <b>Please note that the word “diesel” is implied throughout this manual when the word “fuel” is used.</b>
Fuel Filter / Water Separator	The fuel filter / water separator removes contaminants, sediment and water from diesel fuel going to the fuel filter. This is a required component of the fuel system and is standard equipment with every engine. The separator is installed between the fuel tank and the fuel pump. Periodically drain the water from the fuel filter / water separator using the drain cock at the bottom of the separator.
Fuel Priming Lever	If the unit has a mechanical fuel pump, a fuel priming lever on the mechanical fuel pump primes the fuel system. The fuel system needs to be primed before you start the engine for the first time, if you run out of fuel or if fuel system service is performed. To prime the fuel system, operate the fuel priming lever until the cup in the fuel filter is full of fuel.

Components	Functions
Fuel Tank	The fuel tank is a reservoir that holds diesel fuel. When fuel leaves the fuel tank, it goes to the fuel filter / water separator. Next, fuel is pumped to the fuel filter by the electric or mechanical fuel pump. Next, the fuel goes to the fuel injection pump. Since fuel is used to keep the fuel injection pump cool and lubricated, more fuel than necessary enters the injection pump. When the injection pump pressure reaches a preset value, a relief valve allows excess fuel to be returned back to the fuel tank. The fuel tank is a required engine component.
Mechanical Fuel Pump	The mechanical fuel pump is a diaphragm-type pump and is installed on the fuel injection pump body. The mechanical fuel pump is driven by a cam on the camshaft of the fuel injection pump. An electric fuel pump is available as an option. The mechanical fuel pump is not installed on the fuel injection pump if the electric fuel pump option is installed.
Side and Top Filler Port (engine oil)	You can fill the crankcase with engine oil from <b><i>either the side or top filler port</i></b> , depending on which one is most convenient.
Starter Motor	The starter motor is powered by the battery. When you turn the key switch in the operator's console to the START position, the starter motor engages with the ring gear installed on the flywheel and starts the flywheel in motion.

## PRODUCT OVERVIEW

### FUNCTION OF COOLING SYSTEM COMPONENTS

Components	Functions
Cooling System	The TNM engine is liquid-cooled by means of a cooling system. The cooling system consists of a radiator, radiator cap, engine cooling fan, engine coolant pump, thermostat and reserve tank. <b>Note that all cooling system components are required for proper engine operation. Since some of the components are application specific, they must be carefully selected by an application engineer. The application specific items are not part of the basic engine package as shipped from the Yanmar factory.</b>
Engine Cooling Fan	The engine cooling fan is driven by a V-belt, which is powered by the crankshaft V-pulley. The purpose of the engine cooling fan is to circulate air through the radiator.
Engine Coolant Pump	The engine coolant pump circulates the engine coolant through the cylinder block and cylinder head and returns the engine coolant to the radiator.
Radiator	The radiator acts as a heat exchanger. As the engine coolant circulates through the cylinder block, it absorbs heat. The heat in the engine coolant is dissipated in the radiator. As the engine cooling fan circulates air through the radiator, the heat is transferred to the air.
Radiator Cap	The radiator cap controls the cooling system pressure. The cooling system is pressurized to raise the boiling point of the engine coolant. As the engine coolant temperature rises, the system pressure and the coolant volume increases. When the pressure reaches a preset value, the release valve in the radiator cap opens and the excess engine coolant flows into the reserve tank. As the engine coolant temperature is reduced, the system pressure and volume is reduced and the vacuum valve in the radiator cap opens, allowing engine coolant to flow from the reserve tank back into the radiator.
Reserve Tank	The reserve tank contains the overflow of engine coolant from the radiator. If you need to add engine coolant to the system, add it to the reserve tank, not the radiator.
Thermostat	A thermostat is placed in the cooling system to prevent engine coolant from circulating into the radiator until the engine coolant temperature reaches a preset temperature. When the engine is cold, no engine coolant flows through the radiator. Once the engine reaches its operating temperature, the thermostat opens and allows engine coolant to flow through the radiator. By letting the engine warm up as quickly as possible, the thermostat reduces engine wear, deposits and emissions.



## GAUGES AND INDICATORS

The operator's console provides you with the means to start and stop the unit, and a series of gauges and indicators that inform you about the current status of the engine. This is a required engine component. Since the operator's console is application specific, it must be carefully selected by an application engineer. It is not part of the basic engine package as shipped from the Yanmar factory.

Note: 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.

### Gauges

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

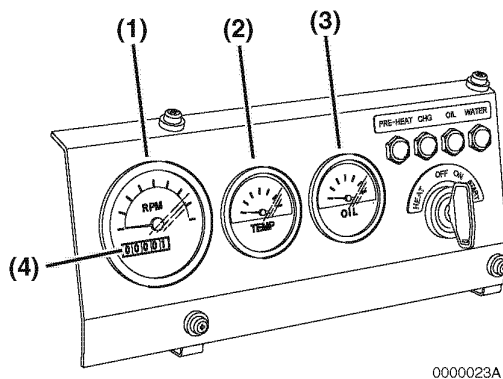


Figure 6

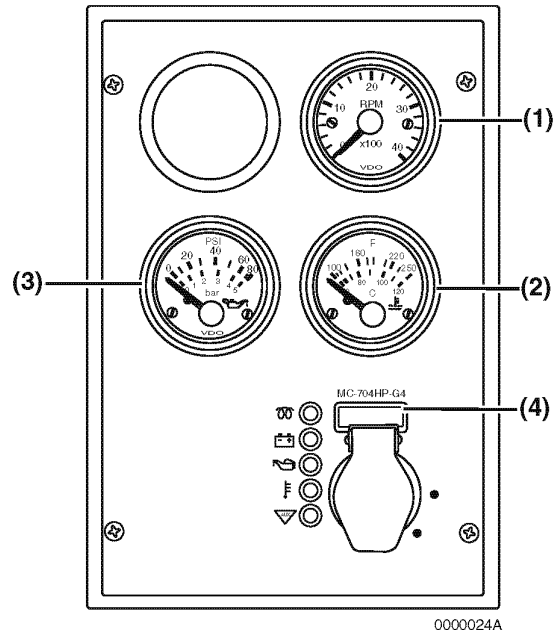


Figure 7

**Tachometer** - The tachometer display (**Figure 6, (1)**) or (**Figure 7, (1)**) shows the engine speed in revolutions per minute (rpm).

**Engine Coolant Temperature** - The engine coolant temperature display (**Figure 6, (2)**) or (**Figure 7, (2)**) shows the temperature of the engine coolant.

**Engine Oil Pressure** - The engine oil pressure display (**Figure 6, (3)**) or (**Figure 7, (3)**) shows the pressure of the engine oil.

**Hour Meter** - The hour meter display (**Figure 6, (4)**) or (**Figure 7, (4)**) shows the total number of hours the engine has run. This is useful for planning the *Periodic Maintenance Procedures* on page 40.

## PRODUCT OVERVIEW

### Indicators

The following indicators are located on a typical operator's console. **NOTICE:** If any indicator fails to illuminate when the key switch is in the ON position, see your authorized Yanmar Industrial engine dealer or distributor for service before operating the engine.

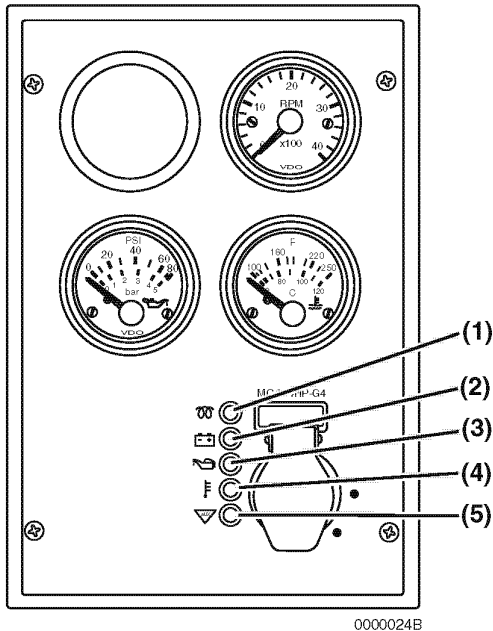


Figure 8

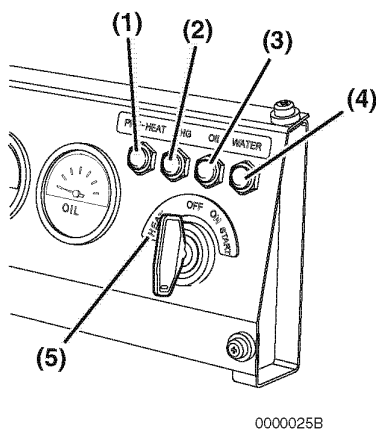


Figure 9

**Pre-Heat (Figure 9, (1))** - The PRE-HEAT function is automatically activated when the key switch is turned to the ON position. The indicator flashes for 4 seconds and when it goes out, you can turn the key switch to START.

**Heat (Figure 8, (1))** - Note that on this type of panel you must turn the key to the HEAT position (**Figure 9, (5)**) to activate the glow plugs. The indicator will flash for 4 seconds when you turn the key to HEAT and when it goes out, you can turn the key switch to START.

**Battery Charge (Figure 8, (2)) or (Figure 9, (2))** - This indicator will come on if there is a problem in the charging system. This indicator does not indicate if the battery is discharged. See *Troubleshooting Chart on page 54*.

**Engine Oil Pressure (Figure 8, (3)) or (Figure 9, (3))** - This indicator will come on if the engine oil pressure is below or exceeds normal limits. See *Troubleshooting Chart on page 54*.

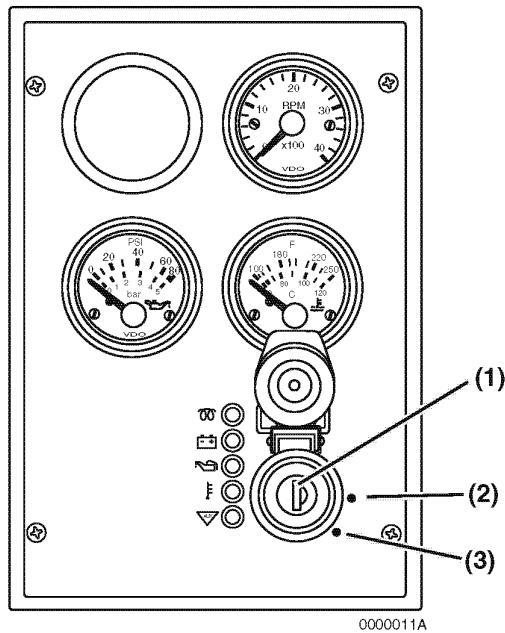
**Engine Coolant Temperature (Figure 8, (4)) or (Figure 9, (4))** - This indicator will come on if the engine coolant temperature exceeds normal limits. See *Troubleshooting Chart on page 54*.

**Auxiliary (Figure 8, (5))** - Used for special applications.

## CONTROLS

### Key Switch

The key switch for the operator's console illustrated in **Figure 10** has three positions - OFF, ON and START.



**Figure 10**

**NOTICE:** For maximum engine life, Yanmar recommends that when shutting the engine down, allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

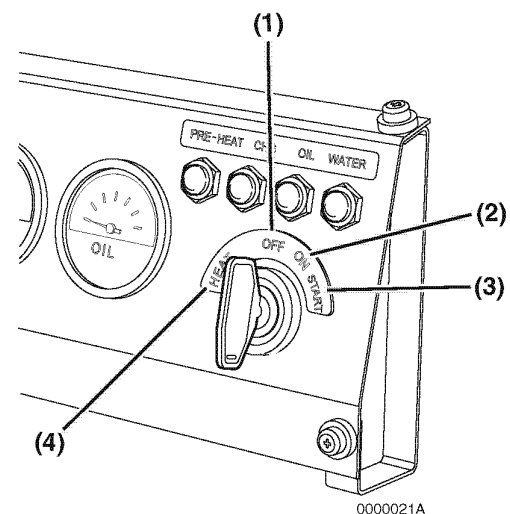
**OFF** (key straight up and down) (**Figure 10, (1)**) and (**Figure 11, (1)**) - When you turn the key to this position, the engine shuts down. Electric current to the gauges and indicators is shut off. You can insert and remove the key in this position.

**NOTICE:** NEVER hold the key in the **START** position for longer than 15 seconds or the starter motor will overheat.

**ON** (**Figure 10, (2)**) and (**Figure 11, (2)**) - This is the position the key will be in when the engine is running. When the engine is not running, use this position to energize the gauges, indicators, electric fuel pump and auxiliary devices.

**START** (**Figure 10, (3)**) and (**Figure 11, (3)**) - Turn the key to this position to start the engine. As soon as the engine starts, release the key and it will automatically return to the ON position. Some key switches may be equipped with a feature that prevents you from turning the key to the START position while the engine is running. When operating a key switch with this feature, you cannot turn the key to the START position without first returning the key to the OFF position.

The key switch for the operator's console illustrated in **Figure 11** has four positions - OFF, ON, START and HEAT.



**Figure 11**

### Glow Plugs

Glow plugs are installed in the cylinder head swirl chambers to help make the engine easy to start in 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.

