

551-88L-1078
Demonstrate Basic Knowledge of a Diesel Engine
Status: Approved

Security Classification: U - Unclassified

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

Destruction Notice: None

Foreign Disclosure: FD1 - This training product has been reviewed by the training developers in coordination with the Transportation School Fort Eustis, VA 23608 foreign disclosure officer.

This training product can be used to instruct international military students from all approved countries without restrictions.

Conditions: Assigned as a Marine Engineer, Soldier will demonstrate basic knowledge of a diesel engine. Given a complete risk assessment, a vessel in port or at sea, all applicable publications, forms, records, tools, materials, personnel, equipment, in all weather conditions day or night, and in an operational environment scenario. Some iterations of this task should be performed in MOPP 4.

Standards: On orders; Soldier will demonstrate basic knowledge of a diesel engine and the principles of operation. Soldier must be able to identify the functionality of diesel engine components IAW TC 55-509, and procedures and specifications while utilizing the task Go / No-Go criteria. Comply with all warnings, cautions, and notes listed in all references. Soldier must perform this task with 100% compliant or without errors.

Special Conditions: Under normal or emergency conditions aboard Army Watercraft, maintaining a diesel engine while on engine room watch.

Safety Risk: Low

MOPP 4: Sometimes

Task Statements

Cue: Soldier will demonstrate basic knowledge of a diesel engine and the principles of operation. Soldier must perform this task with 100% compliant or without errors.

DANGER
MODIFICATION HAZARD Unauthorized modifications, alterations or installations of or to this equipment are prohibited and are in violation of AR 750-10. Any such unauthorized modifications, alterations or installations could result in death, injury or damage to the equipment.
MOVING MACHINERY HAZARDS Be very careful when operating or working near moving machinery. Running engines, rotating shafts, and other moving machinery parts could cause personal injury or death.

WARNING
None

CAUTION

HIGH PRESSURE HYDRAULIC SYSTEM HAZARDS

Hydraulic systems can cause serious injuries if high pressure lines or equipment fail. Never work on hydraulic systems or equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment, and who can give first aid. A second person should stand by controls to turn off hydraulic pumps in an emergency. When the technicians are aided by the operators, the operators must be warned about dangerous areas.

ELECTRICAL HAZARDS

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions". Be careful not to contact 115-Vac input connections when installing or operating this equipment. Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

Remarks: None

- Notes:**
1. Equipment is not all the same and may function differently depending on the make, model, and manufacturer. Troubleshooting steps are similar, but may vary. Always consult the applicable manufacturer's literature for each piece of equipment.
 2. Test should be conducted as specified in the manufacturer's literature or industry standards.
 3. Defective equipment should be repaired or replaced immediately and not used until correctly repaired or replaced.

Performance Steps

1. Identify diesel engine preoperation and securing procedures.

a. Diesel engines are started, operated, and secured under a variety of conditions.

(1) Operation under unusual conditions requires knowledge and understanding of the engine installation, the function of supporting systems, and the reasons for the procedures observed in normal operation.

(2) For the normally encountered situations under which engines are operated, checklists have been prepared for each installation.

(3) The applicable list of procedures must be followed for each condition of engine operation.

Note: Precautions listed in the operating instructions posted at the operating station must be observed.

b. Diesel engines are brought up to starting speed by hydraulic, electric, or air-starting systems or by air-powered starting motors.

(1) The general starting procedure for all types of systems consists of the following:

(2) Preoperational checks

(3) Alignment of supporting systems

(4) Cranking of the engine with the starting equipment until ignition occurs and the engine is running.

Note: Steps in the starting procedure differ depending on whether the engine is being started after routine securing, after a brief period of idleness, or after a long period of idleness.

c. Starting after routine securing

(1) The supporting systems are made ready for operation.

(2) Cooling, lubrication, and fuel systems.

(a) Check all valves in the seawater cooling system to ensure that the system is lined up for normal operation.

(b) Start the separate motor-driven seawater pump if one is provided.

WARNING

If an auxiliary engine is cooled from a ship's saltwater circulating system, ensure that adequate pressure and flow will be available.

(c) Vent seawater coolers, using the vent cocks or vent valves on the heat exchanger shells.

(d) Check the level in the freshwater expansion tank.

(e) Check the lubricating system.

WARNING

In idle engines, the lube oil film can be lost from the cylinder wall. It is desirable to restore this film before actually starting the engine.

