

Summary Report for Individual Task  
551-88L-2053  
Repair a Diesel Engine  
Status: Approved

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**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 repairs 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. The diesel engine was fully mission capable at task completion.

**Special Condition:** None

**Safety Risk:** High

**MOPP 4:**

<b>Task Statements</b>
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**Cue:** None

<b>DANGER</b>
None

<b>WARNING</b>
None

<b>CAUTION</b>
None

**Remarks:** None

**Notes:** None

## Performance Steps

1. Demonstrate basic knowledge for repairing a diesel engine.

a. Diesel engines have many moving parts; to correctly repair a specific engine or part, consult the TM or operators manual for detail information.

b. Many factors will cause a diesel engine to stall or fail; check the engines manufactures manual, TM's and local SOPs for specific engine problems.

c. Many other factors may cause an engine to stall; some of these include the following:

(1) Misfiring.

(a) When an engine misfires or fires erratically or when one cylinder misfires regularly, possible troubles can usually be associated with the fuel or fuel system, worn parts, or the air cleaner or silencer.

(b) In determining what causes a cylinder to misfire, follow these prescribed procedures:

\_1\_ Start the engine and run it at part load until it reaches normal operating temperatures.

\_2\_ Stop the engine and remove the valve rocker cover.

\_3\_ Check the valve clearance. Clearance should be within the recommended tolerance stated in the manufacturers manual.

\_4\_ Isolate the injectors to each cylinder per the manufacturer's manual

\_a\_ If the cylinder has been misfiring, there will be no noticeable difference in the sound and operation of the engine.

\_b\_ If the cylinder has been firing properly, there will be a noticeable difference in the sound and operation of the engine when the cylinder is isolated.

\_5\_ If cylinder no. 1 is firing properly, repeat the procedure on the other cylinders until the faulty one has been located.

\_6\_ Providing that the injector operating mechanism of the faulty cylinder is functioning satisfactorily, remove the fuel injector, install a new one per manufacturer's instructions.

Note: If installation of the new injector does not eliminate the misfiring, compression pressure of the cylinder in question should be checked.

(2) Checking compression pressure.

(a) To check compression pressure, use the following procedure:

Note: The following procedure is used for Detroit Diesel 71-series engines and is provided as an example. For all other engines, follow the manufacturer's instructions.

\_1\_ Start the engine and run it at approximately one-half rated load until normal operating temperature is reached.

\_2\_ With the engine stopped, remove the fuel pipes from the injector and fuel connectors.

\_3\_ Remove the injector from no. 1 cylinder and install an adaptor and pressure gauge from Diagnostic Kit J 9531-01.

\_4\_ Use one of the two fuel pipes as a jumper connection between the fuel inlet and return manifold to permit fuel to flow directly to the return manifold.

\_5\_ Start the engine and run it at 600 rpm. Observe and record the compression pressure indicated on the gauge.

\_6\_ Do not crank the engine with the starting motor when checking the compression pressure.

Note: To perform the compression pressure check, steps 2 through 5 on each cylinder, repeat all but the first step. The compression pressure in any one cylinder at a given altitude above sea level should not be less than the minimum prescribed for the engines as shown in Table 15-2. In addition, the variation in compression pressure between cylinders of the engine must not exceed 25 psi at 600 rpm.

ENGINE						ALTITUDE (Feet above sea level)
	71	71E	71N	71M	71T	
PSI (600 rpm)	390	425	515	425	400	0
	360	395	480	395	370	2,500
	335	365	440	365	340	5,000
	310	340	410	340	315	7,500
	285	315	380	315	295	10,000

Minimum Compression Pressure

Figure 551-88L-3059\_01

(b) If the compression pressure readings of an engine operating at an altitude near sea level were as shown in the following example, it would be evident that no. 3 cylinder should be examined and the cause of the low compression pressure determined and corrected.

(3) Engine out of fuel.

Note: There is a problem in restarting an engine after it has run out of fuel. This stems from the fact that after fuel is exhausted from the fuel tank, fuel is then pumped from the primary fuel strainer and sometimes partially removed from the secondary fuel filter before the supply becomes insufficient to sustain engine firing. Consequently, these components must be refilled with fuel and the fuel pipes rid of air for the system to provide fuel for the injectors.

(a) When an engine is out of fuel, perform the following procedure for restarting the engine:

\_1\_ Fill fuel tank with recommended grade of fuel oil. If only partial filling of the tank is possible, add at least 10 gallons.

\_2\_ Remove fuel strainer shell and element from strainer cover and fill shell with fuel oil. Install shell and element.

\_3\_ Remove and fill fuel filter shell and element with fuel oil as with the fuel strainer shell and element above.

\_4\_ Start engine. Check filter and strainer for leaks.

Note: In some instances, it may be necessary to remove a valve rocker cover and loosen a fuel pipe nut to bleed trapped air from the fuel system. Be sure the fuel pipe is retightened securely before replacing the rocker cover.

(b) Prime the entire fuel system per the manufacturer's instructions.

(4) Fuel flow test.

(a) Refer to the "Engine Operating Conditions" charts of the TM for gallons per minute fuel flow that is applicable to the particular engine being tested. Then proceed as follows:

\_1\_ Disconnect fuel return tube and hold the open end of tube in a suitable receptacle.

\_2\_ Start and run engine at approximately 1,200 rpm and measure fuel flow from the return tube for 1 minute.

(b) Be sure all tube connections between the fuel supply and the pump are tight so that no air will be drawn into the fuel system.