## PRODUCT OVERVIEW

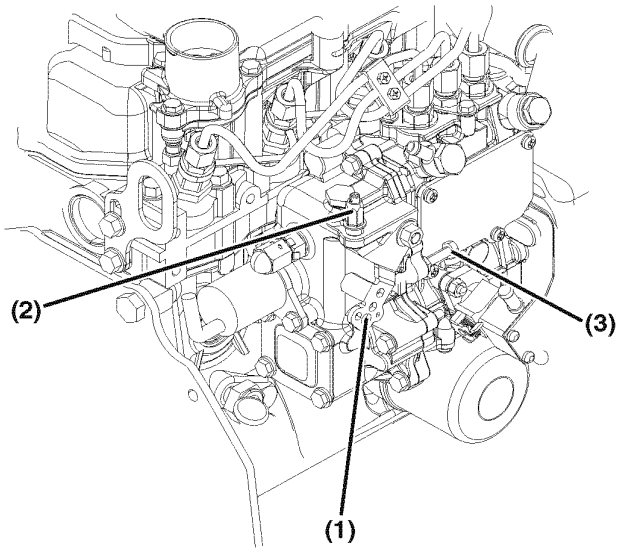
### Governor Lever

*NOTICE: NEVER attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the machine and shorten its life. If adjustment is ever required, contact your authorized Yanmar Industrial engine dealer or distributor.*

The governor lever (**Figure 12, (1)**) controls the engine speed. The lever is linked to the engine speed control device in the driven machine.

The high idle speed limit screw (**Figure 12, (2)**) restricts the maximum engine speed when the engine is operated without a load.

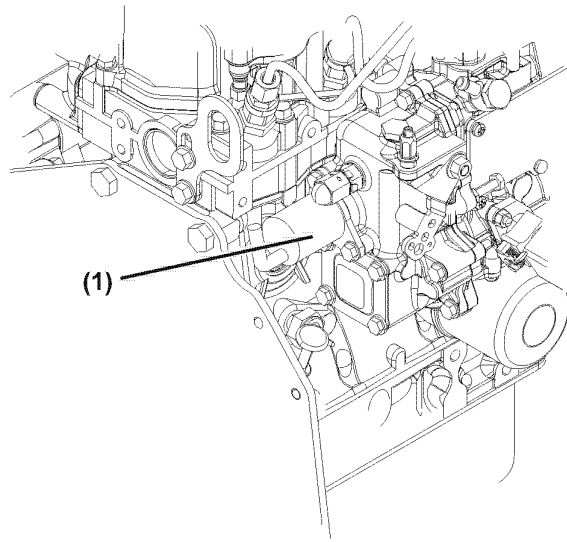
The low idle speed limit screw (**Figure 12, (3)**) sets engine speed while it is idling.



0006460

**Figure 12**

### Engine Stop Solenoid



0006461

**Figure 13**

When the key is turned to the ON position, the engine stop solenoid (**Figure 13, (1)**) is energized and allows the fuel injection pump to deliver fuel to the engine, allowing the engine to be started. When the key is turned to the OFF position, the engine stop solenoid is de-energized and shuts off the fuel supply from the fuel injection pump to the engine, causing the engine to stop.

# BEFORE YOU OPERATE

---

This section of the *Operation Manual* describes the diesel fuel, engine oil and engine coolant specifications and how to replenish them. It also describes the daily engine checkout.

Before you operate the engine, review the *Safety section starting on page 1*.

## DIESEL FUEL

### Diesel Fuel Specifications

**WARNING!** *Diesel fuel is flammable and explosive under certain conditions.*

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

*NOTICE: Only use diesel fuels recommended by Yanmar for the best engine performance, to prevent engine damage and to comply with EPA / CARB warranty requirements. Only use clean diesel fuel.*

Diesel Fuel Specification	Location
ASTM D975 No. 1D S15, S500 No. 2D S15, S500	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. Especially in U.S.A. and Canada, Low Sulfur (300-500mg/kg sulfur content) or Ultra Low Sulfur fuel should be used.
- Bio-Diesel fuels. *See Bio-Diesel Fuels on page 20.*
- NEVER mix kerosene, used engine oil or residual fuels with the diesel fuel.
- Water and sediment in the fuel should not exceed 0.05% by volume.

## BEFORE YOU OPERATE

---

- 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.
- Ash content not to exceed 0.01% by volume.
- Carbon residue content not to exceed 0.35% by volume. Less than 0.1% is preferred.
- Total aromatics content should not exceed 35% by volume. Less than 30% is preferred.
- PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.
- 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: Wear mark of WS1.4 should be Max. 0.018 in. (460  $\mu$ m) 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.

### Precautions and concerns regarding the use of bio-fuels:

1. Free methanol in FAME may result in corrosion of aluminum and zinc FIE components.
2. Free water in FAME may result in plugging of fuel filters and increased bacterial growth.
3. High viscosity at low temperatures may result in fuel delivery problems, injection pump seizures and poor injection nozzle spray atomization.
4. FAME may have adverse effects on some elastomers (seal materials) and may result in fuel leakage and dilution of the engine lubricating oil.
5. Even bio-diesel fuels that comply with a suitable standard as delivered will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and / or fuel storage containers may be necessary.
6. The use of bio-diesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or bio-diesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine. See *Emission System Warranty on page vii*.

## Filling the Fuel Tank

**WARNING! Diesel fuel is flammable and explosive under certain conditions.**

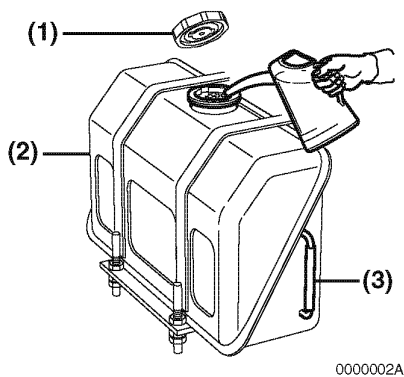
- NEVER refuel with the engine running.
- NEVER remove the fuel cap with the engine running.
- NEVER overfill the fuel tank.

Note that a typical fuel tank is shown. The fuel tank on your equipment may be different.

1. Clean the area around the fuel cap (**Figure 1, (1)**).
2. Remove the fuel cap from the fuel tank (**Figure 1, (2)**).

*NOTICE: NEVER remove the primary strainer (if equipped) from the fuel tank filler port. If removed, dirt and debris could get into the fuel system, causing it to clog.*

3. Fill the tank with clean fuel free of oil and dirt. **WARNING! Hold the hose nozzle firmly against the filler port while filling. This prevents static electricity buildup which could cause sparks and ignite fuel vapors.**
4. Observe the fuel level sight gauge (**Figure 1, (3)**) and stop filling when gauge shows fuel tank is full.
5. Replace the fuel cap (**Figure 1, (1)**); hand tighten. Over tightening the fuel cap will damage it.



**Figure 1**

## Priming the Fuel System

- If the unit has an electric fuel pump, when you prime the fuel system, turn the key switch to the ON position for 10 to 15 seconds to allow the electric fuel pump to prime the system.
- If the unit has a mechanical fuel pump, when you prime the fuel system, operate the fuel priming lever of the mechanical fuel pump several times until the fuel filter cup is filled with fuel.

**The fuel system needs to be primed under certain conditions:**

- Before starting the engine for the first time
- After running out of fuel and fuel has been added to the fuel tank
- After fuel system maintenance such as changing the fuel filter and draining the fuel filter / water separator, or replacing a fuel system component

To prime the fuel system if an electric fuel pump is installed:

1. Turn the key to the ON position for 10 to 15 seconds. This will allow the electric fuel pump to prime the fuel system. **WARNING! NEVER open the air vent valve while the fuel system is being primed. The fuel filter has an internal air bleed port.**
2. NEVER use the starter motor to crank the engine in order to prime the fuel system. This may cause the starter motor to overheat and damage the coils, pinion and / or ring gear.

## BEFORE YOU OPERATE

To prime the fuel system if a mechanical fuel pump is installed:

1. Operate the fuel priming lever (**Figure 2, (1)**) several times until the fuel filter cup (**Figure 2, (2)**) is filled with fuel.
2. NEVER use the starter motor to crank the engine in order to prime the fuel system. This may cause the starter motor to overheat and damage the coils, pinion and / or ring gear.

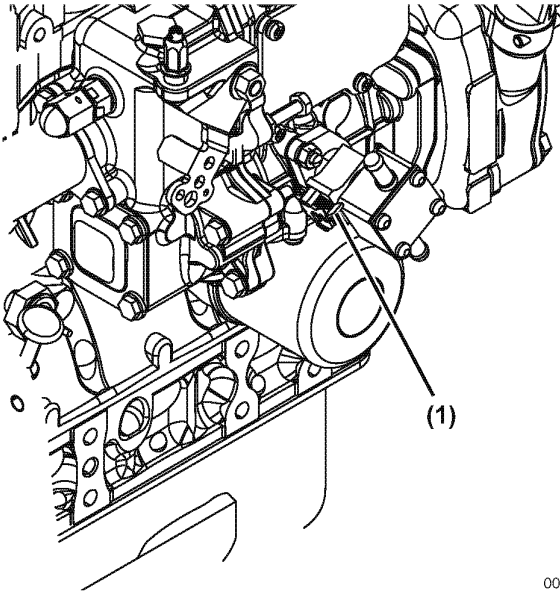


Figure 2

0006462

## ENGINE OIL

### Engine Oil Specifications

*NOTICE: Only use the engine oil specified to avoid engine damage.*

Other engine oils may affect warranty coverage, cause internal engine components to seize and / or shorten engine life.

NEVER mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.

Use an engine oil that meets or exceeds the following guidelines and classifications:

### Service Categories

- API service categories CD or higher
- ACEA service categories E-3, E-4, and E-5
- JASO service category DH-1

### Definitions

- API Classification (American Petroleum Institute)
- ACEA Classification (Association des Constructeurs Européens d'Automobiles)
- JASO (Japanese Automobile Standards Organization)

Note:

1. Be sure the engine oil, engine oil storage containers and engine oil filling equipment are free of sediments and water.
2. Change the engine oil after the first 50 hours of operation and at every 250 hours thereafter.
3. Select the oil viscosity based on the ambient temperature where the engine is being operated. See the SAE Service Grade Viscosity Chart, **Figure 3**.
4. Yanmar does not recommend the use of engine oil "additives."

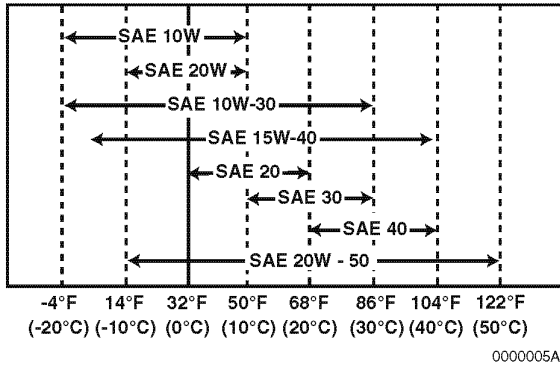
### Additional Technical Engine Oil Requirements:

The engine oil must be changed when the Total Base Number (TBN) has been reduced to 1.0 mgKOH/g. TBN (mgKOH/g) test method: JIS K-201-5.2-2 (HCl), ASTM D4739 (HCl).



### Engine Oil Viscosity

Select the appropriate engine oil viscosity based on the ambient temperature and use the SAE Service Grade Viscosity Chart in **Figure 3**.



**Figure 3**

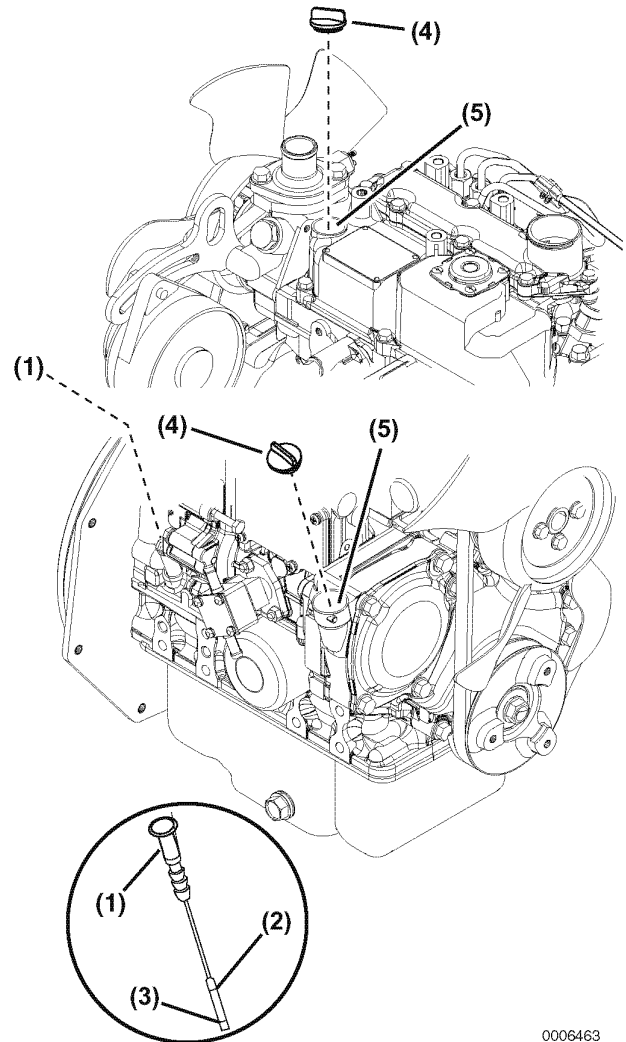
### Checking Engine Oil

1. Make sure engine is level.
2. Remove dipstick (**Figure 4, (1)**) and wipe with clean cloth. *NOTICE: Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap / dipstick and the surrounding area before you remove the oil cap / dipstick.*
3. Fully reinsert dipstick.
4. Remove dipstick. The oil level should be between upper (**Figure 4, (2)**) and lower (**Figure 4, (3)**) lines on the dipstick.
5. Fully reinsert dipstick.

