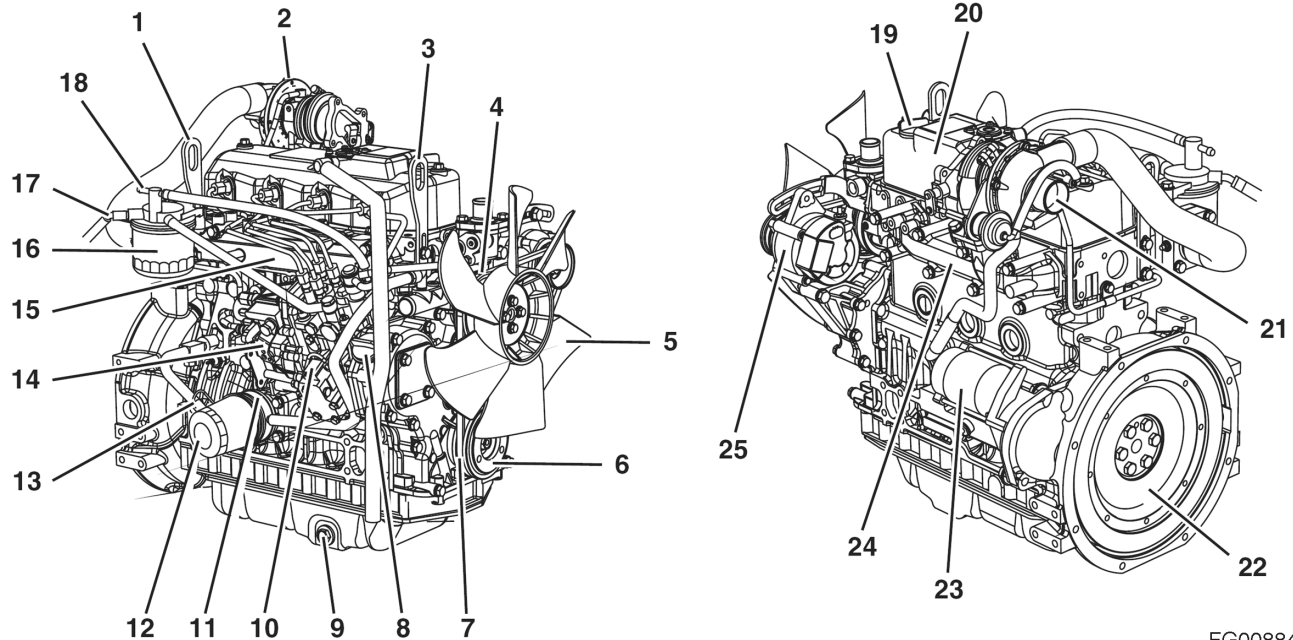


GENERAL SERVICE INFORMATION

Component Identification



FG008847

Figure 31

Reference Number	Description
1	Lifting Eye (Flywheel End)
2	Turbocharger*
3	Lifting Eye (Engine Cooling Fan End)
4	Engine Coolant Pump
5	Engine Cooling Fan
6	Crankshaft V-Pulley
7	V-Belt
8	Side Filler Port (Engine Oil)
9	Drain Plug (Engine Oil)**
10	Fuel Injection Pump
11	Engine Oil Cooler***
12	Engine Oil Filter
13	Dipstick (Engine Oil)

Reference Number	Description
14	Governor Lever
15	Intake Manifold
16	Fuel Filter
17	Fuel Inlet
18	Fuel Return to Fuel Tank
19	Top Filler Port (Engine Oil)
20	Rocker Arm Cover
21	Air Intake Port (From Air Cleaner)
22	Flywheel
23	Starter Motor
24	Exhaust Manifold
25	Alternator

