

Summary Report for Individual Task
551-88L-3059
Troubleshoot a Diesel Engine
Status: Approved

Distribution Restriction: Approved for public release; distribution is unlimited.

Destruction Notice: None

Foreign Disclosure: FD5 - This product/publication has been reviewed by the product developers in coordination with the [installation/activity name] foreign disclosure authority. This product is releasable to students from all requesting foreign countries without restrictions.

Condition: Given a diesel engine, aboard a vessel, at sea, at anchor or moored alongside a pier, day or night, under all sea and weather conditions, wearing appropriate PPE, (i.e. hearing protection, eye protection, etc.), lock out tag out kit and a marine rail tool box.

Standard: The Soldier correctly conducts troubleshooting procedures of a diesel engine aboard an Army vessel, IAW the appropriate Technical Manual and local SOPs, without injury to self or others and without damage to equipment.

Special Condition: None

Safety Risk: Extremely High

MOPP 4:

Task Statements

Cue: None

DANGER
None

WARNING
None

CAUTION
None

Remarks: None

Notes: None

Performance Steps

1. Demonstrate basic knowledge for troubleshooting procedures of the diesel engine.

a. The engine operator must be constantly alert to detect any symptoms which might indicate the existence of trouble.

b. Forewarning is often given in the form of sudden or abnormal changes in the supply, temperature, or pressure of the lubricating oil or cooling water.

c. Color and temperature of exhaust afford warning of abnormal conditions and should be checked frequently.

d. Fuel, oil, and water leaks are an indication of possible troubles; keep the engine clean to make such leaks easier to spot.

2. Perform troubleshooting procedures of a diesel engine.

a. Noises

(1) Unusual noises which may indicate that a trouble exists or is impending may be classified as pounding, knocking (denotation), clicking, and rattling.

(2) Each type of noise must be associated with certain engine parts or systems which may be the source of trouble.

(a) Pounding

1 Pounding is a mechanical knock or hammering (not to be confused with a fuel knock).

2 It may be caused by a loose, excessively worn, or broken engine part.

3 Generally, troubles of this nature will require major repairs.

(b) Knocking (Detonation)

1 Knocking (detonation) is caused by the presence of fuel or lubricating oil in the air charge of the cylinders during the compression stroke.

2 Excessive pressures accompany detonation; if detonation is occurring in one or more cylinders, an engine should be stopped immediately to prevent possible damage.

(c) Clicking

1 Clicking noises are generally associated with an improperly functioning valve mechanism or timing gear.

2 If the cylinder or valve mechanism is the source of metallic clicking, the trouble may be due to a number of following factors:

a Loose valve stem and guide.

b Insufficient or excessive valve tappet clearances.

c Loose cam follower or guide.

d Broken valve springs.

e A valve that is stuck open.

Note:

A clicking in the timing gear usually indicates that there are some damaged or broken gear teeth.

(d) Rattling

1 Rattling noises are generally due to vibration of loose engine parts; however, other sources of trouble exist when rattling noises occur.

2 These are an improperly functioning vibration damper, a failed antifriction bearing, or a gear pump operating without prime.

Note: When you hear a noise, first make sure that it is a trouble symptom. Each diesel engine has a characteristic noise at any specific speed and load. The noise will change with a change in speed or load. As an operator, you must become familiar with the normal sounds of an engine. Abnormal sounds must be investigated promptly. Knocks which indicate a trouble may be detected and located by special instruments or by the use of a "sounding bar" such as a solid iron screwdriver or bar.

NOISES	INSTRUMENT INDICATIONS			SMOKE	CONTAMINATION OF LUBE OIL, FUEL, OR WATER
	PRESSURE	TEMPERATURE	SPEED		
Pounding (mechanical)	Low lube oil High lube oil pressure	Low lube oil temperature High lube oil temperature	Idling speed not normal Maximum speed not normal	Black exhaust smoke Bluish-white exhaust smoke	Fuel oil in the lube oil Water in the lube oil
Knocking (detonation)	Low fuel oil pressure (in low-pressure fuel supply system)	Low cooling water temperature (fresh)		Smoke arising from crankcase	Oil or grease in the water Water in the fuel oil
Clicking (metallic)	Low cooling water pressure (fresh) Low cooling water pressure (salt)	High cooling water temperature (fresh) Low cylinder exhaust temperature		Smoke arising from cylinder head Smoke from engine auxiliary equipment (blower, pumps, and so on)	Air or gas in the water Metal particles in lube oil
Rattling	High cooling water pressure (salt) Low compression pressure Low-firing pressure High-firing pressure Low scavenging-air receiver pressure (supercharged engine) High exhaust back pressure	High exhaust temperature in one cylinder			

Symptoms of Engine Trouble
Figure 551-88L-3059_01

b. Smoke

(1) The presence of smoke can be an aid in locating some types of trouble, especially if used in conjunction with other trouble symptoms.