### Adding Engine Oil

1. Make sure engine is level.
2. Remove oil cap (**Figure 4, (4)**).
3. Add indicated amount of engine oil at the top or side engine oil filler port (**Figure 4, (5)**).
4. Insert the dipstick fully to check the level. *NOTICE: ALWAYS keep the oil level between upper and lower lines on the oil cap / dipstick.*
5. Wait 3 minutes and check oil level.

6. Add more oil if necessary. *NOTICE: Never overfill the engine with engine oil. Overfilling may result in white smoke, engine overspeed or engine damage.*
7. Reinstall oil cap (**Figure 4, (4)**) and hand-tighten. Overtightening may damage the cap.



0006463

**Figure 4**

## BEFORE YOU OPERATE

### Engine Oil Capacity (Typical)

*NOTICE: These are the engine oil capacities associated with a "deep standard" oil pan. Oil capacity will vary depending upon which optional oil pan is used. Refer to the Operation Manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.*

The following are the engine oil capacities for various Yanmar TNM engines.

Engine Oil Capacity (Typical)	
Engine Model	Dipstick Upper Limit/ Lower Limit
3TNM68	2.6 / 1.4 qt (2.5 / 1.3 L)
3TNM72	3.1 / 1.7 qt (2.9 / 1.6 L)

## ENGINE COOLANT

### Engine Coolant Specifications

Use a Long Life Coolant (LLC) or an Extended Life Coolant (ELC) that meets or exceeds the following guidelines and specifications.

*NOTICE: Only use the engine coolant specified. Other engine coolants may affect warranty coverage, cause an internal buildup of rust and scale and / or shorten engine life.*

### Alternative Engine Coolant

If an Extended or Long Life Coolant is not available, alternatively, you may use an ethylene glycol or propylene glycol based conventional coolant (green).

*NOTICE: NEVER mix different types of engine coolants. This may adversely affect the properties of the engine coolant.*

Note:

1. ALWAYS use a mix of coolant and water. NEVER use water only.
2. Mix coolant and water per the mixing instructions on the coolant container.

3. Water quality is important to coolant performance. Yanmar recommends that soft, distilled or demineralized water be used to mix with coolants.
4. NEVER mix extended or long life coolants and conventional (green) coolants.
5. NEVER mix different types and / or colors of extended life coolants.
6. Replace the coolant every 1000 engine hours or once a year.

### Additional Technical Coolant Specifications:

- ASTM D6210, D4985 (US)
- JIS K-2234 (Japan)
- SAE J814C, J1941, J1034 or J2036 (International)

### Filling Radiator with Engine Coolant

Fill the radiator and reserve tank as follows. This procedure is for filling the radiator for the first time or refilling it after it is flushed. Note that a typical radiator is illustrated.

1. Check to be sure the radiator drain plug is installed and tightened or the drain cock (**Figure 5, (1)**) is closed. Also make sure the coolant drain plug (**Figure 6, (1)**) in the cylinder block is closed.

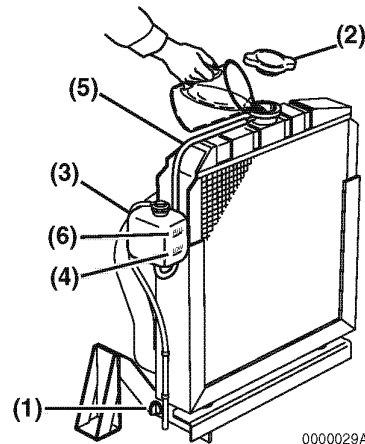
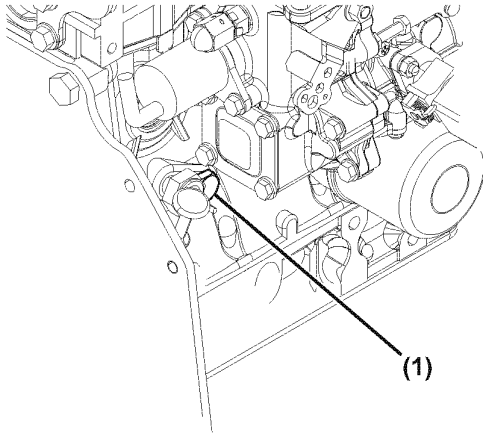


Figure 5



0006464

**Figure 6**

2. Remove the radiator cap (**Figure 5, (2)**) by turning it counterclockwise about 1/3 of a turn. **WARNING! NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spray out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.**  
*NOTICE: Prevent dirt and debris from contaminating the engine coolant. Carefully clean the radiator cap and the surrounding area before you remove the cap.*
3. Pour the engine coolant *slowly* into the radiator until it is even with the lip of the engine coolant filler port. Make sure that air bubbles do not develop as you fill the radiator.
4. Reinstall the radiator cap (**Figure 5, (2)**). Align the tabs on the back side of the radiator cap with the notches on the engine coolant filler port. Press down and turn the cap clockwise about 1/3 of a turn. **WARNING! ALWAYS tighten the radiator cap securely after you check the radiator. Steam can spray out during engine operation if the cap is loose.**
5. Remove the cap of the reserve tank (**Figure 5, (3)**), and fill it to the LOW (COLD) mark (**Figure 5, (4)**) with engine coolant. Reinstall the cap.

6. Check the hose (**Figure 5, (5)**) that connects the reserve tank (**Figure 5, (3)**) to the radiator. Be sure it is securely connected and there are no cracks or damage. If the hose is damaged, engine coolant will leak out instead of going into the reserve tank.
7. Run the engine until it reaches operating temperature. Check the level of engine coolant in the reserve tank. When the engine is running and the engine coolant is at normal temperature, the coolant level in the reserve tank should be at or near the FULL (HOT) mark (**Figure 5, (6)**). If the coolant is not at the FULL (HOT) mark, add coolant to the reserve tank to bring the coolant level to the FULL (HOT) mark.

### Daily Check of the Cooling System

1. Check the level of engine coolant in the reserve tank. When the engine is cold, the coolant level in the tank should be at or slightly above the LOW (COLD) mark (**Figure 5, (4)**) on the coolant reserve tank.  
If the coolant level is at the FULL (HOT) mark (**Figure 5, (6)**) when the engine is cold, the coolant will expand when it becomes hot and possibly spray out of the overflow hose.
2. Add additional engine coolant to the reserve tank if necessary.
3. Check the radiator hoses for cracks, abrasions, cuts or other damage. Replace as necessary.

## BEFORE YOU OPERATE

### Engine Coolant Capacity (Typical)

Note: Capacities listed are for the engine only without a radiator. Refer to the *Operation Manual* provided by the driven machine manufacturer for actual engine coolant capacity on your machine.

The following are the engine coolant capacities for various Yanmar TNM engines.

Engine Coolant Capacity (Typical)	
Engine Model	Engine Coolant Capacity
3TNM68, 3TNM72	1.1 qt (1.0 L)

## DAILY CHECKS

Before you begin any job, make sure the Yanmar TNM engine is in good operating condition. Make sure you check the following items before you start your shift and have any repairs completed before you start work.

**CAUTION!** *It is always important to perform daily checks, as periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor engine performance and helps extend the life of the engine.*

### Visual Checks

**CAUTION!** *If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.*

1. Check for engine oil leaks.
2. Check for fuel leaks.
3. Check for engine coolant leaks.
4. Check for damaged or missing parts.
5. Check for loose, missing or damaged fasteners.

6. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.
7. Check hoses for cracks, abrasions, and damaged, loose or corroded clamps.
8. Check and clean radiator fins as necessary. *See Check and Clean Radiator Fins on page 45.*
9. Check governor lever and engine speed control. *See Check and Adjust the Governor Lever and Engine Speed Control on page 46.*
10. Check the fuel filter / water separator for presence of water and contaminants. If you find any water or contaminants, drain the fuel filter / water separator. *See Drain Fuel Filter / Water Separator on page 43.* If you have to drain the fuel filter / water separator frequently, drain the fuel tank and check for the presence of water in your fuel supply. *See Drain Fuel Tank on page 45.*

### Check Diesel Fuel, Engine Oil and Engine Coolant Levels

Follow the procedures in *Diesel Fuel on page 19*, *Engine Oil on page 22* and *Engine Coolant on page 24* to check these levels.

### Check Engine Speed Control

Check the engine speed control for smooth operation, adjust, and lubricate or clean as necessary. *See Check and Adjust the Governor Lever and Engine Speed Control on page 46.*

### Check Operator's Console

Before you operate the engine, you should make sure that all of the indicators are functioning properly.

**Check Indicators**

Yanmar TNM engines are available with various operator's consoles. The following table summarizes the indicators' functions. For a detailed description of these indicators, see *Indicators on page 16*.

<b>Indicator</b>	<b>OFF to HEAT</b>	<b>OFF to ON</b>	<b>ON to OFF</b>
Heat	Lights for 4 seconds then goes out.	Lights for 4 seconds then goes out.	OFF
Battery Charge	NA	ON	OFF (Stays on until alternator is supplying charging current. Remains on if there is a problem in the charging system. This indicator does not indicate whether the battery is discharged.)
Engine Oil Pressure	NA	ON	OFF (Stays on until oil pressure reaches normal operating pressure. Remains on, or comes back on, if there is a problem in the lubrication system.)
Engine Coolant Temperature	NA	ON	OFF (Stays on momentarily. Comes back on if there is a problem in the cooling system.)

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# ENGINE OPERATION

This section of the *Operation Manual* describes the procedures for starting the engine, checking engine performance during operation, and shutting the engine down.

Before you operate the engine, read the following safety information and review the *Safety section on page 1*.

## WARNING

### Fire and Explosion Hazard



Diesel fuel is flammable and explosive under certain conditions.

- ALWAYS use the key switch to start the engine. NEVER jump-start the engine. Sparks caused by shorting the battery to the starter terminals may cause a fire or explosion.
- Before you operate the engine, check for fuel leaks.

### Entanglement Hazard



NEVER engage the transmission or PTO at an elevated engine speed. This could result in unexpected movement of the equipment.

## NOTICE

Make sure the engine is installed on a level surface. If a continuously running engine is installed at an angle greater than 25° in any direction or if an engine runs for short periods of time (less than 3 minutes) at an angle greater than 30° in any direction, engine oil may enter the combustion chamber, causing excessive engine speed and white exhaust smoke. This may cause serious engine damage.

Before starting the engine, ALWAYS turn the switches on the working instruments (lighting apparatus, motor, etc.) to their OFF position. If the switches are not off, the sudden application of load when the engine is started could be very dangerous.

ALWAYS take the necessary corrective action, if any problem is noted during the visual check, before you operate the engine.

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- The standard range of ambient temperatures for the normal operation of Yanmar engines is from +5°F (-15°C) to +113°F (+45°C).
- Contact your authorized Yanmar Industrial engine dealer or distributor if the engine will be operated outside of the standard temperature range.

## ENGINE OPERATION

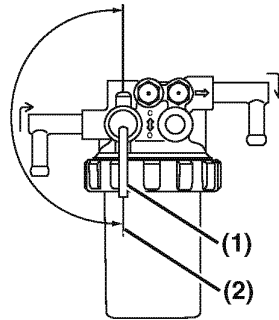
- If the ambient temperature exceeds +113°F (+45°C) the engine may overheat and cause the engine oil to break down.
- If the ambient temperature is below +5°F (-15°C), the engine will be hard to start and the engine oil may not flow easily.
- Turn off the engine if the fault indicator comes on. Continuing running the engine with the fault indicator on may result in a serious malfunction of or damage to the engine, and will void the engine warranty.
- Avoid operating in extremely dusty conditions.
- Avoid operating in the presence of chemical gases or fumes.
- Avoid operating in a corrosive atmosphere such as saltwater spray.
- NEVER install the engine in a floodplain unless proper precautions are taken to avoid being subject to flood.

## STARTING ENGINE

Use the following procedure to start the engine.

Note: Two typical operator's consoles are shown for illustrative purposes only.

1. Make sure you follow the procedures stated in *Daily Checks on page 26*.
2. Make sure the fuel filter / water separator fuel cock (**Figure 1, (1)**) is in the ON position (**Figure 1, (2)**).



