

UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
Training Command
PSC Box 20041
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LVSM 7103

STUDENT OUTLINE

LVS OPERATION AND FIRST ECHELON MAINTENANCE

LEARNING OBJECTIVES

1. Terminal Learning Objectives:

a. Given an LVS, TM 2320-10/11A, LI 2320-12/9B, NAVMC form 10627, tools, and equipment, perform first echelon maintenance on the LVS, per the references. (3521.13.01)

b. Given an LVS and TM 2320-10/11A, operate the LVS in conjunction with road testing, per the reference. (3521.13.02)

2. Enabling Learning Objectives:

a. Given an LVS, TM 2320-10/11A, LI 2320-12/9B, NAVMC form 10627, tools, and equipment, perform "Before Operation" PMCS, per the references.

b. Given an LVS, TM 2320-10/11A, LI 2320-12/9B, NAVMC form 10627, tools, and equipment, perform "During Operation" PMCS, per the references. (3521.13.01b)

c. Given an LVS, TM 2320-10/11A, LI 2320-12/9B, NAVMC form 10627, tools, and equipment, perform "After Operation" PMCS, per the references. (3521.13.01c)

d. Given an LVS, TM 2320-10/11A, LI 2320-12/9B, NAVMC form 10627, tools, and equipment, perform "Weekly" PMCS, per the references. (3521.13.01d)

e. Given an LVS, TM 2320-10/11A, LI 2320-12/9B, NAVMC form 10627, tools, and equipment, perform "Monthly" PMCS, per the references. (3521.13.01e)

f. Given an LVS and TM 2320-10/11A, drive the vehicle in all forward gear ranges, per the reference. (3521.13.02a)

g. Given an LVS and TM 2320-10/11A, drive the vehicle in reverse, per the reference. (3521.13.02b)

h. Given an LVS and TM 2320-10/11A, park the vehicle, per the reference. (3521.13.02c)

OUTLINE

1. INTRODUCTION TO THE LOGISTICS VEHICLE SYSTEM (LVS)

a. General Description. The Logistics Vehicle System or LVS Series trucks are tactical vehicles designed for on and off-road use. The series consists of five vehicles, each of which has a front power unit, MK48, and a rear trailer. Below is a general description of the power unit and each trailer.

(1) The MK48 Front Power Unit, 12 1/2 Ton, 4 X 4 is the primary source of power for the five trailers.

(2) The MK14 Trailer, 22 1/2 Ton, Container Hauler, is a flat bed trailer used for carrying standardized cargo containers.

(3) The MK15 Trailer is a Wrecker/Recovery vehicle fully equipped for the recovery of disabled vehicles and material handling.

(4) The MK16 Trailer, Fifth Wheel, Semitrailer Adapter, is a fifth wheel unit for transport of semitrailers and towed-type military trailers.

(5) The MK17 Trailer, 20-Ton, Dropside Cargo W/Crane, is a flat bed trailer with crane for hauling palletized cargo.

(6) The MK18 Trailer is a ribbon bridge/container hauler with the capability to self-load and self-unload.

(7) The complete vehicle consists of the Front Power Unit (MK48) coupled to any one of the five trailers (MK14, MK15, MK16, MK17 or MK18). When coupled, the complete unit is an 8 X 8 powered, driven vehicle.

b. Capabilities Similar To Each Module. Each of the vehicle combinations is capable of:

(1) Forging water up to 60 inches deep.

(2) Climbing and descending 60% grades with a gross vehicle weight of 64,000 pounds, excluding the MK48/16.

(3) Operating on 30% side slopes and parking on 20% grades.

(4) Articulation and roll between the front power unit and trailer, enabling the vehicle to maintain ground contact with all eight wheels, even in rough terrain.

(5) Pulling an additional MK14, MK15, MK16, MK17 or MK18, using a rear body tow unit.

(6) Operating for a maximum range of 300 miles. This depends on the vehicle load, type of terrain, idling time, and fuel quantity.

(7) Being airlifted.

(8) Being transported by highway, rail, or sea. The MK48 and trailer can be separated into two units for ease of handling.

c. Capabilities of the MK48 Front Power Unit

(1) The MK48 front power unit can separate from the one trailer and couple with any of the four other trailers.

(2) Incorporated within the MK48 electrical system is a test connector that allows for the use of STE/ICE test equipment. This helps maintenance personnel find problems within the engine, electrical system, or hydraulic system.

(3) The MK48 front power unit has the capability to turn while the trailer remains still or with limited movement through the use of two yaw steering cylinders.

d. Capabilities Peculiar To Each Vehicle Combination

(1) MK48/14 Container Hauler Vehicle.

(a) The MK48/14 container hauler's primary mission is to transport ISO/ANSI (International Standards Organizational/American National Standards Institute) containers, standardized cargo, shelters, and functional modules from beach sites to unit supply points.

(b) The MK48/14 can turn within a radius of 38.5 feet.

(c) The MK48/14 can carry a payload of 12.5 tons off-road (rough terrain) and 22.5 tons on-road (highway).

(d) The MK14 has a 20 foot steel bed with standard ISO/ANSI container locks and fittings.

(2) MK48/15 Wrecker/Recovery Vehicle.

(a) The MK48/15 wrecker recovery vehicle is primarily used for the recovery of all LVS vehicles. It is also capable of lifting and towing all tactical vehicles. Lifting of the vehicles is accomplished by an A-Frame attached to the rear of the vehicle. A heavy-duty rear winch enables the wrecker to recover mired vehicles. The wrecker is equipped with a material handling crane (MHC) used for removing power packs and loading equipment and standardized containers. An auxiliary hydraulic circuit on the vehicle provides power for tools and also can be used to supply another trailer (MK15, MK16, MK17, MK18) with hydraulics.