Note: The color of exhaust smoke can also be used as a guide in troubleshooting. The color of engine exhaust is a good general indication of engine performance. The exhaust of an efficiently operating engine has little or no color. A dark, smoky exhaust indicates incomplete combustion. The darker the color, the greater the amount of unburned fuel in the exhaust. Incomplete combustion may be due to a number of troubles. Some manufacturers associate a particular type of trouble with the color of the exhaust. More serious troubles are generally identified with either black or bluish-white exhaust colors.

(2) Abnormal Exhaust Colors

(a) Replace parts causing high exhaust back pressure.

Note: High exhaust back pressure or a restricted air inlet causes insufficient air for combustion and will result in incompletely burned fuel. High exhaust back pressure is caused by faulty exhaust piping or muffler obstruction and is measured at the exhaust manifold outlet with a manometer.

(b) Clean the items that restrict air inlet to engine cylinders such as clogged cylinder liner ports, air cleaner, or blower air inlet screen.

(c) Check emergency stop to see that it is completely open and readjust if necessary.

(d) Check for improperly timed injectors and improperly positioned injector rack control levers.

(e) Time fuel injectors and perform appropriate governor to correct this condition.

1 Replace faulty injectors if this condition still persists after timing injectors and performing engine tune-up.

2 Lugging the engine will cause incomplete combustion and should be avoided.

(f) Check for use of an improper grade of fuel. Consult the fuel oil specifications for correct fuel to use.

(g) Check for internal lubricating oil leaks.

(h) Check for faulty injectors and replace as necessary.

c. Excessive consumption of lube oil, fuel, or water

Note: The possible troubles signified by excessive consumption depend on the system in question. However, leakage is one trouble which may be common to all. Before starting any disassembly, check for leaks in the system in which excessive consumption occurs.

(1) High Lubricating Oil Consumption.

(a) Tighten or replace parts.

(b) Replace defective gaskets or oil seals.

(c) Remove air inlet housing and inspect blower end plates while engine is operating.

Note: If oil is seen on the end plate radiating away from the oil seal, overhaul the blower.

(d) Check engine coolant for lubricating oil contamination.

Note: If contaminated, inspect oil cooler core and replace if necessary. Then use a good grade of cooling system cleaner to remove oil from the cooling system.

- (e) Replace oil control rings on piston.
- (f) Replace piston pin retainer and defective parts.
- (g) Remove and replace defective parts.
- (h) Check crankshaft thrust washers for wear; replace all worn and defective parts.
- (i) Decrease installation angle.
- (j) Fill crankcase to proper level only.

(2) An operator should be aware of engine trouble whenever excessive consumption of any of the essential liquids occurs.

(Asterisks indicates a leader performance step.)

Evaluation Guidance: None

Evaluation Preparation: None

PERFORMANCE MEASURES	GO	NO-GO	N/A
1. Demonstrated basic knowledge for troubleshooting procedures of the diesel engine.			
a. Abnormal changes in the supply, temperature, or pressure of the lubricating oil or cooling water.			
b. Checked color and temperature of exhaust.			
c. Checked for fuel, oil, and water leaks.			
2. Performed troubleshooting procedures of a diesel engine.			
a. Unusual noises such as;			
(1) Pounding			
(2) Knocking (Detonation)			
(3) Clicking			
(4) Rattling			
b. The color of exhaust smoke.			
(1) Abnormal Exhaust Colors			
(2) Excessive consumption of lube oil, fuel, or water			

Supporting Reference(s):

Step Number	Reference ID	Reference Name	Required	Primary
	TC 55-509	MARINE ENGINEMAN'S HANDBOOK	No	No

Environment: Environmental protection is not just the law but the right thing to do. It is a continual process and starts with deliberate planning. Always be alert to ways to protect our environment during training and missions. In doing so, you will contribute to the sustainment of our training resources while protecting people and the environment from harmful effects. Refer to FM 3-34.5 Environmental Considerations and GTA 05-08-002 ENVIRONMENTAL-RELATED RISK ASSESSMENT.

Safety: In a training environment, leaders must perform a risk assessment in accordance with ATP 5-19, Risk Management. Leaders will complete the current Deliberate Risk Assessment Worksheet in accordance with the TRADOC

Safety Officer during the planning and completion of each task and sub-task by assessing mission, enemy, terrain and weather, troops and support available-time available and civil considerations, (METT-TC). Note: During MOPP training, leaders must ensure personnel are monitored for potential heat injury. Local policies and procedures must be followed during times of increased heat category in order to avoid heat related injury. Consider the MOPP work/rest cycles and water replacement guidelines IAW FM 3-11.4, Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection, FM 3-11.5, Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination.

Prerequisite Individual Tasks : None

Supporting Individual Tasks : None

Supported Individual Tasks :

Task Number	Title	Proponent	Status
551-88L-1034	Maintain a Diesel Engine	551 - Transportation (Individual)	Analysis
551-88L-1034	Maintain a Diesel Engine	551 - Transportation (Individual)	Approved

Supported Collective Tasks : None

ICTL Data :

ICTL Title	Personnel Type	MOS Data
88L40 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL4, Duty Pos: TGB, LIC: EN, SQI: O
88L30 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL3, Duty Pos: TFR, LIC: EN