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**Figure 1**

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



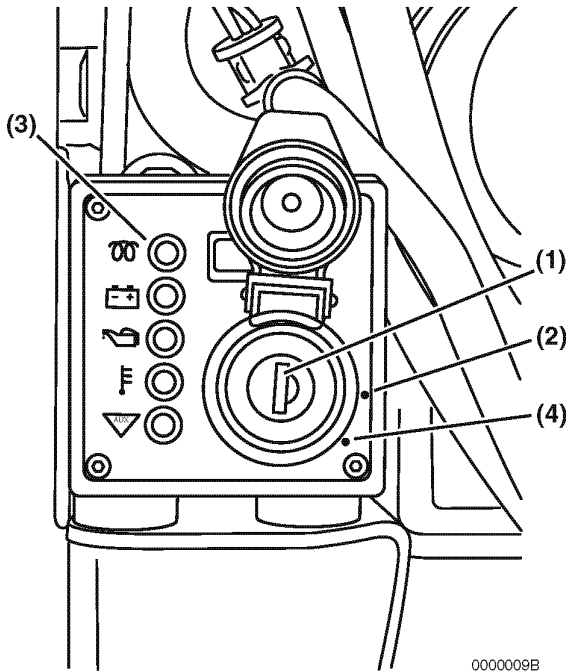


Figure 2

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

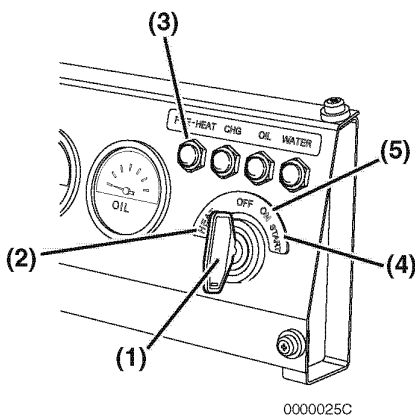


Figure 3

7. Turn the key to the ON position (**Figure 2, (2)**) or the HEAT position (**Figure 3, (2)**). The pre-heat indicator (**Figure 2, (3)**) flashes for several seconds and then goes out. After the pre-heat indicator goes out, you can start the engine. **NOTICE: NEVER use an engine starting aid such as ether. Engine damage will result.**

Note: The glow plugs 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 HEAT function and go directly to START.

8. Turn the key clockwise to the START position (**Figure 2, (4)**) or (**Figure 3, (4)**). Release the key as soon as the engine starts. It will return to the ON position (**Figure 2, (2)**) or (**Figure 3, (5)**). **CAUTION! NEVER hold the key in the START position for longer than 15 seconds or the starter motor will overheat**

9. If the engine fails to start:

- (a) 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. **NOTICE: 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.

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

## ENGINE OPERATION

### CHECKING THE ENGINE DURING OPERATION

During the break-in period for a new engine, check and perform the following:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.
  - During the first hour of operation, vary the engine speed and the load on the engine. Short periods of maximum engine speed and load are desirable.
  - Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 4 to 5 hours.
  - During the break-in period, carefully observe the engine oil pressure and engine temperature.
  - Also, check the engine oil and coolant levels frequently.
1. While the engine is running, check the gauges for normal indications. The gauges shown in **Figure 4** and **Figure 5** are provided for illustrative purposes only. **NOTICE: NEVER engage the starter motor while the engine is running. This may damage the starter motor pinion and / or ring gear.**

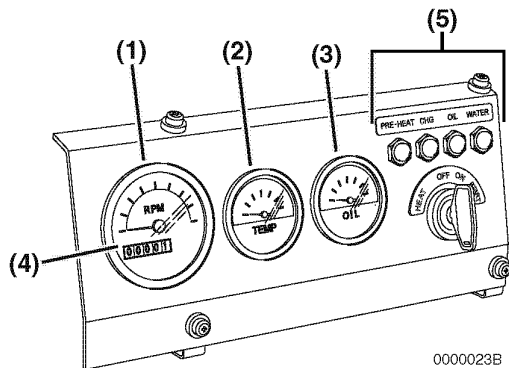


Figure 4

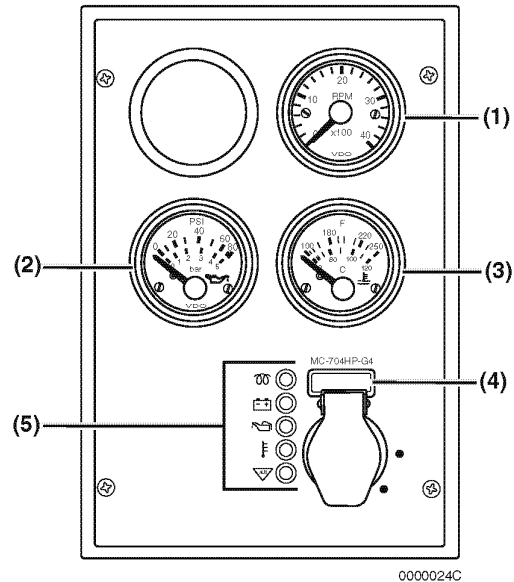


Figure 5

- **Tachometer (Figure 5, (1)) or (Figure 4, (1))** - Make sure the engine speed is within normal limits. See *Engine Speed Specifications* on page 60.
- **Engine Oil Pressure (Figure 5, (2)) or (Figure 4, (3))** - Make sure the engine oil pressure is within normal limits. See *Principal Engine Specifications* on page 61.
- **Engine Coolant Temperature (Figure 5, (3)) or (Figure 4, (2))** - Make sure the engine coolant temperature is within normal limits.
- **Hour Meter** - The hour meter display (**Figure 5, (4)**) or (**Figure 4, (4)**) shows the total number of hours the engine has run. This is useful for planning periodic maintenance operations. See *Periodic Maintenance Schedule* on page 38.
- If any of the gauges show an out of normal limits condition, shut down the engine and have the necessary repairs performed.

- After the engine has reached operating temperature, all of the indicators (**Figure 5, (5)**) or (**Figure 4, (5)**) should be off. If any of the indicators are on, shut down the engine and have the necessary repairs performed.

**CAUTION! If any indicator illuminates during engine operation, stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.**

- Check for white or black smoke from the exhaust system. A small amount of white exhaust smoke is normal on start-up of a cold engine. Black exhaust smoke could mean the engine is overloaded or is being overfueled. If either of these conditions persists, contact your authorized Yanmar Industrial engine dealer or distributor.
- Check for abnormal sounds or vibration. In some applications, the engine and its mounting may start to resonate and cause unusual vibrations at certain engine speeds. Avoid running the engine at these speeds. If the abnormal sounds or vibration cannot be resolved, shut down the engine and have the necessary repairs performed. Contact your authorized Yanmar Industrial engine dealer or distributor.
- Check for any fuel, engine coolant or engine oil leaks. If any leaks are found, shut down the engine and have the necessary repairs performed.
- Check the fuel level during operation. If the fuel level runs low, stop the engine and refuel.

### ADJUST ENGINE SPEED

Use the engine speed control to adjust the engine speed for the task that will be performed.

### SHUTTING DOWN THE ENGINE

Follow these steps to shut down the engine:

- Disengage the PTO and / or set the transmission to NEUTRAL (if equipped).
- Set the engine speed control to its lowest setting. *NOTICE: For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.*
- Run the engine at low idle speed for at least 5 minutes before you shut it down.

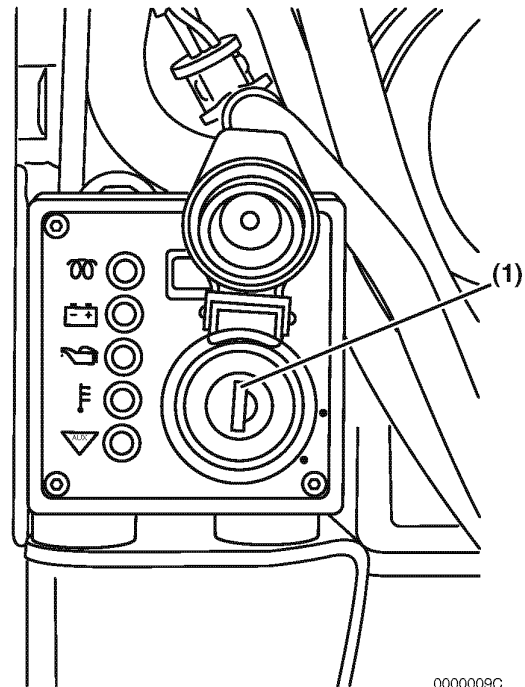


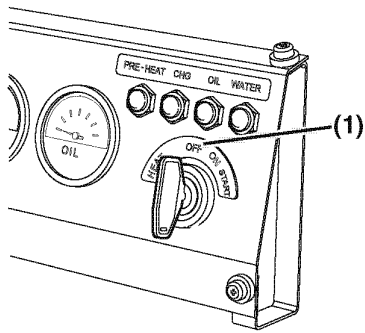
Figure 6

000009C

## ENGINE OPERATION

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4. Turn the key to the OFF position (**Figure 6, (1)**) or (**Figure 7, (1)**) and remove it from the key switch.



0000025D

**Figure 7**

5. If the engine will not be used for 6 months or longer, follow the additional instructions in *Long-Term Storage* on page 57.

# PERIODIC MAINTENANCE

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This section of the *Operation Manual* describes the procedures for proper care and maintenance of the engine.

Before performing periodic maintenance on the engine, read the following safety information and review the *Safety section on page 1*.

ALWAYS protect the air cleaner, turbocharger (if equipped) and electric components from damage when you use steam or high-pressure water to clean the engine.

## WARNING

### Fire and Explosion Hazard



NEVER remove any fuel system component to perform maintenance (such as changing the fuel filter) without an approved container under the opening to catch the fuel.

- NEVER use a shop rag to catch the fuel. Vapors from the rag are flammable and explosive.

### Crush Hazard



If you need to transport an engine for repair, have a helper assist you attach it to a hoist and load it on a truck.

The engine lifting eyes are engineered to lift the weight of the engine only. ALWAYS use the engine lifting eyes when lifting the engine.

### Welding Hazard

Make welding repairs safely.

- ALWAYS disconnect the negative battery cable and the leads to the alternator when welding on the equipment.
- Remove the multi-pin connectors to the engine electronics or engine control unit. Connect the weld clamp to the component to be welded and as close as possible to the welding point.
- NEVER connect the weld clamp to the engine or in a manner which would allow current to pass through a mounting bracket.
- When welding is completed, reconnect the leads to the alternator and engine electronics or engine control unit prior to reconnecting the batteries.

## CAUTION

### Tool Hazard

- ALWAYS check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.
- ALWAYS use tools appropriate for the task at hand and use the correct size tool for loosening or tightening machine parts.

## PERIODIC MAINTENANCE

### CAUTION

#### Burn Hazard



Batteries contain sulfuric acid.

- NEVER allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result.

- ALWAYS wear safety goggles and protective clothing when servicing the battery.
- If battery fluid contacts the eyes and / or skin, immediately flush the affected areas with a large amount of clean water and obtain prompt medical treatment.

### NOTICE

NEVER attempt to modify the engine's design or safety features such as defeating the engine speed limit control or the diesel fuel injection quantity control.

Modifications may impair the engine's safety and performance characteristics and shorten the engine's life. Any alterations to this engine may void its warranty. Be sure to use genuine Yanmar replacement parts.

## PRECAUTIONS

### The Importance of Periodic Maintenance

Engine deterioration and wear occurs in proportion to the length of time the engine has been in service and the conditions the engine is subject to during operation. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

### Performing Periodic Maintenance

Perform periodic maintenance procedures in an open, level area free from traffic. If possible, perform the procedures indoors to prevent environmental conditions, such as rain, wind or snow, from damaging the machine.

### The Importance of Daily Checks

Periodic Maintenance Schedules assume that the daily checks are performed on a regular basis. Make it a habit to perform daily checks before the start of each shift. *See Daily Checks on page 26.*

### Keep a Log of Engine Hours and Daily Checks

Keep a log of the number of hours the engine is run each day and a log of the daily checks performed. Also note the date, type of repair (e.g., replaced alternator), and parts needed for any service needed between the periodic maintenance intervals. Periodic maintenance intervals are every 50, 250, 500, 1000, 1500 and 2000 engine hours. Failure to perform periodic maintenance will shorten the life of the engine.

### Yanmar Replacement Parts

Yanmar recommends that you use genuine Yanmar parts when replacement parts are needed. Genuine replacement parts help ensure long engine life.

### Tools Required

Before you start any periodic maintenance procedure, make sure you have the tools you need to perform all of the required tasks.

### Ask Your Authorized Yanmar Industrial Engine Dealer or Distributor for Help

Our professional service technicians have the expertise and skills to help you with any maintenance or service related procedures you need help with.

**Required EPA / CARB Maintenance - USA Only**

To maintain optimum engine performance and compliance with the Environmental Protection Agency (EPA) Regulations Non-Road Engines and the California Air Resources Board (CARB), it is essential that you follow the *Periodic Maintenance Schedule on page 38* and *Periodic Maintenance Procedures on page 40*.

**EPA / CARB Installation Requirements - USA Only**

The following are the installation requirements for the EPA / CARB. Unless these requirements are met, the exhaust gas emissions will not be within the limits specified by the EPA and CARB.

Maximum Exhaust Gas Restriction shall be 1.71 psi (11.8 kPa; 1200 mm Aq) or less.