(b) The MK48 with the MK15 has a turning radius of 38.5 feet.

(c) The MK15 can carry a payload of 10 tons.

(d) The MK15 is capable of raising and towing an LVS vehicle.

(e) The MK15 is capable of lifting 9,000 pounds with the crane fully extended 15 feet.

(f) The rear winch on the MK15 is capable of pulling 60,000 pounds.

(g) The MK15 has a 7 foot cargo bed with standard ISO/ANSI container lock fittings and front and rear stowage compartments.

(h) The MK15 has a remote control unit that allows for the operation of the crane, A-Frame, and winch from a distance.

(i) The MK15 has an auxiliary hydraulic circuit with 50 feet of hose on a reel for the operation of power tools and the supply of hydraulics to another trailer.

(3) MK48/16 Fifth Wheel Semitrailer Adapter Vehicle.

(a) The MK48/16 fifth wheel is used to transport semitrailers with 3.5 inch diameter kingpins. Its primary mission is to transport the M870A1 trailer. It can also transport towed type trailers like the M105, M149, and M353. A rear winch mounted in front of the fifth wheel is capable of pulling a combat load: for example, a dozer onto an M870A1 semitrailer without using the dozer's own power. The winch may also be used for recovery of other vehicles.

(b) The turning radius of the MK48/16 is 32.5 feet.

(c) A 46,000 pound load may be placed on the fifth wheel.

(d) The MK16 is capable of pulling 60,000 pounds with its winch.

(e) The MK48/16 has a remote control unit for the operation of the winch from a distance.

(f) The MK48/16 has a fully oscillating fifth wheel that can be adjusted for on-road and off-road use.

(4) MK48/17 Drop Side Cargo W/Crane Vehicle.

(a) The MK48/17 drop side cargo w/crane is used to transport palletized cargo and ISO/ANSI containers. The side panels of the cargo bed can be dropped down or removed to ease loading and unloading. The side panels also provide seating for troops. A material handling crane (MHC) at the rear of the vehicle is used to load and unload equipment and cargo. The MK48/17 is also intended to tow and position the M198 howitzer.

(b) The turning radius of the MK48/17 is 38.5 feet.

(c) The MK48/17 is capable of carrying a payload of 10 tons off-road and 20 tons on-road.

(d) The MK48/17 is capable of lifting 9,000 pounds (4086 kg) with the crane fully extended 15 feet and the stabilizers in position.

(e) The MK48/17 has a remote control unit that allows for the operation of the crane from a distance.

(f) The MK48/17 has a 16 foot cargo bed with standard ISO/ANSI container lock fittings.

(5) MK48/18 Ribbon Bridge/Container Hauler.

(a) The MK48/18 is designed to self-load, transport, and self-unload standardized containers or ribbon bridge systems. Additionally, the MK18 can be utilized to self-load/unload a bridge erection and boat cradle assembly or for high-bank launch operations of ribbon bridge.

(b) The turning radius of the MK48/18 is 38.5 feet.

(c) The MK48/18 can transport ISO/ANSI containers, ribbon bridges, or bridge erection boat and cradle assembly on 30 percent side slopes and park on 20 percent grades.

(d) It is capable of transporting ISO/ANSI containers up to 20 feet long, 9 feet high and with a maximum weight of 40,000 pounds.

(e) The MK48/18 can self-load and transport or self-unload ISO/ANSI container loads up to 25,000 pounds off-road and 40,000 pounds on-road.

(f) The MK48/18 is capable of self-loading or self-unloading ISO/ANSI containers on a maximum side slope, of 5 degrees, to either side, a front to rear slope of up to 15 degrees or a rear to front slope of 15 degrees with a maximum load.

(g) The MK48/18 can transport, launch, and recover a ribbon bridge section.

(h) It can transport, launch, and recover a bridge erection boat and boat cradle.

(i) The MK48/18 has the capability of performing ribbon bridge high bank launch operations.

(j) The MK48/18 has a remote control unit (RCU) that allows operation of the trailer from a distance of up to 45 feet.

(k) It also has control levers to allow for manual control in the event of a failure of the RCU.

2. COMPONENTS OF THE MK48 FRONT POWER UNIT

a. Engine

(1) The engine is a Detroit Diesel 8V92TA, diesel powered, turbocharged, blown engine that has a total displacement of 736 cubic inches.

(2) It has a brake horsepower of 445 at a governed speed of 2100 rpm.

b. Transmission. The transmission is a four-speed, automatic, Detroit Diesel Allison model HT 740D.

c. Transfer Case. The transfer case is made by Oshkosh Truck and is a two-speed, model number DA100.

d. Other Components

(1) Fuel Tanks. The MK48 has two fuel tanks that are 75 gallons each. They are located one on each fender of the MK48 front power unit.

(2) Air Cleaner. A two-stage air filter is located on the driver's side above the fuel tank.

3. LVS SYSTEM DESCRIPTION

a. Air System

(1) The air system has two purposes. The first is to operate the vehicle's service and parking brakes, and the second is to power the air operated accessories. The air system is divided into two sections: the front cab section and the rear trailer section. Air pressure in both sections is indicated by a pressure gage in the cab of the MK48.