\_1\_ Immerse the end of fuel tube into fuel in the container.

\_2\_ Air bubbles rising to the surface of the fuel will indicate a leak on the suction side of the pump.

(5) Clogged air cleaners and silencers.

(a) Sometimes the reason for an engine firing erratically or misfiring is because of clogged air cleaners and silencers.

(b) Air cleaners must be cleaned at specified intervals as recommended in the engine manufacturer's TMs.

(c) Clogged cleaner reduces intake air, thereby affecting operation of the engine.

2. Perform basic repair procedures for a diesel engine.

a. Instrument indications.

(1) Engine operator relies on the instruments to warn him/her of impending troubles.

(a) Ensure an instrument is accurate and operating properly.

(b) All instruments must be tested at specified intervals, or whenever they are suspected of being inaccurate.

(2) Replace instruments if found to be inaccurate.

b. Excessive crankcase pressure.

(1) Check compression pressure and, even if only one cylinder has low compression, remove the cylinder head and replace the head gaskets.

(2) Inspect piston and liner and replace damaged parts.

(3) Install new piston rings.

(4) Clean and repair or replace breather assembly.

(5) Replace blower-to-block gasket.

(6) Replace end plate gasket.

(7) Check exhaust back pressure and repair or replace muffler if an obstruction is found.

(8) Check exhaust back pressure and install larger piping if the piping is too small, too long, or has too many bends.

c. Low oil pressure.

(1) Check oil level and bring it to the proper level on dipstick or correct installation angle.

Note: If wrong viscosity of lubricating oil is being used, consult lubricating oil specifications. Check for fuel leaks at the injector seal ring and fuel pipe connections. Leaks at these points will cause lubricating oil dilution.

(2) If a plugged oil cooler is indicated by an excessively high lubricating oil temperature, remove and clean the oil cooler core.

(3) Remove bypass valve and clean valve and valve seat and inspect valve spring. Replace defective parts.

(4) Remove pressure regulator valve, clean valve and valve seat, and inspect valve spring. Replace defective parts.

(5) Change the bearings. Consult the lubricating oil specifications for the proper grade of oil to use and change oil filters.

(6) Replace any missing plugs.

(7) Check oil pressure with a reliable gauge and replace gauge if found faulty.

(8) Remove and clean gauge line; replace if necessary.

(9) Remove and clean gauge orifice.

(10) Repair or replace defective electrical equipment.

(11) Remove and clean oil pan and oil intake screen. Consult the lubricating oil specifications for proper grade of oil to use and change oil filters.

(12) Remove and inspect valve and valve bore and spring. Replace faulty parts.

(13) Disassemble piping and install new gaskets.

(14) Remove pump. Clean and replace defective parts.

(15) Remove flange and replace gasket.

d. Abnormal engine operating temperatures.

(1) Clean cooling system with a good cooling system cleaner and thoroughly flush to remove scale deposits.

(a) Clean exterior of radiator core to open plugged passages and permit normal air flow.

(b) Adjust loose fan belts to the proper tension to prevent slippage.

(c) Check for improper size radiator or inadequate shrouding.

(d) Repair or adjust inoperative shudders.

(e) Repair or replace inoperative temperature-controlled fan.

(2) Check coolant level and fill to filler neck if coolant level is low.

(a) Inspect for collapsed or disintegrated hoses. Replace all faulty hoses.

(b) If thermostat is inoperative, remove, inspect, and test it. Replace it if found faulty.

(c) Check water pump for a loose or damaged impeller.

(d) Check flow of water through radiator. A clogged radiator will cause an inadequate supply of water on the suction side of the pump.

(e) Clean radiator core.

(f) Remove radiator cap and operate engine, checking for combustion gases in the cooling system; the cylinder head must be removed and inspected for cracks and the head gaskets replaced if combustion gases are entering the cooling system.

(g) Check for an air leak on the suction side of the freshwater pump.

(h) Replace defective parts.

(3) Check to see if thermostat is closing, remove, inspect, and test it.

(a) Install a new thermostat if necessary.

(b) Check for an improperly installed heater.

(4) If continued low coolant operating temperature exists, excessive leakage of coolant past the thermostat seal is a cause; when this occurs, replace the thermostat seal.

(Asterisks indicates a leader performance step.)

**Evaluation Guidance:** None

**Evaluation Preparation:** None

<b>PERFORMANCE MEASURES</b>	<b>GO</b>	<b>NO-GO</b>	<b>N/A</b>
1. Demonstrated basic knowledge for repairing a diesel engine.			
a. Checked compression pressure.			
b. Refueled engine.			
c. Performed fuel flow test.			
d. Cleaned air cleaners and silencers.			
2. Performed basic repair procedures for a diesel engine.			
a. Repaired instrument indicators.			
b. Diagnosed and repaired excessive crankcase pressure.			
c. Diagnosed and repaired low oil pressure.			
d. Diagnosed and repaired abnormal engine operating temperatures.			

**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-3050	Troubleshoot a Starting System	551 - Transportation (Individual)	Approved
551-88L-1034	Maintain a Diesel Engine	551 - Transportation (Individual)	Approved

**Supported Collective Tasks :** None

**ICTL Data :**

ICTL Title	Personnel Type	MOS Data
88L30 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL3, Duty Pos: TFR, LIC: EN
88L40 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL4, Duty Pos: TGB, LIC: EN, SQI: O
88L20 Watercraft Engineer	Enlisted	MOS: 88L, Skill Level: SL2, Duty Pos: TFS, LIC: EN