*NOTICE: Maximum air intake restriction, in terms of differential pressure measurement, must not exceed 0.90 psi (6.23 kPa; 635 mm Aq). Clean or replace the air cleaner element if the air intake restriction exceeds the above mentioned value.*

**Tightening Fasteners**

Use the correct amount of torque when you tighten fasteners on the machine. Applying excessive torque may damage the fastener or component, and not enough torque may cause a leak or component failure.

*NOTICE: The tightening torque in the Standard Torque Chart in the Periodic Maintenance Section of this manual should be applied only to the bolts with a "7" head (JIS strength classification: 7T). Apply 80% torque when tightened to aluminum alloy. Apply 60% torque to bolts that are not listed.*



**STANDARD TORQUE CHART**

Thread Size x Pitch mm		M6x1.0	M8x1.25	M10x1.5	M12x1.75	M14x1.5	M16x1.5
Tightening Torque	in.-lb	96.0 ± 9.0	-	-	-	-	-
	ft-lb	-	19.0 ± 2.0	36.0 ± 4.0	65.0 ± 7.0	101.0 ± 7.0	167.0 ± 7.0
	N·m	10.8 ± 1.0	25.5 ± 2.9	49.0 ± 4.9	88.3 ± 9.8	137.0 ± 9.8	226.0 ± 9.8
	kgf·m	1.1 ± 0.1	2.6 ± 0.3	5.0 ± 0.5	9.0 ± 1.0	14.0 ± 1.5	23.0 ± 2.0

Note: Torque values shown in this manual are for clean, non-lubricated fasteners, unless otherwise specified.

## PERIODIC MAINTENANCE

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### PERIODIC MAINTENANCE SCHEDULE

Daily and periodic maintenance is important to keep the engine in good operating condition. The following is a summary of maintenance items by periodic maintenance intervals. Periodic maintenance intervals vary depending on engine application, loads, diesel fuel and engine oil used and are hard to establish definitively. The following should be treated only as a general guideline.

***CAUTION! Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine.***

*See Yanmar Limited Warranty in the Warranty Section of this manual. Consult your authorized Yanmar Industrial engine dealer or distributor for assistance when checking items marked with a ●.*



Periodic Maintenance Chart

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

System	Check Item	Daily See Daily Checks on page 26	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, whichever comes first		
Cylinder Head	Adjust Intake / Exhaust Valve Clearance					●		
	Lap Intake / Exhaust Valve Seats (if required)							●
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						●	
	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	Check or Replace Fuel System and Cooling System Hoses	○						● or every 2 yrs.
Intake and Exhaust	Clean or Replace Air Cleaner Element			○	◇			
Complete Engine	Overall Visual Check Daily	○						

These procedures are considered normal maintenance and are performed at the owner's expense.

## PERIODIC MAINTENANCE

### 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

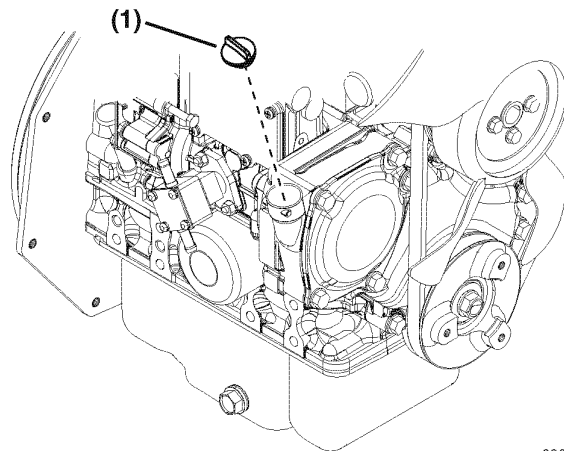
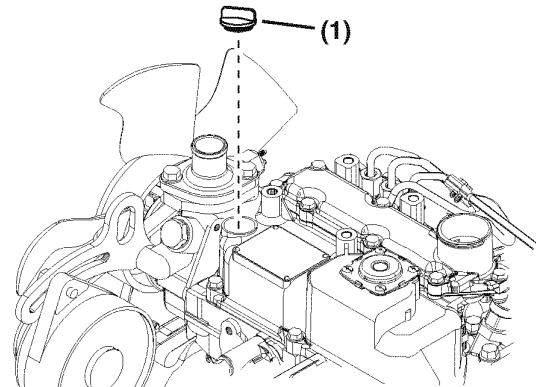
**WARNING! ALWAYS wear eye protection. If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being burned.**

The engine oil on a new engine becomes contaminated from the initial break-in of internal parts. It is very important that the initial oil change is performed as scheduled.

Note: The oil drain plug may be in another location if an optional oil pan is used.

Drain the engine oil as follows:

1. Make sure the engine is level.
2. Start the engine and bring it up to operating temperature.
3. Stop the engine.
4. Remove one of the oil filler caps (**Figure 1, (1)**) to vent the engine crankcase and allow the engine oil to drain more easily.
5. Position a container under the engine to collect waste oil.



0006469

**Figure 1**

6. Remove the oil drain plug (**Figure 2, (1)**) from the engine oil pan. Allow oil to drain.
7. After all oil has been drained from the engine, reinstall the oil drain plug (**Figure 2, (1)**) 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. **NOTICE: ALWAYS be environmentally responsible.**

Remove the engine oil filter as follows:

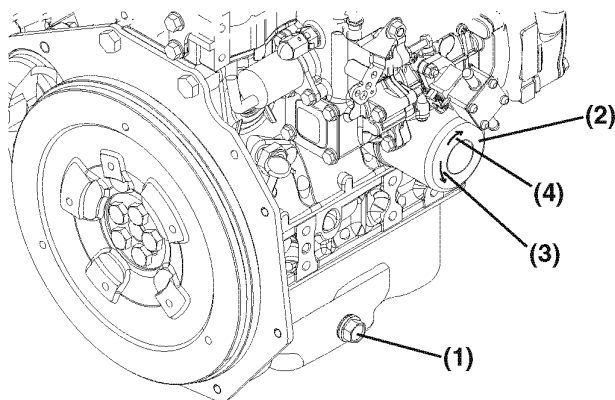
1. Turn the engine oil filter (**Figure 2, (2)**) counterclockwise (**Figure 2, (3)**) using an oil filter wrench.
2. Clean the engine oil filter mounting face.

3. Lightly coat the gasket on the new oil filter with engine oil. Install the new engine oil filter manually by turning it clockwise **(Figure 2, (4))** 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.**

3TNM68, 3TNM72	119305-35160
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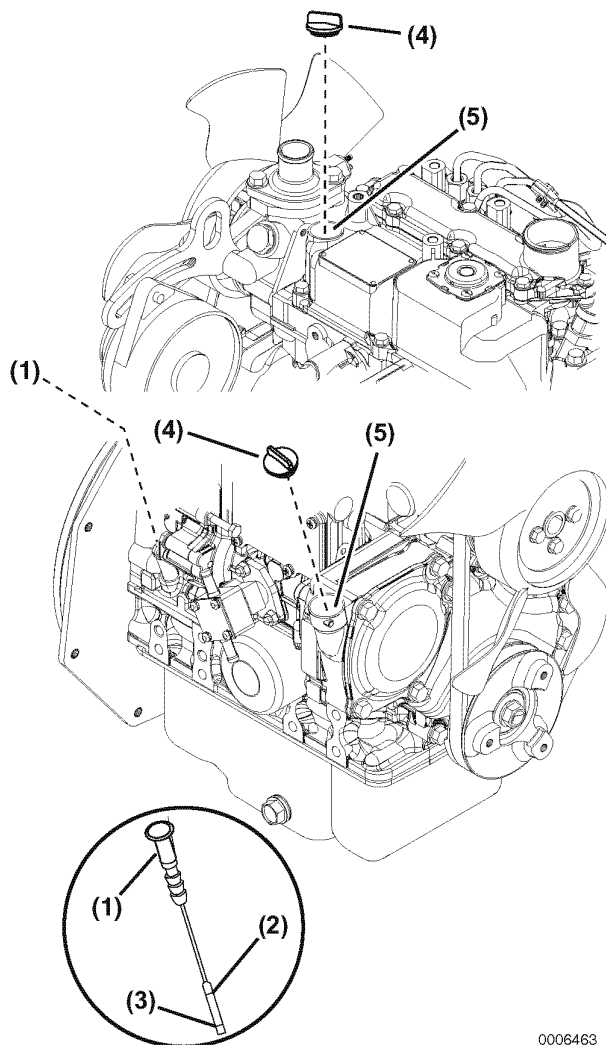
4. Add new engine oil to the engine through either of the oil filler ports as specified in *Adding Engine Oil* on page 23.



0006465

**Figure 2**

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. The level should be between the upper **(Figure 3, (2))** and lower **(Figure 3, (3))** lines on the dipstick. **NOTICE:** ALWAYS keep the oil level between the upper and lower lines on the oil cap / dipstick.
8. Add more oil to the engine oil filler port **(Figure 2, (5))** if necessary. **NOTICE:** NEVER overfill the engine with engine oil. Overfilling may result in white smoke, engine overspeed or engine damage.
9. Reinstall the oil filler cap **(Figure 3, (4))**. If any engine oil is spilled, wipe it away with a clean cloth.



0006463

**Figure 3**

## PERIODIC MAINTENANCE

### Check and Adjust Cooling Fan V-Belt

The V-belt will slip if it does not have the proper tension. This will prevent the alternator from generating sufficient power. Also, the engine will overheat due to the engine coolant pump pulley slipping. **NOTICE: NEVER get any oil on the belt(s). Oil on the belt causes slipping and stretching. Replace the belt if damaged.**

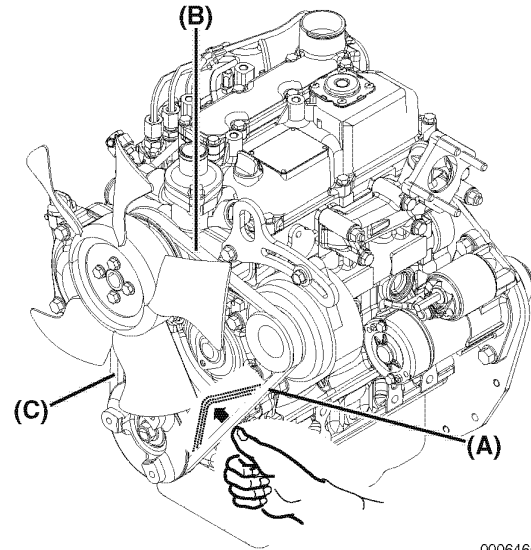
Check and adjust the V-belt tension (deflection) as follows:

1. Press the V-belt down with your thumb with a force of approximately 22 ft-lb (98 N·m, 10 kgf·m) to check the deflection.

There are three positions to check for V-belt tension (**Figure 4, (A, B and C)**). You can check the tension at whichever position is the most accessible. The proper deflection of a used V-belt at each position is:

Used V-Belt Tension
3/8 - 1/2 in. (10 - 14 mm)

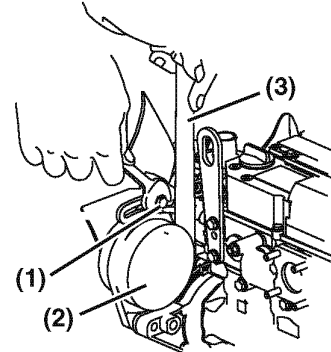
Note: A “used V-belt” refers to a V-belt which has been used on a running engine for 5 minutes or more.



0006466

Figure 4

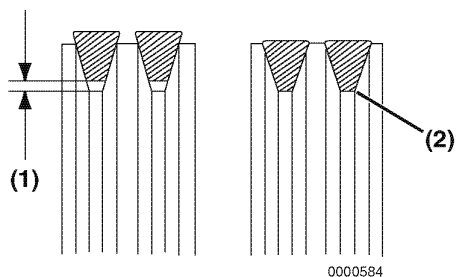
2. If necessary, adjust the V-belt tension. Loosen the adjusting bolt (**Figure 5, (1)**) and move the alternator (**Figure 5, (2)**) with a pry bar (**Figure 5, (3)**) to tighten the V-belt to the desired tension. Then, tighten the adjusting bolt.



0006467

Figure 5

3. Tighten the V-belt to the proper tension. There must be clearance (**Figure 6, (1)**) between the V-belt and the bottom of the pulley groove. If there is no clearance (**Figure 6, (2)**) between the V-belt and the bottom of the pulley groove, replace the V-belt.



**Figure 6**

4. Check the V-belt for cracks, oil or wear. If any of these conditions exist, replace the V-belt.  
*NOTICE: ALWAYS use the specified V-belt. Using a non-specified V-belt will cause inadequate charging and shorten the belt life.*
5. Install the new V-belt. Refer to the table for proper tension.

New V-Belt Tension
<b>A</b>
5/16 - 7/16 in. (8 - 12 mm)

6. After adjusting, run the engine for 5 minutes or more. Check the tension again using the specifications for a used V-belt.

Used V-Belt Tension
<b>A</b>
3/8 - 1/2 in. (10 - 14 mm)

## Every 50 Hours of Operation

After you complete the initial 50 hour maintenance procedures, perform the following procedures every 50 hours thereafter.

- **Drain Fuel Filter / Water Separator**
- **Check Battery**
- **Check and Clean Radiator Fins**

### Drain Fuel Filter / Water Separator

Drain the fuel filter / water separator whenever there are contaminants, such as water, collected in the bottom of the cup. NEVER wait until the scheduled periodic maintenance if contaminants are discovered.