(f) Disengage the jacking gear and restore the valves and cocks to their operating positions.

(g) Line up and prime the fuel system.

(h) Check for malfunction in alarms (such as low-pressure lubricating oil alarm and freshwater high-temperature alarm).

(i) The engine can now be started with the starting system.

(j) Follow all proper procedures for the type of starting system in use.

(k) Once the engine is running, energize the low-pressure, lube-oil alarm and the water temperature alarm.

Note: Pay careful attention to all gauges and other indications of engine condition and performance. If it does not rise immediately to the operating pressure, the engine should be shut down and the cause of low pressure determined. If possible, avoid placing a load on the engine until it has warmed up.

d. Starting After a Brief Period of Idleness

(1) Starting a warm engine after it was recently secured and if no unusual conditions are suspected consists of aligning the systems that may have been secured.

(2) Ensure valve piping is aligned (such as circulating water, fuel piping, and lube oil piping).

(3) Observe lubricating oil pressure.

Note: The temperature of coolant may exceed normal operating temperatures for a minute or so until the heat accumulated in the secured engine is removed.

e. Starting After Overhaul or Long Idle Period

(1) Some additional checks and inspections should be made when the engine to be started has been idle for a long time or has been overhauled.

(2) Inspect any parts of the engine system that have been worked on.

(3) Check all pipe connections to see whether the connections are tight and whether the systems have been properly connected.

(4) Fill the freshwater cooling system with freshwater if it has been drained.

WARNING

Be sure coolant flows through all parts and components of the system. Vent the system. If possible, apply a hydrostatic test to the cooling system.

(5) Check the lubrication system thoroughly.

(6) Check sump level; fill if necessary.

(7) Inspect air receiver, filter, and blower discharge passages for cleanliness and remove any oil accumulations.

(8) Inspect the governor oil level.

(9) Examine all moving parts of the engine to see that they are clear for running.

(10) Check fuel injector timing.

(11) Inspect the fuel oil service tank for the presence of water and sediment.

(12) If the engine has an air-starting system, open the lines on the system and blow them out. Reconnect lines and pressurize the starting air banks.

(13) Make a final check to ensure that all parts are in place. Then open all scavenging-air header and exhaust header manifold drains.

(14) After making the preparations, the engine is ready to be started, using the procedures for a routinely secured engine.

2. Monitor normal operating procedures for a diesel engine.

a. While engines are operating, their performances are monitored and observed for the following two purposes.

(1) Early recognition of unsatisfactory operation or impending malfunctions so that immediate casualty control procedures can be started

(2) Develop a comparative record over a given period so that gradually deteriorating conditions can be detected

CAUTION

The operating pressures and temperatures should be observed and recorded in the log at hourly intervals.

b. Observe the following conditions while operating a diesel engine.

(1) Load – The manner of applying a load to an engine and the regulation of the load depend on the type of load and system design.

(a) Procedures for loading an engine or placing it on the line will be established by local policies or, in new installations, by system designer.

(b) Whenever a cold engine is started, ample time should be allowed to build the load up gradually.

(c) The manufacturer's instructions should be followed in all but emergency situations.

(2) Lubrication – The lubrication system is one of the most important factors of engine operation which the operator can monitor.

(a) Indicators continuously show oil temperature and pressure in key parts of the system.

(b) While the engine is operating, these indicators and sight glasses should be monitored regularly.

(c) If the lubrication system uses a wet sump, the level should be checked at regular intervals.

(d) Under typical operating conditions, operators should be able to estimate the rate at which the engine burns its lubricating oil and to predict when replenishment will be needed.

(e) If lubricating oil purifiers are provided, they should be kept running while the engines are running.

(f) Metal-edge lubricating oil strainers should be cleared by rotating the cleaning handle two complete revolutions.

(3) Pressures and Temperatures – Pressures and Temperatures must be maintained within the normal operating ranges.

(a) All instruments must be checked frequently.

(b) The temperature of the lubricating oil as it leaves the engines should be maintained between 140 degrees F and 180 degrees F.

(c) The temperature of freshwater should not be less than 140 degrees F or more than 180 degrees F when the water leaves the engine.

(d) The temperatures in the saltwater cooling system should not be allowed to go above 130 degrees F.

(e) Coolers and heat exchangers should be vented at least once each watch.

(f) The level of freshwater in the expansion tank should be checked frequently and freshwater added as necessary.