(2) The air system consists mainly of an engine driven compressor and five air storage reservoirs. These components, in conjunction with the necessary valves, hoses, and fittings, supply regulated air to the brakes, and other air operated devices on the vehicle. A complete detailed description and operation of the air system components will be covered in upcoming instruction.

b. Electrical System

(1) The electrical system operates on 24 volts, negative ground. The system is powered by four 12 volt batteries connected in a series-parallel circuit to produce 24 volts. The electricity stored in the batteries is used to start the engine and operate the accessories. Once the engine is started, it drives an alternator that produces electricity to maintain battery voltage and power electrical components on the vehicle.

(2) The ignition switch has three positions: "ON", "OFF", and "START". In the "OFF" position, electricity is confined to the lighting system. In the "START" position, electricity is directed from the batteries through a relay and a solenoid to the starter.

(3) With the engine running and the ignition switch in the "ON" position, the alternator generates between 27.8 and 28.2 volts of electricity for charging the batteries and operating the accessories. A voltage regulator adjusts the alternator output, making sure voltage in the system is maintained at the proper range.

(4) The system is protected against overload by automatic reset type circuit breakers. A diagnostic connector assembly (DCA) is also incorporated within the system to help organizational maintenance mechanics diagnose problems using STE/ICE equipment.

c. Hydraulic System

(1) The hydraulic system has three purposes; operation of the radiator fan motor, power steering, and the auxiliary hydraulics. The hydraulic system consists of an engine-driven, tandem pump, an oil reservoir, a power steering gear, two yaw cylinders, a radiator fan motor, and controlling valves.

(2) The reservoir holds the hydraulic oil that supplies the system. The pump receives the oil from the reservoir to provide the hydraulic pressure for the operation of the front axle steering, yaw cylinder steering, auxiliary equipment, and the fan motor. The fan motor provides cooling of the engine coolant, transmission, and the hydraulic oil.

(3) A hydraulic selector valve mounted on the right fender of the front power unit is a two-position valve used by the operator to select either steering or auxiliary hydraulics.

(a) With the selector valve in the "STEERING" position, the No. 1 axle will turn and the yaw cylinders are operational. The vehicle is driven with the selector valve in this position.

(b) With the selector valve in the "AUXILIARY HYDRAULICS" position, the auxiliary equipment (crane and winch) receive the hydraulic power. Steering at the No. 1 axle will still work, but yaw steering is not possible. Without yaw steering, the vehicle's capability to turn is seriously reduced. For this reason, the vehicle must never be driven with the selector valve in the "AUXILIARY HYDRAULICS" position.

d. Steering System

(1) When the selector valve is in the "STEERING" position, steering is accomplished through the use of two sub systems, yaw steering and hydraulic power-assist steering. These systems work together to make the vehicle highly maneuverable.

(2) The yaw steering system is responsible for turning the front power unit at the articulation joint. This is accomplished through the use of two, double-acting, hydraulic, yaw cylinders that connect to the front and rear bodies on each side of the articulation joint. As one cylinder contracts, the other extends. The front power unit is then forced to turn,

whether the vehicle is rolling or not. This reduces the turning radius and allows the vehicle to navigate among obstacles that are relatively close together.

(3) Operators are cautioned not to operate the steering (dry steer) while the vehicle is sitting still. Damage to the axle shaft and bracket assembly may occur, causing the cab of the MK48 to drop several inches on the broken side, making the vehicle difficult to steer.

(4) The yaw steering system will not operate with the parking brakes applied and the transmission in neutral. The yaw steering system coordinates with the hydraulic power-assist steering system through a feedback linkage. When the operator turns the steering wheel, the No. 1 axle and the yaw steering work together to turn the vehicle. This system maintains proper alignment between the front and rear sections through the full range of steering.

e. Drive Line System

(1) Power for the LVS vehicle comes from a diesel engine housed in the center of the front power unit. The power goes to an automatic transmission attached to the back of the engine. A short propeller shaft delivers power from the transmission to the transfer case. The transfer case then sends the power to both the No. 1 axle of the power unit and the No. 3 axle of the trailer.

(2) A nose box mounted on the No. 1 axle receives power from the transfer case and delivers it to the No. 1 axle. The No. 1 axle has an inter-axle differential that sends power through a propeller shaft to the No. 2 axle. In this way, all four wheels of the power unit are driven.

(3) The No. 3 axle of the trailer receives power from the transfer case through a series of propeller shafts, cardan joint, and universal joints. The No. 3 axle has an inter-axle differential that sends power through a propeller shaft to the No. 4 axle. In this manner, all four wheels of the trailer receive power.

(4) By using the drive line lockup switch in the front power unit, the operator can control parts of the drive line. On dry pavement, the drive line lockup is left in the "UNLOCK" position. This allows the drive line to operate in a way similar to that of an ordinary automobile. If traction is good, all drive wheels pull.

(5) If wheel slippage is expected, either the "TRANSFER-LOCKUP" or the "AXLE-LOCKUP" position is used. In the "TRANSFER-LOCKUP" position, the transfer case differential is locked. This provides power equally between

the front power unit and the trailer. If one section of the vehicle loses traction, the other section will continue to pull or push.

(6) In the "AXLE-LOCKUP" position, a combination of differentials ensures the greatest traction. The inter-axle differentials lock together axles No. 1 and No. 2, and axles No. 3 and No. 4. The controlled traction differentials then lock together the wheels on each axle. Unless the difference in torque between the wheels goes beyond certain limits, they will turn at the same speed.

4. MK48 CONTROLS AND INDICATORS

a. General. The controls, indicators, and features are broken down into sections according to the location of the components.

b. Instrument Panel

(1) The left turn indicator flashes green when the left turn signal is on.