The separator cup is made from semi-transparent material. In the cup is a red-colored float ring. The float ring will rise to the surface of the water to show how much needs to be drained. Also, some optional fuel filter / water separators are equipped with a sensor to detect the amount of contaminants. This sensor sends a signal to an indicator to alert the operator.

## PERIODIC MAINTENANCE

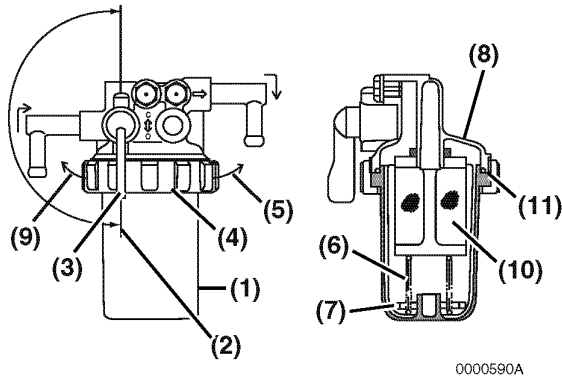


Figure 7

Drain the fuel filter / water separator as follows:

1. Position an approved container under the fuel filter / water separator (**Figure 7, (1)**) to collect the contaminants.
2. Close (**Figure 7, (2)**) the fuel cock (**Figure 7, (3)**).
3. Turn the retaining ring (**Figure 7, (4)**) to the left (**Figure 7, (9)**).
4. Carefully remove the cup (**Figure 7, (1)**). Remove the retaining spring (**Figure 7, (6)**) and float (**Figure 7, (7)**) from the cup. Pour the fuel into an approved container and dispose of waste properly. Hold the bottom of the cup with a shop towel to prevent the fuel from dripping. Wipe up any spills immediately. **NOTICE: ALWAYS be environmentally responsible.**
5. Clean the inside of the cup.
6. Inspect the condition of the mesh filter (**Figure 7, (10)**). Clean the mesh filter if necessary.
7. Inspect the condition of the O-ring (**Figure 7, (11)**). Replace the O-ring if necessary.
8. Put the float (**Figure 7, (7)**) and retaining spring (**Figure 7, (6)**) inside the cup.
9. Reinstall the cup to the mounting flange (**Figure 7, (8)**) and turn the retaining ring (**Figure 7, (4)**) to the right (**Figure 7, (5)**). Hand-tighten only.
10. Open the fuel cock (**Figure 7, (3)**).

11. Be sure to prime the diesel fuel system when you are done. See *Priming the Fuel System* on page 21.
12. Check for fuel leaks. **WARNING! NEVER check for a fuel leak with your hands. Have your authorized Yanmar Industrial engine dealer or distributor repair the damage.**

### Check Battery

**DANGER! NEVER check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge. If the electrolyte is frozen, slowly warm the battery before you recharge it.**

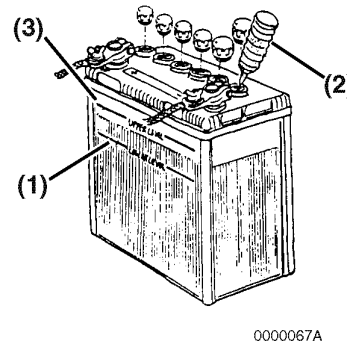


Figure 8

- When the amount of fluid nears the lower limit (**Figure 8, (1)**), fill with distilled water (**Figure 8, (2)**) until it is at the upper limit (**Figure 8, (3)**). **WARNING! If operation continues with insufficient battery fluid, the battery life is shortened, and the battery may overheat and explode.** If operation continues with insufficient battery fluid, the battery life is shortened, and the battery may overheat and explode. During the summer, check the fluid level more often than specified.
- If the engine cranking speed is so slow that the engine does not start, recharge the battery.
- If the engine still will not start after charging, have your authorized Yanmar Industrial engine dealer or distributor check the battery and the engine's starting system.

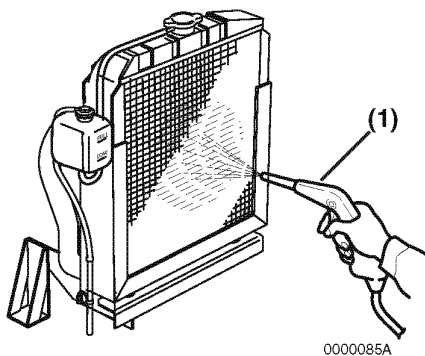
- If operating the machine where the ambient temperature could drop to 5°F (-15°C) or less, remove the battery from the machine at the end of the day. Store the battery in a warm place until the next use. This will help start the engine easily at low ambient temperatures.

### Check and Clean Radiator Fins

Dirt and dust adhering to the radiator fins reduces the cooling performance, causing overheating. Make it a rule to check the radiator fins daily and clean as needed.

Note that a typical radiator is shown in **Figure 9** for illustrative purposes only.

- Blow off dirt and dust from fins and radiator with 28 psi (0.19 MPa, 2 kgf/cm<sup>2</sup>) or less of compressed air (**Figure 9, (1)**). Be careful not to damage the fins with the compressed air.



**Figure 9**

**NOTICE:** NEVER use high-pressure water or compressed air at greater than 28 psi (193 kPa; 19 686 mmAq) or a wire brush to clean the radiator fins. Radiator fins damage easily.

- If there is a large amount of contamination on the fins, apply detergent, thoroughly clean and rinse with tap water.

## Every 250 Hours of Operation

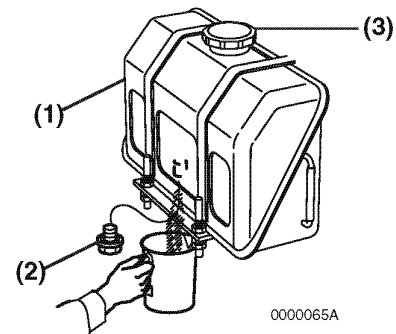
Perform the following maintenance every 250 hours of operation.

- **Drain Fuel Tank**
- **Replace Engine Oil and Engine Oil Filter**
- **Check and Adjust Cooling Fan V-Belt**
- **Check and Adjust the Governor Lever and Engine Speed Control**
- **Clean Air Cleaner Element**

### Drain Fuel Tank

Note that a typical fuel tank is illustrated.

1. Position an approved container under the diesel fuel tank (**Figure 10, (1)**) to collect the contaminants.



**Figure 10**

2. Remove the fuel cap (**Figure 10, (3)**).
3. Remove the drain plug (**Figure 10, (2)**) to drain the contaminants (water, dirt, etc.) from the bottom of the tank.
4. Drain the tank until clean diesel fuel with no water or dirt flows out. Reinstall and tighten the drain plug firmly.
5. Reinstall the fuel cap.
6. Check for leaks.

## PERIODIC MAINTENANCE

### Replace Engine Oil and Engine Oil Filter

Change the engine oil every 250 hours of operation after the initial change at 50 hours. Replace the engine oil filter at the same time.

See *Replace Engine Oil and Engine Oil Filter* on page 40.

### Check and Adjust Cooling Fan V-Belt

Check and adjust the cooling fan V-belt every 250 hours of operation after the initial 50 hour V-belt maintenance. See *Check and Adjust Cooling Fan V-Belt* on page 42.

### Check and Adjust the Governor Lever and Engine Speed Control

The governor lever and engine speed control (throttle lever, accelerator pedal etc.) are connected together by a cable or linkage. If the cable becomes stretched, or the linkage wears or loosens, the governor lever may not respond to a change in the position of the engine speed control.

See your authorized Yanmar Industrial dealer or distributor for the adjustment procedures for your specific engine or machine.

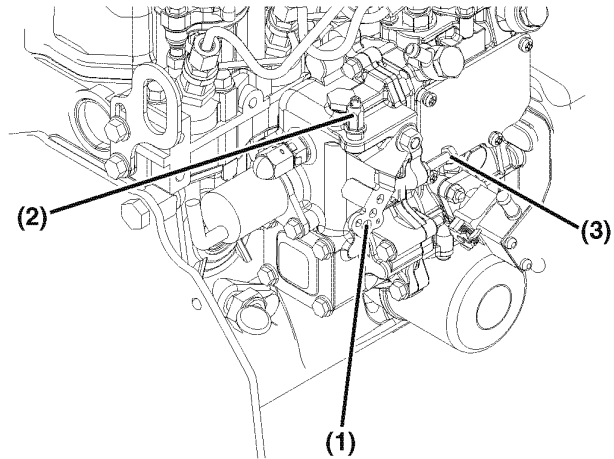
1. Check that the governor lever (**Figure 11, (1)**) makes firm contact with the high idle stop (**Figure 11, (2)**) and the low idle speed limit screw (**Figure 11, (3)**) when the engine speed control is in the full speed or low idle speed position.

*NOTICE: NEVER attempt to adjust the low or high idle speed limit screw:*

- This may impair the safety and performance of the machine and shorten its life.
  - If the idle speed limit screws require adjustment; see your authorized Yanmar Industrial engine dealer or distributor.
2. If the governor lever does not make proper contact with the high idle stop or the low idle speed limit screw, adjust the throttle cable or linkage as necessary.

*NOTICE: NEVER force the throttle cable or linkage to move. This may damage the governor lever, the throttle cable or linkage, and cause irregular operation of the engine speed control.*

*NOTICE: The engine speed control (throttle lever, accelerator pedal, etc.) should be equipped with stops to prevent the application of excessive pressure by the governor lever to either the high idle stop or low idle speed limit screw.*



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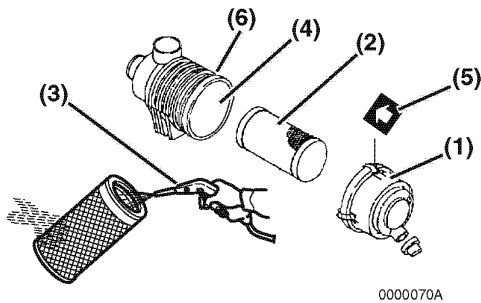
**Figure 11**



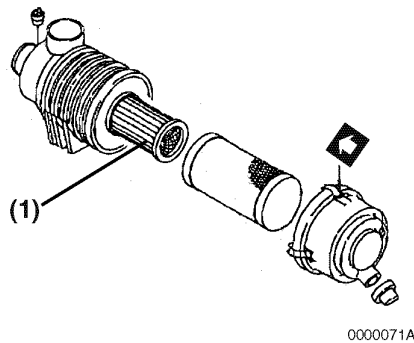
### Clean Air Cleaner Element

**NOTICE:** NEVER operate the engine with the air cleaner element(s) removed. When the engine is operated in dusty conditions, clean the air cleaner element more frequently.

Note: A typical air cleaner is shown in **Figure 12** and **Figure 13** for illustrative purposes only.



**Figure 12**



**Figure 13**

The engine performance is adversely affected when the air cleaner element is clogged with dust. Be sure to clean the air filter element periodically.

1. Unlatch and remove the air cleaner cover (**Figure 12, (1)**).
2. Remove the element (**Figure 12, (2)**) (outer element if equipped with two elements).

3. Blow air (**Figure 12, (3)**) through the element from the inside out using 42-71 psi (0.29-0.49 MPa, 3.0-5.0 kgf/cm<sup>2</sup>) compressed air to remove the particulates. Use the lowest possible air pressure to remove the dust without damaging the element.
4. If the air cleaner is equipped with a double element, only remove and replace the inner element (**Figure 13, (1)**) if the engine lacks power or the dust indicator actuates (if equipped).

**NOTICE:** The inner element should not be removed when cleaning or replacing the outer element. The inner element is used to prevent dust from entering the engine while servicing the outer element.

5. Replace the element with a new one if the element is damaged, excessively dirty or oily.
6. Clean inside of the air cleaner cover.
7. Reinstall the element into the air cleaner case (**Figure 12, (4)**).
8. Reinstall the air cleaner cover, making sure you match the arrow (**Figure 12, (5)**) on the cover with the arrow on the case (**Figure 12, (6)**).
9. Latch the air cleaner cover to the case.

## PERIODIC MAINTENANCE

### Every 500 Hours of Operation

Perform the following maintenance every 500 hours of operation.

- Replace Air Cleaner Element
- Replace Fuel Filter
- Clean Fuel Filter / Water Separator

#### Replace Air Cleaner Element

**NOTICE:** The maximum air intake restriction, in terms of differential pressure measurement, must not exceed 0.90 psi (6.23 kPa; 635 mmAq). Clean or replace the air cleaner element if the air intake restriction exceeds the above-mentioned value.

Replace the air cleaner element (**Figure 12, (2)**) every 500 hours even if it is not damaged or dirty.

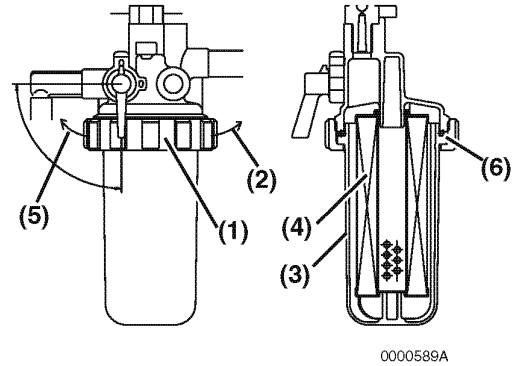
When replacing the element, clean the inside of the air cleaner case (**Figure 12, (4)**).