CAUTION

If the freshwater level gets low enough to cause overheating of the engine, cold water should never be added until the engine has cooled.

(4) Critical Speeds – The term applies to certain ranges of speed during which excessive vibration in the engine is created.

(a) Each engine has a natural period of vibration which cannot be changed by the operator, the only control available to the operator is to avoid operating the engine at critical speeds.

(b) Tachometers must be marked to show any critical speed ranges to make it easier for the operator to keep the engine out of the critical ranges.

(c) Tachometers sometimes get out of adjustment. Therefore, they must be frequently checked with mechanical counters.

(5) Fuel – An adequate supply of the proper type of fuel must be maintained.

(a) Fuel system should be frequently checked for leaks.

(b) All fuel oil strainers should be cleaned at periodic intervals.

(c) Fuel oil filter elements should also be replaced whenever necessary.

(d) When diesel fuel oil purifiers are provided, all fuel should be purified before it is transferred to the service tank.

(e) The service tank should be frequently checked for water and other settled impurities.

(f) Water and impurities should be drained off.

3. Perform stopping and securing procedures for diesel engines.

a. Diesel engines are stopped by shutting off the fuel supply (placing the throttle or the throttle control in the stop position).

b. In addition to the detailed procedures listed in checklists and manufacturer's manuals, the following steps should be taken after an engine has stopped.

(1) Open the drain cocks on the exhaust lines and those on the scavenging-air inlet headers, if provided.

(2) Leave open an adequate number of indicator cocks, cylinder test valves, or hand-operated relief valves to indicate the presence of any water in the cylinders.

(3) See that the air pressure is off.

(4) Close all sea valves.

(5) Allow the engine to cool.

(6) Drain the freshwater when freezing temperatures prevail.

(7) Clean the engine thoroughly by wiping it down before it cools.

(8) Clean the floor plates and see that the bilges are dry.

(9) Arrange to have any malfunctions repaired.

4. Observe the following precautions while operating and maintaining a diesel engine.

- a. If the relief valve on an engine cylinder lifts (pops) several times, the engine must be stopped immediately.
- b. Make sure that the fuel is not pumped into a cylinder while valves are being tested or while the engine is being motored.
- c. Do not allow a large amount of cold water, under any circumstances, to enter a hot engine suddenly.
- d. When engines are stopped, all starting-air lines must be vented.
- e. Clean fuel, clean air, clean coolants, clean lubricants, and clean combustion must be maintained for the basic essentials in the efficient operation and maintenance of diesel engines.

(Asterisks indicates a leader performance step.)

Evaluation Guidance: Score the Soldier a GO if all performance measures are correctly completed/pass (P). Score the Soldier a NO-GO if any of the performance measures are missed or incorrectly performed/fail (F).

Evaluation Preparation: Test this task in with applicable training material. Ensure Soldier understands why this task is important to support the overall training objective.

Setup: Test this task in in accordance with prescribed references or Technical Manual (TM). Brief Soldier: Tell the Soldiers adhere to all Safety precautions when performing the task listed.

Note: Ensure that all required equipment to perform this task is available.

PERFORMANCE MEASURES	GO	NO-GO	N/A
1. Identified diesel engine preoperation and securing procedures according to vessels checklist.			
2. Monitored normal operating procedures for a diesel engine according to manufactures manual.			
3. Performed stopping and securing procedures for diesel engines.			
4. Observed safety precautions while operating and maintaining a diesel engine.			

Supporting Reference(s):

Step Number	Reference ID	Reference Name	Required	Primary	Source Information
	TC 55-509	MARINE ENGINEMAN's HANDBOOK	Yes	Yes	

TADSS :

TADSS ID	Title	Product Type
2 Stroke Single Cylinder Detroit Diesel Cut-Away	2 Stroke Single Cylinder Detroit Diesel Cut-Away (Local TADSS – Not in TSMATS/PAM 25-30)	DVC
A954 GM Series 71 ROOTS Blower Cut-Away	A954 GM Series 71 ROOTS Blower Cut-Away (Local TADSS – Not in TSMATS/PAM 25-30)	DVC
A1602 2 Cycle In line 6 Cylinder Detroit Diesel Cut-Away	A1602 2 Cycle In line 6 Cylinder Detroit Diesel Cut-Away (Local TADSS – Not in TSMATS/PAM 25-30)	DVC
855 Cummings Diesel 4 Stroke Cut-Away	855 Cummings Diesel 4 Stroke Cut-Away (Local TADSS – Not in TSMATS/PAM 25-30)	DVC