(2) The high beam indicator lights red when the vehicle headlights are on high beam.

(3) The right turn indicator flashes green when the right turn signal is on.

(4) The fuel gage shows the amount of fuel in the fuel tanks.

(5) The oil pressure gage shows the engine oil pressure.

(6) The low oil/water indicator light lights red when the engine oil pressure is too low or when engine coolant temperature is too high. A buzzer will sound when the light is on for either the oil pressure or coolant temperature.

(7) The hydraulic oil level buzzer sounds when the hydraulic oil level is low.

(8) The air filter restriction indicator shows the condition of the air filter. Yellow indicates a clean filter and red indicates the filter requires service.

(9) The hydraulic low oil indicator lights red if the level of fluid in the hydraulic reservoir is low.

(10) The drive line lockup indicators lights green when the drive line lockup control is in the axle lockup position or the transfer case lockup position.

(11) The drive line lockup control lever is a three-position lever the center position is "UNLOCK", the left is "AXLE LOCKUP", and the right is "TRANSFER CASE LOCKUP".

(12) The cold weather start button injects ether into the engine for cold weather starting.

(13) The engine stop switch is used to stop the engine.

(14) The engine start switch is a three-position switch with a "OFF", "ON", and "START" position. When the switch is released after the engine starts, the switch will return to the "ON" position.

(15) The low air indicator lights red when the air pressure drops below 60 pounds per square inch. A buzzer will sound when the light is lit.

(16) The air pressure gage shows air pressure in both sections of the air brake system. Green shows the front section and red shows the rear section.

(17) The water temperature gage shows the engine coolant temperature.

(18) The battery gage displays battery voltage.

(19) The transmission gage displays the transmission fluid temperature.

(20) The hydraulic oil temperature gage indicates the hydraulic oil temperature in degrees Fahrenheit.

(21) The tachometer/hourmeter shows the engine operating speed and total operating time in hours. The gage includes red tipped pointers to show the best rpm operating range.

(22) The trailer air supply valve supplies air to the additional trailers being towed behind the MK14, MK15, MK16, MK17, or MK18. Push the valve to charge the brakes and pull to release the brakes.

(23) The parking brake valve applies and releases the vehicle parking brake. Pull to apply and push to release the parking brake.

(24) The speedometer/odometer shows the vehicle's speed and total miles traveled in miles per hour and kilometers per hour.

c. Driver's Side Panel

(1) The trailer hand brake control applies the brakes on additional trailers being towed behind the MK14, MK15, MK16, MK17, or MK18. This is separate from LVS service brakes.

(2) The Jacobs engine brake ON/OFF switch supplies or shuts off the electrical power to the Jacobs engine brake.

(3) The Jacobs engine brake indicator lights green when the Jacobs engine brake is on.

(4) The Jacobs engine brake high/low switch selects the amount of engine braking action. The Jacobs engine brake is a device that alters the operation of the MK48 vehicle's engine to permit it to aid in slowing the vehicle down when it is activated. "HIGH" provides maximum braking.

(5) The fan switch is a three-position switch that controls the fan speed; "HI", "LOW", and "OFF".

(6) The defrost control knob controls the amount of heated air directed at the windshield. Pull out the knob to increase and push in to decrease the amount of heated air.

(7) The heat control knob controls the amount of heated air entering the cab. Pull out to increase and push in to decrease the amount of air.

(8) The lockout strut warning indicator lights orange when the suspension lockout struts are in place.

(9) The manual and automatic disengage lights are on when the transmission is in neutral and the parking brakes are applied. The manual disengage light is on when the selector valve is in the "AUXILIARY HYDRAULICS" position.

(10) The transfer case shifter is pushed forward for direct (high) range and pulled back for low range.

(11) The light switch controls all of the electrical power for the lighting system.

(12) The washer control knob controls the spray of cleaning fluid on the windshield. Push in on the knob for spray.

(13) The transmission range is used to select the transmission driving range. Push the button in to move the lever.

(14) The right wiper control knob controls the operation of the right windshield wiper. Pull for "ON" and push and hold to shut the wipers off. Turn the control to the right to increase wiper speed.

(15) The left wiper control knob controls the operation of the left windshield wiper. Pull for "ON" and push and hold to shut the wipers off. Turn the control to the right to increase wiper speed.

(16) The beacon light switch is a two-position "ON/OFF" switch that controls the amber strobe light, located on top of the cab.

(17) The work light switch is a two-position "ON/OFF" switch that controls the exterior work lights.

(18) The dome light switch is a two-position "ON/OFF" switch that controls the dome light.

(19) The clearance light switch is a two-position "ON/OFF" switch that controls the clearance lights.

d. Passenger Side Panel and Map Compartment

(1) The map light switch is a two-position "ON/OFF" switch that controls the light in the map compartment.

(2) The map light operates by turning on the map light switch.

(3) The map compartment is used for the stowage of maps or a log book.

(4) The STE/ICE receptacle is used to connect the Simplified Test Equipment/Internal Combustion Engine DCA cable.

e. Steering Column

(1) The emergency flasher control operates the four-way flashers. To turn the flashers on, position the turn signal lever in the right turn position, press the hazard tab down and push the turn signal lever up as far as it will go. To shut the flashers off, return the signal lever to the "OFF" position.

(2) The horn button sounds the electric horn when it is pressed.

(3) The turn signal lever controls the turn signals for right, left, and OFF. The signal must be manually shut off after turning.

f. Floor Mounted Controls

(1) The headlight dimmer switch controls the low and high beams of the headlights.