If the air cleaner is equipped with a double element, only remove and replace the inner element (**Figure 13, (1)**) if the engine lacks power or the dust indicator actuates (if equipped). This is in addition to replacing the outer element.

#### Replace Fuel Filter

Replace the fuel filter at specified intervals to prevent contaminants from adversely affecting the diesel fuel flow.

1. Stop the engine and allow it to cool.
2. Close the fuel cock of the fuel filter / water separator.
3. Turn the retaining ring (**Figure 14, (1)**) to the left (**Figure 14, (5)**).



**Figure 14**

4. Carefully remove the cup (**Figure 14, (3)**). Pour the fuel into an approved container and dispose of waste properly. Hold the bottom of the cup with a shop towel to prevent the fuel from dripping. Wipe up any spills immediately.
5. Remove the fuel filter (**Figure 14, (4)**) by pulling it down.
6. Replace the fuel filter with a new one.

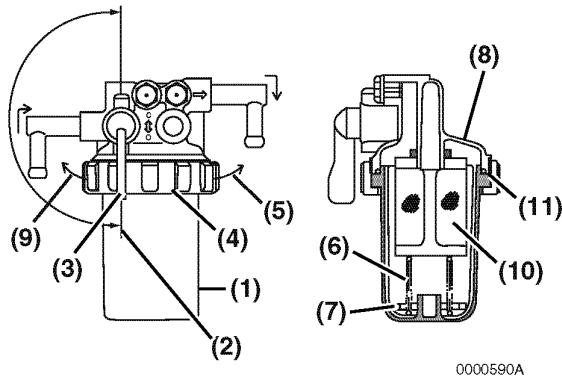
Applicable Fuel Filter Part No.		
	Standard	Dust-proof *
3TNM68	129053-55620	119802-55801
3TNM72		
* Consult the Operation Manual for the driven machine for the applicability of the dust-proof filter.		

7. Wash the inside of the cup.
8. Check the condition of the O-ring (**Figure 14, (6)**). Replace if necessary.
9. Install the cup to the mounting flange and turn the retaining ring (**Figure 14, (1)**) to the right (**Figure 14, (2)**). Hand-tighten only.
10. Open the fuel cock of the fuel filter / water separator.
11. Prime the fuel system. See *Priming the Fuel System* on page 21.
12. Check for fuel leaks.

**Clean Fuel Filter / Water Separator**

Periodically clean the fuel filter / water separator element and inside cup.

1. Position an approved container under the cup (**Figure 15, (1)**) of the fuel filter / water separator to collect the contaminants.



**Figure 15**

2. Close (**Figure 15, (2)**) the fuel cock (**Figure 15, (3)**).
3. Turn the retaining ring (**Figure 15, (4)**) to the left (**Figure 15, (9)**).
4. Carefully remove the cup (**Figure 15, (1)**). Remove the retaining spring (**Figure 15, (6)**) and float (**Figure 15, (7)**) from the cup. Pour the fuel into an approved container and dispose of waste properly. Hold the bottom of the cup with a shop towel to prevent the fuel from dripping. Wipe up any spills immediately.  
*NOTICE: ALWAYS be environmentally responsible.*
5. Clean the inside of the cup.
6. Remove the mesh filter (**Figure 15, (10)**) by pulling it down.
7. Replace the mesh filter with a new one.

Applicable Mesh Filter Part No.	
3TNM68	171081-55910
3TNM72	

8. Inspect condition of the O-ring (**Figure 15, (11)**). Replace if necessary.

9. Put the float (**Figure 15, (7)**) and retaining spring (**Figure 15, (6)**) inside the cup.
10. Install the cup to the mounting flange (**Figure 15, (8)**) and turn the retaining ring (**Figure 15, (4)**) to the right (**Figure 15, (5)**). Hand-tighten only.
11. Open the fuel cock (**Figure 15, (3)**).
12. Prime the fuel system. See *Engine Oil Specifications* on page 22.
13. Check for fuel leaks.

## PERIODIC MAINTENANCE

### Every 1000 Hours of Operation

Perform the following maintenance every 1000 hours of operation.

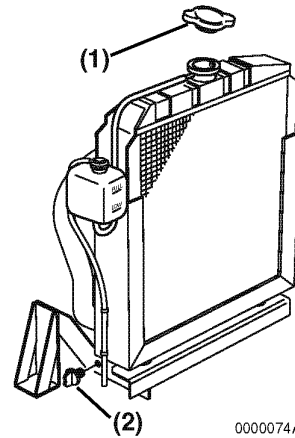
- Drain, Flush and Refill Cooling System with New Coolant
- Adjust Intake / Exhaust Valve Clearance

### Drain, Flush and Refill Cooling System with New Coolant

*NOTICE: Drain, flush and refill the cooling system with new coolant every 1000 hours or once a year, whichever comes first.*

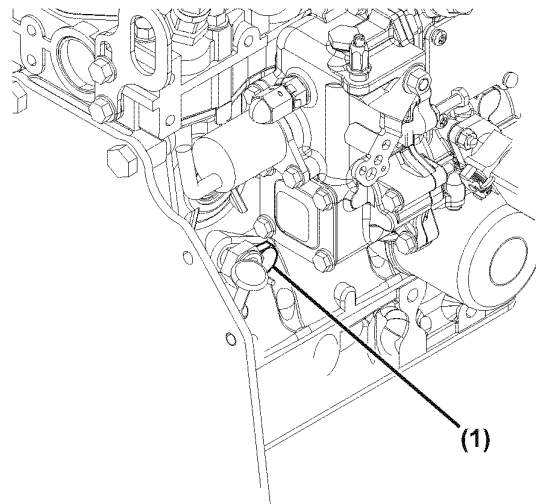
Engine coolant contaminated with rust or water scale reduces the cooling effect. Even when extended life engine coolant is properly mixed, the engine coolant gets contaminated as its ingredients deteriorate.

1. Allow engine and coolant to cool. **WARNING! NEVER drain the engine coolant while the engine is hot.** Wait until the engine cools before you drain the engine coolant.
2. Remove the radiator cap (**Figure 16, (1)**). **WARNING! NEVER remove the radiator cap if the engine is hot. Steam and hot engine coolant will spray out and seriously burn you. Allow the engine to cool down before you attempt to remove the radiator cap.**  
*NOTICE: Prevent dirt and debris from contaminating the engine coolant. Carefully clean the radiator cap and the surrounding area before you remove the cap.*
3. Remove the drain plug or open the drain cock (**Figure 16, (2)**) at the bottom of the radiator and drain the engine coolant.



**Figure 16**

4. Drain the coolant from the engine block.
  - On models not equipped with an oil cooler, remove the coolant drain plug (**Figure 17, (1)**) from the engine block.



**Figure 17**

5. After draining the engine coolant, flush the radiator and engine block to remove any rust, scale and contaminants. Then, reinstall and tighten the drain plug or close the drain cock in the radiator. Reinstall and tighten the engine block drain plug or reconnect the coolant hose at the oil cooler.

6. Fill radiator and engine with engine coolant. See *Filling Radiator with Engine Coolant* on page 24. **WARNING! ALWAYS tighten the radiator cap securely after you check the radiator. Steam can escape during engine operation if the cap is loose.**

### **Adjust Intake / Exhaust Valve Clearance**

Proper adjustment is necessary to maintain the correct timing for opening and closing the valves. Improper adjustment will cause the engine to run noisily, resulting in poor engine performance and engine damage. See your authorized Yanmar Industrial engine dealer or distributor to adjust the intake / exhaust valve clearance.

### **Every 1500 Hours of Operation**

Perform the following maintenance every 1500 hours of operation.

- **Inspect, Clean and Test Fuel Injectors, if necessary**
- **Inspect Crankcase Breather System**

### **Inspect, Clean and Test Fuel Injectors**

Proper operation of the fuel injectors is required to obtain the optimum injection pattern for full engine performance. The EPA / CARB requires that you have the injectors inspected, cleaned and tested every 1500 hours. See your authorized Yanmar Industrial engine dealer or distributor for this service.

This procedure is considered normal maintenance and is performed at the owner's expense. This procedure is not covered by the Yanmar Limited Warranty.

### **Inspect Crankcase Breather System**

Proper operation of the crankcase breather system is required to maintain the emission requirements of the engine. The EPA / CARB requires that you have the crankcase breather system inspected every 1500 hours. See your authorized Yanmar Industrial engine dealer or distributor for this service.

## PERIODIC MAINTENANCE

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### Every 2000 Hours of Operation

Perform the following maintenance every 2000 hours of operation.

- **Check and Replace Fuel Hoses and Engine Coolant Hoses**
- **Lap the Intake and Exhaust Valves (if required)**

#### **Check and Replace Fuel Hoses and Engine Coolant Hoses**

**WARNING!** *Replace rubberized fuel hoses every 2 years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after 2 years or 2000 hours of engine operation, whichever comes first.*

Regularly check the fuel system and engine coolant system hoses. If they are cracked or degraded, replace them. Replace the hoses at least every 2 years. See your authorized Yanmar Industrial engine dealer or distributor to replace fuel hoses and engine coolant system hoses.

#### **Lap the Intake and Exhaust Valves**

Periodic adjustment is necessary to maintain proper valve to valve seat contact. See your authorized Yanmar Industrial engine dealer or distributor to lap the valve seats.

# TROUBLESHOOTING

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The following section provides basic troubleshooting procedures for the TNM engine series.

Before performing any troubleshooting procedures, read the following safety information and review the *Safety section starting on page 1*.

## CAUTION

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

During engine operation, if a problem occurs or any indicator illuminates, stop the engine immediately. Refer to the SYMPTOM column in the Troubleshooting Chart to identify the problem.

## NOTICE

If any indicator fails to illuminate when the key switch is in the ON position, see your authorized Yanmar Industrial engine dealer or distributor for service before operating the engine.

## TROUBLESHOOTING INFORMATION

If your engine does not operate properly, refer to the troubleshooting chart or consult your authorized Yanmar Industrial engine dealer or distributor.

Supply the authorized Yanmar Industrial engine dealer or distributor with the following information:

- Model name and serial number of your engine
- The driven machine type (tractor, generator, skid steer loader), manufacturer's name, model and serial number
- How long the engine has been in service (the number of engine hours or the number of calendar months)
- Operating conditions when problem occurs:
  - Engine RPM
  - Color of exhaust smoke
  - Type of diesel fuel
  - Type of engine oil
  - Any abnormal noises or vibration
- Operating environment, such as high altitude or extreme ambient temperatures, etc.
- Engine maintenance history and previous problems
- Other factors that contribute to the problem

# TROUBLESHOOTING

## TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
<b>Indicator Turns On - Engine Running</b>			
Engine oil pressure indicator	Low level of engine oil	Check and adjust oil level as necessary.	<i>Checking Engine Oil on page 23</i>
	Too high an oil level		
	Clogged engine oil filter	Replace engine oil filter.	<i>Replace Engine Oil and Engine Oil Filter on page 40</i>
<b>Indicator Turns On - Engine Running</b>			
Engine coolant indicator	Low engine coolant level	Add engine coolant.	<i>Filling Radiator with Engine Coolant on page 24</i>
	Dirty radiator fins	Clean the radiator fins.	<i>Check and Clean Radiator Fins on page 45</i>
	Engine coolant leaking	See authorized Yanmar Industrial engine dealer or distributor.	—
	V-belt loose or damaged	Adjust V-belt or replace.	<i>Check and Adjust Cooling Fan V-Belt on page 42</i>
	Contaminated engine coolant	See authorized Yanmar Industrial engine dealer or distributor.	—
	Faulty engine coolant pump		—
Battery Indicator	V-belt loose or damaged	Adjust V-belt or replace.	<i>Check and Adjust Cooling Fan V-Belt on page 42</i>
	Battery failure	Check battery condition.	<i>Check Battery on page 44</i>
	Faulty alternator	See authorized Yanmar Industrial engine dealer or distributor.	—
<b>Indicator does not turn ON - Key Switch is Turned to ON (OFF→ ON) - Engine not Running</b>			
	Faulty electrical wiring or faulty indicator	See authorized Yanmar Industrial engine dealer or distributor.	—



## TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
<b>Indicator Stays On - Key Switch is Turned from Start to ON (START → ON) - Engine not Running</b>			
Battery indicator stays ON.	Faulty alternator	See authorized Yanmar Industrial engine dealer or distributor.	—
Engine oil pressure indicator stays ON.	Faulty engine oil pressure switch		—
	Low level of engine oil	Check and adjust oil level as necessary.	<i>Checking Engine Oil on page 23</i>
	Clogged engine oil filter	Replace engine oil filter.	<i>Replace Engine Oil and Engine Oil Filter on page 40</i>
<b>Engine does not Start</b>			
Starter motor operates but engine does not start.	No diesel fuel	Refuel and prime fuel system.	<i>Filling the Fuel Tank on page 21</i>
	Air in fuel system	Prime fuel system.	<i>Priming the Fuel System on page 21</i>
	Improper diesel fuel	Replace with recommended diesel fuel.	<i>Diesel Fuel Specifications on page 19</i>
	Clogged fuel filter	Replace fuel filter.	<i>Replace Fuel Filter on page 48</i>
	Poor fuel injection	See authorized Yanmar Industrial engine dealer or distributor.	—
	Compressed air leakage from intake / exhaust valves		—
	Faulty engine stop solenoid		—
Starter motor does not operate or rotates too slowly (engine can be turned manually).	Battery needs charging	Check electrolyte, recharge.	<i>Check Battery on page 44</i>
	Faulty cable connection at battery terminals	Clean terminals, retighten.	—
	Faulty starter switch	See authorized Yanmar Industrial engine dealer or distributor.	—
	Faulty starter motor		—
Engine cannot be manually turned.	Inner parts seized or damaged		—

## TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	ACTION	REFER TO
<b>White or Black Exhaust Smoke</b>			
Black exhaust smoke	Engine overloaded	Reduce load.	—
	Clogged air cleaner element	Clean element or replace.	<i>Clean Air Cleaner Element on page 47</i>
	Improper diesel fuel	Replace with recommended diesel fuel.	<i>Diesel Fuel Specifications on page 19</i>
	Faulty spraying of fuel injection	See authorized Yanmar Industrial engine dealer or distributor.	—
	Excessive intake / exhaust valve clearance		—
White exhaust smoke	Improper diesel fuel	Replace with recommended diesel fuel.	<i>Diesel Fuel Specifications on page 19</i>
	Faulty spray pattern of fuel injection	See authorized Yanmar Industrial engine dealer or distributor.	—
	Fuel injection timing delay		—
	Engine burning oil		—

# LONG-TERM STORAGE

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This section of the *Operation Manual* describes the procedures necessary to place the engine into long-term storage (six months or longer) and how to place it back into operation.