Equipment Items (LIN): None

Materiel Items (NSN) :

Step ID	NSN	LIN	Title	Qty
	5120-00-221-7983	Y85377	Wrench, Torque, Rigid Frame End Drive Style, 3/4 Inch Drive, 0-600 Foot-Pound Capacity	1
	2815-00-522-1871		POWER UNIT,MULTIPLE ENGINE	1
	2815-00-892-5088		ENGINE,DIESEL	1
	4940-00-367-7380	MB408H	Parts Rack, Engine, Portable< Wheeled, Four Shelves	1
	2815-00-000-0075		ENGINE,DIESEL	1
	6730-01-363-4544	P18230	Projector, Multimedia: Model 800	1
	2815-00-271-9083		POWER UNIT,MULTIPLE ENGINE	1
	5120-00-247-2540	MC206A	Wrench, Torque, 150 Foot-Pounds	1
	2815-01-018-0637		ENGINE,DIESEL	1
	5180-00-629-9783	W39032	Tool Kit, General Mechanic's, Rail and Marine Diesel Engine	1
	5180-00-785-3895	MC801F	Tool Kit, Diesel Engine, Detroit Diesel Series 53, 71 and 92 Engines	1
	7021-01-107-2284		Computer, Digital: HP-85A	1

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 the current Environmental Considerations manual and the current GTA Environmental-related Risk Assessment card. It is the responsibility of all Soldiers and DA civilians to protect the environment from damage. AR 200-1 delineates TRADOC responsibilities to integrate environmental requirements across Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities (DOTMLPF) and ensure all training procedures; materials and doctrine include sound environmental practices and considerations.

The Army's environmental vision is to be a national leader in an environmental and natural resource stewardship for present and future generations as an integral part of all Army missions. This Training Support Package meets this standard.

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 ATP-45.5 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 current Risk Management Doctrine. 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 current CBRN doctrine. In a training environment, leaders must perform risk management in accordance with ATP 5-19, Risk Management. Leaders will complete a DD Form 2977 DELIBERATE RISK ASSESSMENT WORKSHEET 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), as well as any other variables.

All operations will be performed to protect and preserve Army personnel and property against accidental loss. Procedures will provide for public safety incidental to Army operations and activities and safe and healthful workplaces, procedures, and equipment. Observe all safety and/or environment precautions regarding electricity, cable, and lines. Provide ventilation for exhaust fumes during equipment operation and use hearing protection when required IAW AR 385-10, the Clean Air Act (CAA) and the CAA amendments, and the OSHA Hazard Communication standard.

Accidents are an unacceptable impediment to Army missions, readiness, morale, and resources. Decision makers at every level will employ risk management approaches to effectively preclude unacceptable risk to the safety of personnel and property affiliated with this task.

- (a) Take personal responsibility.
- (b) Practice safe operations.
- (c) Recognize unsafe acts and conditions.
- (d) Take action to prevent accidents.
- (e) Report unsafe acts and conditions. No food or drink is allowed near or around electrical equipment (CPU, file servers, printers, projectors, etc.) due to possible electrical shock or damage to equipment. Exercise care in personal movement in and through such areas. Avoid all electrical cords and associated wiring. In event of electrical storm, you will be instructed to power down equipment.

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 ATP 3-11.32, NBC Protection, ATP 3-11.32, CBRN Decontamination.

Prerequisite Individual Tasks : None

Supporting Individual Tasks : None

Supported Individual Tasks : None

Supported Collective Tasks : None

Knowledges :

Knowledge ID	Knowledge Name
K-551-V-0041	Knowledge of vessel characteristics
K-551-V-0042	Knowledge of vessel SOP
K-551-U-0022	Knowledge of safety rules
K-551-P-0023	Knowledge of diesel engine inspection procedures
K-551-U-0045	Knowledge of starting engine procedures and components
K-551-V-0081	Knowledge of vessel layout

Skills :

Skill ID	Skill Name
S-551-P-0028	Ability to inspect a diesel engine
S-551-P-0092	Ability to comply with safety rules
S-551-U-0017	Ability to conduct an inspection
S-551-P-0199	Ability to check moving parts
S-551-U-0024	Ability to check components.

ICTL Data : None