(2) The throttle treadle increases or decreases the engine speed.

(3) The service brake treadle applies the service brakes.

(4) The cab drain plug provides an opening to drain any water that may be in the cab. One is located under each seat. Turn the T-handle to the left to loosen and to the right to tighten the drain plug.

g. Operator And Crew Seat Controls. Controls on the driver's seat and the passenger's seat are identical.

(1) The ride adjustment control is used to adjust the seat tension.

(2) The seat belt and shoulder harness secure the operator or crewman in the seat.

(3) The height adjustment control is used to adjust the seat height.

(4) The forward/backward adjustment control is used to move the seat forward or backward.

h. Vehicle Exterior

(1) The articulation joint lockout strut is used to keep the articulation joint straight when air lifting and towing. The strut mounts provide a mounting for the struts.

(2) The front glad hands allow the towing vehicle to supply air to the reservoirs on the towed vehicle for operation of the towed vehicle's brakes.

(3) The tow brackets are used for towing the vehicle.

(4) The peep window provides ground vision for the driver when climbing and cresting hills.

(5) The step allows for easier access in or out of the vehicle.

- (6) The door latch is used to open the cab door.
- (7) The battery box latch is used to open and also secure the battery box cover.
- (8) The slave receptacle (NATO connector) is used for jump starting the vehicle. Slide the cap off to connect the slave cable.
- (9) Fuel tank cap. Turn to the left to open and to the right to close.
- (10) The ether quick start provides ether to the engine for cold weather starting. The ether start is operated by a button inside the cab.
- (11) The spare wheel and tire provides an additional wheel and tire for the vehicle.
- (12) The grab handles provide for access into or onto the vehicle.
- (13) The lockout strut locks the Number 2 axle to the frame to lock out the suspension action. This stabilizes the front power unit when it is uncoupled from the trailer. One is located on each side of the Number 2 axle.
- (14) When the cap or lockout strut sensor is removed, the lockout strut indicator will be on in the cab. The sensor is an electrical switch that indicates the suspension lockout strut position; there is one on each side of the unit.
- (15) The wheel chock rack is used to store the wheel chocks.
- (16) The tie down ring is used to secure the vehicle in place during transportation.
- (17) The tire hoist assembly is used to raise or lower the spare tire from the vehicle. Remove the retaining pins to remove the hoist parts.
- (18) Hydraulic quick disconnects are used when coupling or uncoupling the front power unit from its trailer. Pull back on the sleeve to connect or release the hoses.
- (19) The air reservoir quick disconnect is used for the connection of the air hose. Pull back on the sleeve to connect or release the air hose.
- (20) Fuel tank shutoff valve. Leave the shut off valve open unless in rough terrain or when parking on a slope. Allow the left fuel tank to be

shut off so fuel can be drawn from the right fuel tank. Turn the handle clockwise to open and counterclockwise to close the valve.

(21) The pioneer tool bracket is used to secure the pioneer tools.

(22) Engine compartment door latch. Lift up and turn clockwise to open the engine compartment door.

(23) The coolant sight glass allows for a visual inspection of the radiator coolant level.

(24) The transmission dipstick is used to check the transmission fluid level. Turn the T-handle to the left to loosen and to the right to tighten the dipstick.

(25) The worklight can be removed by removing the retaining pin. The worklight is operated by turning on the switch inside the cab and the switch on the worklight.

(26) The radiator cap provides the pressurization of the cooling system and covers the filler opening. Turn the cap to the left to open and to the right to close.

(27) The hydraulic reservoir filler cap provides a cover for the hydraulic reservoir filler opening. Turn the cap to the right to install it and to the left to remove it.

(28) The hydraulic reservoir filter has a 6 micron filter that prevents contaminants from entering the hydraulic oil system.

(29) The engine oil filler cap provides an opening to add the engine oil. Turn the T-handle to the left to loosen the cap and to the right to tighten the cap.

(30) The hydraulic reservoir sight glass provides a visual inspection of the fluid level in reservoir. The level is inspected with the crane in the stowed position.

(31) The selector valve is a two-position valve. Push the valve in to shift to the steering position and pull the valve out to shift to the auxiliary hydraulics position.

(32) The engine oil dipstick is used to check the engine oil level. Turn the T-handle to the left to loosen the dipstick and to the right to tighten the dipstick.

(33) The hand primer pump is used to manually prime the fuel system. Push in the knob and turn to the left to pump and push the knob in to override the spring, then turn to the right to lock the pump.

(34) The water/fuel separator traps the condensation in the lower portion of the separator. Drain the condensation by opening the drain on the bottom of the bowl.

(35) The tire hoist base mount provides a base for assembling the tire hoist.

(36) The storage box is used to store the extension cord for the worklight.

5. PERFORM "BEFORE OPERATION" PREVENTIVE MAINTENANCE

a. First, let's review the classification of leaks.

(1) Class I - Seepage of fluid not great enough to form drops.

(2) Class II - Leakage of fluid great enough to form drops but not enough to cause drops to fall from item being inspected.

(3) Class III - Leakage of fluid great enough to form drops that fall from the item being inspected.

b. Cab Exterior

(1) Inspect the cab for damage that would impair operation. If such damage is present, the vehicle is not ready for operation.

(2) Inspect for broken, cracked, or loose mirrors.

(3) Look under the vehicle for fuel, oil, or coolant leakage.

(4) The vehicle is not ready for operation if it has any Class III fuel, oil, or coolant leaks.

c. Tires

(1) Check the tire tread depth. If the tire tread is worn beyond the level of the wear bar, the vehicle is not ready for operation.