Before performing storage or maintenance procedures, review the *Safety section starting on page 1*.

## BEFORE YOU PLACE THE ENGINE IN LONG-TERM STORAGE

Before placing the engine in long-term storage, perform the next scheduled preventive maintenance procedure. For example, if there are 10 hours remaining before the 250 hour maintenance, you should perform the maintenance before you place the engine in storage.

*See Periodic Maintenance Schedule on page 38.*

1. Flush the radiator and refill with Long Life Engine Coolant. *See Engine Coolant Specifications on page 24* for engine coolant specifications and *See Filling Radiator with Engine Coolant on page 24* for the procedure for draining and refilling the cooling system.
2. Clean the exterior of the engine so it is free of grease and oil.

*NOTICE: Protect the air cleaner, turbocharger (if equipped) and electric components from damage when you use steam or high-pressure water to clean the engine.*

3. Drain the fuel tank or make sure it is completely full. *See Filling the Fuel Tank on page 21.*
4. Lubricate exposed parts of the engine speed control system.
5. Protect the air cleaner, muffler and electrical components (alternator, starter motor, switches) from water and dust.
6. Disconnect the negative (-) battery cable to prevent the battery from discharging.
7. Check the battery fluid and add distilled water as required. *See Check Battery on page 44.*
8. Charge the battery once a month during storage.
9. Rotate the engine without starting, every 4 to 6 months.

## LONG-TERM STORAGE

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### RETURNING THE ENGINE TO SERVICE

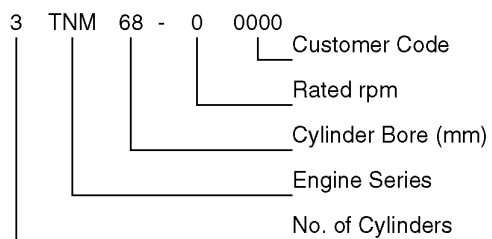
1. Perform the *Daily Checks on page 26*.
2. The engine should be pre-oiled before start-up. Crank the engine, leaving the fuel system shut off so the engine will not start, for 15 seconds. Then, pause for 30 seconds. Repeat the procedure until you have cranked the engine for a total of 1 minute. This will circulate the oil in the engine's lubrication system.
3. Prime the fuel system. *See Priming the Fuel System on page 21*.
4. Start the engine. Allow the engine to idle for approximately 15 minutes while you check for:
  - Proper oil pressure
  - Fuel, engine oil or coolant leaks
  - Proper operation of the indicators and / or gauges
5. Avoid prolonged operation at minimum or maximum engine speeds and loads for the remainder of the first hour of operation.

# SPECIFICATIONS

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## GENERAL

### Description of Model Number



# SPECIFICATIONS

## Engine Speed Specifications

Notation	Available Engine Speed	Intended Uses
VH (Variable High Speed)	3200 - 3600 rpm (min <sup>-1</sup> )	Lawn Mower, Construction, Industrial Machine
VM (Variable Medium Speed)	2000 - 3000 rpm (min <sup>-1</sup> )	Agricultural, Construction, Industrial Machines
CH (Constant High Speed)	3000 - 3600 rpm (min <sup>-1</sup> )	2-pole Generator Sets, Irrigation Pumps
CL (Constant Low Speed)	1500 or 1800 rpm (min <sup>-1</sup> )	4-pole Generator Sets, Irrigation Pumps

## Engine General Specifications

Type	Vertical In-line, Water Cooled, 4-Cycle Diesel Engine	
Combustion System	Indirect Injection	Swirl Chamber (Ball-Type)
Starting System	Electric Starting	
Cooling System	Radiator	
Lubricating System	Forced Lubrication with Trochoid Pump	
PTO Position	Flywheel End	
Direction of Rotation	Counterclockwise Viewed from Flywheel End	

Note:

1. The information described in *Principal Engine Specifications* is for a “standard” engine. To obtain the information for the engine installed in your driven machine, please refer to the manual provided by the driven machine manufacturer.
2. Engine rating conditions are as follows (SAE J1349, ISO 3046/1):
  - Atmospheric condition: room temperature 77°F (25°C), atmospheric pressure 29.53 in. Hg (100 kPa, 750 mm Hg), relative humidity 30%
  - Fuel temperature at fuel injector pump inlet: 104°F (40°C)
  - With cooling fan, air cleaner, muffler: Yanmar standard
  - After the engine break-in period. Output allowable deviation: ± 3%
  - 1 PS = 0.7355 kW
  - 1 hp SAE (Society of Automotive Engineers) = 0.7457 kW

PRINCIPAL ENGINE SPECIFICATIONS

3TNM68 (EPA Tier 4)

Engine Model		3TNM68												
Version		CL			VM					CH		VH		
Type		Vertical In-line Diesel Engine												
Combustion System		Ball-Type Swirl Chamber												
Aspiration		Natural												
No. of Cylinders		3												
Bore × Stroke		2.67 × 2.83 in. (68 × 72 mm)												
Displacement		47.8 cu in. (0.784 L)												
Continuous Rated Output	rpm (min <sup>-1</sup> )	1500	1800						3000	3600				
	hp SAE	7.3	8.8						14.8	17.8				
	kW	5.5	6.6						11.1	13.3				
	PS	7.5	9.0						15.1	18.0				
Max. Rated Output (Net)	rpm (min <sup>-1</sup> )	1500	1800	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600
	hp SAE	8.1	9.7	10.9	12.2	13.4	14.4	15.6	16.8	16.3	19.5	17.1	18.1	18.9
	kW	6.1	7.3	8.2	9.1	10.0	10.8	11.7	12.6	12.2	14.6	12.8	13.5	14.1
	PS	8.3	10.0	11.1	12.3	13.6	14.7	15.9	17.1	16.6	19.9	17.4	18.3	19.2
High Idling	rpm (min <sup>-1</sup> ) ± 25	1600	1900	2185	2380	2595	2805	3020	3235	3175	3770	3415	3630	3840
Engine Weight (Dry) with Flywheel Housing*		229 lb (104 kg) SAE#5			174 lb (79 kg)					229 lb (104 kg)		174 lb (79 kg)		
PTO Position		Flywheel End												
Direction of Rotation		Counterclockwise Viewed from Flywheel End												
Cooling System		Liquid-Cooled with Radiator												
Lubricating System		Forced Lubrication with Trochoid Pump												
Normal Oil Pressure at Rated Engine Speed		34.8 - 63.8 psi (0.240 - 0.440 MPa, 2.4 - 4.4 kgf/cm <sup>2</sup> )												
Normal Oil Pressure at Low Idle Speed		8.5 psi (0.06 MPa, 0.6 kgf/cm <sup>2</sup> ) or greater												
Starting System***		Electric Starting - Starter Motor: DC12V, 1.6 hp (1.2 kW)												
		Dynamo: DC12V, 20A												
		Recommended Battery Capacity: 12V, 36 Amp-Hour (5h rating)												
Dimensions (L × W × H)*		20.4 × 16.3 × 19.6 in. (520 × 416 × 500 mm)			19.0 × 16.3 × 19.6 in. (483 × 416 × 500 mm)					20.4 × 16.3 × 20.7 in. (520 × 416 × 528 mm)		16.9 × 16.3 × 19.6 in. (431 × 416 × 500 mm)		
Engine Oil Pan Capacity**		2.6 / 1.4 qt (2.5 / 1.3 L) (Dipstick Upper Limit / Lower Limit)							3.4 / 1.8 qt (3.2 / 1.7 L) (Dipstick Upper Limit / Lower Limit)			2.6 / 1.4 qt (2.5 / 1.3 L) (Dipstick Upper Limit / Lower Limit)		
Engine Coolant Capacity		0.26 gal (1.0 L) Engine Only												
Standard Cooling Fan***		11.4 in. (290 mm) O.D., 5 Blade Pusher-Type												
Crank / Fan V-pulley Dia.***		3.9 / 3.5 in. (100 mm / 90 mm)												

\* Engine specifications without radiator

\*\* Engine oil capacity for a "Deep Standard" oil pan. Refer to the Operation Manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

\*\*\* May vary depending on application

# SPECIFICATIONS

## 3TNM72 (EPA Tier 4)

Engine Model	3TNM72														
Version	CL			VM					CH		VH				
Type	Vertical In-line Diesel Engine														
Combustion System	Ball-Type Swirl Chamber														
Aspiration	Natural														
No. of Cylinders	3														
Bore x Stroke	2.83 x 2.91 in. (72 x 74 mm)														
Displacement	55.1 cu in. (0.904 L)														
Continuous Rated Output	rpm (min <sup>-1</sup> )	1500	1800						3000	3600					
	hp SAE	8.8	10.4						17.7	21.3					
	kW	6.6	7.8						13.2	15.9					
	PS	9.0	10.6						17.9	21.6					
Max. Rated Output (Net)	rpm (min <sup>-1</sup> )	1500	1800	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600	
	hp SAE	9.7	11.5	12.7	14.2	15.6	16.8	18.2	19.7	19.4	23.4	20.9	22.1	23.6	
	kW	7.3	8.6	9.5	10.6	11.7	12.6	13.6	14.7	14.5	17.5	15.6	16.5	17.6	
	PS	9.9	11.7	12.9	14.4	15.9	17.1	18.5	20.0	19.7	23.8	21.2	22.4	23.9	
High Idling	rpm (min <sup>-1</sup> ) ± 25	1600	1900	2185	2380	2595	2805	3020	3235	3175	3770	3415	3630	3840	
Engine Weight (Dry) with Flywheel Housing*		242 lb (110 kg) SAE#5			205 lb (93 kg)					242 lb (110 kg) SAE#5		187 lb (85 kg)			
PTO Position	Flywheel End														
Direction of Rotation	Counterclockwise Viewed from Flywheel End														
Cooling System	Liquid-Cooled with Radiator														
Lubricating System	Forced Lubrication with Trochoid Pump														
Normal Oil Pressure at Rated Engine Speed	34.8 - 63.8 psi (0.240 - 0.440 MPa, 2.4 - 4.4 kgf/cm <sup>2</sup> )														
Normal Oil Pressure at Low Idle Speed	8.5 psi (0.06 MPa, 0.6 kgf/cm <sup>2</sup> ) or greater														
Starting System***	Electric Starting - Starter Motor: DC12V, 1.6 hp (1.2 kW)														
	Dynamo: DC12V, 20A														
	Recommended Battery Capacity: 12V, 36 Amp-Hour (5h rating)														
Dimensions (L x W x H) <sup>†</sup>	19.5 x 16.8 x 21.3 in. (497 x 427 x 542 mm)														
Engine Oil Pan Capacity**	3.1 / 1.7 qt (2.9 / 1.6 L) (Dipstick Upper Limit / Lower Limit)								4.1 / 2.2 qt (3.9 / 2.1 L) (Dipstick Upper Limit / Lower Limit)		3.3 / 1.9 qt (3.1 / 1.8 L) (Dipstick Upper Limit / Lower Limit)				
Engine Coolant Capacity	0.26 gal (1.0 L) Engine Only														
Standard Cooling Fan***	12.2 in. (310 mm) O.D., 5 Blade Pusher-Type														
Crank / Fan V-pulley Dia.***	3.9 / 3.5 in. (100 mm / 90 mm)														

\* Engine specifications without radiator

\*\* Engine oil capacity for a "Deep Standard" oil pan. Refer to the Operation Manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

\*\*\* May vary depending on application



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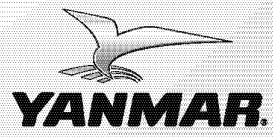
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