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. "Periodic Maintenance Schedule" on page 1-66 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 12 VDC. It must be installed on every application. This is standard equipment with every engine.
Engine Oil Filter	The engine oil filter removes contaminants and sediments from the engine oil. Periodic replacement of the engine oil filter is necessary. "Periodic Maintenance Schedule" on page 1-66 for the replacement frequency.
Engine Oil Cooler (If Equipped)	The engine oil cooler helps to keep the engine oil cool. Engine coolant from the cooling system is circulated through an adapter at the base of the engine oil filter assembly and then returned to the cylinder block.
Fuel Filter	The fuel filter removes contaminants and sediments from the diesel fuel. Periodic replacement of the fuel filter is necessary. "Periodic Maintenance Schedule" on page 1-66 for the replacement frequency. Please note that the word "diesel" is implied throughout this manual when the word "fuel" is used.
Fuel Filter / Water Separator	The fuel filter / water separator removes contaminants, sediments and water from the diesel fuel going to the fuel filter. This is a required component of the fuel system. This is standard equipment with every engine. The separator is installed between the fuel tank and the electric fuel pump. Periodically drain the water from the fuel filter / water separator.
Fuel Tank	The fuel tank is a reservoir that holds diesel fuel. When the fuel leaves the fuel tank it goes to the fuel filter / water separator. Next the fuel is pumped to the fuel filter by the electric fuel pump. Then the fuel goes to the fuel injection pump. Since the 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 the excess fuel to be returned back to the fuel tank. The fuel tank is a required engine component.
Side and Top Filler Port (Engine Oil)	You can fill the crankcase with engine oil from either the side or the top filler port depending upon 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.
Turbocharger	The turbocharger pressurizes the air coming into the engine. It is driven by a turbine that is energized by exhaust gases.

Function of Cooling System Components

Components	Functions
Cooling System	The TNV 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. 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.
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 the 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 the 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 the 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 the 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.

Diesel Fuel

Diesel Fuel Specifications

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

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

Additional Technical Fuel Requirements

The fuel cetane number should be equal to 45 or higher.

The sulfur content must not exceed 0.5% by volume. Less than 0.05% is preferred.

Bio-Diesel fuels. "Bio-Diesel Fuels" on page 1-37.

Never mix kerosene, used engine oil, or residual fuels with the diesel fuel.

The water and sediment in the fuel should not exceed 0.05% by volume.

Keep the fuel tank and fuel-handling equipment clean at all times.

Poor quality fuel can reduce engine performance and / or cause engine damage.

Fuel additives are not recommended. Some fuel additives may cause poor engine performance. Consult your Yanmar representative for more information.

The ash content must not exceed 0.01% by volume.

The carbon residue content must not exceed 0.35% by volume. Less than 0.1% is preferred.

The total aromatics content should not exceed 35% by volume. Less than 30% is preferred.

The PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.

The metal content of Na, Mg, Si, and Al should be equal to or lower than 1 mass ppm. (Test analysis method JPI-5S-44-95)

Lubricity: The wear mark of WS1.4 should be Max. 0.018 in (460 µm) at HFRR test.

Bio-Diesel Fuels

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

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

These B5 diesel fuels must meet certain requirements.

The bio-fuels must meet the minimum specifications for the country in which they are used.

1. In Europe, bio-diesel fuels must comply with the European Standard EN14214.
2. In the United States, bio-diesel fuels must comply with the American Standard ASTM D-6751.

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.

 **DANGER!**

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.

Never refuel with the engine running.

Wipe up all spills immediately.

Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) well away when refueling.

Never overfill the fuel tank.

Fill the fuel tank. Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.

Failure to comply will result in death or serious injury.



HDO1015I

Figure 32

 **DANGER!**

Fire And Explosion Hazard!

Diesel fuel is extremely flammable and explosive under certain conditions.

Be sure to place the diesel fuel container on the ground when transferring the diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. 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.

Failure to comply will result in death or serious injury.



HDO1015I

Figure 33

 **CAUTION!**

Only use diesel fuels recommended by Yanmar for the best engine performance, to prevent engine damage and to comply with EPA / ARB warranty requirements.

Only use clean diesel fuel.

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.