(2) Check the tires for cuts, gouges, or cracks. Tires damaged to the degree which would result in tire failure during operation or one or more

unserviceable tire(s) with no spare available would render the vehicle not ready for operation.

(3) Check the wheels for broken, cracked, or bent surfaces. Check that the side ring and clamp plates are not damaged or loose and that they fit securely in their grooves. Any of these conditions would make the vehicle not ready for operation.

(4) Check the wheel studs and nuts for obvious looseness. Check for bent or broken studs and missing nuts. If two or more studs on the same wheel are bent, broken or missing, the vehicle is not ready for operation.

(5) Check the tires for proper air pressure, using the PMCS chart found in your vehicle's technical manual.

d. Ether Start System. When the temperature is below 45 degrees Fahrenheit, inspect the ether canister for punctures or obvious damage. If the canister is punctured or empty, the vehicle is not ready for operation.

e. Work Lamp. Check the work lamp for damage to the lens or case. Make sure the lamp is secure in its holder.

f. Fuel Tank. Check the fuel tank for leaks or damage. Remember what we said earlier about the fuel leaks.

g. Trailer Coupling Bolts. Check for broken, loose, or missing coupling bolts. Any bolts in this condition would render the vehicle not ready for operation.

h. Lights. Check the stoplights, clearance lights and headlights for burned out bulbs or broken lens.

i. Electrical Connector. Inspect the electrical connector for damage. If the connector is unserviceable, a rear body tow unit cannot be used.

j. Fuel/Water Separator

(1) Check the fuel/water separator for leaks and/or damage.

(2) Check the priming pump for leaks or damage.

k. Engine Oil

(1) If the engine has been running, wait for approximately five minutes after engine shutdown before checking the engine oil level.

(2) Check the engine oil level on the dipstick. The oil level should be between the low (L) mark and the full (F) mark. Add oil as required.

l. Hydraulic System Reservoir

(1) Check that the hydraulic fluid level in the sight glass on the reservoir is between the "ADD" and "FULL" marks. Add fluid as required.

(2) Inspect the hydraulic fluid in the sight glass for a milky, foamy, or dirty appearance. If it has any of these appearances, the vehicle is not ready for operation.

m. Wiper Arms and Blades. Check the windshield wiper arms and blades for damage or wear.

n. Windshield and Glass. Check for a broken or cracked windshield, door glass, or peep window.

o. Radiator Coolant. Check for coolant in the sight glass. Add coolant, if required, as follows:

(1) Turn the radiator cap only one half turn counterclockwise and allow the pressure to escape before fully removing the cap.

(2) Add coolant to the radiator until the coolant level is approximately one inch below the filler neck.

p. Cab Interior

(1) Check to see that the seat belts are securely mounted and that they operate properly.

(2) Check the fire extinguisher for missing or broken seal.

(3) Check the condition of the fire extinguisher.

(4) Check the condition of the fire extinguisher mounting bracket.

6. PREPARE THE VEHICLE FOR OPERATION

a. Climb into the vehicle and adjust the seat and both rear view mirrors.

b. When starting the vehicle, perform the following:

- (1) Fasten the seat belt.
 - (2) Apply parking brake by pulling the parking brake valve out.
 - (3) Place the transmission shifter in the neutral (N) position. The vehicle is equipped with a neutral safety switch to prevent starting the engine while the transmission is in gear.
 - (4) Before starting the vehicle, be sure all of the personnel are clear of the articulation joint and the vehicle. The articulation joint may make a sudden movement when the engine starts up.
 - (5) Turn the engine start switch to the "ON" position. If the air pressure in the brake system is low, a warning buzzer will sound and a red indicator will light. The buzzer and light will shut off once the air pressure builds to a safe pressure for brake operation. A low oil/water indicator and warning buzzer will also come on. The automatic disengage light will stay on until the ignition switch is turned off or the engine is started and the parking brake is released.
 - (6) For cold weather, below 32 degrees Fahrenheit, push the ether start switch for 2 seconds, then release.
 - (7) Move the engine start switch to "START" and release the switch once the engine starts, allowing the switch to return to the "ON" position. Upon start up, the engine must be operated at low idle, 690-700 rpm for two minutes.
- c. Check the following gages for their proper readings.
- (1) The oil pressure should indicate 5-49 psi at an idle.
 - (2) The battery gage should indicate 26-28 volts.
 - (3) The water temperature gage should indicate 160-220 degrees Fahrenheit after engine warm up.
 - (4) The air pressure indicator light should go out and the low air pressure warning buzzer should stop when the air pressure reaches approximately 65 psi.

7. DRIVE THE VEHICLE OVER ON-ROAD COURSE IN ALL FORWARD RANGES

- a. With the engine running, check all instruments for proper operation.
- b. Turn on the necessary lighting and controls as conditions require.

c. Select "LOW" or "DIRECT" range on the transfer shifter as needed for driving conditions or load on the vehicle. This must be done only when the vehicle is stopped and transmission is in neutral.

d. Apply the foot brake pedal.

e. With the engine idling, use the shifter to select the proper gear range for your driving conditions. Each drive range is described as follows:

(1) Reverse (R). To move the vehicle in reverse, idle the engine and shift the selector to the reverse position. Depressing the accelerator will then cause the vehicle to move backwards. Completely stop the vehicle when shifting from forward to reverse or from reverse to any forward gear.

(2) Neutral (N). Place the shift selector at the neutral position before starting the engine. Shifting from neutral should be done at engine idle. Any time the operator is not at the vehicle controls, shift the transmission to neutral and apply the parking brakes.

(3) Drive (D). The transmission will start in first and automatically upshift at the proper speeds thru all gears. Downshifts also will occur automatically in relation to speed and throttle position.

(4) Drive (3). In this range, the transmission will start in first and automatically upshift, at the proper speed, to third gear.

(5) Drive (2). In this range, the transmission will start in first and automatically upshift, at the proper speed, to second gear.

(6) Drive (1). In this range, the transmission will start in first gear. No automatic upshift will occur unless the engine's governed speed is exceeded.

f. Position the drive line lockup in the unlock position.

g. Release the parking brake by pushing the parking brake valve in. The vehicle is ready to drive.

8. DRIVE THE VEHICLE OVER OFF-ROAD COURSE IN ALL FORWARD RANGES

a. Before entering an area where poor traction conditions are likely to occur, bring the vehicle to a complete stop. Place the transmission in neutral and move the drive line lockup lever from "UNLOCK" to "AXLE LOCKUP" position. The indicator will come on when in this position.

b. If the axle lockup position does not supply the necessary traction, bring the vehicle to a complete stop. Shift the drive line lockup lever to "XFR CASE LOCKUP". The indicator will come on in this position.

c. If excessively slippery or muddy conditions, stop the vehicle, place transmission in neutral, and shift the transfer shifter into low range.

d. After regaining normal traction, bring the vehicle to complete stop. Move the drive line lockup lever to the "UNLOCK" position. The green indicator will then shut off. It may take a few feet of slow forward travel before all sliding clutches disengage.

e. Shift the transfer shifter into high range if conditions permit.

9. PERFORM "DURING OPERATION" PREVENTIVE MAINTENANCE

a. Cab Exterior. Inspect the cab door for damage or misalignment.

b. Work Lamp. Check the work lamp for proper operation.

c. Cab Interior

(1) Check the engine for:

(a) noisy or slow cranking starter,

(b) excessive smoke, unusual noise, rough running, or misfiring, and

(c) correct idle of 690 to 700 rpm.

(2) The engine oil pressure gage must show normal operating pressure of 49 to 70 psi at 2,100 rpm. minimum oil pressure at an idle can go as low as 5 psi.

(3) The air cleaner restriction indicator must read within the yellow area. If the restriction window reads yellow but the gage reads 18 inches in vacuum or more, the filter is partially clogged and should be replaced at end of vehicle operation or mission.

(4) The air pressure gage indicates the system air pressure in both the front and rear sections. The low air pressure indicator and buzzer will operate until the air pressure is between 55 and 75 psi in both sections.

(5) The battery gage should read between 24 and 28 volts.

- (6) Turn signal control and indicators operate properly.
- (7) Emergency flasher control operates properly.
- (8) Both wiper controls and the washer control operates properly.
- (9) Both horns, air and electric, operate properly only if tactical situation permits.

(10) The heat and defrost controls operate properly and the fan switch operates properly in "LO" and "HI" positions.

(11) Check that the engine water temperature gage indicates normal operating temperature of 160 to 230 degrees Fahrenheit. If the gage doesn't work or if it reads higher than 230 degrees, the vehicle is not ready for operation. Shut it down immediately.

d. Check that the hydraulic oil temperature gage indicates normal operating temperature of 130 to 150 degrees Fahrenheit.

e. Transmission Fluid. With the engine running and the transmission in neutral, check the transmission fluid level on the dipstick. If the transmission temperature is below 160 degrees Fahrenheit, the fluid level should be within the "COLD RUN" area. If the transmission temperature is above 160 degrees Fahrenheit, the fluid level should be within the "HOT RUN" area.

f. Brakes

(1) Check the brakes for chatter, noise, or side pull. If any of these conditions are present, the vehicle is not operational.

(2) Check that the trailer brake hand control operates properly by moving the truck and applying the trailer brakes. The trailer brake hand control is only used when towing another vehicle or trailer behind the LVS.

g. Steering. Check the steering system for any unusual noise, binding, or steering difficulty during operation. If the steering binds or is unresponsive, the vehicle is not ready for operation.

h. Transfer Case. The truck must be stopped when making this check. The transfer case will be damaged if shifted while the truck is moving. With the vehicle stopped, check the transfer case for proper operation in "DIRECT" and "LOW" range. The vehicle should be operated in each selected range.

i. Transmission

(1) Check the transmission for proper shifting. The vehicle is not operational if the transmission does not operate in all ranges.

(2) At an idle speed, the automatic transmission oil temperature may not reach 160 degrees Fahrenheit. Check the transmission temperature gage for normal operating temperature of 160 to 220 degrees Fahrenheit. If the transmission temperature exceeds 220 degrees Fahrenheit, downshift to a lower gear to avoid overheating.

10. DRIVING THE VEHICLE IN REVERSE RANGE

- a. Stop the vehicle.
- b. Place the transmission in neutral (N).
- c. Have another person act as a ground guide to direct backward movement.
- d. Select "LOW" or "DIRECT" range on the transfer shifter as required by driving conditions.
- e. Place the transmission shifter in reverse (R).
- f. Release the brake pedal and slowly depress the throttle treadle valve.
- g. Observe the directions from the ground guide.

11. PARKING THE VEHICLE

a. To park the vehicle, bring the vehicle to a complete stop. Place the transmission shifter in neutral (N). Pull the parking brake valve out to engage the parking brake.

b. Before shutting down the engine, run at an idle for 4 to 5 minutes to allow the turbocharger to slow down. Running the engine also allows lubrication to continue to be supplied to the turbocharger to prevent damage to its bearings.

c. Hold the engine stop switch down until the engine stops. The low oil/water indicator buzzer will sound and the low oil/water indicator will come on.

d. Turn the engine start switch to "OFF", the buzzer and indicator light will shut off.

e. Turn off the lights and all electrical switches.

12. PERFORM "AFTER OPERATION" PREVENTIVE MAINTENANCE

a. Fuel/Water Separator. Check the sediment bowl for water. If water is present, drain the fuel from the bowl into a suitable container until clean fuel flows out.

b. Air Reservoir

(1) With the engine off, listen for leaks at all the air reservoirs and reservoir lines. The low air pressure indicator and buzzer should operate until the air pressure is between 55 and 75 psi.

(2) Drain all the air reservoirs.

c. Battery Indicator The battery gage should read 24-28 volts.

13. PERFORM "WEEKLY OPERATION" PREVENTIVE MAINTENANCE

a. Cab Exterior. Check for broken or loose reflectors.

b. Batteries

(1) Inspect for a missing battery.

(2) Remove the battery caps and check the fluid level of each cell. The fluid level should be up to the split ring.

(3) Inspect the batteries for a cracked or leaking casing and loose, broken, burned, or corroded terminal posts.

c. Fuel Tanks

(1) Check the fuel hoses and connections for leaks or damage. Make sure all connections are secure.

(2) Check the fuel tank shut-off valves for proper operation.

d. Rear Glad Hands. Check the glad hands and air lines for damage. Inspect the glad hands for missing or rotted seals.

e. Front Glad Hands. Check the glad hands for damage. Inspect the glad hands for missing or rotted seals.

f. Undercarriage and Frame

(1) Inspect for missing or broken suspension limit chains on the Number 1 and Number 2 axle. If one or more chains are missing or broken on the same axle, the vehicle is not ready for operation.

(2) Visually inspect the spring brake chamber for missing dust covers.

14. PERFORM "MONTHLY OPERATION" PREVENTIVE MAINTENANCE

a. Cab Exterior

(1) Check for missing, illegible, or damaged data plates between the two frames.

(2) Inspect the cab door seals for tears or rot.

b. Batteries

(1) Check the battery box for damage or corrosion.

(2) Inspect the slave receptacle for loose cables, damage, or a missing cover.

c. Ether Start System. Check for loose or damaged mounts or hardware.

d. Air Dryer

(1) Inspect the air dryer for punctures and obvious damage. The vehicle is not ready for operation if the air dryer is punctured.

(2) Check the air dryer for loose bolts and loose air line connections.

e. Stowage Compartments. Check the compartment for water in the bottom of compartment or other obvious damage. Ensure the drain holes are clear.

f. Pintle Hook

(1) Check the pintle hook for secure mounting and proper operation of the locking mechanism. The vehicle is not operational to tow with a rear body tow unit if the pintle is damaged.

- g. Electrical Connector
 - (1) Inspect the electrical connector cover seal for tears or rot.
 - (2) Inspect the electrical connector cable for damage.
- h. Tire Hoist. Check the tire hoist for any damaged or missing parts.
- i. Secondary Fuel Filter. Check the secondary fuel filter for leaks or damage.
- j. Coolant Filter. Check the coolant filter for leaks or damage.
- k. Hydraulic Pump
 - (1) Inspect the hydraulic pump for cracks.
 - (2) Check the hydraulic pump, hoses, and split flanges for leaks.
 - (3) Check the hydraulic pump for looseness or missing mounting bolts. Make sure the pump is secure.
 - (4) The vehicle is not ready for operation if the pump is loose or the pump housing is cracked.
- l. Undercarriage and Frame
 - (1) Check for loose, broken, or missing cargo body mounting studs.
 - (2) Inspect the frame rails and crossmembers for loose or broken bolts and cracked or broken welds.
 - (3) Check the air lines and hoses for leaks or obvious damage.
 - (4) Inspect the hydraulic lines and hoses for breaks, cracks or leaks.
 - (5) The vehicle is not operational if these above conditions exists.
 - (6) Check that all the axle and shift unit breathers are not clogged and that they spin.
- m. Air Intake System. Check the air intake system for loose clamps and punctured or damaged tubes. Any punctured or damaged tube that would allow unfiltered air to enter the engine would make it not ready for operation.

n. Engine Compartment

(1) Check the turbocharger oil line and fittings for signs of leaks or damage. If any leaks are present, the vehicle is not operational.

(2) Check the air compressor for oil and coolant leaks. Check that the compressor is securely mounted. A loose compressor would make the vehicle not operational.

o. Exhaust System. Check the exhaust system for damaged pipes, muffler, or loose or missing clamps. While the engine is running, listen for exhaust leaks. The vehicle is not ready for operation if the pipe between the turbocharger and the exhaust manifold leaks.

p. Radiator Hoses. Check the radiator hoses for rot, leaks, or loose clamps.

q. Cargo Body Tiedowns, Locks, and Fittings. Check for broken or cracked tiedown slots, locks, and fittings. If any of these are broken, the vehicle is not ready for operation.

r. Fuel Tank Strainer. Check the fuel tank strainer for clogs or damage. If the strainer is clogged, clean the strainer.

15. ALL LUBRICATION ON THIS VEHICLE SHOULD BE ACCOMPLISHED IN ACCORDANCE WITH LO 9-2320-297-12

REFERENCES:

LI 2320-12/9B
NAVMC 10627
TM 2320-10/11A